# FY 2002 Annual Report

**DoD Programs**
Missile Defense, Chemical and Biological, Health Systems, Logistics, Support Systems

**Army Programs**
Aviation, C4I, Armored Vehicles, Fire Support, Munitions, UAV Systems

**Navy and Marine Corps Programs**
Amphibious Systems, Surface Ships, Mine Warfare Systems, EW, Submarine Systems, Munitions, C4I, Aviation Systems, UAV Systems

**Air Force Programs**
Aircraft Systems, Space Systems, Munitions, C4I, Avionics, UAV Systems

# DIRECTOR'S INTRODUCTION

In last year's annual report, I committed to testing that was adequate by any standard, an infrastructure that could support such testing, and "tell-it-like-it-is" reports. This is a "tell-it-like-it-is" report on the status of operational testing within the Department and identifies infrastucture needs to assure adequate testing in the future. Succinctly put, transforming the military requires transforming test and evaluation (T&E).

## THE ENVIRONMENT SURROUNDING OPERATIONAL TESTING AND EVALUATION IS CHANGING

Several initiatives are underway that will have significant impact on how the T&E community carries out its responsibilities. An example of such changes is the creation of the Missile Defense Agency (MDA). In January 2002, the Secretary restructured the Ballistic Missile Defense Organization and related programs into MDA and a single integrated Ballistic Missile Defense System (BMDS). MDA implemented the Secretary's guidance to develop a layered BMDS capable of defending the United States, as well as deployed forces, allies, and friends. The strategy was also to use prototypes and test assets to provide early capability, if required in an emergency. Central to this implementation is a concept described as a capabilities-based acquisition strategy.

Capabilities-based acquisition requires detailed assessments of demonstrated operational capability, coupled with a military utility assessment by the user community to support block production and deployment decisions. Under this approach, characterizations of the capabilities demonstrated during each development block replace traditional evaluations of performance compared to user-defined operational requirements. MDA plans a two-year period for each block. The MDA can acknowledge performance shortcomings and field limited capabilities while working to correct identified deficiencies and to develop the objective system.

My assessment for each block will be a characterization of demonstrated capabilities and will point out operational strengths and weaknesses that feed a military utility study. The decision will be made to procure or field in an emergency a block increment after my assessment and the military utility study is complete. This is a significant departure from the traditional acquisition approach in which such decisions are based upon the degree to which demonstrated performance meets specified operational requirements.

We have addressed congressional concerns regarding limitations on DOT&E oversight of MDA efforts through numerous discussions with the MDA, congressional staff, and testimony before the members of Congress. Presently, my staff and technical support personnel have access to all the information necessary to independently evaluate the MDA goals and objectives, assess demonstrated operational capabilities, and determine test program adequacy.

While MDA led the paradigm shift to capabilities-based acquisition, the Services are implementing capabilities-based acquisition strategies under different names. For example, the Army refers to "Blocking Systems" and the Air Force calls it "Seamless Verification." However, congressional concerns about capabilities-based acquisition are stated in the FY03 Defense Authorization Act. This statute limits the programs that can use such an acquisition strategy and requires additional reporting by the Department.

Streamlining the Department's acquisition documents is also affecting the acquisition environment. The Department cancelled acquisition documents signed in May and replaced them with greatly pared down interim guidance documents in September. The Department has new, streamlined documents intended to replace the interim guidance in a final coordination process. While I fully support this effort, the overall impact of this documentation streamlining remains to be seen.

One of my chief concerns is the potential for systems to circumvent the rigorous acquisition process and enter into full-rate production or into the hands of our warfighters without learning the operational capabilities and limitations demonstrated by adequate operational testing and evaluation.

The FY03 Appropriations Bill provided specific direction to Combatant Commands, Services, and the test and evaluation community to perform operational evaluations of Information Assurance (IA) and interoperability during warfighter exercises. Evaluating fielded systems is a change for DOT&E, but not substantially different from the role of this office during the Y2K operational evaluations. The Department needs this effort to maintain information superiority in the face of the growing information operations threat and rapidly evolving information architectures, even though most systems were adequate in this regard when initially fielded. DOT&E has partnered with the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)) and the Joint Staff to initiate this effort. I am pleased to report that our three organizations, in coordination with Combatant Command and Service representatives, are beginning to implement this direction.

In that context, the above organizations identified candidate FY03-04 exercises for robust operational evaluations including network attacks. These organizations also began to develop a template for IA and interoperability evaluation plans to supplement exercise plans; a plan for Service Red Team enhancement, training, and certification; and metrics to serve the multiple organizations that will benefit or otherwise employ the results of these evaluations. In my FY03 annual report, I will provide an update on the progress of these new efforts and the emerging trends.

I continue to see increased pressure to reduce operational T&E in particular, and T&E in general. I am concerned that emphasis within the acquisition community to control cost and schedule is leading to a practice in which learning about performance is avoided. The cost of testing complex systems, as well as the risk of performance shortfalls delaying programs further, is motivating managers to skimp on testing. Performance results are the product of testing and, if poor, may force further development to correct deficiencies. Additional development inevitably leads to schedule delays and increased cost. Blaming T&E for cost increases and schedule delays is a practice akin to shooting the messenger.

Having said that, I remain convinced that T&E within the Department must change to serve the military transformation goals of the Department. In particular, T&E must transform to be able to provide the warfighters and the acquisition community with timely, affordable, demonstrated performance information. A first step toward that transformation occurred last summer. Spurred by a draft legislative proposal and a review of previous studies, the Deputy Secretary established a Department position that acknowledged, for the first time, the need to assess the adequacy of the T&E infrastructure and the investment and modernization of that infrastructure at the DoD enterprise level. This position was reinforced by the FY03 Defense Authorization Act which prescribed the creation of the Defense Test Resource Management Center as a defense field activity reporting to the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)).

To avoid being viewed as the root cause of cost increases and schedule delays, T&E policies, processes, practices, infrastructure, and the T&E events themselves must not contribute significantly to the length of the planned development cycle. The remainder of this introduction discusses what is needed to maintain adequate testing and improve infrastructure to support testing in the future.

Earlier this past year, the Deputy Secretary directed OSD and the Services to examine T&E modernization and align T&E policies with the new acquisition strategies. As stated before, the Department is implementing new approaches to the development, production, and deployment of military capabilities. When all complexities are considered together, it is appropriate to rethink, as part of a broad review, how T&E would best function in this transformed environment.

To prepare this review, we first identified the common areas that have caused performance problems with new systems. We examined what could be done in testing to mitigate these problems. We considered how new acquisition approaches might affect the problem areas. We examined future weapons and operational concept developments for what should be addressed early to aid the ongoing military transformation. Finally, we identified the investments in resources needed over the next decade in people, processes, and facilities to support that transformation.

During the review, my overarching goal was to make T&E more useful and responsive both to our combat forces and the development process. There are problems in both areas worth describing.

# DIRECTOR'S INTRODUCTION

## TO SERVE OUR COMBAT FORCES BETTER, WE SHOULD TEST BASED ON THE WAY WE FIGHT, NOT ON HOW WE PROCURE

We need to conduct operational testing and evaluation before a system goes to combat. During the last year, I became concerned about the pressure to deploy new systems that have not been adequately tested. I recognize and agree, in principle, with the desire to field new capabilities as soon as possible, but that desire should be tempered with the responsibility to ensure that the weapons will not put Americans at risk. Part of the problem is that we have not provided adequate resources. As a result, T&E currently cannot be done fast enough to satisfy the desired timelines in the acquisition process. This ought to be a major theme for T&E transformation.

Congressional concern about fielding systems that have not been adequately tested was evident in new legislation that requires this Annual Report to identify waivers or deviations from testing requirements by the Services. There are four cases of deviations from previously approved testing requirements, reported in detail in the sections for the relevant systems: Shadow 200 Tactical Unmanned Aerial Vehicle System, Advanced Amphibious Assault Vehicle, Evolved Sea Sparrow Missile, and the Joint Standoff Weapon Baseline Variant.

We must reinforce the principle that systems that go to war must be tested the way they will be employed. In this respect, T&E should align itself better with the revolution in training that is underway. Just as we train the way we fight; we should test the way we fight. Training is based on a set of principles that have direct application to testing. Those principles include: training should be realistic; training should have a smart opposition force; there should be ground truth recorded; and the lessons learned should be documented. Finally, the training should be conducted in a joint context and with joint scenarios. We should follow these same principles in T&E.

One major finding about testing "the way we fight" is the need for a national joint test capability. The individual Service ranges are too limited and insufficiently interoperable to test in a joint environment consistently and effectively. This need is considered further under the discussion of facilities. We can summarize how T&E can better serve combatants by saying: we should test based on the way we fight, not on how we procure.

## TO SERVE THE DEVELOPMENT PROCESS BETTER, WE SHOULD INCREASE THE QUALITY OF TESTING AND DECREASE THE PROGRAMS' TIME AND COST OF TESTING

The second aspect of the overarching goal is to make T&E more useful to the development process. Some of the changes needed to accomplish this goal have been documented in Defense Science Board (DSB) and General Accounting Office (GAO) reports over the last few years. The GAO recommendations included carrying out more testing, and testing earlier and more completely. Many of the obstacles to thorough learning about performance can be attributed to the desire to streamline acquisition. With respect to acquisition, we reviewed test policies, procedures, and practice to ensure they are optimized for our acquisition process and that the test infrastructure is capable of supporting affordable, adequate testing. To make this viable in an environment of high pressure on cost and schedule, it will be necessary for testing to increase its quality, while also decreasing the time and cost of testing to the programs. Achieving this goal depends on people, processes, and facilities.

Testing should be of quality and produce results quickly. It ought to be a continuous process – it should not simply stop when a system goes into production or is deployed. We all say, "We test to learn." If we believe that, why should we stop learning about the equipment with which our men and women are going to war? Why should we stop learning about the equipment the taxpayers are entrusting to us to build and continue to improve? Spiral development and evolutionary acquisition are both forthright in stating that development is never over — that there is always something to learn and improve. Therefore, we should plan for continuous testing, as it will inform engineering changes, evolutionary requirements, and logistics needs.

We can organize the solutions around the actions needed that affect people, processes, and facilities.

***People***

Without doubt, the highest priority is to attract, retain, and properly use the talented people needed to get the job done as part of the T&E workforce. First, we must reverse the shift away from the involvement of military Tactical Operations and Engineering and Maintenance personnel in operational testing. These are precisely the people we need to provide early feedback to developers.

Secondly, we must provide the ranges and other T&E facilities with a workforce able to deal with advanced technology, address the shortfall in government expertise in a variety of areas, and provide continuity of operations during what I view to be a looming workforce crisis.

For example, at least one test facility, the Utah Test and Training Range (UTTR), is faced with 92 percent of its workforce eligible for retirement in five years. In general, the average age of our T&E workforce is the late forties or early fifties, and there is a void of younger people. The age profile of the OT&E civilian workforce is clearly a cause for concern as only 11 percent of the civilian workforce is under 40.

To address this current and worsening civilian workforce problem, the T&E facilities desperately need innovative approaches such as those advocated by the Under Secretary of Defense for Personnel and Readiness. These innovative approaches include:

- The right to participate in the Demonstration Pay Plans – The pay banding initiatives to allow them to compete better with the private sector.
- The ability to direct hire. (This also helps in the recruiting process.)

The timeline for the reconstitution of the testing workforce is an important aspect of any plan to address this problem. Clearly, the priority we have accorded military transformation puts a premium on short-term remediation. We should assume that hiring 10 percent of the current workforce each year is reasonable, given the demographics and the effect that pay banding might have on workforce turnover. For the next five years, in order to address situations like that of UTTR discussed above, even higher hiring rates might be required, both to address the retirement challenge and to guarantee successful transfer of the existing knowledge and experience base to the next generation.

Bringing operational users into the development process should occur immediately. Each program should have at least one or more operational users assigned, depending on size and complexity of the project and personnel should increase when the system is brought to field testing. Mission performance should be the primary focus of the evaluations done on systems, but several capable individuals will be required if hardware, software, and interoperability are each continuously examined.

An increase in test facility personnel may be needed to prepare for spiral development and evolutionary approaches to acquisition. Every system in the inventory should be undergoing some kind of test as its design, manufacture, or interoperability demands change. We should not repeat the recent experience of a major program office implying that the OT&E was irrelevant after 18 months because of the number of system changes introduced after the Initial Operational Test and Evaluation (IOT&E). Necessary personnel in order to provide continuous testing will ensure performance is verified throughout the life cycle changes from development through deployment.

***Processes***

The processes that need to change include funding, contracting, and design. They are aimed at permitting us to:

- Test the way we fight, not the way we procure.
- Increase the tempo at which we test.
- Develop common instrumentation.

- Provide earlier real involvement of operational military personnel.
- Test before deployment.
- Make testing more valuable.
- Contribute to evolutionary acquisition and spiral development so that we understand performance before production or fielding.
- Address the shortfall in methodologies for Information Assurance and Interoperability.

A major theme of military transformation has been the recognition of the importance of joint operations. Our testing should recognize that too. All Test and Evaluation Master Plans (TEMPs) should recognize the joint nature of operations to ensure joint requirements are adequately tested. With truly transitional equipment, there is also a great advantage in seeing early on how forces would use the system when developed. Encouraging early, or parallel, development of training systems could foster such experimentation and early experimentation with new concepts of operation. This will help ensure that we test the system the way it would actually be used.

However, testing the way we fight is more than just testing in a joint environment. The physical and threat environments are also important. The process of preparing test plans, ranges, and opposition forces to challenge new systems has to take into account our weapons' increasing range, and the new diversity of scenarios that our forces confront. There no longer is a single relevant scenario, or expected place, for the next conflict. Testing should not focus narrowly on a given scenario but must inform potential users about performance across a much broader spectrum of potential use. This is capabilities-based testing and evaluation.

Programs' cost for testing has risen over the last decade. This has occurred primarily because of changes in the way we are funding the ranges. The current process forces the programs to pay a greater fraction of the cost of testing. This problem is discussed in more detail in the Resources section. Related to this issue, a recent Inspector General (IG) study found that the Department's information on institutional funding and backlog of test assets is so poor that, "program managers may also be lacking the relevant information necessary to make informed test decisions for their programs." The first step in addressing this problem is to establish a common financial system with activity-based costing. The next step is to decrease the cost of testing to programs by increasing the level of institutional funding of the ranges.

Decreasing the testing cost to programs could encourage an increase in the amount of testing during development including reliability testing, software testing, component level testing, and operational concepts testing. A major failing in the recent past, which DOT&E has documented repeatedly, is the large number of immature systems that come to operational test, encounter problems and often fail. Developmental testing must be more effective than it has been in assuring the maturity of systems entering operational testing. As we move to eliminate or reduce redundancy in contractor and government testing in programs, we need to assess our contracting strategies to facilitate the flow of information during early design and development efforts. We should change the contracting structure to allow the government to review, and comment on, contractor test plans, witness contractor testing, and have access to contractor test data and reports. At present these are too often considered proprietary to the contractor.

Other features of the Acquisition Strategy could help speed the information gathering process needed to mature system designs. For example, we should consider the life cycle cost effectiveness of embedded instrumentation, aligned with embedded training, in the design of our systems. Another key consideration is that embedded instrumentation will provide us with many opportunities to examine performance and reliability even after the system is in field use. This is particularly important when the acquisition strategy involves constant improvement, as hoped for in spiral development or evolutionary acquisition.

In fact, all items in the inventory should be under continuous testing so that faults are found before, rather than in, combat. This is "lead-the-fleet" testing. In this process, a few systems are used at a higher rate than usual in order to get information of potential trouble areas before the whole fleet is affected. This is particularly important for systems that are evolutionary with constantly changing engineering designs. Procurement contracts must include "lead-the-fleet" test articles.

Operational tests are now often conducted using Engineering and Manufacturing Development (EMD) models, and these models are sometimes even shipped to the field for use in operations. As a result, I believe that, in addition to its current responsibility with respect to recommending the number of items needed for test, DOT&E should recommend the number of EMD items needed for testing. This recognizes the reality that often no low-rate initial production items are used in the IOT&E.

One final process improvement that could increase the readiness of ranges and other facilities to test new systems involves the Central Test and Evaluation Improvement Program (CTEIP). We should enhance CTEIP by replacing the Service's "requirements and de-confliction process" with one that takes less time to define a need. While new systems are seldom Service-unique, they are often tested on ranges that have Service-unique instrumentation. We should not develop Service-unique instrumentation for weapons that will be used in Joint Operations.

***Facilities***

The third component of infrastructure is facilities without which the people and processes cannot work. The DoD IG has reviewed the backlog of maintenance and repair and found cases of significant neglect. To remove that backlog will require a considerable investment. Repair and maintenance may not be the most judicious path. It may be wiser to invest in new equipment to replace the 1960s and 1970s vintage equipment that our ranges too often strive to maintain.

The solutions included in the table below are designed to:

- Address the test needs of military transformation – with its increased emphasis on joint operations.
- Ensure that we can test new weapons, test them before they are deployed, and test them realistically and in the right environments.

Again, the goal of a successful military transformation and the needs of the war on terrorism are important timeline drivers. However, the realities of planning for improvement are such that a 10-20 percent increase in the funding to ranges (above that to provide increased institutional funding) could be absorbed in the FY05 budget. Larger increases will be needed after that to actually implement the developments.

## SOLUTIONS TO ADDRESS ACQUISITION PROBLEMS

The above sections suggest a large number of improvements that have made themselves evident when considering the real acquisition problems faced by real programs. I have found that there are systemic problems shared across the spectrum of weapon system types as well as problems that are specialized to particular warfare areas. While it is not necessary to understand how the problems and solutions are connected to appreciate the magnitude of the task, it does help in justifying those solutions. First, the systemic problems are addressed and problems in particular warfare areas are treated in summary form, with more details provided in the Resources Section of this report.

***Systemic Problems***

Some performance problems arise from causes shared across the whole spectrum of weapon system types. For the most part, these problems are associated with the acquisition system in general rather than any particular weapon system. They are discussed primarily in the context of their implications for T&E transformation. The solutions will involve changes to the three components of the T&E infrastructure: people, processes, and facilities. In addition, solutions will require some change in the acquisition processes beyond those in T&E.

**The inability to reliably identify immature technology** could be alleviated if the T&E workforce were more technically expert and more familiar with the newest technology. This expertise should be expected of the testing infrastructure. To develop it, T&E should become familiar with and use advanced technologies in its own instrumentation. T&E should anticipate new technologies to be ready to test them when they appear at the ranges. The T&E infrastructure should stay ahead of the acquisition systems in the sophistication of the technology with which it deals. I call this a capability-based testing infrastructure in analogy with some acquisition strategies that are not based on requirements, but on capabilities.

There is a critical need for technologically expert personnel who could carry out such research and development to support our T&E capability. Our test facilities must be able to attract, hire, and retain a quality technical workforce. The kinds of activities this workforce should pursue include many of those we are promoting in the Test and Evaluation/ Science and Technology program: embedded instrumentation, nanotechnology, hypersonics, etc.

Investments in testing should be forward-looking, incorporating leading-edge technologies as rapidly as possible, just as weapons systems are moving to incorporate new technologies as rapidly as possible. In such an environment, if testers wait to define testing requirements until the new technology is already in the system under test, the tester will never be ready to test new capabilities adequately.

Current instrumentation maintenance practices are not forward looking. We must introduce leading-edge technology into the T&E infrastructure. This will have the secondary benefit of ensuring a corporate knowledge within government of the real-world capabilities and limitations of those technologies.

**Failure of feedback loops** is another common cause of performance problems. It is the failure to translate successfully what is learned from testing into changes, either engineering or operational, as a result of what is learned. In the case of Joint Standoff Weapon, the Navy test report recommended the program office "Conduct analysis to determine overall benefit of correcting wind estimator error." Failure to take any action led to weapon misses experienced in air attacks on Iraq in January 2001. These problems can be attributed to a failure to integrate testing well into Systems Engineering. We should insist that expert government evaluation is available and shared with the contractor, starting at the component level. Even components can be tested in a "realistic" environment if enough is known about the system concept.

Throughout the last decade, there has been a push to provide earlier operator feedback to the development process. The Air Force is striving to institutionalize this initiative in an approach it calls "Seamless Verification." Providing airmen to work T&E issues early on is beneficial. This may help reverse a trend identified in a March 2002 study by the Institute for Defense Analyses (IDA), which found a significant shift away from Tactical Operations Officers; down from 41 percent of the officer workforce in 1990, to 33 percent in FY00. The biggest challenge that DoD T&E will have to meet is the need to provide more of the right kind of personnel for earlier involvement with programs. The same IDA study concluded, after examining all the Operational Test Agencies, "The reduction in the military presence in OT&E and the move away from tactical operations and engineering and maintenance officer billets suggest cause for concern…"

In summary, we need to put soldiers, sailors, airmen, and Marines who are operators, back into the development process for systems. The first step is to recognize that testers are not "acquirers," and that they should be independent from them. In that context, workforce positions for testers should be separate from acquisition corps positions.

**Insufficient or inadequate Developmental testing** can often be traced to the cost and schedule pressures on program management. Unfortunately, problems revealed late in testing can become a major source of cost and schedule issues. A GAO evaluation of DoD test and evaluation processes concluded that "Several factors weaken the contribution testing and evaluation make, particularly early in the program. These include the disruptive effects of attempting to develop technology concurrently with the product; optimistic assumptions embedded in test plans; and the fact that testing and evaluation is not viewed or funded as being central to the success of the weapons system." A change in DoD Directive 3200.11 and the financial activities regulations may be necessary to provide incentives to program offices planning and funding testing and seeking relief from the rising cost of testing.

**The lack of adequate reliability testing** is a particular case of insufficient developmental testing. Evidence of insufficient development testing has been demonstrated, in cases where the data has been kept, by the high reliability failure rate of systems when they enter operational test. The National Research Council concluded in 1998, "The Department of Defense and the military services should give increased attention to their reliability, availability, and maintainability data collection and analysis procedures because deficiencies continue to be responsible for many of the current field problems and concerns about military readiness." This was serious enough that DOT&E asked the National Academy of Sciences to investigate further. The Academy produced two reports, one on reliability in general, and a second on software reliability, a separate and special problem deserving attention in its own right. They concluded reliability problems should be addressed in the design phase and include early-on testing starting with components. To accomplish this, contracts need to be tailored to allow the government access to component and subcomponent test data.

In addition, increased emphasis on hardware-in-the-loop testing could improve the process. Test facilities should include the capability to make such testing affordable, easy, and quick. Coupled with the reliability problem is the problem of insufficient maintainability testing. We should have a force of expert reliability engineers to allow for every test event to have a reliability component. Unfortunately, too often test events are planned without collection of reliability data. The National Academy report made two significant comments: the Department's reliability tracking methods are significantly out of date, and industry has found collection and analysis of data after the system has entered the market to be of significant benefit.

Early commitment to investment in embedded instrumentation will yield information returns throughout the life cycle of a program. New DoD acquisition strategies such as spiral development and evolutionary acquisition are built around the idea that the design is never finished since improvements are continuously introduced. In such situations, the need for continuous learning from testing is clear. With respect to reliability, we can say we test to learn and need continuous learning. This means we should have continuous, ongoing data collection and testing of all fielded equipment to learn where the next dollar of improvement could provide the greatest value in terms of performance. DoD should be prepared to continue to collect data on all systems even after the full-rate production decision is made.

For modern systems development, the configuration of the weapon is constantly subject to change. The Army helicopter community has tacitly agreed with this assessment and re-instituted the practice of "lead-the-fleet" testing. This is a useful process for many system types, not just helicopters. Our procurement contracts should include "lead-the-fleet" test articles.

**Inability to track and evaluate software** is the subject of a recent National Academy of Sciences report. The report suggested a number of improvements. The major impact will be on the need to hire software experts capable of evaluating software architectures and designs. In this area, the test facilities are critically deficient. Our testing infrastructure is designed around hardware; and increasingly, as evidenced in numerous programs, software is a critical development, integration, and performance-driving component.

**Insufficient prototypes and other test resources** have slowed the pace of testing and put pressure on program managers to drop tests. This was the tragic case with the V-22 testing as reported in the accident investigation, and contributes significantly to our desire to increase the tempo of testing and reduce the cost to programs so that program managers are not placed in a position where they are forced to choose between adequate testing, and cost or schedule. Existing legislation requires DOT&E to determine the number of LRIP items required for operational testing. More rigorous attention to the number of production representative items needed for testing, whether they be EMD or LRIP, might avoid problems with test schedules in the future. We have seen decisions to cut test assets to save money in the short-term result in long-term delays in the developmental test program.

**We must address the adequacy of our engineering workforce** and technical human resources. The proper way to do this is to begin to correct the demographics of the workforce so that it becomes more stable. Technical expertise is needed in a number of areas including flight safety, software, chemical and biological research, and mathematical and statistical analyses.

**Late and inadequate evaluation of training** is also a common problem. The Army has decided, tentatively, to try to reverse the process and insist that training systems actually precede the hardware/software. There are good systems engineering reasons for hoping that, by keeping training devices up front, what is built the first time is what the soldier will find most useful. This should be a general goal for all the Services.

**Encroachment on land, sea, and air space, as well as the frequency spectrum,** is a major problem. In the frequency spectrum, we will need to balance trying to do better in the bands that are left for us and, moving to bands that are of less commercial value. The problem is real; the ranges already delay tests because they do not have enough spectrum to run them simultaneously. The Department is addressing the general problem of encroachment under the rubric "Sustainable Ranges." Both testing and training ranges are affected, and the Under Secretary of Defense for Personnel and Readiness and I together share responsibility for that effort.

**Hardware/software integration** continues to be a significant problem and is getting worse as software-intensive systems become prevalent. Our ability to test systems-of-systems requires new methodologies and new infrastructure.

**A slow tempo of testing** increases the chances that programs that are driven by schedules will tend to forego sufficient testing and its associated learning. An industry test manager quoted in a study of commercial best practices for the Office of the USD(AT&L) expressed the conflict in commercial industry simply, "If something doesn't have to work, we can ship it tomorrow." In general, test avoidance only delays the recognition of problems and increases the cost to fix them. Increasing the tempo of testing involves increasing the resources for test execution, and the available means to move, share, and analyze data and improved test design. Many of the CTEIP activities begun in the last few years have this goal in mind. We also need to increase the number of personnel available to surge testing when that is necessary. This also means using common practices and procedures and interoperable equipment and instrumentation throughout our test facilities and ranges.

**Lack of interoperability of our weapons systems**, we are beginning to realize, begins with the basics. Individual test ranges typically have a Service-centered focus. If T&E ranges do not interoperate, chances are the systems will not either. Several of our test ranges have different and incompatible data collection formats, data rates, and telemetry systems. The CTEIP program has been working through its Foundation Initiative to improve inter-range interoperability. CTEIP and its Foundation Initiative played a key role in making *Millennium Challenge 02* a reality. It was the glue that held the exercise together by linking together the testing and training ranges and by linking the ranges back to the exercise control center. That inter-range interoperability should be extended. What is needed is a Joint Test & Evaluation Capability. The design and procurement of new instrumentation have to be harmonized and recognized as areas needing national focus. Common instrumentation that allows ranges to interoperate when needed also cuts the cost of modernization by leveraging larger buys. One trend that seems to be emerging and should be encouraged is the preference for mobile instrumentation, rather than fixed sites.

We must improve our data sharing and transmission capabilities. It now takes three to four days to transmit data from Kwajalein to the Continental United States (CONUS) for analysis. There are plans for improvement, but we need an order of magnitude improvement on that front. Data sharing will be key to range interoperability in the near term, linking test and training ranges. I hope to see both Kwajalein and the Atlantic Undersea Test and Evaluation Center (AUTEC) as leaders in this effort, in the process increasing the productivity of scientists, engineers, and developers at their home stations in Massachusetts, Rhode Island, and elsewhere in CONUS.

Acquisition strategies such as spiral development and evolutionary acquisition will require data archiving with a reliability for reuse that we have not seen before now. We should move to develop such a central repository.

The financial accounting system has to change. At present the main function of the accounting system is to trace where the money goes, not for what the money is spent. Thus it is possible to account for spending without knowing how much a test on a particular system costs or how to compare costs, if investment decisions have to be made. This year we asked the Inspector General to examine the records of the Major Range and Test Facilities. They concluded that it was impossible to compare costs from range-to-range because of differences in the accounting systems. The lack of visibility into actual test costs is a major concern. Fortunately visibility can be gained without putting disincentives in the way of the adequate funding of test programs. Visibility, which will be an essential ingredient in financial management, can be achieved by activity-based costing, which should be our principal financial model.

The Department has begun a five-year effort to modernize the cost accounting system. The effort, optimistically, will take until 2007. Legislation requires T&E to have such a common system in place by FY04-FY06. The goal of the system is to be able to account for the cost of tests so that Defense-wide investment strategies can be developed, and so that we can account for what testing is costing the taxpayer.

***Particular Test Capability Problems***

The generic needs discussed are not the only needs that can be identified. Particular systems and classes of systems have suffered, or will suffer, from limitations in the test ranges and facilities. These are addressed in the section on Resources. The significant changes needed in each warfare area are summarized in the table.

| WARFARE AREA | MAJOR NEEDS |
|---|---|
| Land Warfare Testing | Bigger ranges, "Joint" Instrumentation, Urban and Tropical Testing. |
| Air Warfare Testing | Real "Operational" Testing, Improved Electronic Warfare Testing, Targets, Hypersonics, Testing Before Deployment. |
| Surface Warfare and Air Defense | Self-Defense Test Ship, Targets, Range-Size. |
| Underwater Warfare | Shallow Water Test Capability, Realistic Targets. |
| C4ISR Testing | Information Assurance and Interoperability Methodologies. |
| Space Program Testing | A Space Test Range. |
| Missile Defense Testing | Methodologies and Evaluation Plans, Integrating into the rest of the Infrastructure, Directed Energy Testing. |
| Chemical-Biological Testing | Test facilities and Methodologies, Government Personnel and Expertise. |

## CONCLUSION

We must re-examine our T&E policies, processes, and capabilities if we are to meet the challenges of transforming the U.S. military. We must keep what works, discard what does not, and remain flexible in adapting to new requirements. We cannot accomplish this without a corporate approach to policies, processes, and investment priorities. The plan to do the things we have discussed is not business-as-usual.

The T&E infrastructure needs modernization and repair. The backlog in maintenance and repair will ultimately affect our ability to test adequately. This year has seen weapons deployed without adequate testing due to the pressures of war, and we see these pressures continuing. To respond effectively, we must modernize our T&E infrastructure.

Last year we got agreement on specific investments for selected test programs. In general, the Service-proposed FY04 budgets for the T&E infrastructure appear to be higher this year than last. All this is good, but further increases will be required to meet the recommendations accepted by the Deputy Secretary. The Department needs a more comprehensive approach, harmonized among the test facilities and the Services - a comprehensive approach that looks beyond the crisis of the next program milestone.

# DIRECTOR'S INTRODUCTION

DoD is transforming to meet the dynamic operational requirements of the war on terrorism as well as future high-technology conflict. This transformation is not limited to new hardware and technological innovation. It also involves transforming our capabilities through operational innovation. The future T&E infrastructure should comprise a comprehensive suite of joint, interoperable capabilities that provide a spectrum of full and realistic opportunities to test new technologies, improved platforms, and innovative tactics and training methods. We face a strong challenge to recruit and retain personnel, define and implement innovative T&E processes, maintain and recapitalize an adequate T&E infrastructure, and transform our capabilities to meet the demands of the future.

Thomas P. Christie
Director

# TABLE OF CONTENTS

Click on a title to go to that page.

## DOT&E Activity and Oversight



## DoD Programs



## Army Programs

# TABLE OF CONTENTS

Click on a title to go to that page.



## Navy Programs

# TABLE OF CONTENTS

Click on a title to go to that page.



## Air Force Programs

# TABLE OF CONTENTS

Click on a title to go to that page.

Click on a title to go to that page.

**DOT&E Activity and Oversight**

# DOT&E Activity and Oversight

# DOT&E ACTIVITY SUMMARY

DOT&E activity for FY02 involved oversight of 213 programs, including 21 major automated information systems. Oversight activity begins with the early acquisition milestones, continues through approval for full-rate production and, in some instances, during full production until deleted from the DOT&E oversight list.

Our review of test planning activities for FY02 included approval of 34 Test and Evaluation Master Plans (TEMPs), as well as 40 Operational Test Plans. Live Fire Test and Evaluation (LFT&E) activity included the approval of 9 LFT&E Strategies and Test Plans for inclusion in the TEMPs. In FY02 through January 31, 2003, DOT&E prepared 9 reports for the Secretary of Defense and Congress.

DOT&E also prepared and submitted numerous reports to the Defense Acquisition Board (DAB) principals for consideration in DAB deliberations.

## TEST AND EVALUATION MASTER PLANS APPROVED

AN/SPY-1D(V) Radar System

Battlefield Combat Identification System (BCIS)

Bradley Fighting Vehicle System-A3

Business Systems Modernization (BSM)

C-5 Modernization Program

CH-47F

Composite Health Care System II (CHCS II)

DDG 51 Guided Missile Destroyer (Rev 9)

Defense Medical Logistics Standard Support (DMLSS) Automated Information System (AIS)

Defense Message System (DMS) Capstone

Defense Message System (DMS) Revised Capstone

DoD Teleport

F/A-18 MIDS-LVT Integration Annex A

Family of Medium Tactical Vehicles (FMTV)

Joint Air-to-Surface Standoff Missile (JASSM) LRIP (Change 4)

Joint Primary Aircraft Training System (JPATS) MOT&E

Joint Strike Fighter (JSF)

Joint Tactical Radio System-Cluster 1

Large Aircraft Infrared Countermeasure System (LAIRCM)

MH-53E Airborne Mine Neutralization System (AMNS)

MH-60S (Change One)

Multifunctional Information Distribution System (MIDS-LVT(2)) (Rev A) JTEMP

Multiple Launch Rocket System (MLRS) M270A1 Launcher Program

Navstar Modernization Global Positioning Satellite

Navy Marine Corps Intranet (NMCI) (TESP)

PATRIOT Advanced Capability 3 (PAC-3)

Pine Bluff Chemical Agent Disposal Facility, Chemical Demilitarization Program

Shadow 200 Tactical Unmanned Aerial Vehicle (TUAV)

Standoff Land Attack Missile-Expanded Response (SLAM-ER)

Theater Battle Management Core Systems (TBMCS) Post Core Program

Tomahawk Weapon System

Transportation Coordinators' Automated Information for Movement System II (TC-AIMS II)

UH-60M Black Hawk Utility Helicopter

V-22 Osprey

## OPERATIONAL TEST PLANS APPROVED

Advanced Mission Computer and Displays (AMC&D) (OT-IIA-1)

AGM-154A Joint Standoff Weapon System (JSOW) (OT-IIIA) FOT&E

AIM-9X Weapon System Program (OT-IIB)

Amphibious Personnel Dock Ship Program (LPD 17) (OT-IIB)

AN/BQQ-10V Submarine Sonar System (OT-IID2)

AN/BSY-1 High Frequency Upgrade Submarine Sonar System (OT-IIB)

Auxiliary Cargo and Ammunition Ship (T-AKE) Program (OT-IIA)

B-1B Conventional Mission Update Program (CMUP) Block E IOT&E

Composite Health Care System II (CHCS II) Release 1 EDP

DDG 51 Flight IIA Class Guided Missile Destroyer (OT-IIIF)

DDG 51 Flight IIA Destroyer FOT&E (OT-IIIE)

Defense Medical Logistics Standard Support (DMLSS) Automated Information System (AIS) Release 3.01

Department of Defense Advanced Automation System (DAAS) / Digital Airport Surveillance Radar (DASR) MOT&E II

Department of Defense (DoD) Teleport System OA

Extremely High Frequency (EHF) Satellite Communication Program (NESP)

F/A-18E/F Positive Identification System (PIDS)

Force XXI Battle Command, Brigade and Below (FBCB2) and Integrated Systems Control (ISYSCON) EDP

Future Aircraft Carrier Program (CVNX) Change 1 EOA

Joint Air-to-Surface Standoff Missile (JASSM) IOT&E

Joint Biological Point Detection System

Joint Computer-Aided Acquisition and Logistics Support (JCALS) System SEP/EDP

Joint Direct Attack Munitions (JDAM) QRA

Joint Mission Planning System (JMPS) OA

Joint Primary Aircraft Training System (JPATS) MOT&E

Joint Service Lightweight Nuclear Biological Chemical Reconnaissance System (JSLNBCRS) EDP

Large Aircraft Infrared Countermeasure System (LAIRCM) OA

Medium Armored Vehicle

MH-60S OPEVAL (OT-IIB)

Milstar II Satellite Communications System MOT&E

Multifunctional Information Distribution System Low Volume Terminal 2 (MIDS-LVT-2) EDP

Navy Marine Corps Intranet (NMCI) (OT-IIA)

Navy Standard Integrated Personnel System (NSIPS) (OT-IIC)

Patriot Advanced Capability-3, Configuration-3 IOT&E EDP

Patriot Advanced Capability-3, Configuration-3 IOT&E EDP - Flight Testing

Reserve Component Automation System (RCAS) SEP/EDP

Test Plan Serial 1200/0224-01

Tomahawk Command and Control System

Transportation Coordinators'-Automated Information for Movement System II (TC-AIMS II) SEP/EDP

Virginia (SSN 774) Class Submarine OT-IIB

XM142 High Mobility Artillery Rocket System Extended System Integration Test

# DOT&E ACTIVITY AND OVERSIGHT

### LFT&E STRATEGIES AND TEST PLANS APPROVED

C-130 Avionics Modernization Program (AMP)
Alt LFT&E Plan

Joint Air-to-Surface Standoff Missile (JASSM) (OT-1)
LFT&E Plan

Joint Air-to-Surface Standoff Missile (JASSM) DT-6
LFT&E Plan

Joint Air-to-Surface Standoff Missile (JASSM) DT-7
LFT&E Plan

Joint Air-to-Surface Standoff Missile (JASSM) OT-3
LFT&E Plan

Line-of-Sight Antitank Weapon LFT - Request to Delete the Explosively Formed Penetrator Shot

M829E3 Phase III Live Fire Lethality Test DTP

SSGN

Stryker Family of Vehicles LFT&E EDP

### REPORTS TO CONGRESS FOR FY02 THROUGH JANUARY 31, 2003

Predator Medium Altitude Endurance UAV
OT&E Report October 01

Joint Primary Aircraft Training System: T-6A Aircraft
OT&E Report November 01

Cooperative Engagement Capability (CEC)
OT&E Report February 02

Sensor Fuzed Weapon (SFW P3I)
LFT&E Report March 02

Advanced Medium Range Air-to-Air (AMRAAM)
LFT&E Report March 02

MLRS M270A1 Launcher
OT&E Report April 02

MH-60S Fleet Combat Support Helicopter
Combined OT&E / LFT&E Report August 02

Patriot Advanced Capability-3 (PAC-3) Block 2002 System
Combined OT&E / LFT&E Report October 02

Shadow 200 Tactical UAV
OT&E Report December 02

During FY02, DOT&E met with Service operational test agencies, program officials, private-sector organizations, and academia; monitored test activities; and provided information to the DAB committees as well as the DAB principals, the Secretary and Deputy Secretary of Defense, the Under Secretary of Defense (Acquisition, Technology and Logistics), the Service Secretaries, and Congress. Active on-site participation in, and observation of, tests and test-related activities remain the most effective tools. In addition to on-site participation and local travel within the national capital region, approximately 675 trips supported the DOT&E mission.

Security considerations preclude identifying classified programs in this report. The objective, however, is to ensure operational effectiveness and suitability do not suffer due to extraordinary security constraints imposed on those programs.

# DOT&E PROGRAM OVERSIGHT

DOT&E is responsible for approving the adequacy of plans for operational test and evaluation and for reporting the operational test results for all major defense acquisition programs to the Secretary of Defense, Under Secretary of Defense (Acquisition, Technology and Logistics), Service Secretaries, and Congress. For DOT&E oversight purposes, major defense acquisition programs were defined in the law to mean those programs meeting the criteria for reporting under section 2430, title 10, United States Code (Selected Acquisition Reports (SARs)). The law (sec.139(a)(2)(B)) also stipulates that DOT&E may designate any other programs for the purpose of oversight, review, and reporting. With the addition of such "non-major" programs, DOT&E was responsible for oversight of a total of 213 acquisition programs during FY02.

Non-major programs are selected for DOT&E oversight after careful consideration of the relative importance of the individual program. In determining non-SAR systems for oversight, consideration is given to one or more of the following essential elements:

- Congress or OSD agencies have expressed a high level of interest in the program.
- Congress has directed that DOT&E assess or report on the program as a condition for progress or production.
- The program requires joint or multi-Service testing (the law (sec. 139(b)(4)) requires the DOT&E to coordinate "testing conducted jointly by more than one military department or defense agency").
- The program exceeds or has the potential to exceed the dollar threshold definition of a major program according to DoD 5000.1, but does not appear on the current SAR list (e.g., highly classified systems).
- The program has a close relationship to or is a key component of a major program.
- The program is an existing system undergoing major modification.
- The program was previously a SAR program and operational testing is not yet complete.

This office is also responsible for the oversight of LFT&E programs, in accordance with 10 USC 139. DoD regulation uses the term "covered system" to include all categories of systems or programs identified in 10 USC 2366 as requiring live fire test and evaluation. In addition, systems or programs that do not have acquisition points referenced in 10 USC 2366, but otherwise meet the statutory criteria, are considered "covered systems" for the purpose of DOT&E oversight.

A covered system, for the purpose of oversight for LFT&E, has been determined by DOT&E to meet one or more of the following criteria:

- A major system, within the meaning of that term in 10 USC 2302(5), that is:
  - User-occupied and designed to provide some degree of protection to the system or its occupants in combat.
  - A conventional munitions program or missile program.
- A conventional munitions program for which more than 1,000,000 rounds are planned to be acquired.
- A modification to a covered system that is likely to affect significantly the survivability or lethality of such a system.

DOT&E was responsible for the oversight of 86 LFT&E acquisition programs during FY02.

# DOT&E ACTIVITY AND OVERSIGHT

## PROGRAMS UNDER DOT&E OVERSIGHT FISCAL YEAR 2002
(As taken from the April 2002 Official T&E Oversight List)

### ARMY PROGRAMS

Advanced Field Artillery Tactical Data System (AFATDS)

Aerial Common Sensor (ACS)

Air and Missile Defense Planning And Control System (AMDPCS)

All Source Analysis System (ASAS)

AN/TPQ-47 Counterfire Radar

Army Tactical Missile System Block II / Brilliant Anti-Armor (ATACMS/BAT) And ATACMS Block II / P3I BAT

Battlefield Command Information System (BCIS)

CH-47F Improved Cargo Helicopter Upgrade

Chemical Demilitarization

Comanche (RAH-66) (Includes 20mm Ammunition)

Combat Service Support Control System (CSSCS)

Common Missile

Crusader

Distributed Common Ground System (DCGS) - Army

Excalibur (155mm Round)

Family of Medium Tactical Vehicles (FMTV)

Force XXI Battle Command Brigade & Below (FBCB2)

Forward Area Air Defense System (FAADS) Command, Control, and Intelligence (C2I) - Includes GBS

Future Combat System

Future Scout/Calvary System

Global Command and Control System - Army (GCCS-A)

High Mobility Artillery Rocket System (HIMARS)

Integrated System Control (ISYSCON V4)

Interim Armored Vehicle (IAV) - Includes NBC Reconnaissance Vehicle

Javelin Anti-Tank Missile

Joint Computer-Aided Acquisition and Logistical Support (JCALS)

Joint Land Attack Cruise Missile Defense Elevated Netted Sensor (JLENS)

Joint Simulation System (JSIMS)

Joint Tactical Radio System (JTRS)

Kiowa Warrior (OH-58D)

Land Warrior

Line-of-Sight Anti-Tank Missile (LOSAT)

Longbow Apache (AH-64D)

Longbow Hellfire Missile (Upgrades/Modifications)

M1A2 Abrams Upgrade

M2/M3 Bradley Upgrade

M270A1 Multiple Launch Rocket System (MLRS) Upgrade

M829E3 (120mm Round)

Maneuver Control System (MCS)

Multiple Launch Rocket System Guided Rocket (GMLRS)

Objective Crew Served Weapon System (OCSWS)

Objective Individual Combat Weapon System (OICWS)

Reserve Component Automation System (RCAS)

Secure Mobile Anti-Jam Reliable Tactical Terminal (SMART-T)

Sense and Destroy Armor (SADARM)

Sensor Fuzed Muniton

Single Channel Anti-Jam Man-Portable (SCAMP) (MILSTAR, Block II)

Stinger Re-Programmable Microprocessor Missile (RMP)

Suite of Integrated Infrared Countermeasures / Common Missile Warning System to Include Advanced Threat Countermeasures (SIIRCM/CMWS)

Suite of Integrated Radio Frequency Countermeasures (SIRFC) (AN/ALQ-211)

Tactical Unmanned Aerial Vehicle (TUAV)

Tow-Fire & Forget Anti-Tank Missile

Transportion Coordinator Automated Information Movement System II (TC-AIMS II)

UH-60M Black Hawk - All Upgrades

Warfighter Information Network-Terrestrial (WIN-T)

Wide Area Munition (WAM) - Advanced Hornet

## NAVY PROGRAMS

Acoustic Rapid Cots Insertion for Sonar

Advanced Amphibious Assault Vehicle (AAAV)-Includes 30mm Ammunition

Advanced Integrated Electronic Warfare System (AIEWS)

Advanced Land Attack Missile (ALAM)

Advanced Seal Delivery System (ASDA)

Aim-9x Sidewinder (Short Range Air-to-Air Missile Upgrade)

Air Early Warning (AEW)

Airborne Mine Neutralization System / Rapid Airborne Mine Clearance System (AMNS/RAMICS)

Amphibious Helicopter - Assault (Replacement) (LHA(R)) Ship Class

Amphibious Helicopter - Dock (LHD) Ship Class

Amphibious Personnel - Dock (LPD-17) Ship Class-Includes 30mm Ammunition

AN/AAR-47 V2 Upgrade Missile / Laser Warning Receiver

AN/ALR-67 Advanced Special Receiver (ASR) V2 & V3

AN/APR-39A V2 Radar Warning Receiver

AN/SPY-1 B/D (All Versions)

Auxillary Cargo / Ammunition Ship Class (T-AKE)

Cooperative Engagement Capability (CEC)

Cruiser Conversion

CVN-68 Class

CVN-77 Warfare System

CVNX Class

DD(X) Land Attack Destroyer

DDG-51 Destroyer (All Variants)

Defense Integrated Military Human Resources System (DIMHRS)

E-2C Hawkeye

EA-6B Improved Capabilities (ICAP) III & Multiple Upgrades (Low Band Transmitter, Band 7-8 Transmitter, USQ-113 Communications Jammer)

Evolved Sea Sparrow Missile (ESSM)

Extended Range Guided Munition (ERGM)

F/A-18 E/F AESA

F/A-18 E/F Super Hornet (All Upgrades)

Fixed Distributed System / Advanced Deployable System (FDS/ADS)

Global Command and Control System (GCCS) (Maritime)

Integrated Defensive Electronic Countermeasure (IDECM)

Integrated Surface Ship ASW Combat System (AN/SQQ-89)

Joint Command and Control Capability (JCC(X)) Ship Class

Joint Mission Planning System (JMPS)

Joint Standoff Weapon (JSOW) Baseline (AGM-154 JSOW A)

Joint Standoff Weapon (JSOW) Blu-108 (AGM-154 JSOW B)

Joint Standoff Weapon (JSOW) Unitary (AGM-154 JSOW C)

Joint Strike Fighter (JSF) - Includes 27mm Ammunition

KC-130J Aircraft

Maritime Prepositioning Force (Future)

MH-60R Helicopter

MH-60S Helicopter

Mk-48 MODS ADCAP

Mobile User Objective System (MUOS)

Multifunction Information Distribution System - Low Volume Terminal (MIDS-LVT) (All Variants)

Multi-Mission Maritime Aircraft (MMA)

Navy EHF Satcom Program (NESP)

Navy Standard Integrated Personnel System (NSIPS)

Navy-Marine Corps Intranet (NMCI)

Quick Reaction Combat Capability / Ship Self Defense System (QRCC/SSDS)

Rolling Airframe Missile (RAM)

SSGN-26 Ohio Class Conversion

SSN-21 Seawolf / AN/BSY-2

## NAVY PROGRAMS (continued)

SSN-23 Jimmy Carter

SSN-774 Virginia Class

Standard Missile-2 (SM-2) (Block IV)

Standard Missile-2 (SM-2) (Blocks III/III A&B)

Standoff Land Attack Missile - Expanded Response (SLAM-ER)

Strategic Sealift Program (SSP) Ship Class

Sub Comms (SUBSECS)

Surveillance Towed Array Sensor System (SURTASS) / Low Frequency Active (LFA)

T-45Ts

Tactical Aircraft Mission Planning System (TAMPS)

Tactical Control System (TCS)

Tactical Tomahawk Missile

Tactical Tomahawk Mission Planning System / Tomahawk Command & Control System (MPS/TCCS)

Trident II Missile

Ultra High Frequency (UHF) Follow-On Satellite

Unmanned Combat Aerial Vehicle - Navy

USMC H1 Upgrade

V-22 Osprey

Vertical Take-Off Unmanned Aerial Vehicle (VTUAV) Mission

## AIR FORCE PROGRAMS

Advanced EHF (AEHF)

Advanced Medium Range Air-to-Air Missile (AIM-120) (AMRAAM)

Advanced Wide Band System

ALR-56M Radar Warning Receiver

ALR-69 Radar Warning Receiver

B-1B CMUP/Computer Upgrade Block E

B-1B CMUP/DSUP(Defensive Systems Upgrade Program)

B-1B Conventional Munitions Upgrade (CMUP) All Upgrades

B-2A Spirit

C-130 Avionics Modernization Program (AMP)

C-130J All Variants

C-17A/C-17A Upgrades

C-5 Avionics Modernization Program (AMP)

C-5 Reliability And Re-Engineering Program (RERP)

Combat Search & Rescue Replacement (CSAR)

Combat Survivor Evader Locator (CSEL)

Defense Civilian Personnel Data System (DCPDS)

Defense Meteorological Satellite System (DMSS)

Distributed Common Ground System - Air Force (DCGS-AF)

E-3A Airborne Warning and Control System (AWACS)

Evolved Expendable Launch Vehicle (EELV)

F-15 Tactical Electronic Warfare Suite (TEWS) (AN/ALQ-135 Band 1.5 Fiber-Optic Towed Decoy)

F-22 Raptor

Global Broadcast System (GBS)

Global Combat Support System - Air Force (GCSS-Af)

Global Command and Control System - Air Force (GCCS-AF) - Theater Battle Management Core System (TBMCS) - Air Operations Center - Weapons System (AOCWS)

Global Hawk Unmanned Aerial Vehicle (UAV)

Global Transportation Network-21 (GTN-21)

Integrated Log System-Supply (ILS-S)

Integrated Maintenance Data System (IMDS)

Joint Air-Surface Standoff Missile (JASSM)

Joint Direct Attack Munition (JDAM) 500 Lbs

Joint Direct Attack Munitions (JDAM) 1000 & 2000 lbs

## AIR FORCE PROGRAMS (continued)

Joint Helmet Mounted Queing System (JHMCS)

Joint Precision Approach and Landing System (JPALS)

Joint Primary Training System (JPATS)

Joint Surveillance Target Attack Radar System (JSTARS) (E-8C)

KC-135 Global Air Traffic Management (GATM) Upgrade

Large Aircraft Infrared Countermeasures (LAIRCM)

Milstar (Satellite Low/Med Data Rate Communications)

Minuteman III Guidance Replacement Program (GRP) Phase I

Minuteman III Propulsion Replacement Program (PRP)

Multi-Platform Radar Technology Insertion Program (MP-RTIP)

Multiple Platform - Common Data Link (MP-CDL)

National Airspace System (NAS)

National Polar-Orbiting Operational Environment Satellite (NPOESS)

Navstar Global Positioning System (GPS)

Predator Unmanned Aerial Vehicle (UAV)

Sensor Fuzed Weapon (SFW) P3I (CBU-97/B)

Small Diameter Bomb (SDB)

Space-Based Infrared System-High (SBIRS-H)
Titan IV

Unmanned Combat Aerial Vehicle - Air Force

Wideband Gapfiller Satellite (WGS)

## DoD PROGRAMS

Artemis (Chemical Agent Standoff Detection System)

Ballistic Missile Defense Program

Business System Modernization (BSM)

Composite Health Care System II (CHCS II)

Corporate Executive Information System (CEIS)

Defense Joint Accounting System (DJAS)

Defense Medical Logistics Standard Support (DMLSS)

Defense Message System (DMS)

Defense Procurement Payment System (DPPS)

DFAS Corporate Database/Warehouse (DCD/DCW)

Fuels Automated System (FAS)

Global Command and Control System (GCCS) - Joint

Ground Based Midcourse Defense Segment

Joint Biological Point Detection System

Joint Biological Stand-Off Detection System

Joint Chemical Agent Detector

Joint Service Light NBC Reconnaissance

Joint Service Lightweight Standoff Chemical Agent Detector

Joint Warning & Reporting Network

Medium Extended Air Defense System (MEADS)

Patriot Advanced Capability-3 (PAC-3) Missile

Sea Based Midcourse Defense Segment

Space-Based Infrared System-Low (SBIRS-L)

Space-Based Laser

Standard Procurement System (SPS)

Teleport

Theater High-Altitude Area Defense (THAAD) / GBR

Theater Medical Information Program (TMIP)

Yal-1 Airborne Laser (ABL)

Click on a title to go to that page.

## DoD Programs

# DoD Programs

# BALLISTIC MISSILE DEFENSE SYSTEM (BMDS)

## BACKGROUND

In January 2002, the Secretary of Defense created the Missile Defense Agency (MDA) and consolidated the ballistic missile defense programs under the new agency. The rationale behind this decision was the creation of a comprehensive, integrated Ballistic Missile Defense System (BMDS) that provides a layered defense capable of countering threat missiles in all phases of flight. Former missile defense acquisition programs are now referred to as BMDS elements. Leading up to this restructure, DOT&E oversight of program activity was very limited. However, involvement in the planning, observation, and evaluation of documentation and test events improved significantly throughout 2002. With the exception of PAC-3, which is in the process of being transitioned to the Army, all of the BMDS elements are in a Research and Development Test and Evaluation phase.

MDA has adopted a capability-based acquisition strategy with 2-year development blocks. Technical goals and objectives for each block are based on promising new technologies, progress in the development of BMDS elements, and estimates of current and future threat capabilities. These blocks provide manageable development increments and opportunities to fielding capabilities as they mature. Critical assessments of military utility and operational effectiveness, suitability, and survivability will accompany each block decision. While developmental goals will be based on broad classes of missions and threat characteristics, operational assessments of a block's demonstrated capabilities will be based on more specific missions and threats.

The Secretary established a Department goal to develop a layered BMDS capable of defending the United States, deployed forces, allies, and friends using prototypes and test assets to provide early capability, if necessary. DOT&E is responsible for providing advice to the Director, MDA on his goals and objectives for the BMDS. Due to the restructuring, detailed goals and objectives were not available in FY02, but the MDA provided information on their evolving plans for the test bed architecture, element research plans, and management strategy. MDA very recently provided their proposed Technical Goals and Objectives for review and comment. These goals and objectives outline the components and layered systems that are planned for the Block 2004 test bed. These plans also extend to the Block 2006 test bed configuration. Given their preliminary nature and the time available to review these plans prior to this report, the capability that each element may contribute to the test bed will be discussed separately, recognizing the intent to demonstrate an integrated layered defense in the future. The test bed approach answers some aspects of long standing criticism regarding a lack of flight test and system integration realism. Currently the planned test bed infrastructure for Block 2004 includes hardware and software components that are in active development. As the test bed matures and capabilities are demonstrated, an inherent defensive capability will develop. However, it will be very difficult to estimate operational availability or performance in real engagement conditions. This is a test bed, first and foremost.

MDA has established corporate activities for characterizing threat capabilities, building targets and countermeasures, and studying system lethality. These initiatives, as well as the major BMDS elements, are discussed in the following unclassified summary. More detailed discussions are available in a classified report to Congress.

## THREAT BALLISTIC MISSILES

MDA is preparing an Adversary Capabilities Document that describes the threat missiles typically identified in a System Threat Assessment Report. The Adversary Capabilities Document will emphasize performance characteristics that describe threat capabilities, accounting for uncertainty in intelligence data and threat evolution. This will facilitate the evaluation of system performance against a range of threat characteristics relevant to the intended defeat mechanisms. For example, missile body construction, rocket motor internals, and fuel type are threat characteristics that will demonstrate BMDS effectiveness when employing a laser weapon, while the effectiveness of a direct hit interceptor will depend much more heavily on threat trajectory, decoys, or terminal maneuvers.

**TARGETS**

The target development program is designing targets that can emulate the physical and flight characteristics of a broad range of threats. Since detailed targets which are representative of an actual threat are extremely expensive and prone to changing intelligence estimates, a robust, versatile set of targets is needed. Limitations on test ranges, practical limits on program budgets, uncertainties in the threat, and the enormous variety of conditions under which a system may be employed, require that hardware-in-the-loop facilities, models, and simulations be used to extend understanding of system performance against various threats. Test targets that can be flown in a variety of modes are an important aspect of sensitivity assessments that validate the models and simulations used to predict missile system performance.

**LETHALITY**

Lethality has long been defined at intercept. Kill criteria have been based on destroying the lethal payload, dismembering the warhead or rendering the payload inert, or damaging the aeroshell sufficiently to prevent the threat missile from hitting its intended target. When the intended target of the threat missile is an area populated with allied soldiers or civilians, the suitability of these criteria is questionable, since they do not address residual effects on the ground due to an intercept. The technical challenges to estimating these effects are substantial, and are proving very difficult. The MDA lethality program is pursuing research activities to characterize impact damage, evaluate agent response to impact and aerodynamic forces, and examine the transport mechanisms that deliver residual agents to the ground. Over the years, DOT&E has encouraged research to better understand ground effects and will continue to follow developments to assure that kill assessment methodology is updated and consistently integrated into an operational context.

**ASSESSMENTS OF BMDS ELEMENTS**

The BMDS elements have made progress this year in one or more of four areas: flight tests, system ground tests, component ground tests, or system definition. The following sections briefly discuss the major BMDS elements. More detail is included in our classified report to Congress.

**GROUND-BASED MIDCOURSE DEFENSE**

The Ground-Based Midcourse Defense (GMD) element mission is to defend the United States against a limited strike of Intercontinental Ballistic Missiles (ICBMs) from rogue nations, and unauthorized or accidental launches from nations with existing nuclear weapons. The GMD element is an integrated collection of components that perform dedicated functions during an ICBM engagement. As planned, the GMD element includes the following subsystems:

- GMD Battle Management, Command and Control and communications network
- In-Flight Interceptor Communications System
- Long-range sensors, including Upgraded Early Warning Radars and a sea-based X-Band Radar
- Ground Based Interceptors emplacements, consisting of a silo-based ICBM-class booster motor stack and the Exoatmospheric Kill Vehicle. The President's announced plan for the 2004 Test Bed plan places six Ground Based Interceptors at Fort Greely, Alaska, and four at Vandenberg Air Force Base, California. In 2005, plans are to place ten more at Fort Greely.

GMD plans to interface with other BMDS elements and existing systems through external system interfaces. Through FY06, these plans include GMD interfacing with the Cobra Dane radar, SPY-1B radars on Aegis ships, and Satellite-based sensors in the existing Defense Support Program.

In FY02, the GMD program continued to demonstrate the technical feasibility of intercepting a "bullet with a bullet" against simple target complexes. However, due to the stage of development and the following testing limitations, the GMD element has yet to demonstrate significant operational capability. The GMD test program in FY02 has suffered from the lack of production representative test articles and test infrastructure limitations. It is noteworthy, however, that these limitations are not the result of conscious decisions to minimize the test program, but result from an effort to gain early insight into system design at a reasonable pace and cost. The GMD program is taking a slower, more deliberate approach to testing to reduce both testing and program risk. This approach essentially responds to the "rush to failure" criticism received from the Welch Panel. It is also a sound engineering approach for maturing both the system design and test infrastructure. GMD is addressing these limitations as the 2004 GMD Test Bed is defined. Highlighted limitations are described in Table I below.

**Table I. Major GMD Test Limitations and MDA Mitigation Plans**

| Limitation | Comments | MDA Mitigation Plan |
|---|---|---|
| Lack of a deployable boost vehicle | A deployable boost vehicle has yet to be developed. Integrated flight tests have used boost vehicles with lower burnout velocity and agility. Intercepts have been achieved in a small region of the threat engagement space. | Two boost vehicles are under development. Initial flight testing of both vehicles is scheduled for FY03. |
| Lack of a realistically placed midcourse sensor | The GMD test radar is collocated at the interceptor launch site. The FPQ-14 radar, a non-deployable asset, which tracks a transmitter located on the test target, currently accomplishes the midcourse tracking and discrimination functions. | Development of a mobile, sea-based radar is planned. GMD has scheduled incorporation of this radar into the GMD Test Bed in the post-2005 time frame. |
| Fixed intercept point | All of the flight tests have similar flyout and engagement parameters. This limitation includes range constraints and a requirement not to create space debris. | The 2004 Test Bed will expand the range of flyout and engagement conditions. Space debris creation remains a problem.[a] |

[a] This constraint continues to force an unrealistic engagement at relatively low altitudes and with both the target and interceptor velocities directed downward.

The flight test agenda for FY02 was intended to further validate the "hit-to-kill" concept for ICBM defense. To provide more confidence in the concept, MDA planned Integrated Flight Test (IFT)-7 to be identical to the previously successful IFT-6. Also, IFT-8 was nearly identical to IFT-7, with the exception of additional balloons in the target complex. These balloons were not intended to be representative of actual countermeasures, but to increase the number of objects to be tracked, without over-stressing the ground sensor or kill vehicle discrimination capabilities.

In early FY03, GMD executed IFT-9 and IFT-10. IFT-9 had the same engagement parameters as IFT-8 with a slightly different, but still simple, target complex. Additionally, an Aegis SPY-1 radar participated as an associated operation to gather data for more active roles in future flight tests. IFT-9 successfully intercepted the reentry vehicle. In December 2002, GMD attempted a night intercept on IFT-10. The Exoatmospheric Kill Vehicle failed to separate from the surrogate test booster and could not be guided to the target. Failure analysis for this event is ongoing. The Airborne Laser prototype aircraft participated and successfully tracked the target with its passive infrared sensor.

The Program Office has suspended intercept flight-testing until the two developmental tactical boosters have been successfully tested during IFT-13a and IFT-13b. Intercept flight tests, IFT-11 and IFT-12, have been eliminated from the schedule. IFT-14 will be the next intercept attempt and will accommodate IFT-10 and IFT-11 test objectives. This decision is reasonable given the increased risk of surrogate booster failure, the resources that would have to be diverted from tactical booster development to fix the problems, and the limited amount of additional information would be gained in IFT-10 and IFT-11 over that available from previous flight tests.

MDA must successfully complete planned developments to build and deploy the 2004 Test Bed so it is available to support integrated system level testing that will verify the adequacy of the GMD system design and demonstrate its limited operational capability in the case it is needed for emergency defense. Three critical developments include: a deployable boost vehicle, demonstrated and integrated with the kill vehicle; a midcourse sensor to provide adequate real-time track and classification capabilities to support an engagement; and kill vehicle discrimination and homing at higher closing velocities and against targets with signatures, countermeasures and flight dynamics more closely matching the threat. Threat likeness should consider infrared and radar signatures, tumbling targets, and off-nominal target complex deployments. Test design should reflect the operators' imperfect knowledge of the characteristics of the threat. In addition, testing must demonstrate all necessary communications and interfaces with external systems. Testing should go beyond the typical proof-of-concept demonstrations in order to provide a higher confidence in estimates of operational capability.

The planned GMD 2004 Test Bed program is expected to accomplish some of these objectives. Key exceptions are demonstrating kill vehicle performance in the absence of detailed foreknowledge of target characteristics and against tumbling or off-nominally deployed targets. Given the uncertainty of the threat, it is unclear that the target signatures will be consistent with the threat when fielded.

### AEGIS BALLISTIC MISSILE DEFENSE

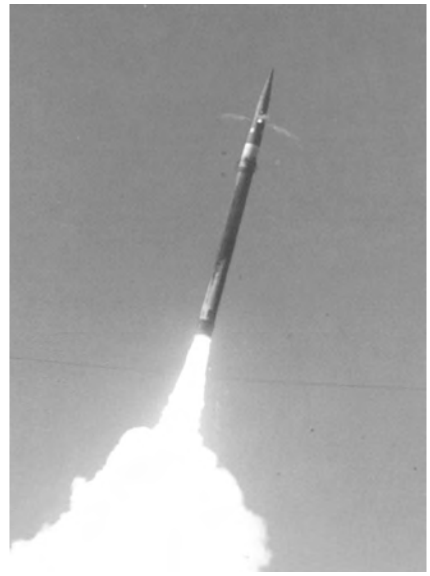
The Aegis Ballistic Missile Defense (Aegis BMD) element is intended to provide U.S. Navy surface combatants with the capability to defeat short, medium, and long-range ballistic missiles during exoatmospheric flight. Ultimately, the Aegis BMD system is intended to act in concert with other boost, midcourse, and terminal defensive elements of the BMDS.

The Aegis BMD test strategy through FY02 has been commensurate with the early maturity level of the system. Flight test engagement scenarios have been simplistic and limited to establishing the hit-to-kill proof-of-concept, and flight qualifying non-legacy hardware and software components of the Aegis BMD system. The ground test program on the solid-fuel divert attitude control system has demonstrated good performance using a simpler, more producible monolithic design. These ground test results support the planned transition to flight-testing with a fully capable divert system. Lethality ground testing to date has established an important collection of data for assessing the lethality of an intercept event.

All three intercept shots (Flight Missions-2, 3, and 4) in 2002 were successful, with Flight Mission 4 demonstrating an ascent phase intercept. The flight test engagement geometries, scenarios, and timelines were non-stressing. These missions employed a simplified divert system design that has demonstrated sufficient agility to intercept at the target mid-body. A more sophisticated divert system, capable of multiple divert pulses, is under development and must be integrated into the system before engagement of the target warhead section is possible. Prior to Flight Mission-4, test targets were not threat-representative in trajectory and pointing attitude, employing a lofted trajectory and a constant target aspect angle that increased the target radar cross section as viewed from the ship. For Flight Mission-4, the target was representative in both trajectory and signature. Flight tests have used unitary targets, with no intercept attempts against more stressing separating targets. Flight tests against separating threats, or threats that employ countermeasures, are required to fully assess the discrimination and designation capability of Aegis BMD. These test limitations will be addressed as the Aegis BMD program matures and the test program becomes more challenging.

Since these firings have been from functional, fully manned, operational ships, this system could be employed in an emergency with limited expectation of success. There are significant capabilities yet to be demonstrated before the engagement conditions can be considered operationally realistic.

### THEATER HIGH ALTITUDE AREA DEFENSE



The Theater High Altitude Area Defense (THAAD) is a mobile ground-based missile defense element designed to protect forward-deployed military forces, population centers, and civilian assets from Short and Intermediate Range Ballistic Missile attacks. THAAD is intended to intercept incoming ballistic missiles using kinetic energy "hit-to-kill" technology. The THAAD system is intended to be capable of intercepting missiles at either high endoatmospheric or exoatmospheric altitudes. THAAD plans to provide an upper-tier missile layer of defense complementing the lower-tier PATRIOT Advanced Capability-3 (PAC-3).

The THAAD test program continued to show progress during FY02, with several successful component-level contractor tests. Additionally, THAAD demonstrated limited interoperability with other BMDS systems (PATRIOT and Aegis) in hardware-in-the-loop tests.

Funding shortfalls have reduced the number of spare flight missiles to one and have caused the flight test program to be extended about nine months. An earlier schedule showed the last flight test in 2QFY08; it is now scheduled for 4QFY08.

Element restructuring has also shifted some essential ground testing events to occur later in the program, relative to flight testing. The THAAD element's first flight test intercept attempt against a threat-like missile is planned for 1QFY06. Missile safety testing, system level mobility, logistics, environments, reliability, and maintainability are all tested later in the program. The prioritization of flight testing is intended to reduce the risk of finding significant system integration problems late in the test program. This is a sound approach, but means that significant ground testing will have to be performed if a decision is made to deploy capability early.

At this time, the THAAD element has no operational capability because there is no deployable hardware.

### PATRIOT ADVANCED CAPABILITY-3

The PATRIOT air defense system uses guided missiles to engage and destroy air-breathing threats (ABTs) and tactical ballistic missiles (TBMs). PAC-3 Configuration-3 is the latest version. The PATRIOT system is designed to defend against multiple hostile TBMs and ABTs in electronic countermeasures and clutter environments. The ABTs include fixed-wing and rotary-wing aircraft, cruise missiles, tactical air-to-surface missiles, anti-radiation missiles, and unmanned aerial vehicles.

The PAC-3 Configuration-3 system underwent Initial Operational Test and Evaluation (IOT&E) between February and September 2002. IOT&E, when combined with the developmental test and lethality test programs that were completed in 2001, was adequate to assess the potential operational effectiveness, suitability, survivability, and lethality of the PAC-3 system against a set of existing and postulated threats.

The PAC-3 Follow-On Test Program (FOTP) currently consists of one flight test in FY03, five in FY04, twelve in FY05, and five in FY06 and beyond. The flight tests in FY05 and beyond are not yet funded. The FY03 flight test is scheduled for May 2003 and will consist of two PAC-3 missiles ripple-fired at a TBM target flying the same trajectory as the Operational Test/Developmental Test (OT/DT)-4a target. DT/OT-11 is scheduled for February 2004. It is a PAC-3 ripple-fire (shoot-shoot) engagement against a TBM target and a PAC-3 shoot-look-shoot engagement against a cruise missile target flying the same trajectory as the Operational Test-3b target. DT/OT-12 is scheduled for April 2004 and will consist of PAC-3 ripple-fire engagements against two TBM targets. The first interceptor fired against each target in DT/OT-11 and DT/OT-12 will be built with the cost-reduction initiative hardware changes that are intended to reduce the cost of the PAC-3 missile without reducing capability. The other three FOTP flight tests in FY04 will be ripple-fire engagements against short-range TBMs performing in-plane, out-of-plane, and range-extension maneuvers.

PAC-3 system capability is discussed in detail in the classified beyond low-rate initial production (BLRIP) report dated October 2002. The BLRIP report supported the Defense Acquisition Board's review of the program in late 2002 and its recommendation to transfer the PAC-3 program to the Army for all future development and procurement. While the Acquisition Decision Memorandum has not yet been approved, it is expected that the Army's plan will be approved to purchase 208 additional missiles in FY03- 04 to meet immediate inventory needs. The program office has proposed a robust follow-on test program, details of which are in the final stages of definition. It is essential that the transition to the Army include the funding resources needed to properly execute the follow-on test program.

### MEDIUM EXTENDED AIR DEFENSE SYSTEM

The Medium Extended Air Defense System (MEADS) is intended to be a highly mobile air defense system for protection of maneuver forces and fixed assets. The system should provide area and point defense capabilities against multiple, simultaneous, 360-degree attacks by ballistic missiles, large caliber rockets, fixed-wing and rotary-wing aircraft, unmanned aerial vehicles, cruise missiles, tactical air-to-surface missiles, and anti-radiation missiles. It should be strategically deployable by C-130 roll-on/roll-off and tactically mobile to keep up with maneuver forces. MEADS has not yet entered the Design and Development phase; testing to date has been limited. MEADS is in the early prototyping stages and has demonstrated no operational capability to date.

The MEADS is an international program being developed to meet the technical requirements agreed to by the MEADS partners: the United States, Germany, and Italy. In July 1996, NATO formed the NATO MEADS Management Agency (NAMEADSMA) to lead program activity. The United States, Germany, and Italy have staffed the agency.

The proposed program management structure includes both U.S. and international arrangements. U.S. oversight is accomplished through the Integrated Product Team process. The Army's MEADS National Product Office oversees U.S. requirements development and serves as the single point of contact for U.S. support to NAMEADSMA. International oversight is accomplished through the National Armaments Directors and a MEADS Steering Committee. The Army Program Executive Officer for Air and Missile Defense represents the U.S. on the Steering Committee. Leadership positions of NAMEADSMA will rotate among the nations.

Significant differences between the threats, operational environments, operational concepts, and technologies employed for MEADS and PAC-3 dictate a robust developmental and operational test that builds on the PAC-3 testing efforts. DOT&E is engaged in on-going testing program negotiations.

**AIRBORNE LASER**


The Airborne Laser (ABL) is intended to shoot down enemy ballistic missiles during their boost phase. The ABL engagement concept is to place laser energy on the threat missile booster motor casing, rupturing or damaging it sufficiently to cause the missile to lose thrust or flight control and fall short of its intended target. The ABL engagement of ballistic missiles in the boost phase is intended to negate the missile before decoys, warheads, or submunitions are deployed.

Currently three different Block configurations are planned: Blocks 2004, 2006, and 2008. Blocks 2004 and 2008 are on Boeing 747 transport aircraft modified to accommodate ABL subsystems. Block 2006 consists of hardware and software updates and continued testing of the 2004 weapon system Block 2008 will also include the "Iron Bird," a ground test facility constructed inside the hull of a 747. The scope of the Iron Bird ground test facility is still under discussion, but it is expected to develop from the System Integration Lab. The System Integration Lab is a facility at Edwards Air Force Base where the Block 2004 laser software and hardware will be integrated and tested prior to being integrated into the Block 2004 aircraft. Block 2006 will include the production of deployment specific sub-systems, including a deployable chemical farm. During Block 2006, there will also be software and hardware enhancements to the ABL interoperability.

During FY02, the detection and tracking capabilities of the passive infrared sub-system were tested. It successfully tracked F-16s during multiple flight tests. After verifying surveillance functionality with the F-16s, a Lance missile was successfully tracked. Also, the GMD IFT-10 target was acquired and tracked by the passive infrared sensor, and tracking data was collected for analysis. A determination of whether the track quality was sufficient for Battle Management is expected in 2QFY03. Vibration in the Active Ranging System pod during the first flight and subsequent test flights of the block 2004 aircraft prompted a re-design study of that structural component.

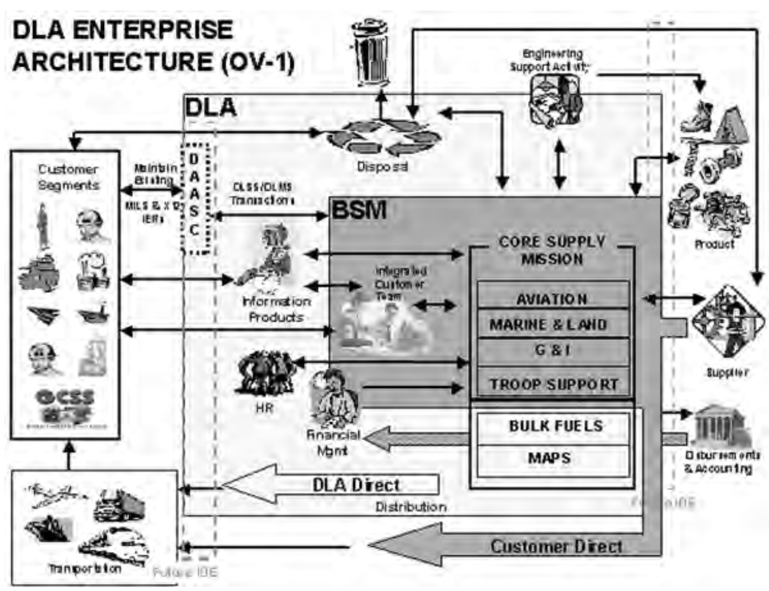
The ABL Block 2004 test program has significantly improved in the last year due to extension of the testing schedule, resulting in a more realistic plan. The primary goal for Block 2004 is to demonstrate and ability to defeat a threat ballistic missile using an airborne laser. Operational capabilities testing will not occur before the system demonstration at the end of CY04. Due to the developmental nature of the Block 2004, there will be limited information on operational capability until after the system demonstration. There is currently no ABL emergency capability apart from some passive detection capabilities.

# Business System Modernization (BSM)

The BSM program was conceived in late 1998 to address the radical changes in the way the Defense Logistics Agency (DLA) does business and to overcome severe deficiencies in existing information support systems. As DLA strives to align business practices with best commercial practices by re-engineering logistics processes at all echelons, robust information technology is needed to support this re-engineering. Specifically, the BSM program is designed to establish a framework for continuous business practice improvements by:

- Shifting to commercial business practices and capitalizing on industry-based integrated supply chain management solutions.
- Moving from organic to commercial sector support when business and readiness factors dictate.
- Exploiting DLA's leveraged buying capabilities and harnessing that power through value-added electronic shopping opportunities to enable customers to get the best prices and fastest delivery of products and services.

The primary objective of this initiative is the attainment of a modern business systems environment. The Joint Requirements Oversight Council-approved Operational Requirements Document identified the need for DLA to manage to specific outcomes, allow optimization within given levels of resource, and support a management focus on product and operating-cost reduction. These objectives represent DLA's approach to meeting the requirements of the DoD Future Logistics Enterprise and the DLA Strategic Plan. The BSM strategy's first focus is to replace DLA's primary legacy supply chain management/materiel management systems—The Standard Automated Materiel Management System and the Defense Integrated Subsistence Management System—with an expanded enterprise computing environment and commercial-off-the-shelf software packages that include Enterprise Resource Planning and Advanced Planning Systems. The BSM strategy, over the course of several years, will result in a new agency-wide information technology architecture that will enable the DLA to reengineer its logistics processes to reflect best modern commercial business practices.




*Business System Modernization provides a new agency-wide computing architecture, enabling DLA to reengineer its logistics processes to reflect the best modern commercial business practices.*

# Composite Health Care System II (CHCS II)

The Composite Health Care System II (CHCS II) is a tri-Service, medical management automated information system (AIS) that will be used in all military treatment facilities (MTFs) worldwide—fixed, deployed, and aboard ships. The core capability is a uniform, comprehensive, legible, secure Computer-based Patient Record (CPR) for every beneficiary. Building on the existing CHCS, CHCS II integrates medical and dental information, and is a key enabler for Force Health Protection and Population Health Improvement, two cornerstones of military medicine. CHCS II also addresses the need for readily accessible health care information on deployed Service members.

CHCS II will be implemented in multiple blocks with increasing functionality. It achieved Milestone I in 1998, and is expected to receive a Milestone B/C limited deployment authority by the beginning of 2003. CHCS II is a complex system requiring coordination among the Services, DoD Tricare regions, MTFs, the DoD acquisition community, various oversight organizations, and the test community. The Program Manager (PM) has effectively utilized Integrated Product Teams (IPTs), but requirements and architectural changes have presented challenges in planning for Operational Test and Evaluation (OT&E) of the integrated system.

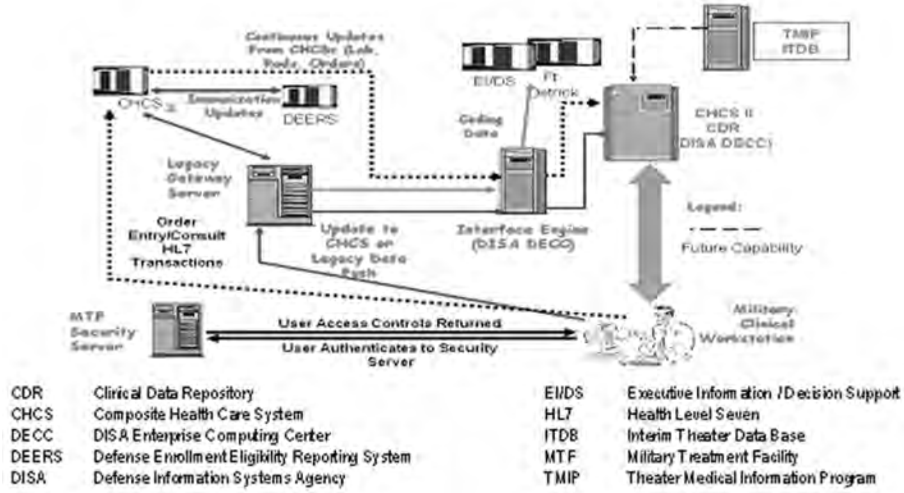
During 1999 and 2000, Army Test and Evaluation Command (ATEC), the independent Operational Test Agency, conducted Customer Tests (i.e., Operational Assessments) on CHCS II prototype systems that were installed in selected clinics at MTFs in Hawaii. Although the results indicated that these systems were not yet operationally effective or suitable, the assessments provided valuable information used to design the next iterations of the software, which incorporated substantial operational and technical architectural changes. In August 2002, the Joint Requirements Oversight Council (JROC) approved an updated CHCS II Operational Requirements Document (ORD).

## TEST & EVALUATION ACTIVITY

- During 2000 and 2001, CHCS II Block 1, which targets ambulatory care, was installed in selected clinics at four test sites, which comprise medium and large MTFs of the three Services: Portsmouth Naval Medical Center, Virginia; Langley Air Force Base, Virginia; Fort Eustis, Virginia; and Seymour-Johnson Air Force Base, North Carolina. The Program Manager (PM) continued to improve the software based on user input from the test sites and completed Developmental Test and Evaluation in May 2002.
- ATEC conducted Initial Operational Test (IOT) at the four test sites May 24 through July 3, 2002. More than 130 typical users (e.g., doctors, physician's assistants, nurses, technicians, and administrative personnel) participated.

## TEST & EVALUATION ASSESSMENT

CHCS II is on the leading edge of technology and must link multiple commercial-off-the-shelf products in a way that is not being done, or is even feasible, in the civilian sector. It requires health care providers to become increasingly computer literate and also introduces new techniques and procedures, such as the use of templates to record patient encounters in an effort to standardize the CPR. Since it will be DoD's premier health care system, CHCS II will have a tremendous operational impact on the fighting force. The CPR will be the first (military or civilian) cradle-to-grave automated health care record: one that can




*Composite Health Care System II provides a computer-based patient record for every beneficiary of the military health system. It integrates medical and dental information and will be used in every military treatment facility worldwide.*

revolutionize the effectiveness of the Military Health System (MHS) by providing instantaneous patient information to health care providers worldwide.

ATEC found Block 1 to be operationally effective, operationally suitable, and survivable. DOT&E determined that the Initial Operational Test and Evaluation (IOT&E) was adequate and agreed with the ATEC findings based on the JROC-approved operational requirements. However, during the course of the IOT&E, it became apparent that an additional mission performance parameter – one not found in the approved ORD – also applied. Health care providers (HCPs) at every test site reported that the number of patient encounters that can be completed is a major measure of mission performance in today's MHS. Many of these HCPs said that they had been told to see as many as 25 patients per day. User surveys, conducted during the IOT, indicated that a majority of HCPs who perform full patient encounters are dissatisfied with the ability of CHCS II to help achieve this requirement. These HCPs indicated that a patient encounter usually takes longer using CHCS II than it would if documented solely on paper. The impact appears to be more severe for some clinics (e.g., family practice and primary care) than for others.

CHCS II clearly offers major benefits to the MHS, including a legible, accurate, and electronically transferable CPR mandated by the President. Although the relationship between CHCS II and the number of patients that can be seen is not yet completely understood, the system may save time in other ways and may improve the quality of care. There are, however, very limited test data at this time to support these contentions due to limited implementation of CHCS II. The OT&E could not establish whether the acknowledged benefits of the system, and the fact that it fully met its ORD requirements, outweigh the reported "bottom line" need to maximize the number of patient encounters. During the limited deployment, the medical community will determine the overriding measures of success and will continue to assess CHCS II Block I. ATEC will conduct a continuing evaluation of Block 1 in April 2003, with an emphasis on productivity and interoperability. Meanwhile, the Test and Evaluation Master Plan is being updated to prepare for test and evaluation of Block 2 at selected test sites still to be determined. Block 2 OT&E is currently scheduled to begin during the summer of 2003.

As part of the limited deployment process, the Assistant Secretary of Defense (Health Affairs), in consultation with the Services' Surgeons General, should reconsider the operational requirements for CHCS II and the relative importance of maximizing patient encounters before deciding whether to pursue fielding CHCS II Block 1 worldwide. The results of the Block 1 reassessment should provide information to aid this decision. The PM, in the meantime, continues to focus on improving system response time and refining system functionality, including the elimination of some manual workarounds required during IOT. DOT&E will continue to work test issues with the PM, the test community, and the users through the IPT process.

# Defense Medical Logistics Standard Support Automated Information System (DMLSS AIS)

The Defense Medical Logistics Standard Support (DMLSS) program defines and implements a more efficient medical logistics capability for military treatment facilities (MTFs) and deployed field units by radically changing the business processes. The DMLSS Automated Information System (DMLSS AIS) automates the processes. The system integrates the medical logistics systems of the Services and reduces MTF inventories of medical and pharmaceutical items. It supports four major functional areas: materiel management, facility management, equipment and technology, and wholesale operations. DMLSS Release 3 is currently replacing all remaining legacy systems operated by the individual Services except for one Army system, the Theater Army Medical Management Information System.

The Operational Requirements Document was revalidated by the Joint Requirements Oversight Council in August 2001 and the Test and Evaluation Master Plan (TEMP) was updated during 2002. Since the system was first deployed to test sites in 1995, the Navy Operational Test and Evaluation Force (OPTEVFOR), the independent Operational Test Agency, has performed Operational Test and Evaluation (OT&E) on three major releases and some incremental system enhancements. DMLSS AIS Release 2 was fielded worldwide to approximately 110 MTFs. Release 3 is currently being fielded to Navy and Air Force MTFs. No further major releases are planned.

## TEST & EVALUATION ACTIVITY

- During 2001, DMLSS AIS Release 3 was installed at three operational test beta sites: Naval Medical Center, Portsmouth, Virginia; David Grant Medical Center, Travis Air Force Base, California; and Brooke Army Medical Center, Fort Sam Houston, Texas. These sites comprise large MTFs that collectively exploit all of the Release 3 capabilities.
- OPTEVFOR conducted Operational Test in the normal operational environment at the three sites January 7-25, 2002. The general concept was to: observe users performing typical actions in an operational environment; distribute user questionnaires and conduct user interviews; and review relevant reports, logs, and other documentation.
- In June 2002, OPTEVFOR performed a limited Verification of Correction of Deficiencies (VCD) at the Navy and Air Force sites.

## TEST & EVALUATION ASSESSMENT

As a result of the January 2002 OT&E, DOT&E assessed DMLSS AIS Release 3 as operationally ineffective for the Army and operationally unsuitable for all of the Services. The release was not operationally effective for the Army primarily because critical interfaces with financial systems did not work, significantly hampering fiscal accountability. Because of these failures, DMLSS AIS Release 3 could not yet replace the Army legacy system, the Theater Army Medical Management Information System. The Navy and the Air Force, with different financial interfaces, legacy systems, and procedures, did not have these operational effectiveness problems.

*Defense Medical Logistics Standard Support Automated Information System integrates the medical logistics systems of the Services. It automates radically changed business processes that provide better support for military treatment facilities and deployed medical units.*

In addition to the Army's financial interoperability deficiencies, there were two rather less critical interoperability deficiencies that affected the other two Services and caused DOT&E to judge the release as operationally unsuitable. There were deficiencies in logistic supportability, training, and documentation. Some of the software had not fully stabilized, configuration management exhibited weaknesses, on-line help features were inadequate, and user manuals were not available or planned. In May 2002, the Program Manager (PM) stated that he had corrected the suitability deficiencies and invited immediate verification of his corrective actions.

In June 2002, OPTEVFOR performed a limited VCD. Since resolution of all the Army problems was expected to take considerably longer, this retest was limited to the Navy and Air Force sites. OPTEVFOR determined that there was still one suitability anomaly: an automated Materiel Management Quality Control (MMQC) feature, designed to input quality control warnings and messages into DMLSS AIS, did not always provide the required information. Although the interface itself was fully operational, the outside Army activity responsible for formatting and posting MMQC data was not always performing this task thoroughly and accurately.

The OT&E and VCD for DMLSS AIS Release 3 were adequately planned and executed. The test was conducted as outlined in the approved TEMP and operational test plan. The system is not operationally effective or suitable for the Army, but is operationally effective and suitable for the other two Services as long as the automated MMQC feature is not used.

The PM asked the Army to intensify its efforts to properly format and post the MMQC data so that the messages can be imported into DMLSS AIS for joint use. OPTEVFOR will continue its VCD to verify this. In the meantime, the Navy and Air Force determined that their immediate critical needs for DMLSS AIS Release 3 warranted fielding to their sites before the MMQC process was verified, and this was done with no significant operational or safety impact. DOT&E agreed that these two Services could field the system and simply continue to use manual MMQC procedures until OPTEVFOR verifies that the automated MMQC feature is working correctly.

In November 2002, the PM stated that the remaining Army deficiencies were corrected. DOT&E will work with OPTEVFOR and the Joint Interoperability Test Command to plan for the Army VCD and will continue to provide oversight of DMLSS AIS for any follow-on OT&E of required interfaces or other future DMLSS AIS enhancements. OPTEVFOR plans to complete the final VCD for the Army in January 2003.

# Defense Message System (DMS)

The Defense Message System (DMS) is designed to enable anyone in DoD to exchange both classified and unclassified messages with anyone else in DoD using a secure, accountable, and reliable writer-to-reader messaging system. DMS supports organizational and individual messaging, although only organizational messaging provides the ability to sign and encrypt messages using Fortezza cards. DMS is intended to reduce the cost and manpower demands of the legacy Automatic Digital Network (AUTODIN) organizational messaging system. To replace AUTODIN, DMS must be implemented in more than 40,000 organizations at more than 700 sites worldwide and must support message exchanges with tactical forces, allies, other Federal Government users, and defense contractors. The DMS program will ensure innovation by employing the latest commercial technology, supporting Allied Communications Publications 120, and operating on Defense Information Infrastructure computers and communications backbone. While today's security needs require using the international X.400 messaging standard and X.500 directory services standard, the DMS program expects to eventually move to the use of commercial Internet e-mail standards once they evolve to adequately support security and military features. The timeline for such evolution is unclear at this time, but is a number of years in the future.

The Defense Information Systems Agency started the DMS program in 1988. Since the 1997 Initial Operational Test and Evaluation of release 1.0, DMS has continued to improve through operational assessments (OAs) in 1998 and 1999, and operational tests and evaluations (OT&Es) of releases 2.1 and 2.2. The AUTODIN backbone has been downsized to three message-switching centers called DMS Transition Hubs. Most tests have revealed difficulties with site installations, configurations, and overall security posture of DMS. DMS 2.2 Gold was approved for fielding in 2001, and DMS 3.0 was approved for fielding to the General Services (GENSER) and tactical communities in May 2002.

### TEST & EVALUATION ACTIVITY

- DMS 3.0 OT&E, late Spring 2002, for the GENSER and Air Force tactical communities.
- DMS 3.0 OA for the Intelligence Community (IC), conducted in conjunction with the GENSER community OT&E. The IC plans to conduct an OT&E of the IC solution in Spring 2003.
- Operational assessment of the Army's Tactical Messaging System during the Joint User Interoperability Communications Exercise (JUICE) 2002 communications exercise in August 2002.

### TEST & EVALUATION ASSESSMENT

DMS 3.0 performed well for the GENSER and Air Force tactical communities during OT&E. However, with respect to the Critical Operational Issue (COI) on security, tests revealed that system administrators had again failed to protect all elements, primarily attributable to poor security password practices at many of the sites. This COI was unfavorably resolved. The operational test agency, Joint Interoperability Test Command (JITC), found that other than poor password practices, DMS did not have other significant vulnerabilities, and therefore determined the system to be operationally suitable. Administering DMS requires attention to detail and relies heavily on complex documentation and manual configuration. System administrators were very competent in administering the system, although in


*The Defense Message System is designed to enable anyone in DoD to exchange both classified and unclassified messages with anyone else in DoD using a secure, accountable, and reliable writer-to-reader messaging system. DMS supports organizational and individual messaging.*

general they required assistance from the developer to initially configure the system. The Program Management Office must continue to streamline system operations and system administration tasks, improve training, and enhance documentation. The system administrators must strictly follow all established security policies and procedures. There are several significant operational concerns with DMS. Two of these address the complexity of the DMS Certificate Management Infrastructure (CMI) and the risk associated with value added products not going through the JITC developmental test process.

Although many measures of effectiveness were successfully met, the IC's OA of DMS 3.0 showed that the IC solution was not sufficiently mature for a full OT&E. Interfacing to the legacy AUTODIN system was problematic within the IC. There were also problems with certificates and Fortezza cards within the CMI.

During the JUICE 2002 exercise, the test of the Army Tactical Messaging System showed that the system hardware and the DMS software worked very well. However, system administrators again experienced difficulties with Fortezza cards, initial configuration of the system, and interfacing with the legacy AUTODIN.

# Defense Procurement Payment System (DPPS)

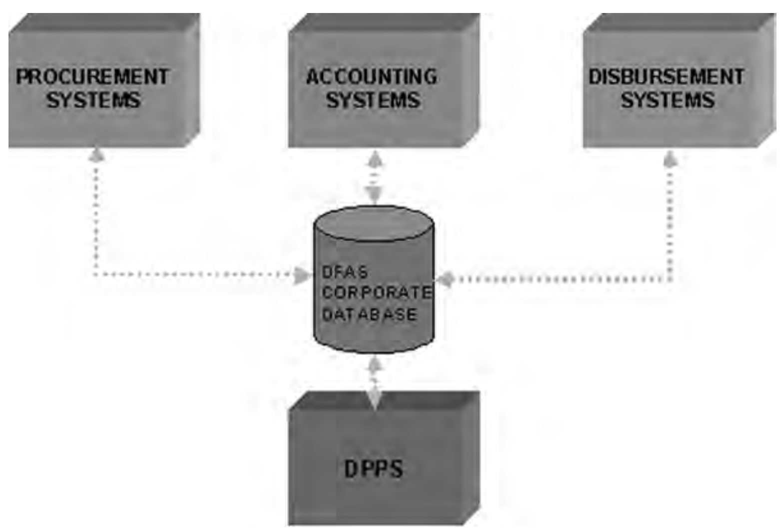
DPPS is designed to be the standard DoD procurement payment system used for calculating contract and vendor payments, grants, and other agreement entitlements; and generating information that will be used by accounting, disbursing, procurement, and other systems. Numerous DoD contract and vendor payment systems will be consolidated into DPPS. DPPS will incorporate advanced technological solutions and business process improvements that promote more effective and efficient payment activities throughout the DoD. To improve the DoD procurement payment operations, DPPS must accomplishing the following:

- Prevent negative unliquidated obligations.
- Reduce overpayments.
- Establish single point funds availability validation.
- Prevent unmatched disbursements.
- Standardize processes.
- Standardize shared data.
- Improve data management capability.
- Improve data integrity.
- Improve cross functional processes.
- Improve accuracy of procurement payment processes.
- Reduce labor intensive processes.
- Reduce reliance on hard copy documents.
- Provide greater flexibility for system changes.
- Eliminate manual reconciliation.

To take advantage of commercially available software applications designed to operate in an open systems environment, DPPS will be implemented on Oracle Financials with four tiers. Tier One is a thin-client component acting primarily as the presentation layer. Tier Two is a web server supporting navigation via the web and workload balancing. Tier Three is an application server containing a bulk of the application logic. Tier Four is a database server. End-user hardware must be compliant with the Defense Financing and Accounting Service standards, which are consistent with the Defense Information Infrastructure Common Operating Environment.

**TEST & EVALUATION ACTIVITY**

There were no operational testing activities during FY02. Developmental test and evaluation activities included the completion of an Integrated Functional Validation Test and phase 1 of the Enterprise Integration Test. Several Test and Evaluation Integrated Product Team meetings were held during FY02 and a draft Test and Evaluation Master Plan was completed and in staffing.




*The Defense Procurement Payment System will be the standard DoD system used for calculating contract and vendor payments.*

**TEST & EVALUATION ASSESSMENT**

Enterprise Acceptance Testing was underway in November 2002 when the DoD Comptroller issued Program Budget Decision 704 that effectively terminated the DPPS program. Accordingly, all planned testing activities have been discontinued. Even more significant in this decision was the assessment that DPPS, within the DoD end-to-end procurement solution, would not likely fit the future enterprise architecture. As a result, knowledge gained in the development and testing of DPPS will be reviewed and, where applicable, applied to this future modernization initiative.

# DoD Distributed Common Ground/Surface Systems (DCGS)

The DoD DCGS is the architecture model for a family of systems capable of receiving, processing, exploiting, and disseminating intelligence in support of a Joint Force Commander. DCGS objectives include the receipt of imagery at ground and surface systems from national and tactical sensors and the exchange of intelligence between ground and surface systems through use of common components and compliance with standards. U.S. Joint Forces Command (USJFCOM) is the user representative for the architecture.

In FY01, a joint working group drafted a DCGS Capstone Requirements Document (CRD) with Information Exchange Requirements (IERs). The CRD underwent O-6 and O-7 level reviews and was resubmitted to the Joint Requirement Oversight Council in FY02. The DoD DCGS will subsume the Common Imagery Ground/Surface System (CIGSS) architecture model that has been developed for imagery intelligence. The CIGSS TEMP has defined a Test and Evaluation (T&E) strategy for assessing compliance with the CIGSS architecture model. Where applicable, the DoD DCGS T&E strategy will re-use the concepts of the CIGSS T&E strategy. The Joint Interoperability Test Command (JITC) is responsible for implementation of interoperability T&E programs for CIGSS and DCGS.

### TEST & EVALUATION ACTIVITIES

- CIGSS certification testing to determine the extent to which a CIGSS system complies with the standards for the CIGSS architecture.
- Working group meetings to begin drafting a Capstone TEMP.

### TEST & EVALUATION ASSESSMENT

The CIGSS certification testing continues to reflect the technical exchange of information between components within a system and between systems. Progress has been made in exchange testing which includes joint information exchanges, albeit for a very limited set of systems (i.e., between the Marine Corps' Tactical Exploitation Group, and the Navy's Joint Service Imagery Processing System-Navy.

There has been no operational testing of the capability of a family of CIGSS systems to support a Joint Force Commander with timely and accurate intelligence products. Service participants to the CIGGS T&E Working-level Integrated Process Team have argued against such testing based on their perception that there is no joint concept of operations that employs a joint family of CIGSS systems. The Commander Operational Test and Evaluation Force would like to conduct testing of the Naval Fires Network in a joint environment that includes systems from the other Services. However, it has proven difficult for an operational test agency to obtain the participation of systems that are outside of the control of their Service.


*DoD Distributed Common Ground/Surface Systems is a worldwide deployable ground system that receives, processes, exploits, correlates, and disseminates intelligence information to the warfighters.*

Further development of the DoD DCGS Capstone TEMP is in limbo pending the Joint Chiefs of Staff–approval of the DoD DCGS Capstone Requirements Document. This document will be necessary to steer interoperability testing within the DoD DCGS architecture.

# Fuels Automated System (FAS)

The FAS program was initiated in FY96 to accommodate evolving requirements for the fuels mission of the Defense Logistics Agency. FAS is designed to increase fuel accountability at the Defense Fuel Supply Points, integrate automatic tank gauging and automated leak detection capabilities, provide a mechanism for specialized customer support through tailored terminal interfaces, and promote real-time data processing.

FAS consists of Base and Enterprise levels, that collectively will provide an automated, integrated, and responsive system for managing DoD fuels. The Base Level system provides transaction data at the fuel distribution terminal, whereas the Enterprise Level system handles procurement, supply, and financial functions. The Base Level System consists of 400 commercial-off-the-shelf (COTS) microcomputer servers and 1,300 COTS microcomputer workstations deployed to 600 Military Services and Defense Logistics Agency locations. The Enterprise Level system comprises ten COTS mid-tier servers and existing office automation at the Defense Energy Support Command headquarters, its regions, and field offices.

Since the completion of the Base Level system in FY97, the FAS Program Management Office has turned its attention to the Enterprise Level system. The Enterprise Level system comprises two major components: Oracle Federal Financials provides accounts payable, general ledger, and accounts receivable functions; and Oracle Energy Downstream, a COTS package that Oracle acquired from British Petroleum, manages fuels purchases.

Throughout FY98 and FY99, implementation of the Enterprise Level System was delayed because the vendor failed to incorporate all requirements for prompt payment and price escalation into the Government layer of the financial applications. During FY00 and FY01, the FAS Program Management Office implemented changes in the FAS software, established information transfer capability between all FAS users, conducted FAS developmental test, and provided training to FAS users.

Joint Interoperability Test Command (JITC) conducted the Initial Operational Test and Evaluation (IOT&E) for FAS (Base and Enterprise levels combined) in August and September 2001. The testing was conducted primarily in the Rocky Mountain/West Coast Region. During the IOT&E, FAS was operating in parallel with the legacy system, Defense Fuels Automated Management System (DFAMS). DFAMS was the system of record during the test.

## TEST & EVALUATION ACTIVITY

An operational assessment (OA) was conducted in December 2001 to reevaluate deficiencies identified during the IOT&E, which was conducted in August and September 2001.

## TEST & EVALUATION ASSESSMENT

The IOT&E conducted during FY01 showed that FAS was operationally suitable, but not operationally effective. This conclusion was based on the fact that Critical Operation Issue (COI) Mission Performance and COI Interoperability were not satisfactorily met during the IOT&E. DOT&E directed that a follow-on OA be conducted to re-evaluate the deficient areas after they are rectified. JITC conducted the follow-on OA in December 2001. The OA results showed that most of the

*The Fuels Automated System provides an automated, integrated, and responsive system for managing DoD fuels.*

problems have been either fixed or improved upon, with the exception of the problems associated with system access and audit log capabilities. The workarounds implemented during the OA were meeting the users' needs and most users interviewed indicated they were satisfied with the progress made. In May 2002, FAS received full fielding approval for its first increment. An Operational Test and Evaluation is planned for the next FAS increment to support posts, camps, and stations in FY03.

# Global Command & Control System - Joint (GCCS-J)

GCCS-J is the Department of Defense joint Command and Control (C2) system of record for achieving the full spectrum dominance articulated in Joint Vision 2020. It is a suite of mission applications that provides critical joint warfighting C2 capabilities. GCCS-J is the principal foundation for dominant battlespace awareness, providing an integrated, near real-time picture of the battlespace necessary to conduct joint and multinational operations. It fuses select C2 capabilities into a comprehensive, interoperable system by exchanging imagery, intelligence, status of forces, and planning information.

GCCS-J consists of a series of capability improvements fielded as spiral and incremental releases within evolutionary blocks. Each release supports evolving user requirements for new or enhanced functional capabilities. Current releases feature an adaptable and constantly improving client/server architecture using commercial software and hardware, open systems standards, government-developed military planning software, web technology, and office automation.

## TEST & EVALUATION ACTIVITY

All releases are tested in accordance with the *Guidelines for Conducting Operational Test and Evaluation for Software-Intensive System Increments*, dated October 10, 1996.

**GCCS-J v3.4.0**

GCCS-J v3.4.0 included significant upgrades to the Integrated Imagery and Intelligence ($I^3$) suite of applications supporting battlespace awareness and minor upgrades to several other functional and office automation suites of applications. The operational assessment was conducted February through March 2002. GCCS-J v3.4.0 was initially assessed not operationally effective or suitable, primarily due to documentation and system loading problems. These problems were addressed. The release was successfully retested and approved for fielding. The Operational Test Agency created a white paper and briefing outlining lessons learned, which are being applied to subsequent operational testing of GCCS-J releases.

**GCCS-J 3.5.0**

GCCS-J v3.5.0 included major enhancement to the Global Combat Support System (Combatant Command/Joint Task Force) (GCSS (CC/JTF)). Selective improvements were made to the Information Assurance posture of GCCS-J. The operational assessment was conducted August through September 2002. GCCS-J v3.5.0 was deemed to be operationally effective and suitable with two caveats. First, a query against the Joint Operational Planning and Execution System (JOPES) database will be changed in future releases to account for blank data, with workaround instructions provided in the release instructions for GCCS-J v3.5.0. Second, the status of system security testing will remain open pending the National Security Agency Information Assurance assessment report to be completed in November 2002. No new significant security findings are anticipated for v3.5.0.

**GCCS-J v3.6.0**

GCCS-J v3.6.0 is the next spiral release, planned for May 2003. It includes enhancements in $I^3$ and Global Status of Resources and Training System capabilities as well as migration of the personal computer client operating system from Windows NT to Windows 2000. Operational testing is scheduled for late February 2003.


*Global Command & Control System - Joint provides a seamless operational picture of the joint battlespace and GCCS supports situational awareness and deliberate/ crisis planning with an integrated set of analytical tools and flexible data transfer capabilities.*

**GCCS-J v4.0.0**

GCCS-J Block IV culminates with GCCS-J v4.0.0, which will introduce a new version of the underlying Common Operating Environment infrastructure and a reengineered JOPES. GCCS v4.0.0 will be a major operational testing effort, currently scheduled for early FY04.

## TEST & EVALUATION ASSESSMENT

The Joint Interoperability Test Command (JITC) assessment leading up to and including the testing of GCCS-J v3.4.0 was valuable and should be continued for all testing of the system. Several measures were key to achieving success in the test of GCCS-J v3.5.0. DOT&E worked more closely with both the GCCS-J Program Management Office (PMO) and JITC during the early test planning stages to ensure that test readiness review checklists were complete and the data feed information in the Test and Evaluation Master Plan (TEMP) was accurate. DOT&E will continue to be more actively involved in the minor releases. Execution of the following recommendations will ensure smooth operational assessment events.

- The entire software release should be loaded and launched at JITC's Indian Head facility prior to operational testing.
- More detailed test readiness review checklists, with dates, should be developed.
- PMO should continue to play an active role in test site selection based on site capabilities and software version release requirements.
- The PMO should identify all external data feeds early in the test process. Normally, this should appear in the TEMP.
- JITC should coordinate the test plan earlier with the PMO.
- Testing should be conducted in two phases. The system administrators need at least 48 hours after installing the release to perform functional checks prior to the start of the second phase of the operational test.

# Joint Biological Point Detection System (JBPDS)

The Joint Biological Point Detection System (JBPDS) is intended to provide early warning and identification of biological warfare agents to supported forces. It will provide biological agent point-detection, identification, and sampling capability for both fixed-site and mobile operations. The system is intended to detect biological agents in less than one minute and identify the agents in less than 15 minutes. The Block I version, scheduled for limited urgent fielding during FY03, is intended to identify ten agents. These ten agents are associated with Schedule A of International Task Force 6, representing agents that have been produced in significant quantities and weaponized by threat nations.

The capabilities of JBPDS will be used by each of the Services. The Army's JBPDS platform is the S788 lightweight multi-purpose shelter mounted on a High Mobility Multipurpose Wheeled Vehicle- Heavy Variant. For the Marine Corps, the JBPDS will be a component of the Joint Services Light Nuclear, Biological, and Chemical Reconnaissance Systems (JSLNBCRS). It will complement the nuclear and chemical detection and monitoring capabilities of the platform.

The Navy's JBPDS application will be permanently installed on naval surface combatant ships and at high priority shore installations worldwide. The Air Force JBPDS will be deployed in the M116A3 trailer or man-portable configuration for air base protection. Like the Marine Corps, the Air Force will also procure the JSLNBCRS (with JBPDS onboard) for defensive air base operations.

In December 1996, the Joint Program Manger for Biological Defense approved the Milestone II decision for JBPDS, and the system transitioned into the engineering and manufacturing development phase. JBPDS was placed under DOT&E oversight in January 2000. The Under Secretary of the Defense (Acquisition, Technology and Logistics) designated the entire Department of Defense Chemical Biological Defense Program, including JBPDS, as a Major Defense Acquisition Program in May 2002. In November 2002, the Under Secretary rescinded the Major Defense Acquisition Program designation, and the program is now an Acquisition Category 2 program.

### TEST & EVALUATION ACTIVITY

In October 2000, the Joint Program Manager approved a two-phased, low-rate initial production strategy to fabricate nine systems to support Operational Assessment (OA2). He established specific performance entrance criteria for the operational assessment and detection, identification, and reliability entrance criteria for the Initial Operational Test and Evaluation (IOT&E). With a favorable assessment and recommendation from the Operational Test Agencies to proceed to IOT&E, the remaining 16 low-rate initial production systems needed for IOT&E were authorized. The Air Force Operational Test and Evaluation Center, the Army Test and Evaluation Command, and the Marine Corps Operational Test and Evaluation Activity conducted OA2 during September and October 2001. OA2 was conducted at Dugway Proving Ground using man-portable and shelter mounted JBPDSs in a ground scenario challenged by biological simulants. The Navy's Operational Test and Evaluation Force conducted a shipboard test of JBPDS against biological simulants in November 2001.

*The Army's Joint Biological Point Detection System platform is the S788 lightweight, multi-purpose shelter mounted on a High Mobility Multipurpose Wheeled Vehicle - Heavy Variant.*

In February 2002, the Army requested an urgent fielding of the JBPDS to upgrade the 310th Chemical Company Biological Integrated Detection System

(BIDS) due to the heightened threat to deployed forces. It also requested that an IOT&E be conducted with BIDS-JBPDS beginning in August 2002 using the 310th Chemical Company as the operational test unit. There are six phases of the IOT&E. Phase I is the Army's IOT&E at Dugway Proving Grounds. Phase II is an Air Force and Marine Corps IOT&E at Eglin Air Force Base in 2003. Phase III is a cold weather operations test at McKinley Laboratory, Eglin Air Force Base in 2003. Phase IV is the Navy IOT&E on board a U. S. Navy Ship in 2003. Phase V is a follow-on test to confirm that currently planned changes to the biological aerosol warning system (BAWS) and software have not degraded the performance of the JBPDS. Phase VI is planned, as necessary, to repeat the first three phases with production articles. Pursuant to the new strategy, the Army executed the first phase of the initial operational test from September to November 2002 to support the urgent fielding request to the 310th Chemical Company.

### TEST & EVALUATION ASSESSMENT

JBPDS field test results from OA2 in September- October 2001, demonstrated that these systems met some, but not all detection, identification, and reliability requirements established in the Acquisition Decision Memorandum (ADM) of 2 October 2000. The shelter-mounted JBPDS configuration met the ADM criteria for detection of dry BG.[1] It did not meet the ADM criteria for identification of dry BG, nor for the detection or identification of wet BG. The man-portable JBPDS configuration met the ADM criteria for both the detection and identification of dry BG. It did not meet the ADM criteria for the detection and identification of wet BG. Further, the demonstrated detection performance of both the shelter-mounted and man-portable JBPDS units decreased rapidly with time and the system failed to meet reliability objectives established by the Operational Requirements Document. Since this operational assessment, changes have been made to the BAWS and other components to increase system durability and reliability. Multi-Service Operational Test and Evaluation (MOT&E) will use the final production-representative systems, as modified.

The developmental component-level testing of biological warfare agents has been accomplished with aerosol challenges against the BAWS and liquid-injection challenges against the identifier. These tests have established a tentative correlation between live biological warfare agents and simulants planned for MOT&E field releases. The BAWS and assay identifier as components do not adequately represent the whole system including the collector and fluid transfer system. An adequate evaluation of the system will be based on the performance of the whole system tested in a chamber against live biological warfare agents. The whole system test will also include the determination of agent viability after the sample is collected from the system, transported, and delivered to a theater medical laboratory for analysis.

Phase 1 of the IOT&E was completed in November 2002. Analysis of the data is not complete at this time. Results will be used to support the Army urgent-need fielding request.

[1] Bacillus subtilis var. niger, a BW agent simulant.

# Joint Chemical Agent Detector (JCAD)

The Joint Chemical Agent Detector (JCAD) is a hand-held device that is intended to automatically detect, identify, quantify, and warn users of the presence of nerve, blister, and blood chemical agents. JCAD will be mounted on a vehicle, aircraft, or fastened to the operator's load bearing equipment. JCAD will be used for on-station monitoring at designated locations and employed as a survey instrument aboard ships. The system is intended to operate as a stand-alone detector, as part of a small local network of other JCAD units, or interface with the Joint Warning and Reporting Network as part of a larger network of biological and chemical detectors.

JCAD's hardware consists of the main Detector Unit (DU); a pre-concentrator accessory for extending the lower detection limit of the DU; and an interface cradle that includes a mount and connections to interface the DU with external power, external alarms, and other DUs to form a local detection network. One detector configuration is planned for use by all of the Services. JCAD will replace or augment existing Service-unique chemical agent detectors.

A combined Milestone I/II decision was made in December 1997 that allowed JCAD to enter into Engineering and Manufacturing Development (EMD). Phase I of the EMD contract was awarded to BAE Systems in February 1998 and the Phase II contact option was exercised in April 1999. JCAD was placed under DOT&E oversight in January 2000.

The Air Force is JCAD's lead materiel developer, while the Army is the lead developmental and operational evaluator.

### TEST & EVALUATION ACTIVITY

In January 2002, the contractor conducted a government-witnessed blind test of the agent detection algorithm as part of the chemical surety testing. Overall, the detector successfully completed its Critical Design Review 3 in February 2002. The contractor has been conducting government witnessed Military Standard 810 testing as part of Contractor Verification Testing.

The Operational Requirements Document was updated and approved as of March 2002. The program office re-baselined the program in June 2002 to account for funding changes. The current program baseline calls for Milestone C in September 2003 and Initial Operational Test and Evaluation beginning in FY04. The Test and Evaluation Master Plan is currently in staffing.

### TEST & EVALUATION ASSESSMENT

JCAD failed a series of chamber tests including: high and low temperature operations, high humidity, solar radiation, and blowing rain environment. A retest is scheduled in 2003. The electromagnetic interference test indicates some redesign of the case is required. The system entered Production Qualification Testing (PQT) in FY03.

The live agent algorithm tests indicated the detector has difficulty detecting a certain agent, particularly at low concentrations. The operational risk is low, however, because this agent is difficult to use as a weapon, highly volatile, and not widely used as a chemical agent. The system is experiencing problems in detecting at the extremely low (miosis) levels of concentration. This issue must be corrected if JCAD is to be operationally effective in aircraft.

The PQT plan provides a robust set of agent and interferant challenges to the detector, including weapon grade agent testing. In all, there are over 9,000 separate challenges throughout the PQT.


*The Joint Chemical Agent Detector is a hand-held device that is intended to automatically detect, identify, quantify, and warn users of the presence of nerve, blister, and blood chemical agents.*

Agent-simulant correlation testing is ongoing at Aberdeen Proving Ground. So far, testing has identified one simulant that will cause the detector to alert. The simulant, Triethyl Phosphate, is considered unsuitable because of its damaging effects on paint and plastics. A final decision regarding its use will be made in 2003. However, there will be at least one agent simulant available for operational testing. The PQT described above will provide the only data to assess JCAD's performance against live agents.

# Joint Service Light Nuclear, Biological, and Chemical Reconnaissance System (JSLNBCRS)

The Joint Service Light Nuclear, Biological and Chemical Reconnaissance System (JSLNBCRS) is a mobile reconnaissance system intended to detect and report Nuclear, Biological, and Chemical (NBC) hazards on the battlefield. The JSLNBCRS consists of a Base Vehicle equipped with hand-held and vehicle-mounted NBC detection and identification equipment. Detectors selected for use on the JSLNBCRS provide the capability to detect, sample, and identify known NBC agents, as well as Toxic Industrial Materials. Communications equipment is required to transmit analog and digital messages and NBC contamination warnings. A system for marking contaminated areas is also included. Local meteorological and accurate navigation information is provided by onboard meteorological and global positioning systems. Two base vehicles are planned: the High Mobility Multipurpose Wheeled Vehicle (HMMWV) for the Army, Air Force, and Marine Corps and the Light Armored Vehicle (LAV) for the Marine Corps.

JSLNBCRS is intended to provide new sensors and information dissemination systems to detect chemical or biological attacks at extended ranges and provide warning to affected units. JSLNBCRS will be employed in forward combat areas and integrated into the overall reconnaissance and surveillance effort to support combat operations. It will also be employed in rear areas to monitor main supply routes, logistics bases, airfields, ports, and key command and control centers for NBC hazards.

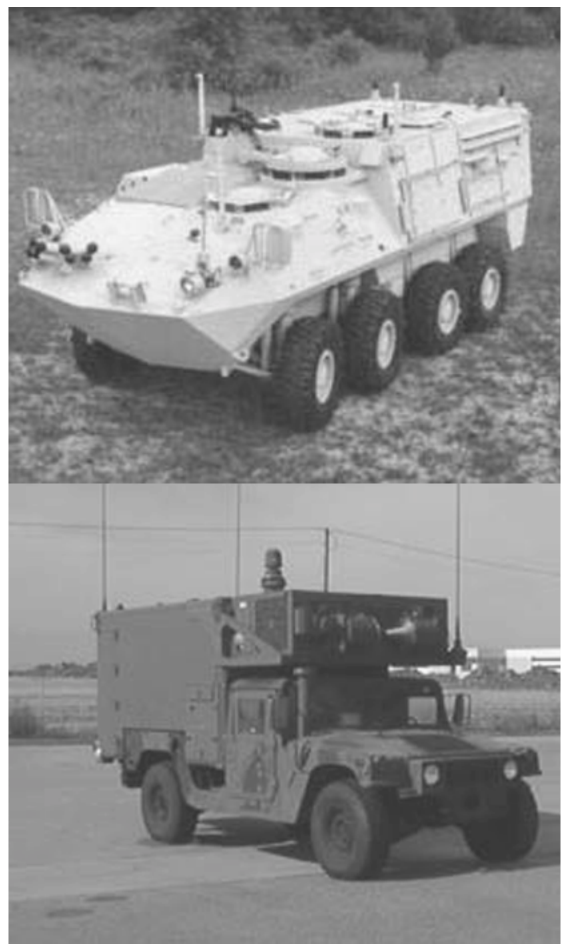
## TEST & EVALUATION ACTIVITY

The JSLNBCRS Test and Evaluation Master Plan (TEMP) was approved by DOT&E in June 2001.

Developmental Test (DT) II was conducted for the HMMWV variant from May 2002 to August 2002. A Limited User Test (LUT) followed DT II during September and November 2002, which is intended to support the Low-Rate Initial Production decision in January-February 2003. The HMMWV LUT tested the operational effectiveness and suitability of JSLNBCRS performing its reconnaissance and security missions in a United States Marine Corps ground scenario and a United States Air Force airbase scenario. A DT III of the Low-Rate Initial Production units will follow the LUT to address operational issues found in testing before the Initial Operational Test and Evaluation (IOT&E).

Two production representative LAV vehicles, which have been refurbished, will be integrated with the common JSLNBCRS mission suite from October 2002 to April 2003. DT I for the LAV system is planned from June to July 2003 and precedes the IOT&E.

A common HMMWV-LAV IOT&E will be conducted in FY04 with Army, Marine Corps, and Air Force participation.



*The Joint Service Light Nuclear, Biological, and Chemical Reconnaissance System consists of a base vehicle equipped with hand-held and vehicle-mounted NBC detection and identification equipment. Two base vehicles are planned: the High Mobility Multipurpose Wheeled Vehicle for the Army, Air Force, and Marine Corps and the Light Armored Vehicle for the Marine Corps.*

**TEST & EVALUATION ASSESSMENT**

The results of DT II HMMWV testing were reviewed, in accordance with the TEMP, prior to the start of the LUT in September 2002. The Army determined that JSLNBCRS had demonstrated system integration of the sensor suite prior to the start of the LUT. The TEMP planned for the use of prototype sensors for the LUT. The data from this test is still being analyzed.

Because the final full-rate production contract will be a full and open competition, the system that will be tested in IOT&E might not be the system that is fielded. A Follow-On Test and Evaluation will be conducted for the full-rate production system, if it is different than the system used for IOT&E.

During the past year the Army has debated its participation in the JSLNBCRS program and the most effective mix of light HMMWV and armored NBC reconnaissance systems to support light, rear, and heavy forces. The Army withdrew from participation in the LUT, but now the Army intends to procure the HMMWV JSLNBCRS system, although the final mix of light and armored systems is under review. The uncertainties of Army participation in the program and deviations from the TEMP might force an additional operational assessment excursion prior to the IOT&E using the Army's Force Battle Command Brigade and Below Command and Control System.

# Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)

JSLSCAD is intended to be a passive detector of chemical agent vapors at ranges up to 5 km (10 km objective). It is intended to provide real-time detection of specific types of chemical warfare threats to U.S. forces at both fixed sites and while on the move.

This system will be installed in fixed locations for protection of facilities and installations such as air bases. The mobile configurations of Block I JSLSCAD will be used on platforms such as ground vehicles and ships. Aircraft configurations will be included in JSLSCAD Block II. The JSLSCAD will have visual and audible indicators to display the chemical agent class (nerve, blister, and blood), and to indicate the azimuth and elevation (but not distance) of the detection. Detection and warning information may be entered automatically into Service command, control communications, computers and intelligence ($C^4I$) systems, or the information may be reviewed and distributed manually. JSLSCAD is to be interoperable with the Joint Warning and Reporting network when it becomes available.

JSLSCAD consists of four major components: scanner module, sensor electronics module, operator display unit, and power adapter. There are two configurations of the scanner module. The aerial applications scanner covers a 60-degree forward-looking cone, and the ground mobile/fixed site/shipboard configurations scan 360-degrees in azimuth and +50 to –10-degrees in elevation. The JSLSCAD Block I is intended to be integrated into the Joint Service Light Nuclear, Biological, and Chemical (NBC) Reconnaissance System (JSLNBCRS) and the Stryker-NBC Reconnaissance Vehicle, and will be employed aboard Navy landing ship docks or equivalent aviation capable amphibious ships. JSLSCAD Block II is intended to be carried on Army and Navy helicopters, and outboard on selected Air Force C-130 aircraft. Present plans call for the JSLSCAD to be carried as an unmanned aerial vehicle payload, but the unmanned aerial vehicle to be used has not been selected.

The current operational requirements document was approved in June 1997, and is now being revised. JSLSCAD achieved Milestone II on September 17, 1996. The Test and Evaluation Master Plan for JSLSCAD was approved in 1997, before the system came under DOT&E oversight in January 2000. A revised Test and Evaluation Master Plan dated September 30, 2002, is in Service coordination.

## TEST & EVALUATION ACTIVITIES

JSLSCAD's engineering development tests were completed in April 2001.

Production qualification test/developmental test (PQT/DT) began in February 2002 at Dugway Proving Ground. The February PQT/DT events were in the chamber, using three nerve agents and one blister agent, and were intended to prove system performance and to correlate the system's chamber performance with open-air releases of chemical simulants. Problems encountered during the developmental testing resulted in the contractor revising the processing algorithm and retraining the system's neural network. High false alarm performance has caused early termination of some developmental tests. PQT/DT began anew in the test chamber at Dugway in July 2002 with the revised algorithm.

*This system will be installed in fixed locations for protection of facilities and installations such as air bases. The mobile configurations of Block I Joint Service Lightweight Standoff Chemical Agent Detector will be used on platforms such as ground vehicles and ships.*

### TEST & EVALUATION ASSESSMENT

The revised algorithm used in the renewed tests appears able to process most of the signals it has received from the same agents where it failed in February. There remain questions, however, about JSLSCAD's performance in terms of its ability both to detect adequately agent vapor levels other than that for which its neural network was trained or its ability to detect and identify weapons grade agent in varying strengths. Completion of PQT/DT events should answer many of these questions, but lack of weapons grade agent from various potential threats may leave some questions not completely answered.

Test limitations in the Initial Operational Test and Evaluation (IOT&E) will include the use of simulants instead of actual agents. Although the chosen simulants approximate spectral or physical characteristics of agents, they do not match them. Current testing is intended to support the ability to correlate concentration levels of real chemical vapors to concentration levels of simulant vapors. Even if a good correlation could be determined, the details of the algorithm in the JSLSCAD must be changed to allow it to detect a simulant vapor, and hence there could be low confidence that the system will be operationally effective on the battlefield. Other limitations include simulation of agent delivery by explosive, line, and stack release devices instead of actual weapons, and a restricted $C^4I$ network warning capability instead of a full theater or joint task force $C^4I$ system. Achieving ideal delivery conditions during tests is difficult due to the vagaries of weather, and the desired effects of the atmospheric mixing layer dictate that releases are best made during pre-dawn hours. The test site at Dugway, an isolated, desert location that does not represent military bases, cities, or many types of battlefields where JSLSCAD likely will be deployed, is a limitation. A Navy test is planned to be done at sea and the Air Force plans to test the system at Eglin Air Force Base.

The IOT&E budget for Block I (fixed site, ground mobile, and shipboard) is not fully funded; $8.303 Million is required, of which $2 Million is unfunded. Block II tests (the airborne and networked version) are unfunded. The program office has requested $2 Million for the test in 2003.

# Joint Warning and Reporting Network (JWARN)

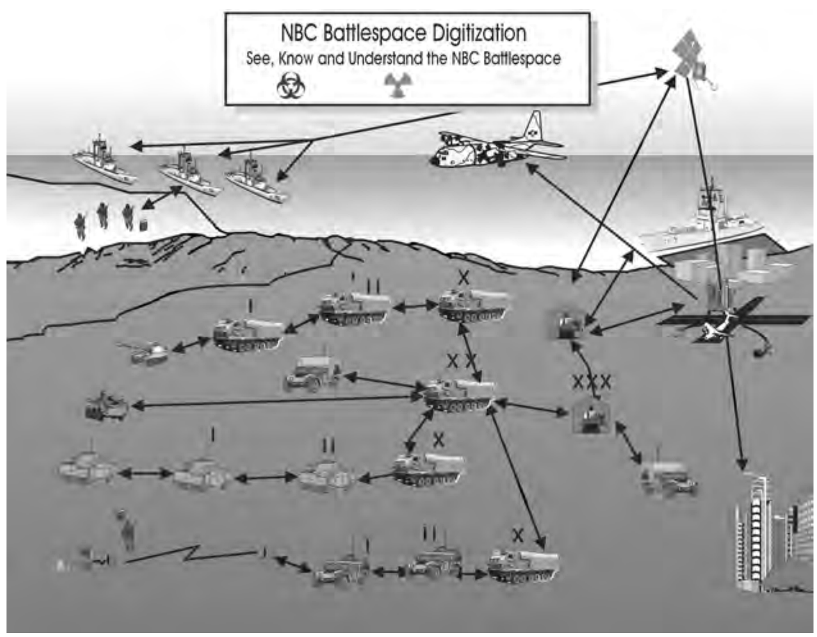
The Joint Warning and Reporting Network (JWARN) is a standardized software application intended to provide Nuclear, Biological, and Chemical (NBC) warning and reporting, downwind hazard prediction, operations planning, and NBC management capabilities for Joint Forces, from battalion to theater-level command. JWARN will be located in the NBC Cell of Command and Control Centers and employed by NBC specialists and other designated personnel. Its primary functions are to report and warn Commanders and personnel of NBC attacks; to perform analysis of NBC information and provide hazard predictions; to support planning and assessments of NBC defense; and to support sensor management including maintenance planning, configuration control, performance monitoring, and testing.

JWARN will be hosted on Joint and Service Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance ($C^4ISR$) systems utilizing the Defense Information Infrastructure Common Operating Environment (DII COE) common resources applications. JWARN $C^4ISR$ host systems include: Global Command and Control System (GCCS), GCCS-Army, GCCS-Maritime, Intelligence Operations Server (IOS), the Theater Battle Management Core System (TBMCS), Maneuver Control System (MCS), Force XXI Battle Command, Brigade and Below (FBCB2), Advanced Field Artillery Tactical Data System (AFATDS), and Command and Control PC (C2PC). The JWARN will share information with Command and Control and other DoD databases providing information on friendly and enemy forces, terrain, weather, and others.

This system is intended to exchange information with legacy and new development NBC sensors, including the M8A1 Chemical Agent Alarm, M21 Remote Sensing Chemical Agent Automatic Alarm, M22 Automated Chemical Agent Detection Alarm, Integrated Point Detection System, Radiac AN/VDR-2, Radiac ADM-300A, and the following systems currently in development: Joint Biological Point Detection System, Joint Services Lightweight Standoff Chemical Agent Detector, Joint Chemical Agent Detector, NBC Reconnaissance System, and Joint Services Light NBC Reconnaissance Vehicle. The JWARN Component Interface Device (JCID) will allow the exchange of information between the NBC sensors and the JWARN application hosted on the $C^4ISR$ systems via Service specific $C^4ISR$ communications architecture (radio, wire, etc).

JWARN is being developed in three Blocks. Block I is stand-alone NBC analysis software that is already fielded. Block II is mission software only and will be hosted on the higher echelon command and control systems, GCCS, GCCS-M, GCCS-A, TBMCS, and IOS. Block III will be hosted on these $C^4ISR$ platforms plus C2PC, MCS, FBCB2, and AFATDS. Block III will be linked to the NBC sensors via JCID interface for remote monitoring and control. This Block will also be linked to the Joint Effects Model (JEM), which will provide advanced hazard prediction and modeling and simulation for use by JWARN.

The Embedded Common Technical Architecture (ECTA) program is a related effort to provide warning and reporting of NBC hazards to U.S. Forces. Unlike JWARN Block II, it is intended to link tactical sensors to Service unique command and control systems such as the Army's FBCB2, and it will integrate with the Navy's GCCS-M command and control system. ECTA is managed by the Army.




*The Joint Warning and Reporting Network's primary functions are to report and warn Commanders and personnel of NBC attacks; to perform analysis of NBC information and provide hazard predictions; to support planning and assessments of NBC defense; and to support sensor management including maintenance planning, configuration control, performance monitoring, and testing.*

**TEST & EVALUATION ACTIVITY**

The Test and Evaluation Master Plan (TEMP) has been undergoing revisions for the past year due to its re-baselined schedule and evolutionary blocking strategy for the program.

**TEST & EVALUATION ASSESSMENT**

Since the program was placed on oversight, DOT&E has worked closely with the Marine Corps Systems Command to address the inadequacies of the draft TEMPs.

JWARN must integrate with many joint $C^4$ISR systems and NBC sensors. A significant degree of planning is necessary to ensure co-development of JWARN with the Service command and control hosts. There has been a tendency to view the performance of JWARN in isolation– first from the NBC sensors, and, second from the host $C^4$ISR systems. It will be a challenge to conduct operational testing within the context of the total system of sensors, and $C^4$ISR systems. The TEMP must address strategies to co-develop JWARN on the command and control hosts and it must plan for a system-of-systems Initial Operational Test and Evaluation with JWARN, the GCCS host, sensors, and JEM.

DOT&E is also involved with a separate review of the ECTA Test and Evaluation strategy, which must also demonstrate its integration strategy with GCCS-M, FBCB2, and a system-of-systems Initial Operational Test and Evaluation prior to fielding.

# Standard Procurement System (SPS)

The Standard Procurement System (SPS) is designed to improve the speed and effectiveness of contract placement and contract administration functions. Once completed, it will interact more effectively with other DoD activities and with industry, and improve visibility of contract deliverables while maintaining DoD readiness with reduced resources. SPS comprises components at multiple levels, including mainframe processing at Defense Information Systems Agency MegaCenters, minicomputers at the intermediate level, and Local Area Network-based workstations at the user level. Software consists of selected operating systems, network operating systems, client-server software, distributed systems software, and American Management Systems' commercial derivative software.

The SPS acquisition strategy is based on procuring and enhancing American Management Systems' "Procurement Desktop–Defense" software. To be delivered in four increments, SPS Increments 1 and 2 were operationally tested in 1997 and fielded to limited Defense Logistics Agency and Navy sites.

During the summer of 1998, Joint Interoperability Test Command (the designated Operational Test Agency), conducted tests at two Army sites and two Navy sites on a portion of the Increment 3 (Version 4.0) software functionality. Based on the user-validated requirements in the Operational Requirements Document, Joint Interoperability Test Command (JITC) found that Version 4.0 software was operationally effective and suitable for only a small number of contracting offices that had no (or minimal) prior automated procurement support. Due to the significant number of system deficiencies and inaccuracies, DOT&E determined that Version 4.0 software was neither operationally effective, nor operationally suitable for administering large procurement contracts. DOT&E recommended that the Program Management Office take immediate actions to correct these deficiencies prior to full fielding.

Since the completion of Version 4.0 Operational Test and Evaluation, testing activities had been focused on conducting Operational Assessments (OAs) on Version 4.1 and follow-on maintenance releases to verify correction of deficiencies and to assess enhanced capabilities. Throughout FY00 and FY01, JITC continued to conduct OAs to provide feedback to improve SPS performance. JITC uses sites that had already converted over to SPS from their legacy systems. The OA results showed that there were still many unresolved system deficiencies of major operational impact, even though users noted that system functionality had improved in comparison with the previous versions.

In January 2002, the DoD Deputy Chief Information Officer directed that SPS cease further development of Version 5.0 and limit its development efforts to SPS Version 4.2 and maintenance of prior versions, due to schedule breach (and possibly cost breach) and other reasons.


*The Standard Procurement System will improve the speed and effectiveness of contract placement and contract administration functions.*

### TEST & EVALUATION ACTIVITY

During the past year, there have been no operational test activities.

### TEST & EVALUATION ASSESSMENT

Based on earlier Operational Test and OA findings, a variety of operational issues remain; some span many sites and some are site-unique. In general, users expressed a desire for longstanding deficiencies to be corrected as soon as possible. The SPS Program Management Office must continue to focus on correcting deficiencies identified during the previous tests.

# Teleport

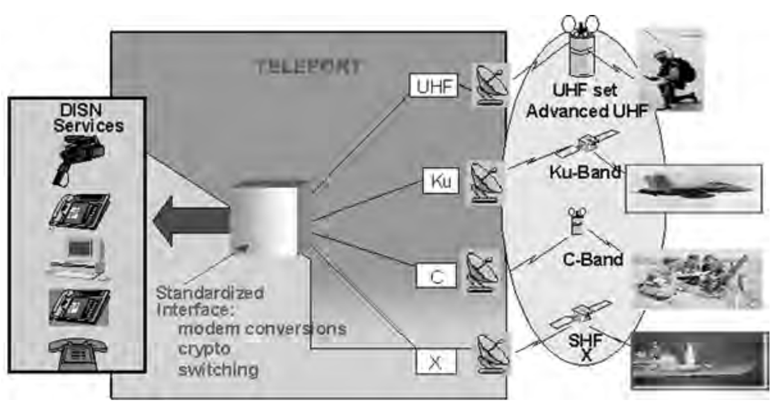
The Department of Defense (DoD) Teleport System will provide deployed Satellite Communications (SATCOM) users access to Defense Information System Network (DISN) services and will provide cross banding between different SATCOM systems. The Teleport program was established to satisfy the communications requirements and objectives specified in the DISN Capstone Requirements Document (CRD). The DoD Teleport directly supports the DISN CRD requirements of worldwide coverage and connectivity, interoperability, responsiveness, and technology insertion. The Teleport system will perform its mission from six teleport core facilities, (Northwest, Virginia; Ramstein/Landstuhl, Germany; Lago Patria, Italy; Fort Buckner, Japan; Wahiawa, Hawaii; and Camp Roberts, California), and will be operated by the local operations and maintenance command at each installation or facility.

The Teleport fielding plan uses a spiral acquisition process for three Generations of the Teleport System. Generation One IOC1, scheduled for 1QFY04, provides upgraded X-, C-, and Ku-band capabilities and capacities at existing Standardized Tactical Entry Point (STEP) sites. Generation One IOC2, scheduled for 3QFY04, provides Ultra High Frequency (UHF) capabilities. Generation Two, scheduled for completion during 4QFY05, incorporates Extremely High Frequency (EHF), L-, and commercial/military Ka-band SATCOM capabilities, as well as High Frequency (HF) radio capability. Generation Three, Full Operational Capability, scheduled for 4QFY10, incorporates advanced Military SATCOM systems, including Advanced EHF and the Advanced Wideband System, into the Teleport design. The Defense Information Systems Agency (DISA) is the lead agency for system development. The Joint Interoperability Test Command (JITC) is the Operational Test Agency for this program.

## TEST & EVALUATION ACTIVITY

The TEMP was initially written to support the Generation One program initiation at Milestone C. The primary focus of this version of the TEMP was the Operational Assessment (OA) supporting Milestone C and the Initial Operational Test &Evaluation (IOT&E) supporting the IOC1 declaration. A TEMP update is in coordination, which will support Generation Two program initiation.

In support of Generation One program initiation, JITC performed an OA at the Northwest Interim Teleport during 2QFY02. The Northwest facility is one of the STEP sites and as such was considered an Engineering Development Model (EDM) for the Teleport. An OA for EHF was conducted in 1QFY03 to support a Generation Two Milestone C Decision for EHF long-lead items and a Milestone B for the remainder of the Generation Two program. The OA consisted of two major parts, a field demonstration using Marine EHF terminals at Camp Le Jeune and Fort Bragg to access DISN services, and observation of operational Navy EHF communications at the Naval Computer and Telecommunications Area Master Station (NCTAMS) Atlantic Area (LANT). Because the Navy was in the process of correcting several problems with the shipboard EHF terminal, the data collection for the OA will continue into the winter of 2003 to verify that these problems have been corrected.




*DoD Teleport System is a telecommunications collection and distribution point providing deployed forces with multiband, multimedia communications system and worldwide reach-back capabilities to the Defense Information System Network.*

IOT&E will be conducted in 4QFY03 on the first complete site to support the Generation One IOC 1 decision, and Follow-on Test and Evaluation (FOT&E) will be carried out in 3QFY04 to support the Generation One IOC 2 decision. There will then be a subsequent FOT&E to support Generation Two IOC in 4QFY05 and a FOT&E to support Generation Three in FY10.

## TEST & EVALUATION ASSESSMENT

During the OA at Northwest during 2QFY02, JITC determined that the Northwest STEP site represented approximately 83 percent of the full functionality of the target Teleport sites and thus was sufficiently representative for the test. The Northwest Interim Teleport successfully met current user requirements according to the capabilities assessed. The site had adequate satellite coverage, demonstrated DISN services and interoperability over multiple satellite bands, provided bulk encryption for SATCOM links and limited automated technical control, and maintained greater than 95 percent operational availability for circuits, trunks, and links. The level of functionality and the system performance demonstrated during the OA was sufficient for DOT&E to support the Milestone C decision and initiation of contracts for the Generation One Teleport sites.

The JITC conducted an OA of the proposed DoD Teleport's Generation Two capabilities in October 2002. The OA focused on providing DISN service access to deployed users over a MILSTAR EHF connection. During the field demonstration, deployed Marines at Camp Le Jeune used a SMART-T EHF satellite link with a SMART-T at Fort Bragg to place Defense Switched Network (DSN) phone calls and send Unclassified-but-Sensitive Internet Protocol Router Network (NIPRNET) and Secret Internet Protocol Router Network (SIPRNET) messages. The exchanges successfully provided proof of concept for accessing DISN services via EHF using the general architecture proposed for DoD Teleport. A similar exchange of DSN phone calls and electronic mail messages demonstrated the feasibility of cross-banding from Super High Frequency to EHF. To complement the field demonstration, JITC also observed operational NIPRNET and SIPRNET traffic at NCTAMS LANT. This confirmed that deployed users are already using EHF satellite links to access DISN services and provided an assessment of the Navy Medium Data Rate (MDR) appliqué terminal.

The Teleport program is actually purchasing the MDR Follow-On Terminal (FOT), which was not accessible during the OA at any shore locations. Therefore, to supplement the data collected at NCTAMS LANT, during 2QFY03 JITC will collect FOT data from a deployed battle group. This will also verify if all major problems have been corrected before purchasing the majority of the EHF terminals for the Teleport program.

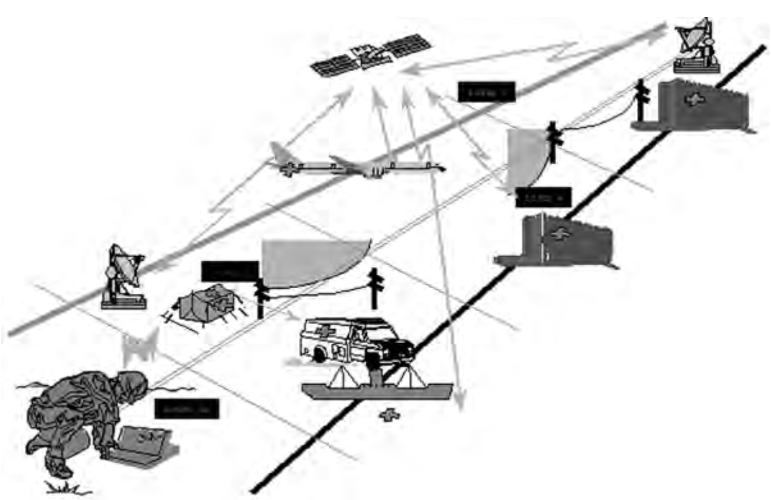
# Theater Medical Information Program (TMIP)

The Theater Medical Information Program (TMIP) is a tri-Service system that is designed to provide information to deployed medical forces to support all medical functional areas, including command and control, medical logistics, blood management, patient regulation and evacuation, medical threat/intelligence, health care delivery, manpower and training, and medical capability assessment and sustainment analysis. TMIP Block 1 performs these services by integrating information from existing medical systems, including the Composite Health Care System (CHCS), CHCS II, Defense Blood Standard System, and Defense Medical Logistics Standard Support (DMLSS). TMIP will continue to integrate other medical applications that have been developed for use during deployment such as the Transportation Command Regulating and Command and Control Evacuation System.

TMIP will be developed incrementally in "blocks" of increasing functionality and integration. The military Services fund their own infrastructure (networks and communications) and computer hardware to host the TMIP software in the theater environment. The Joint Requirements Oversight Council (JROC) approved a Capstone Requirements Document in January 1999 and the Operational Requirements Document (ORD) for TMIP Block 1 in October 2000. The JROC revalidated the Block 1 ORD in August 2001. Block 2 Milestone B and Block 1 Milestone C decisions were awarded by the Information Technology Acquisition Board in November 2002.

## TEST & EVALUATION ACTIVITY

- In March 2001, the Army Test and Evaluation Command (ATEC), the lead independent Operational Test Agency, conducted a Limited User Test (LUT) on a prototype version of TMIP Block 1 at Fort Sam Houston, Texas, in combination with a LUT of the Army's TMIP hardware.
- A Capstone Test and Evaluation Master Plan, along with an annex that specifically addresses TMIP Block 1, was approved in April 2001 and an updated version was approved in October 2002.
- A joint alpha test, a Developmental Test/Operational Test event employing typical users from the Navy and Air Force, is scheduled for February 17 through March 21, 2003, in Diego Garcia. The Air Force will also conduct Echelon 3 testing at Brooks Air Force Base in San Antonio, Texas. A command and control center will be established at United States Pacific Command in Hawaii to consolidate and analyze the data collected from various test sites. The Navy and the Marine Corps will also conduct alpha tests from March 24 through April 30, 2003, with the Navy exercising five ships of the 7th Fleet and the Marine Corps conducting testing in Hawaii.
- A joint Block 1 Initial Operational Test and Evaluation (IOT&E) will be conducted at a minimum of four locations, one for each of the four Services, during the period of June 16 through June 27, 2003. ATEC and the U. S. Army Medical Department Board have developed a comprehensive Operational Test and Evaluation plan and continue to refine it.



*The Theater Medical Information Program is a tri-Service system that integrates information from various existing medical information systems and provides it to deployed medical forces. It supports all medical functional areas.*

**TEST & EVALUATION ASSESSMENT**

During the LUT of the Block 1 prototype, ATEC determined that all of the features and capabilities that were available for testing were operationally effective, but these included only about half of those planned for the Initial Operational Capability. Using an Army infrastructure, TMIP successfully provided the following capabilities to deployed users: CHCS, DMLSS Assemblage Management, preparation of several Joint Task Force reports, and limited administrative processing of patients. The planned capabilities that were not tested included operations using Air Force and Navy infrastructures, immunization tracking, lower echelon reporting and surveillance, and more detailed patient encounters. The TMIP Block 1 prototype was not considered suitable due to deficiencies in continuity of operations, security, and information assurance. There were also shortfalls in training and documentation.

TMIP must integrate several existing and developmental systems into a single system that can be easily used by theater commanders and medical personnel in combat environments. Its heavy dependence on the successful operation of the other systems presents additional technical challenges. The functional and operational testing of each TMIP application is supposed to occur prior to delivery to the TMIP Program Manager for integration. This can impose a scheduling problem for TMIP, since a delay in, or problem with, any application can impact the delivery of that TMIP block. In the past, this and other factors resulted in slippage of the schedule, and there were some difficulties in sharing data with the various applications. However, TMIP-Joint successfully completed Block 1 integration and independent software qualification testing in October 2002. In December 2002, the production version of the TMIP-Joint software was issued to the Services for training and use during alpha testing and IOT&E.

Click on a title to go to that page.

## Army Programs

# Army Programs

# Abrams Tank (M1A2) System Enhancement Package (SEP)

The mission of the M1A2 System Enhancement Package (SEP) Abrams tank is to close with and destroy enemy forces using firepower, maneuver, and shock effect. The M1A2 SEP is being fielded to armor battalions and cavalry squadrons of the heavy force. SEP upgrades are intended to improve lethality, survivability, mobility, and sustainability; and to provide increased situational awareness and command and control enhancements. Specific changes include:

- The addition of two 2nd generation Forward Looking Infrared sights (FLIRs).
- An under armor auxiliary power unit to power the tank and sensor suites.
- A thermal management system to provide crew and electronics cooling.
- Increased memory and processor speeds and full color map capability.
- Force XXI Battle Command, Brigade and Below (FBCB2) Integrated Combat Command and Control ($IC^3$) to share battle command information and situational awareness with all components of the combined arms team.

In addition to the aforementioned SEP components, additional weight reduction measures, survivability enhancements, and safety improvements applied to the M1A2 were incorporated into the configuration that underwent Live Fire Testing and Evaluation in FY01.

The M1A2 Initial Operational Test and Evaluation (IOT&E) was conducted from September to December 1993. Based on the results of the IOT&E, DOT&E determined that the M1A2 was operationally effective, but not operationally suitable or safe. DOT&E's assessment was based on poor availability and reliability of the tank, instances of uncommanded main gun and turret movement, and unintended .50 caliber machinegun fire. Follow-On Test and Evaluation (FOT&E) II in June 1996 confirmed the adequacy of the applied corrective actions, and DOT&E assessed the M1A2 as both operationally effective and suitable.

The M1A2 SEP is a further upgrade to the M1A2 tank. Operational testing conducted to date has demonstrated an improved capability of the 2nd generation FLIR over the 1st generation FLIR to detect, recognize, and identify targets at operationally relevant ranges. During FOT&E III, the M1A2 SEP demonstrated significantly better performance during night engagements than the baseline M1A2 in the number of targets hit. During day engagements, no performance difference was detected between the M1A2 SEP and the baseline M1A2.

*Follow-On Test and Evaluation II in June 1996 confirmed the adequacy of the applied corrective actions, and DOT&E assessed the M1A2 as both operationally effective and suitable. In 2002, the Army discontinued production of the M1A2 (SEP) after 588 vehicles.*

Phase III system level live fire tests were conducted between October 2000 and July 2001. Phase III comprised three system-level live fire tests, and 14 full-up, system-level live fire tests. The tested threats included hand-held infantry weapons, mines, artillery, anti-tank guided missiles, and tank-fired munitions. In addition to performing detailed assessments of system damage following each test, most test events provided opportunities for representative crews and maintenance teams to exercise Battle Damage Assessment and Repair procedures to assess training and techniques. Damage assessment team meetings concluded in August 2001. Initial test reports, evaluations, and assessment briefings were disseminated in December 2001.

In 2002, the Army discontinued production of the M1A2 (SEP) after 588 vehicles. In 2002, the Crusader program was terminated, but the Abrams Program plans to continue developing the tank portion of Abrams/Crusader Common Engine. Production is scheduled to start in 2003.

### TEST & EVALUATION ACTIVITY

The U.S. Army conducted the M1A2 SEP FOT&E IV in conjunction with the M2A3 Bradley Fighting Vehicle IOT&E at Fort Hood, Texas, from September to October 2000. Testing was structured to compare the operational effectiveness and suitability of the M1A2 SEP against the currently fielded M1A2. The Army conducted the test in accordance with an approved plan and DOT&E monitored the test on site and conducted an independent evaluation.

In 2002, the Army conducted several technical test events and demonstrations to evaluate fixes for FBCB2 and other unresolved issues. The results of these tests are currently being evaluated.

### TEST & EVALUATION ASSESSMENT

The M1A2 SEP is operationally effective and shows an improved level of operational effectiveness in comparison to the M1A2. This improvement in operational effectiveness is attributed to the M1A2 SEP's superior capability to detect, identify, and hit targets, as well as the M1A2 SEP's improved night fighting capability as demonstrated in FOT&E III and a Detection, Acquisition, Recognition, Identification (DARI) test.

The M1A2 SEP met the specified reliability requirements and did better than the baseline M1A2s. However, there were many failures attributable to the $IC^3$ and FBCB2. If these failures had been included in the overall reliability evaluation, the M1A2 SEP would not have met its reliability requirements. The M1A2 SEP met its availability and maintainability requirements.

$IC^3$ was designed to meet a key system requirement for digital battle command and is the M1A2 SEP link to FBCB2. Technical testing conducted on the M1A2 SEP indicated that the system's $IC^3$ was sufficiently mature to enter FOT&E IV and successfully demonstrated system digital $C^2$ requirements. Despite acceptable performance in developmental testing, the system performed poorly in operational testing.

The FOT&E III, FOT&E IV, and the DARI were adequate to determine the operational effectiveness and suitability of the M1A2 SEP. The Army has no plans for follow-on operational testing of the M1A2 SEP. Plans for operational testing of the engine program are unknown.

# Advanced Field Artillery Tactical Data System (AFATDS)

The Advanced Field Artillery Tactical Data System (AFATDS) is a network of computer workstations that processes and exchanges information from the forward observer to the fire support element for all fire support assets (field artillery, mortars, naval gunfire, attack helicopters, and close air support). Features include the automatic processing of fire requests, generation of multiple tactical fire solutions for missions, monitoring of mission execution, and support for the creation and distribution of fire plans. AFATDS is one of the battlefield functional areas comprising the Army Battle Command System (ABCS) and is also used by the Marine Corps.

The AFATDS Initial Operational Test and Evaluation (IOT&E) in 1995 and the subsequent fielding of the AFATDS96 software following the Milestone III acquisition decision established the core capability for this program. The program continues enhancing the fielded capability through testing and release of software upgrades designated AFATDS97, AFATDS98, and AFATDS99. The program is also developing software that integrates into the ABCS Version 6 architecture supporting Army digitization and transformation efforts.

## TEST & EVALUATION ACTIVITY

As a result of a series of Limited Users Tests in CY01, the AFATDS obtained a material release in July 2002 of the AFATDS Version 6.3 update for fielded units. This software, previously designated AFATDS99, extended the AFATDS to the firing platforms by providing the capability to produce technical fire solutions.

The AFATDS, as a supporting system, participated in ABCS developmental and operational tests leading to the planned Force XXI Battle Command, Brigade and Below, Maneuver Control System, and Integrated System Control Version 4 IOT&Es in April 2003. The Army has indefinitely postponed this IOT&E due to preparations for anticipated real-world operations

## TEST & EVALUATION ASSESSMENT

The Army conducted no AFATDS specific testing in 2002. Test issues that remain for this program include testing of future upgrades within the system-of-systems concept, interoperability within the ABCS, and development supporting Army transformation efforts. The Army must update the existing AFATDS Test and Evaluation Master Plan to address the testing to include the horizontal interoperability required to operate within the integrated ABCS software architecture and the joint common database.

*The Advanced Field Artillery Tactical Data System is a network of computer workstations that process and exchange information from the forward observer to the fire support element for all fire support assets (field artillery, mortars, naval gunfire, attack helicopters, and close air support).*

The ability to evaluate the ABCS components as individual programs is becoming more difficult as the Army continues to integrate the software and foundation products that comprise these systems, as well as integrate the information into the Common Tactical Picture. An assessment of operational effectiveness and suitability is no longer limited to what the system provides within a single functional area (fire control for AFATDS), but now expands to what the integration of that information with other functional areas provides to the commander's ability to prosecute the mission. Testing must be done with all the ABCS components present to assess operational effectiveness and suitability. The Department of the Army should begin to look for Capstone acquisition, development, testing, and fielding strategies to more effectively and efficiently support, fund, and synchronize the ABCS programs.

# AH-64D Longbow Apache & Longbow Hellfire Missile

The AH-64D Longbow Apache is a remanufactured and upgraded version of the AH-64A Apache attack helicopter. The primary modifications to the Apache are the addition of a millimeter-wave Fire Control Radar (FCR) target acquisition system, the fire-and-forget Longbow Hellfire air-to-ground missile, updated T700-GE-701C engines, and a fully integrated cockpit. In addition, the aircraft has improved survivability, communications, and navigation capabilities. Most existing capabilities of the AH-64A Apache are retained.

The AH-64D is being fielded in two configurations. The full-up AH-64D includes all of the improvements listed above. The other version of the AH-64D does not have the FCR, Radar Frequency Interferometer, or the improved engines. The AH-64D without FCR is more affordable yet remains capable of employing Longbow Hellfire missiles autonomously or in cooperation with the FCR-equipped AH-64D. Five hundred and one AH-64A Apaches in the fleet are to be upgraded to the AH-64D configuration. Approximately half (227) will be equipped with the FCR.

The Longbow Hellfire missile is a radar-guided version of the laser-guided Hellfire anti-tank, air-to-ground missile and is managed by the Army as a separate program. The Longbow Hellfire missile features an active millimeter wave seeker and a dual tandem warhead designed to defeat reactive armor. Either the FCR or the Target Acquisition and Designation Sight can be used to provide target location data to the missile prior to launch. The Longbow Hellfire missile can engage both moving and stationary vehicles.

The mission of the attack helicopter is to conduct precision strike, armed reconnaissance, and security in day, night, or adverse weather conditions across the entire battle space through the entire spectrum of combat.

The 1995 combined Longbow Apache and Longbow Hellfire Initial Operational Test & Evaluation compared the AH-64D Longbow Apache with the baseline AH-64A Apache aircraft. Both the Longbow Apache and baseline Apache units conducted missions against a battalion-sized enemy ground force augmented with formidable air defenses while a real-time casualty assessment system imposed realistic friendly and enemy losses. The AH-64D force was significantly more lethal and survivable than the AH-64A force, primarily as a result of major improvements in situational awareness, reduced exposure to enemy air defenses, and increased engagement ranges.

As the ongoing procurement and fielding of the Longbow Apache continues, the configuration of the aircraft will change with the goal of improving system reliability and survivability. The changes include the aircraft's new portable fire extinguisher, the possible integration of the Suite of Integrated Infrared Countermeasures (with a focus on the advanced flare dispenser and the advanced flares), and the integration of the internal auxiliary fuel system, which is a new crashworthy and ballistically tolerant fuel tank and ammunition magazine, located internal to the aircraft.

*The Longbow Apache is a remanufactured and upgraded version of the AH-64A Apache Attack Helicopter.*

## TEST & EVALUATION ACTIVITY

As reported last year, during operations in Poland (October 2000), 19 of 43 Apache Aircraft sustained damage from firing debris from Hellfire missiles with Alliant Tech rocket motors. The affected Hellfire missiles were suspended for training /peacetime use and were coded for wartime use only. During the past year, the Army has identified the cause of the ejected debris from the Hellfire Missile Motor produced by Alliant and developed, applied, and tested the solution to the ejection debris problem. Qualification testing of the redesigned missile was satisfactorily completed in

March 2002. Retrofit and fielding of the redesigned motors has begun.

Concerns with the accuracy and adequacy of the published performance tables for the AH-64D prompted the initiation of Airworthiness and Flight Characteristics (A&FC) testing of the AH-64D Longbow Apache in February 2002. Anticipating completion in March of 2003, A&FC testing will require approximately 300 flight hours and is being conducted at Fort Rucker, Alabama. Additionally, the test team will conduct handling qualities testing and test the latest software releases for the Embedded Global Positioning System, Inertial Navigation System, and the Flight Management Computer.
The Army is developing an internal auxiliary fuel system ballistic vulnerability test plan to ensure that this configuration does not adversely affect the survivability of the helicopter. DOT&E will continue to monitor the development and testing of these configuration changes.

### TEST & EVALUATION ASSESSMENT

Possible upgrades to the AH-64D helicopters include improvements to the Longbow fire control radar, new engines and transmission, new composite rotor blades, expanded digital situational awareness, connectivity with unmanned aerial vehicles, and electronic warfare self-protection. If these initiatives are funded, DOT&E will consider requirements for additional operational testing.

The Live Fire Test & Evaluation (LFT&E) Integrated Product Team reviewed all of the changes to the Apache helicopter since full-up system level LFT&E in 1995, and has agreed that they do not effectively change the vulnerability of the aircraft. The only outstanding LFT&E requirement is the completion of the engine fire detection and suppression system (FDSS) test, and the ballistic vulnerability subsystem test of the internal auxiliary fuel system. The former test, required by the Apache Longbow Test and Evaluation Master Plan, was deferred so that it could be conducted with the Army Aviation Halon replacement. Currently, the Army is preparing an event design plan describing the necessary Live Fire Testing and analysis efforts required to address the testing of both the FDSS and the internal auxiliary fuel system. Since a suitable drop-in halon replacement has not yet been identified, the Program Management Office has agreed to conduct this test with the existing Halon 1301 system. The Army intends to use an operational representative, but not flight worthy, ground test article to conduct this series of tests in FY04.

# All Source Analysis System (ASAS)

The All Source Analysis System (ASAS) is a network of computer workstations that processes and exchanges sensor data, fuses multi-source data into a single intelligence picture, and supports management of intelligence sensors. It is tactically deployable, supports intelligence and electronic warfare operations at battalion through echelons above corps, and provides interoperability with joint intelligence and sensor systems. Intelligence provided by ASAS allows commanders to identify key points for dominant maneuver and find high priority targets for precision targeting.

The ASAS Block I successfully completed its operational test in 1993 and is fielded to selected theater, corps, and division units throughout the Army. The current Block II development is structured so that the interim capability is attained through a series of stand-alone products that can be tested and fielded when they are ready. The ASAS Remote Workstation (RWS) began fielding after completing its operational test in March 1999. An upgrade to the Communications Control Set obtained a conditional material release in June 1999 following a series of developmental tests. The Analysis Control Team Enclave, a shelter for the team at brigade, successfully completed testing and started fielding in September 2000. The ASAS Light, a downsized laptop version of the ASAS RWS at battalion, obtained a conditional material release and began fielding in FY01. The ASAS Block III is the objective capability.

## TEST & EVALUATION ACTIVITIES

Test and Evaluation Integrated Product Team continued planning and coordination for the ASAS Block II Initial Operational Test and Evaluation (IOT&E) tentatively scheduled for late 2003.

The Army consolidated the Limited User Test for the ASAS RWS (without the companion ASAS Light) into the same test event as the Maneuver Control System; the Force XXI Battle Command, Brigade and Below; and the Integrate System Control Version 4 IOT&Es.

ASAS Light requires another test venue, as the unit supporting the Limited User Test does not use the ASAS Light. Tests involving the interim brigade combat team are the most likely candidates.

The ASAS RWS completed developmental testing and participated in the Field Test 5.

The second ASAS Block II upgrade to the Communications Control Set consisting primarily of a new shelter, new power supply, and new communications interfaces completed developmental testing and a functionality demonstration.

## TEST & EVALUATION ASSESSMENT

The consolidation of the Army Battle Command System (ABCS) Version 6 tests into a single test period has a significant impact on the ASAS RWS and ASAS Light test and fielding strategies. The consolidation delayed the ASAS RWS/ASAS Light Limited User Test to better support the overall acquisition and fielding objectives for the ABCS. Although the concept of consolidating the various ABCS component tests into one event has great merit from a System-of-Systems perspective, the down side for the ASAS RWS/ASAS Light was that the test unit is only fielded with the ASAS


*The All Source Analysis System is a network of computer workstations that processes and exchanges sensor data, fuses multi-source data into a single intelligence picture, and supports management of intelligence sensors. It supports operations at battalion through echelons above corps, and is interoperable with joint intelligence and sensor systems.*

RWS. The architecture present in the test unit is not representative of how ASAS RWS and ASAS Light will be used in the remainder of the Army. The absence of ASAS Light raises questions as to whether the test architecture for the other ABCS components is sufficient. It also requires the Army and the ASAS program to find additional opportunities to test the ABCS architecture that includes the ASAS Light.

The Army Evaluation Command and DOT&E determined that developmental tests and a functional demonstration were the appropriate level of testing for the second Block II upgrade to the ASAS Communications Control Set. The tests confirmed that the upgrades were ready for release to the field. The Block II IOT&E also will assess the operations of the Communications Control Set as part of the full ASAS Block II architecture.

The challenges of testing the ASAS Light highlighted the differences in the architecture of networks, hardware, and software capability between the Army units involved in the processes of digitization and transformation. The application of uncoordinated spiral development at the various units and sites working these issues is producing locally unique systems and capabilities that often use the same name. The differences complicate the ability to make acquisition decisions for programs rather than specific units and the long-term implications for interoperability and logistics supportability are unknown.

# Army Tactical Missile System Block II / Brilliant Anti-Armor (ATACMS BAT)

The Brilliant Anti-Armor (BAT) is a self-guided submunition that uses on-board sensors to seek, identify, and engage enemy combat vehicles. Thirteen BATs are dispensed from the Army Tactical Missile System (ATACMS) Block II missile. The Army has two BAT variants. The basic BAT variant is designed to engage moving armored vehicles using acoustic and infrared sensors. The acoustic sensor acquires and guides the submunition to the moving vehicles. Once in the vicinity of a threat vehicle, the infrared sensor guides the BAT to its aim point, where it uses a tandem-shaped warhead to destroy the vehicle. This precision engagement capability is intended to provide joint U.S. and combined forces a capability to delay large moving enemy formations at depth.

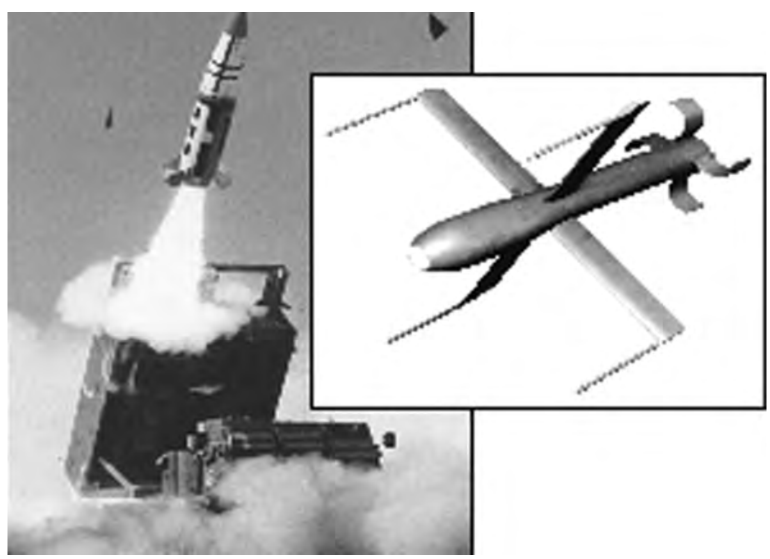
The pre-planned product improvement ($P^3I$) BAT variant incorporates a more robust counter-counter-measure system, enabling the attack of moving and stationary armor as well as surface-to-surface transporter-erector-launchers and heavy multiple rocket launchers. As with the basic BAT, $P^3I$ BAT will use acoustic sensors to initially acquire moving vehicles. Once acquired by the acoustic sensor, the $P^3I$ BAT uses its millimeter wave and imaging infrared sensor to track the target to impact. When the system engages stationary targets, the $P^3I$ BAT will use its millimeter wave and imaging infrared sensors to detect, acquire, and track a target to impact.

Both ATACMS Block II and basic BAT were approved to enter low-rate production in February 1999. The $P^3I$ BAT began development in July 1999. Due to poor performance in Operational Test, the Block II/BAT Initial Operational Test and Evaluation and the full-rate production decision were cancelled. The Army will accept approximately 90 Low-Rate Initial Production (LRIP) Block II missiles equipped with basic BAT. A portion of these missiles has been approved for conditional release to meet operational needs. The Army conducted a successful demonstration drop of a BAT from a Hunter Unmanned Aerial Vehicle, but further development and testing within the $P^3I$ BAT program is unfunded. In FY03 however, the Army did receive funding to further develop the multi-mode seeker.

## TEST & EVALUATION ACTIVITIES

Basic BAT technical and operational testing for the past two years has focused on missile firings of the ATACMS Block II/BAT.

In the $P^3I$ BAT program, the contractor has thus far completed five recoverable BAT (RBAT) engineering tests. RBATs have similar hardware and algorithm to the $P^3I$ BAT. However, when an RBAT locks onto a target, it briefly tracks it and deploys an additional parachute so that it can be recovered. Hence, multiple tests can be conducted with the same hardware. There is only one more drop test scheduled. $P^3I$ BAT Live Fire Test and Evaluation (LFT&E) planning activities also continued in FY02.



*Thirteen Brilliant Anti-Armor are dispensed from the Army Tactical Missile System Block II missile.*

## TEST & EVALUATION ASSESSMENT

The basic BAT variant is not operationally effective against targets with realistic countermeasures and is adversely affected by high wind.

Last year, three missions were fired as part of the operational test, with limited success. In the first mission of 2001, there were no hits, resulting from poor seeker performance in the presence of Defense Intelligence Agency (DIA)-

approved, mid-level countermeasures on the target vehicles. The second mission was a technical test which yielded mixed results against targets equipped with the same countermeasures. The third mission was fired against a dispersed array of three armored columns without countermeasures. Four targets were hit (one of them twice) in a flank column. Analysis indicates that the BATs detected high acoustic background noise, miscalculated altitudes, and had other problems. Most of these problems were likely caused by turbulent, but realistic, air conditions.

This year, the Army executed a dual missile mission, the expected employment concept. The countermeasures for the targets included a mix of DIA- approved and unapproved measures. BATs from the first missile hit only some of the counter-measure targets. Due to a M270A1 launcher software problem, the second missile dispensed the BATs too low, so the thirteen BATs did not have the opportunity to acquire targets. The missile contractor has identified and applied a fix to the launcher software.

Early in the program, the contractor had problems with submunition reliability. The LRIP units now being delivered to Letterkenny Army Depot, however, have been 100 percent functional. The first increment of these LRIP missiles will be fielded in Korea and stored in the United States.

Missile firings to date indicate that the missile will meet its accuracy requirement and will dispense its BAT submunitions over the target area.

Although in early development, the $P^3I$ BAT RBAT series uncovered technical problems with the millimeter wave and infrared sensors. The problems have been identified and the fixes are being tested.

The LFT&E strategy for the weapon system was developed to take advantage of expected hits on armored vehicles during the planned flight tests of Basic BAT submunitions with live warheads. There have been 33 BAT drops/dispenses with live warheads that have been scored to date; seven of these have detonated on targets (including tanks and light armored vehicles). These test results, along with the detailed lethality results from the seven shots against a T-72 tank in dedicated live fire test, provided sufficient data to determine that the Basic BAT submunition does meet its lethality requirements.

# Bradley Fighting Vehicle System Upgrade-A3

The M2A3 and M3A3 Bradley Fighting Vehicle System (BFVS) are improved versions of the M2A2 and M3A2 BFVS. The BFVS-A3 includes enhancements intended to improve lethality, mobility, survivability, and sustainability. Additionally, these enhancements provide increased situational awareness and digital command and control capabilities.

The mission of the BFVS is to provide mobile protected transport of an infantry squad to critical points on the battlefield and to perform cavalry scout missions. The BFVS will also provide overwatching fires to support dismounted infantry and suppress or defeat enemy tanks and other fighting vehicles. BFVS-A3 enhancements include:

- Force XXI Battle Command, Brigade and Below (FBCB2) Integrated Combat Command and Control to share battle command information and situational awareness with all components of the combined arms team.

- The improved Bradley acquisition system and commander's independent viewer, both 2nd generation Forward Looking Infrared (FLIRs), to enhance target acquisition and target engagement.

- A position navigation system with a Global Positioning System receiver and a backup inertial navigation system to enhance situational awareness.

- Integrated maintenance diagnostics and Built In Test/Built In Test Equipment.

In March 1994, the Army began the Engineering, Manufacturing, and Developing phase. Previous operational testing conducted prior to FY01 included a Limited User Test (LUT) I in December 1997; an Operational Experiment in September 1998; a Detection, Acquisition, Recognition, Identification (DARI) test in October 1998; and a LUT II in August-September 1999.

The evaluation of the M2A3 vulnerability was based on the full-up, system-level live fire test (FUSL LFT), early M2A3 ballistic shock testing, electronic fault insertion events (controlled damage tests), directed energy weapon (laser) testing, and other subsystem or component Test and Evaluation, as well as previous M2A2 Live Fire Test and Evaluation (LFT&E). The culminating LFT&E event was the FUSL LFT, conducted during the period of December 1998 through September 1999.

*Improvement in operational effectiveness is attributable to the M2A3's superior capability compared to the M2A2 Operation Desert Storm to detect, identify, and hit targets and the M2A3's improved night fighting capability.*

### TEST & EVALUATION ACTIVITY

The BFVS-A3 Initial Operational Test and Evaluation (IOT&E) was conducted in October-November 2000 in accordance with a DOT&E approved plan. DOT&E monitored test events and conducted an independent assessment of the test results and provided an Operational and LFT&E Report to the Secretary of Defense and Congress in April 2001. Planning for possible post-Milestone III vulnerability testing is currently ongoing. Such testing could include exploring fixes to unexpected vulnerabilities revealed in the LFT&E or shock vulnerabilities of FBCB2 components.

In 2002, the Army conducted several technical test events and demonstrations to evaluate fixes for FBCB2 and other unresolved issues. The results of these tests are currently being evaluated.

**TEST & EVALUATION ASSESSMENT**

DOT&E assessed the M2A3 to be operationally effective, suitable, and survivable, based on the results of the IOT&E, LUT-2, and the DARI. Overall, the M2A3 showed an improved level of operational effectiveness in comparison to the M2A2 Operation Desert Storm (ODS), the most advanced currently fielded version of the BFVS. This improvement in operational effectiveness is attributable to the M2A3's superior capability compared to the M2A2 ODS to detect, identify, and hit targets and the M2A3's improved night fighting capability. However, FBCB2 digital command and control, as integrated into the M2A3, demonstrated during the IOT&E that it was neither effective nor suitable and it did not contribute to the operational effectiveness of the M2A3/M1A2 System Enhancement Package equipped force. Despite this, the M2A3 was able to demonstrate an overall improved level of operational effectiveness in comparison to the M2A2 ODS, predominately because of the capabilities of the M2A3's 2nd Generation FLIR and improved fire control system.

Field Test 5 (FT5) was conducted from July 15- September 27, 2002, at the Electronic Proving Ground, Fort Huachuca, Arizona. If the FT5 results show that integration problems continue with the M2A3, a Follow-On Operational Test and Evaluation (FOT&E) may be required. This FOT&E would focus on the operational effectiveness and suitability of the FBCB2 integration.

# CH-47F Improved Cargo Helicopter (ICH)

The CH-47F Improved Cargo Helicopter (ICH) is a remanufactured version of the CH-47D Chinook equipped with the new T55-GA-714A engines. This Service Life Extension Program is intended to sustain the aging CH-47D airframes and extend the aircraft's life expectancy another 20 years. The CH-47D is a twin-turbine tandem rotor helicopter designed for combat and combat support heavy-lift cargo missions. ICH improvements include fuselage stiffening (to reduce vibrations in the cockpit area) and an integrated cockpit and digital communications for Objective Force compatibility. The ICH program will rebuild 300 systems.

OSD approved entry into Engineering and Manufacturing Development (EMD) in FY98 based on the perceived low technical risk, and delegated Milestone Decision Authority to the Army Acquisition Executive. The program has experienced aircraft delivery delays, changes to the Operational Requirements Document, and cost overruns that resulted in a Nunn-McCurdy breach and significant program restructuring in FY02. Additionally, due to contingency operations in Afghanistan, the unit scheduled for the Initial Operational Test and Evaluation (IOT&E) was unable to participate in the test, thereby forcing the event to be rescheduled. A Low-Rate Initial Production (LRIP) decision to purchase up to 30 aircraft was approved August 19, 2002. The IOT&E is now scheduled for FY04 and the Full-Rate Production decision in FY05.

The current Test and Evaluation Management Plan (TEMP) was approved in January 2002. A TEMP update is currently being staffed to support the restructured program with an anticipated approval date in FY03.

DOT&E approved an alternative Live Fire Test and Evaluation (LFT&E) plan after concurring with the Army's request for a waiver from full-up system-level testing in December 1997. The waiver certification to Congress was provided by the Under Secretary of Defense for Acquisition Technology and Logistics) in March 1998. DOT&E approved the Army's LFT&E Strategy in January 1999. A damaged CH-47D production aircraft was repaired and is being used as the ground test vehicle (GTV) for the live fire test program. Live fire testing started in FY99.

### TEST & EVALUATION ACTIVITY

The first refurbished EMD aircraft began developmental flight-testing on June 25, 2001, with the second EMD aircraft following on October 17, 2001. Together, the EMD aircraft have completed approximately 170 developmental test (DT) flight hours through November 2002. Following initial contractor shakeout flights by Boeing flight test pilots, Army test pilots have participated in most developmental flight-test events. Reliability and Maintainability (R&M) data was collected throughout DT. The second EMD aircraft has completed electromagnetic environmental effects (E3) testing at the Patuxent River E3 test facility.

The CH-47F performed an external lift demonstration with an M198 Howitzer along with associated internal loads, exceeding the requirements for weight, range, vertical rate of climb, and fuel reserve. In another flight demonstration, the ICH, weighted to simulate 31 combat-equipped troops and a crew of four,= exceeded the objective distance requirement for troop transport capability. The CH-47F also demonstrated achievement of the LRIP exit criteria for self-deployment during flight-testing in November 2002.

*The CH-47 Improved Cargo Helicopter Upgrade performing external lift demonstration with an M-198 Howitzer.*

During in-flight technical testing, the CH-47F demonstrated the capability to send and receive selected digital messages between aircraft and with a ground-based Force XXI Battle Command– Brigade and Below simulator. Compliance with the appropriate Joint and Army technical architecture is yet to be demonstrated. The CH-47F Program Manager has coordinated with the Army Systems Engineering Office (ASEO) to develop the required compliance matrix versus Joint Technical Architecture - Army Version 5.0 in FY99, with all applicable issues being resolved. In support of Milestone III, an update to the matrix and review by ASEO will occur in FY03.

The CH-47F met the LRIP vibration reduction Exit Criteria for the cockpit, but initial data suggests there may be an increase in vibration levels in the aft sections of the aircraft at medium to high gross weights. In response, further testing began in October 2002 that will collect comparative vibration data on CH-47D and CH-47F aircraft. This flight-testing will continue through January 2003.

The LFT&E program has prepared event design plans for testing and for modeling and simulation (M&S) as well as detailed test plans that describe the testing for the Cockpit Skin Panels, Cockpit Components, Fuel Subsystem, Propulsion System, and Engine Nacelle Fire Suppression System. Planning for the Fuselage Tunnel Flight Controls System started during FY02. The initial M&S for the baseline CH-47D and the CH-47F ICH has been completed. It will be updated at the conclusion of the live fire tests to incorporate the lessons learned from the testing.

The program initiated ballistic testing of the Cockpit Skin Panels in FY99, and completed all the planned shots. Testing of the T55 engine and fuel subsystem started in FY00 and was completed in FY02. Fire Suppression System testing started in FY02, while the Cockpit Component testing will begin in FY03. In addition, as part of the DOT&E Joint Live Fire (JLF) program, ten ballistic tests and one structural fatigue test were performed for the CH-47D rotor blades. Since these blades are the same as those to be used on the F-model, the data derived from the JLF program is directly applicable to the CH-47F.

#### TEST & EVALUATION ASSESSMENT

Overall, prospects for successful demonstration of system effectiveness are good. Concerns about system reliability and vibrations pose moderate risk to aircraft suitability and the anticipated reductions in Operations and Support costs.

LRIP exit criteria for external loads, troop transport, self-deployment, and Joint Variable Message Format message transfer were successfully demonstrated during technical testing.

Stiffening of the fuselage has reduced vibration levels in the cockpit and meets LRIP exit criteria. However, certain flight test instruments and the operators have noted vibrations in the aft section, prompting concerns about the long-term reliability of aircraft components as well as fatigue life for airframe structure in the aft section. The aft section stress and vibration are under investigation.

Army test pilots have identified 18 issues related to cockpit configuration, displays, illumination, and cooling. The test report that describes these issues in detail and the program manager's corrective action plan are near completion.

Reliability testing to date has revealed failures that are common to legacy CH-47D aircraft. Based on this data, the CH-47F is not expected to demonstrate attainment of the Mean Time Between (MTB) Mission Abort requirement by Milestone III. The MTB Essential Maintenance Action, the MTB Mission Affecting Failure, and the MTB Unscheduled Maintenance Action requirements are all currently on track to be achieved by Milestone III. CH-47F data indicates an improvement in all four reliability measures over the CH-47D.

The CH-47F LFT&E program is a robust program. Test data from the Army's CH-47F LFT&E Program and the DOT&E Joint Live Fire program of the baseline CH-47D will support an adequate evaluation of the CH-47F. The only LFT&E concern at this time is that, at the completion of live fire testing, damage to the GTV may preclude dynamic testing of the main rotor blades.

# Chemical Demilitarization Program

The Chemical Demilitarization Program is an Army managed program responsible for the destruction of the U.S. stockpile of lethal chemical agents and munitions. This program is required to comply with the Chemical Weapons Convention (CWC), which is a major arms control and nonproliferation treaty that entered-into-force on April 29, 1997. As a result of CWC entry-into-force, destruction of 100 percent of the stockpile of unitary chemical weapons is required by April 29, 2007, unless the signatories to the CWC approve a five-year extension.

The Chemical Stockpile Disposal Project is responsible for destruction of the U.S. stockpile of unitary chemical weapons. Nine chemical agent disposal facilities are or will be collocated with nine chemical depots. Five disposal facilities are employing the baseline chemical weapons disassembly and incineration process. The Alternative Technology and Approaches Project is responsible for conducting pilot testing of alternative (to incineration) destruction technologies. The Army has selected chemical neutralization of agent followed by post-treatment of the neutralized products for the disposal facilities at the two bulk agent storage sites in Aberdeen, Maryland, and Newport, Indiana. At the direction of Congress, the Assembled Chemical Weapons Assessment Program was established in 1996 to evaluate alternative technologies for the Pueblo and Blue Grass disposal facilities. Selection of the final destruction technologies is awaiting the Records of Decision from the Environmental Impact Statement process for those sites. Technology decisions are planned for 4QFY02 and 1QFY03, respectively. Due to the events of September 11, 2001, accelerated destruction is being implemented at the two bulk storage sites and the Pueblo site to reduce the risk of continuing agent storage.

The Non-Stockpile Chemical Materiel Project (NSCMP) is responsible for the destruction of non-stockpile chemical warfare materiel, including the components of binary chemical weapons, miscellaneous chemical warfare materiel, recovered chemical weapons, former production facilities, and buried chemical warfare materiel. The NSCMP has developed, tested, and fielded several mobile systems: the Explosive Destruction System, Phase 1, System 1 (EDS-1/1); the Rapid Response System; the Mobile Munitions Assessment System; and the Portable Raman System. Two additional variants of EDS are in testing. Two mobile systems are in development: Single Chemical Agent Identification Set Access Neutralization System , and Large Items Transportable Accessing and Neutralization System. Three non-stockpile disposal fixed facilities are in development: the Munitions Assessment and Processing System at Aberdeen Proving Ground, Maryland; the Pine Bluff Non-Stockpile Facility at Pine Bluff Arsenal, Arkansas; and the Pine Bluff empty ton container recycling facility.

As of June 30, 2002, the Johnston Atoll and Tooele facilities had successfully destroyed approximately 26 percent of the total U.S. chemical weapons stockpile (originally 31,496 agent tons). The Army has met the first two milestones of the CWC (1 percent and 20 percent destruction, respectively).

The Johnston Atoll disposal facility completed chemical agent operations in November 2000, and is currently in the closure process. The Tooele disposal facility is currently the only operational facility. The Anniston and Umatilla disposal facilities are planned to begin agent operations in FY03.

*As of June 30, 2002, the Johnston Atoll and Tooele facilities had successfully destroyed approximately 26 percent of the total U.S. chemical weapons stockpile (originally 31,496 agent tons).*

The disposal facilities are government owned and contractor operated. Each site's prime contractor conducts all developmental and operational testing under oversight of the Program Office and the U.S. Army Materiel Systems Analysis Activity. The Chemical Demilitarization Program was placed under OSD oversight in December 1994. Since then, DOT&E has provided oversight of the stockpile, non-stockpile, and alternate technologies projects within the Chemical Demilitarization Program.

### TEST & EVALUATION ACTIVITY

The Anniston and Umatilla disposal facilities have completed the DT phase of testing. In FY02, DOT&E supported recommendations to begin Developmental Test/Operational Test at each site, which are currently in progress. DOT&E will monitor the test activity and independently analyze selected portions of the test data, leading to a determination of readiness to begin operational testing with active agent in FY03. The Pine Bluff, Aberdeen, and Newport disposal facilities are still under construction. Test activities in FY02 at those sites consisted of limited component and sub-system checkout.

DOT&E reviewed and approved the Pine Bluff Test and Evaluation Master Plan (TEMP). DOT&E previously approved the Anniston, Umatilla, Aberdeen, and Newport TEMPs. In implementing accelerated destruction at the Aberdeen and Newport sites, the program office has proposed replacing the approved TEMPs for those sites with Test Concept Plans (TCPs). The TCPs would still be subject to DOT&E approval. DOT&E is reviewing the proposed draft TCPs.

DOT&E provided selective on-site monitoring of non-stockpile test activities throughout FY02. DOT&E observed operational testing for the EDS, Phase 1, System 2 (EDS-1/2), and independently assessed the test results. DOT&E will actively participate in the Operational Readiness In-Process Reviews for these systems, which will support a Program Manager's decision to declare EDS-1/2 operational in FY02. FOT&E of EDS-1/2 will follow this decision. Early Developmental Test of EDS, Phase 2 (EDS-2) system commenced in FY02.

DOT&E approved the Non-Stockpile Overarching Test Concept Plan, which is a TEMP-like document covering test planning for all non-stockpile programs. DOT&E also reviews individual test plans for each of the non-stockpile systems.

### TEST & EVALUATION ASSESSMENT

U.S. Army testing of stockpile and non-stockpile systems in the Chemical Demilitarization Program has been adequate to ensure the safe and efficient disposal of the inventory of chemical warfare materiel. The implementation of accelerated destruction at three sites increases the amount of manual handling of agent materiel, thereby increasing the risk of safe operation of these facilities. DOT&E will monitor the safety issue closely during testing of these facilities.

Operational testing of EDS-1/2 to date has been inadequate to make a determination of operational effectiveness and suitability. DOT&E anticipates that upon completion of the EDS-1/2 Follow-on Test & Evaluation, the operational testing will be adequate to make this determination. DOT&E is concerned at the absence of a defined vessel vacuum "go/no-go" criterion for the EDS systems. Absence of this criterion increases the risk of inadvertent agent release from the EDS vessel when detonation occurs without a proper seal. Although risks of agent release are very low for the EDS-1 systems, the subsequent EDS-2 system that employs more powerful explosives will incur greater risks, and will require a defined "go/no-go" criterion for the vessel.

The U.S. Army Materiel Systems Analysis Activity is providing effective independent oversight of the testing of both stockpile and non-stockpile programs.

# Comanche (RAH-66)

The RAH-66 Comanche is a twin-engine, two-pilot stealthy armed reconnaissance/attack helicopter. The Comanche features low observable (LO) composite technologies with retractable landing gear and weapons pylon to achieve a low Radar Cross-Section (RCS) and a unique engine exhaust system to suppress its infrared signature. A five-bladed main rotor and a shrouded tail rotor minimize the acoustic and radar signatures. A fly-by-wire flight control system and fully integrated digital avionics assist in piloting the aircraft. The Mission Equipment Package integrates a radar, a forward-looking infrared sensor, and an image-intensified television sensor for night flying and target acquisition. The Comanche will be armed with the Hellfire missile, 2.75-inch aerial rockets, a turreted 20mm gun, and an air-to-air missile.

As a member of an Objective Force air-ground task force, Comanche units will conduct the following operations: armed reconnaissance, mobile strike, close combat with ground forces, and vertical maneuver. Comanche's primary role in these operations is to collect and share intelligence information and destroy enemy forces. As technology and Objective Force concepts mature, the Army intends to use Comanche to provide on-site command and control of the air-ground maneuver team.

The Army received approval in October 2002 for a sixth program restructuring in order to reduce risk and accommodate emerging Objective Force requirements. The new schedule will add about 30 months to Engineering Manufacturing and Development (EMD), establish a blocking strategy, and reduce the amount of concurrent developmental testing, training, and operational testing. The proposed schedule includes a Low-Rate Initial Production (LRIP) decision in FY07, delivery of an initial operational capability in FY09, and a Full-Rate Production (FRP) decision in FY10.

The Comanche program was designated a Live Fire Test & Evaluation (LFT&E) system in November 1989. The original LFT&E strategy was approved in the fall of 1995, and will be updated in FY03. The revised LFT&E strategy presents a sequential test program, progressing from components to subsystem and ultimately full-up system level. The full-up system level test article will be a Block I production representative aircraft. In addition, it includes the lethality testing required for the new XM1031 20mm projectile.

### TEST & EVALUATION ACTIVITY

Testing to date has featured flight-testing of two prototype aircraft, RCS testing of a full-scale model, contractor testing of mission equipment (sensors, antennas, communications, armament) and crew- and team-level simulation events.


*Testing to date has featured flight testing of the prototype aircraft and crew and team simulation level events.*

LFT&E activities since Milestone II have included the completion of the initial analytical vulnerability assessment and a series of ballistic and structural tests on evolving designs for the main rotor blade, lightweight crew armor, and several tail rotor components. The ballistic effort will provide data to assist in validation/verification of the finite element analysis model of the dynamic structural response of the tail rotor components when impacted by high explosive incendiary projectile. Lethality evaluation planning for the 20mm projectile was also completed.

### TEST & EVALUATION ASSESSMENT

Technical challenges remain for software development, integration of mission equipment, weight reduction, RCS and Infrared signatures, and radar performance. However, with both time and funding added to the program by the restructure, these high-risk areas now appear to be at a manageable medium level of risk.

Evolution of Comanche into a network-centric Objective Force helicopter should occur by the FRP decision. Based on the remaining software concurrency and complexity, it will be challenging for the Army to produce Block 2 or Block 3 aircraft in the currently projected timelines of FY10 and FY11, respectively.

- Performance and Weight. There has been weight growth of 675 lbs since Milestone II, which is attributed mainly to the redesign of drive train components. To offset weight growth, engine power output has been increased 100 shaft horsepower, but at the expense of engine life (3,400 to 2,800 hours). At the projected weights, Comanche will meet the Key Performance Parameter Vertical Rate of Climb (500 fpm) requirement with little or no margin for additional weight growth or engine power.
- Software Development, Integration, and Testing. The Comanche program strategy for integrating and testing mission equipment on the aircraft still entails significant risk. The EMD strategy proposes parallel development and testing of four major software drops before the Block 1 aircraft completes operational testing in FY09. Minimal mission equipment functionality (no armament, radar, aircraft survivability equipment, or digital communications) will be available for the Limited User Test (LUT). Ability to conduct night operations may also be prohibited due to the timing of the required airworthiness release. Primarily developmental testing, as opposed to operational testing, will support the LRIP decision.
- Antennas. Antenna placement, design, and performance remain significant program risks to meet some antenna performance goals. Also problematic is the translation of antenna areas. Testing of LO antennas to date has confirmed that the designs meet RCS goals but fail performance goals in some real world situations. There is concern that flight-testing of EMD antennas cannot be scheduled until FY06, just prior to the LUT. To be a command and control platform, Comanche must have robust antennaperformance.
- Flight Handling. The prototype aircraft has demonstrated some undesirable flight handling characteristics including vibration, buffeting and directional stability. However, design changes and flight control software modifications continue to correct these flight-handling anomalies.
- Comanche Radar. Design of the Comanche radar antenna in the past two years appears to be maturing, but challenges remain to achieve stationary target detection requirements. At Milestone II, the Comanche radar used an electronically steered array antenna that failed to meet performance requirements. Since Milestone II, the contractor has completed design, assembly, and laboratory testing of a mechanical scanning antenna that employs azimuth and elevation mono-pulse radar waveforms. Laboratory test results suggest that the new design may improve performance as expected.
- Radar Cross-Section. Comanche appears to be in a position, based on RCS measurements of a full-scale model, to meet RCS goals in most areas. As expected, technical challenges are emerging that could compromise the demonstrated RCS levels. For example, rain erosion of the polyurethane strips on the fantail blades has prompted a search for dielectric materials for the leading edges of the blades. In addition, materials currently identified for conductive door/skin seals have not achieved the durability and RCS characteristics desired. Materials have not been identified that will produce the desired RCS and withstand the harsh environments common to helicopter operations.
- Command and control software and employment concepts. The software that enables wideband digital communications will not be delivered until late in EMD. Achieving real-time digital interoperability will not likely occur on Block 1 aircraft.

The LFT&E program is scheduled to be completed before FRP decision (FY10). It includes component qualification and subsystem level ballistic testing for over 20 critical components, as well as dynamic testing on the full-up production-representative aircraft. Because of the late (FY08) delivery of the LFT&E aircraft, correction of vulnerabilities discovered during LFT&E will be difficult to implement on initial production aircraft.

# Combat Service Support Control System (CSSCS)

The Combat Service Support Control System (CSSCS) is the combat service support (CSS) node of the Army Battle Command System (ABCS). CSSCS supports combat commanders in determining the sustainability and supportability of current and planned operations. CSSCS collects and processes selected combat service support data from Standard Army Management Information Systems and other automated information systems and manual inputs from using units. CSSCS software tools maintain combat information, generate reports and orders, and provide analytical tools to support commanders and their staffs from maneuver brigade through echelons above corps. Commanders at each echelon can tailor the amount of information tracked within their organization. Within the ABCS, the CSSCS is the capstone decision support system for command and staff matters associated with CSS operations.

The CSSCS completed its Initial Operational Test and Evaluation (IOT&E) and began fielding of Version 3 following a Milestone III acquisition review in 1998. Since then, the CSSCS program focus has been fielding Version 3 and development of the Version 4 functionality, the initial integration of CSSCS into the Army Battle Command System baseline. Version 5 will further enhance and refine the capabilities needed by CSS commanders and their staffs at all echelons, provide the potential for direct Joint Interface, and provide an interface with the approved simulation system (dependent upon simulation development/ schedule). Version 5 objectives include the incorporation of artificial intelligence decision support modules, shared database technology, and complete transition to the Defense Information Infrastructure Common Operating integrated ABCS environment.

## TEST & EVALUATION ACTIVITIES

The CSSCS participated as a supporting system in ABCS developmental testing (the Maneuver Control System System Stress Tests and Field Test 5) leading to the Force XXXI Battle Command, Brigade and Below, Maneuver Control System, and Integrate System Control Version 4 IOT&E in April 2003. The Army has indefinitely postponed this IOT&E due to preparations for anticipated real-world operations.

OSD disapproved and returned the CSSCS Test and Evaluation Master Plan (TEMP) to the Army in June 2001. The program began revising the TEMP in November 2002 to resolve OSD concerns and devise a new test program.

## TEST & EVALUATION ASSESSMENT

The CSSCS participation in ABCS developmental testing revealed that the CSSCS must still implement the joint common database and associated database updates to fully integrate into the ABCS architecture. The integration of CSSCS remains limited to messages and client applications for the ABCS Version 6 series of software.

The CSSCS requires an updated TEMP to describe their planned testing for ABCS Version 7 and to start defining an appropriate level of testing for the objective Version 5 capability.

The ability to evaluate the ABCS components as individual programs is becoming more difficult as the Army continues to integrate the software and foundation products that comprise these systems, as well as integrate the information into the Common Tactical Picture. An assessment of operational

*The Combat Service Support Control System supports combat commanders in determining the sustainability and supportability of current and planned operations. Its software tools maintain combat information, generate reports and orders, and provide analytical tools to support commanders and their staffs from maneuver brigade through echelons above corps.*

effectiveness and suitability is no longer limited to what the system provides within a single functional area (logistics support for CSSCS), but now expands to what the integration of that information,with other functional areas, provide to the commander's ability to prosecute the mission.  Testing with all the ABCS components present is required to assess operational effectiveness and suitability.  The Department should begin to look for Capstone acquisition, development, testing, and fielding strategies to more effectively and efficiently support, fund, and synchronize the ABCS programs.

# Common Modular Missile (CMM)

The Common Modular Missile (CMM) is intended to be the Army's anti-armor air-to-ground missile to replace the Hellfire II on its helicopters. A ground-to-ground requirement was dropped in FY02. There is a possible interest by the Navy, Marines, and Air Force for the system to be employed in a fixed wing configuration; backward compatibility with legacy platforms would be a requirement. The Army has established a requirement for 49,000 missiles.

This is a Pre-Major Defense Acquisition Program with the Milestone B currently scheduled for September 2003. The Full-Rate Production Decision is planned for FY09 with production through FY23.

## TEST & EVALUATION ACTIVITIES

An Early Operational Assessment, scheduled for FY03, will provide information to support the Milestone B decision to enter the System Development and Demonstration phase in early FY08.

A Limited User Test, planned for FY07, will consist of force-on-force training exercises and live missile firings from both Army and Navy/Marine Corps aviation platforms. Evaluations of data from these events will support the Milestone C, the Low-Rate Initial Production decision, in FY07.

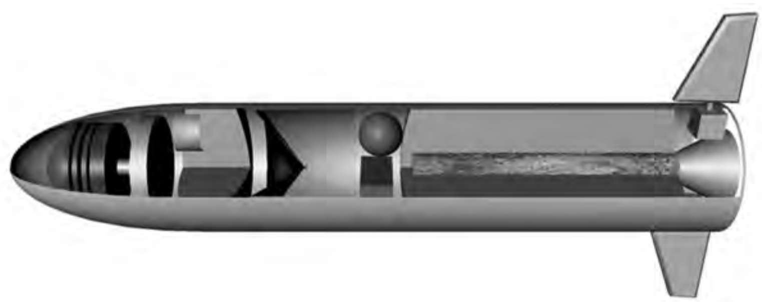
The Initial Operational Test and Evaluation (IOT&E), planned to occur in FY09, will consist of field training exercises and live missile firing exercises and will compare force effectiveness of a CMM equipped unit to a baseline-equipped unit.

Operational effectiveness, suitability, and survivability of a CMM equipped force will be examined and compared to a Hellfire II baseline-equipped force. During testing, potential incidents of fratricide and situational awareness in air-to-ground engagements will be examined. In addition, the adequacy of training devices will be determined. The Key Performance Parameters to be met include fire and forget accuracy, man in the loop accuracy, system effectiveness (including missile lethality) and range (minimum and maximum).

The Live Fire Test and Evaluation (LFT&E) Integrated Process Team has drafted an initial LFT&E strategy. It is expected that the LFT&E program will include three phases and will culminate in five live missile shots against representative threat targets.

## TEST & EVALUATION ASSESSMENT

During future testing and evaluations platform compatibility effects of missile back blast and debris on helicopter in flight will be examined. Validation of training devices and real time casualty assessment will be conducted. The adequacy and sufficiency of the number of missile firings to demonstrate effectiveness and reliability will be reviewed. Procedures for correct identification of targets beyond line of sight will be examined.



*The Common Modular Missile is envisioned to replace the Hellfire II as the Army's helicopter missile.*

# Crusader Howitzer and Resupply Vehicle

Crusader was to have been the Army's next-generation, 155mm Self-Propelled Howitzer (SPH) and its companion re-supply vehicle (RSV), either tracked (RSV-T) or wheeled (RSV-W). Crusader would have been the indirect fire support system for Army armored and mechanized forces.

The Crusader SPH employed Advanced Solid Propellant Armament using a modular propellant charge system, auto-settable multi-option fuze, automated ammunition handling, Global Positioning System (GPS)-based position location, and azimuth reference system. The SPH was designed to deliver unassisted munitions at ranges up to 30 kilometers and assisted munitions up to 40 kilometers, provide a maximum rate of fire of 10 to 12 rounds per minute for three to five minutes, and a sustained rate of fire of three to six rounds per minute. It was required to have the agility and mobility to keep up with the supported maneuver force of the M1 Abrams tanks and Bradley fighting vehicles. It had to be able to complete a survivability move of 750 meters within 90 seconds of identifying a potential threat. There were to be an equal mix of RSV-Ts and RSV-Ws with automated ammunition and fuel re-supply functions and GPS-based navigation system. The SPH and RSV-T each had a crew of three, and the RSV-W had a two-man crew.

The Crusader SPH and RSV program, formerly the Advanced Field Artillery System and Future Ammunition Re-supply Vehicle, began in 1992. Crusader Operational Requirements Documents were approved in June 1993. In November 1994, the program completed a successful Defense Acquisition Board Milestone I review and entered the Program Definition and Risk Reduction phase. In 1997, a decrement in program funding caused the program manager to revise the Acquisition Program Baseline (APB) and slip the Milestone B review to 2001.

In FY00, the program was again restructured to address software development/integration problems, a funding reduction, and a change in the Army's priorities. Crusader re-entered the preliminary design phase to make it lighter (38 to 42 tons per vehicle) enabling both C-5s and C-17s to transport two SPHs without weight waivers. The program restructure added an RSV-W with an automated re-supply module mounted on a palletized load system carrier. Crusader also joined the Abrams program in seeking a common engine. The Milestone B Review slipped to FY03, with the Initial Operational Test and Evaluation and first unit equipped in 2008. In August 2000, DOT&E approved a Crusader Test and Evaluation Master Plan (TEMP).

In May 2002, the Secretary of Defense directed the Army to terminate the Crusader program.

*Crusader would have been the indirect fire support system for Army armored and mechanized forces.*

**TEST & EVALUATION ACTIVITIES**

During FY02, the Self-Propelled Howitzer-1 Emulator (SPH1E) underwent propellant handling and firing tests at Yuma Proving Ground, Arizona. SPH1E included the chassis, armament, and ammunition handling equipment hardware of a heavy Crusader prototype with emulation electronics and software. SPH1E achieved a 40-kilometer range, fired a ten-round mission at the maximum rate of fire, and demonstrated a four-round, multiple-round-simultaneous-impact fire mission.

United Defense, the prime contractor, integrated armament and ammunition handling test stands, crew stations, electronics, and tactical software into a Crusader Integrated Test Station to exercise fire missions, re-supply, upload/download, and inventory management functions for both the SPH and RSV.

In FY02, the Crusader LFT&E Integrated Product Team (IPT) reached consensus on the details of the vulnerability Live Fire Test and Evaluation (LFT&E) strategy and received DOT&E approval to integrate the strategy into the Crusader TEMP for final approval at Milestone B. During FY02, DOT&E continued to participate in IPT activities refining the LFT&E strategy and planning the post-Milestone B Ballistic Hull and Turret test. All LFT&E IPT activity ceased after termination of the Crusader program.

### TEST & EVALUATION ASSESSMENT

Test firings with the SPH1E showed that Crusader had the potential to meet its range and rate-of-fire requirements. However, technical problems delayed the SPH1E testing that was intended to demonstrate that Crusader could consistently achieve those requirements.

OSD directed the Army to take appropriate action to retain Crusader technologies under development that present potential benefits to other programs. DOT&E will assist in evaluating those programs that receive the Crusader technologies.

# Excalibur Family of Artillery Projectiles

Excalibur is a family of precision-guided, extended-range modular projectiles incorporating three unique payload capabilities. The high explosive, fragmenting, or penetrating unitary munitions (Block I) are intended to enhance traditional fire support operations with increased range and improved accuracy against personnel, light materiel, and structure targets. The smart munitions (Block II) will be designed to search, detect, acquire, and engage fleeting and short-dwell targets common to open-terrain battlefields. Discriminating munitions (Block III) are expected to add the capability to selectively identify and engage individual vehicular targets in urban environments by distinguishing specific target characteristics. Excalibur's precision capabilities are intended to be used by Future Combat System (FCS) Non-Line-of-Sight (NLOS) Cannon units to provide close support to maneuver units in urban or complex terrain. Digitized light-weight 155mm howitzer systems will be used to develop and test Excalibur's capabilities before FCS NLOS Cannon is fielded.

The Excalibur development team combines U.S. guidance expertise with Swedish airframe experience. The projectile will employ Global Positioning System (GPS)-aided inertial guidance and navigation, free spinning base fins, four-axis canard airframe control, base bleed technology, and a trajectory glide to achieve increased accuracy and extended ranges beyond 35 kilometers. The FCS NLOS Cannon will incorporate an inductive fuze setter to transfer target and fuze data to the integral fuze.

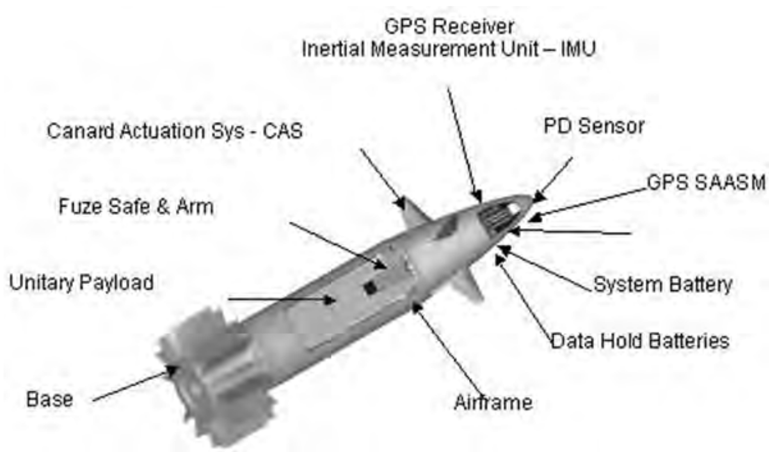
Excalibur system development began in 1997 with a dual-purpose improved conventional munitions variant. However, in January 2001, the Army shifted the development priority to the unitary projectile. In November 2001, the Army Acquisition Executive decided to merge the Raytheon Excalibur (U.S.) and Bofors (Sweden) Trajectory Correctible Munition programs and directed the program to schedule an in-process review for FY02. Following a Systems Review in February 2002, Army leadership directed Excalibur to follow a block acquisition strategy. An early, limited production version of the unitary round (Block IA) will provide an initial capability for the Army in FY06. The Block I (unitary) Milestone C is scheduled for FY06 and an initial operational capability (IOC) in FY08. For Block II (smart) and Block III (discriminating), Milestone B is scheduled in FY08, Milestone C in FY13, and IOC in FY16.

## TEST & EVALUATION ACTIVITIES

Raytheon and Bofors have conducted merger negotiations and trade studies. Contract award is planned in FY03.

Test events thus far have been limited to component-level testing. Raytheon has tested the Guidance, Navigation, and Control system and the payload, while Live Fire Test and Evaluation (LFT&E) activities were limited to preliminary developmental testing of the unitary warhead.

DOT&E worked with the Excalibur Integrated Product Team to develop a Block I Excalibur Test and Evaluation Master Plan (TEMP), including a comprehensive LFT&E Strategy.




*Excalibur's precision capabilities are intended to be used by Future Combat System Non-Line-of-Sight Cannon units to provide close support to maneuver units in urban or complex terrain.*

## TEST & EVALUATION ASSESSMENT

Key technical risks for the unitary program include reliable fin deployment, airframe maneuverability, warhead fuze development, inertial measurement unit (IMU) hardening, and GPS acquisition. In the last year, gun-hardening tests demonstrated integrated GPS acquisition and tracking, and IMU mechanical performance to mid-zone acceleration levels. The canard actuator system passed the static deployment test. Raytheon is making progress on hardening the IMU and should be on schedule for the Block I series. Accuracy required for engaging area targets should be achievable, but achieving the greater accuracy required for structures and other point targets is higher risk. The fielding of the early production version in FY06 is high risk however, the two years between this fielding and the full-rate production of the Block IB in FY08 reduces this risk.

Smart projectiles such as SADARM (U.S.), Smart155 (Germany), and Bonus (Sweden) that employ millimeter wave variants and infrared sensors to engage armored targets already exist. They have shown success against benign targets, but are less successful against countermeasured targets. Germany and Sweden are working on product improvements that should make the technology more effective by the start of the Block II and III programs. Technology that discriminates between individual targets is unproven.

No testing supporting the assessment of system lethality has been completed at this time. The Army has proposed an LFT&E based on static arena tests, warhead penetration tests, end-to-end firings against representative targets from each of the expected target classes, and modeling and simulation. DOT&E has stressed the importance of demonstrating the effects of fuze function variation, terrain, and projectile angle of fall. The Army understands these concerns and is currently working to revise the draft LFT&E Strategy.

Excalibur may be susceptible to GPS jamming. If GPS jammers are employed in the vicinity of the target, then the Army expects Excalibur to use its inertial navigation system to hit the target. However, if the round encounters jamming that prevents initial GPS acquisition, then the round will follow a ballistic trajectory instead of achieving guided flight. This ballistic trajectory may endanger friendly forces if they are in the area of the ballistic round's impact.

Excalibur will require accurate target location data in order to achieve desired effects for the unitary variants. Target location errors will need to be 35 meters or less for personnel targets, and approximately 10 meters or less for targets requiring a direct hit.

Excalibur susceptibility to height of burst spoofing and its resultant diminished weapons effects are undetermined at this point.

Test and Evaluation issues of concern for DOT&E to be resolved in the TEMP development include: conducting an end-to-end evaluation of effectiveness against the likely Excalibur target set from target acquisition to effects on target; the development and inclusion of embedded instrumentation into the projectile to separate the measure of reliability from effectiveness; the selection of an adequate test site that can accommodate testing in a GPS-jammed environment and at the extended range Excalibur offers; and the adequacy of testing to support the early production and Milestone C decisions (i.e. most available data will come from contractor development testing).

# Family of Medium Tactical Vehicles (FMTV)

The Family of Medium Tactical Vehicles (FMTV) is a family of 2.5-ton and 5-ton vehicles and trailers based on a common truck cab, chassis, and internal components. The components are primarily non-developmental items configured for rugged tactical environments. The light-medium tactical vehicles are 2.5-ton payload capacity models consisting of cargo, airdrop cargo, and van variants. The medium tactical vehicles are 5-ton payload capacity models consisting of cargo (with and without material handling crane), long wheel base cargo (with and without material handling crane), airdrop cargo, tractor, wrecker, dump, and airdrop dump variants. Designed and tested, but not yet in production, is the 5-ton expansible van. Also designed, but not yet tested, is a load handling system truck and trailer intended to self-load and transport containerized and palletized cargo weighing up to seven tons. The first 11,000 of the trucks produced were designated the A0. The Army approved an anti-lock braking system, integrated data bus, and an Environmental Protection Agency 1999 compliant engine for vehicles now being produced (8,000 vehicles) as model A1. At present the Army is conducting full and open competition for the next production series (14,000 vehicles) with an EPA 2004 compliant engine and other changes. The Army has a total acquisition objective of 83,000 trucks and 10,000 trailers.

The Army made the full-rate production decision for the A0 trucks in August 1995. The contract is being re-competed in a two-phased program called the FMTV Competitive Rebuy. The first phase, a competitive downselect from two competitors to one, will take place in March 2003. The second phase is a multi-year production contract to be awarded in 2003 with first unit equipped scheduled for FY05.

Operational testing was conducted at Ft. Bragg, North Carolina, in three phases. Phase I, September-December 1993, was terminated for poor demonstrated reliability. Phase II, conducted June-November 1994, was interrupted and cancelled when the soldiers of the test unit deployed to Haiti. Phase III, conducted April-July 1995, was the basis of the DOT&E Beyond Low-Rate Initial Production report.

DOT&E approved the current Test and Evaluation Master Plan (TEMP) on April 16, 2002. This TEMP requires a Limited User Test in FY05 of the load handling system variant and the Competitive Rebuy variants.

## TEST & EVALUATION ACTIVITY

During the past year follow-on production testing to verify the performance and quality of current production A1 vehicles was completed. Other testing completed this past year included Government testing to verify performance, reliability, maintainability, and conformance to the technical data package of the upgraded A1 vehicles submitted by the two Competitive Rebuy contractors. Production qualification testing to demonstrate performance and reliability of the Load Handling System (LHS) truck and trailer had been expected to start this year but is awaiting approval of the changed Joint Service Operational Requirement, the first mention of LHS.

*The first phase, a competitive downselect from two competitors to one, will take place March 2003.*

At DOT&E's suggestion, the Army Research Laboratory Survivability and Lethality Analysis Directorate undertook a vulnerability reduction analysis of FMTV, which was finished this year.

#### TEST & EVALUATION ASSESSMENT

Based on prior year operational test and evaluation and current production testing, the FMTV trucks being produced continue to be effective and suitable.

The preliminary results of the vulnerability reduction analysis indicate that approximately 50 percent of the side-on and frontal presented areas are vulnerable to small arms projectiles as well as artillery and mine fragments. If all vulnerability reduction measures described in the report were incorporated, vulnerability would be cut roughly in half, mostly due to gains in tire, fuel, and crew survivability. All significant improvements have considerable weight, dollar, and maintenance penalties.

# Force XXI Battle Command, Brigade & Below (FBCB2)

FBCB2 is a digital battle command system that links together brigade, battalions, companies and platoons tactical combat and combat services and support vehicles. Its primary purpose is to accurately and quickly disseminate/display friendly and enemy unit locations, and to communicate orders, overlays, and graphical tactical control measures throughout the force. The system consists of a small-ruggedized computer, a display, and a digital radio that is used for line-of-sight FM communications either Single-Channel Ground and Airborne Radio System or Enhanced Position Location Reporting System. The system also has a connection to a Global Positioning System receiver for self-location.

At the brigade and battalion tactical operation centers (TOCs), the Tactical Internet interfaces with Army Tactical Command and Control System (ATCCS), an Ethernet-based local area network of computers representing the functional areas of intelligence, maneuver, air defense, combat service support, and fire support. This interface permits the information collected and disseminated via ATCCS systems to be rapidly passed through the Tactical Internet to FBCB2 computers. Likewise, the position reports of individual and unit locations are passed upwards through the FBCB2 and Tactical Internet into the ATCCS systems for dissemination throughout the force. The Tactical Information Management System at the brigade TOC performs network initialization and management functions.

Army systems with a computer processor and display mounted in them will receive the FBCB2 software often referred to as Embedded Battle Command software. Examples of Army systems that employ the Embedded Battle Command software include the M2A3 Bradley Infantry Fighting Vehicles and the M2A2 SEP main battle tanks. In addition to the tactical vehicles, the ATCCS component computers have Embedded Battle Command software installed to facilitate the interface between FBCB2 and ATCCS.

### TEST & EVALUATION ACTIVITIES

The Army conducted one operational test during the month of December 2001 at Fort Hood, Texas. The operational test was followed by a developmental test conducted in September 2002 at Fort Huachuca, Arizona. The operational test was intended to be the Initial Operational Test and Evaluation (IOT&E) supporting a Full-Rate Production Decision, but a few days before the test began it was downgraded to a limited user test (LUT 2A) by senior Army leadership. The test was downgraded because the entrance criteria were not met during the pilot test, there were unresolved doctrinal issues concerning network security, the TOC server and the mass data loader, and the documentation was not complete. Documentation that was not signed at the start of the test included significant changes to the Operational Requirements Document and the Test Evaluation Master Plan. The LUT was conducted with no changes made to the events, instrumentation, data collection, or analysis. There was no acquisition decision made at the conclusion of the limit user test. A developmental test, Field Test 5, was conducted at Fort Huachuca in September 2002 to determine readiness to proceed to the rescheduled IOT&E in FY03.

*Force XXI Battle Command, Brigade & Below enhances the Army Battle Command System by providing automated tools to facilitate the battle command process. It enhances the ability of the soldier to operate in an unpredictable and changing environment, across the spectrum of conflict.*

### TEST & EVALUATION ASSESSMENT

Based on testing of FBCB2 within the 4th Infantry Division architecture, survey data through interviews suggests that FBCB2 assists commanders in their ability to maneuver their forces and synchronize their combat power. Commanders also indicate that situation awareness provided by FBCB2 permits them time to focus more on commanding. These results highlight the potential of FBCB2; however, these anecdotes reflect satisfaction in FBCB2 when it works, and do not reflect the inconsistent performance that has been observed to date. Furthermore, operational testing conducted to date has been restricted to near-ideal conditions of Electronic Warfare (EW)/ Informational Warfare (IW), weather, and terrain. Degradation in FBCB2 performance is expected when tasked to perform in more stressful environments. Tactics, techniques, and procedures also remain immature. Testing in the mentioned environments is required in order to demonstrate that FBCB2 is operationally effective and suitable. Testing must also be conducted for any new employment architectures for FBCB2. New architecture designs will introduce new performance and interoperability challenges.

During the December 2001 LUT 2A, FBCB2 performance was marginal:

- The average percent of the blue force that was visible on an FBCB2 screen was 68 percent, with one quarter of the force able to see fewer than 50 percent of the blue platforms.
- Several specific message categories deemed to be essential, such as Nuclear, Chemical, and Biological reports, bridge and obstacle reports were not delivered in a timely manner, with only 33 percent of the force notified within 20 minutes and only 48 percent of the force ever receiving these messages. These messages are broadcast over the Tactical Internet to quickly notify all elements of the force.
- Unit Task Reorganizations is an essential part of military operations and the ability to re-organize quickly is a Key Performance Parameter for FBCB2. Attempts to task reorganize during this test resulted in frequent system lock-ups, and excessive time was spent trying to reinitialize the system.
- The message completion rate for command and control message traffic remained unsatisfactory at approximately 69 percent, although the speed of message completion was satisfactory at 2-3 seconds.
- The transmission of lengthy orders and graphical overlays from higher to lower echelons using FBCB2 was not reliable. Some orders were truncated as they passed from Maneuver Control System (MCS) to FBCB2, and certain features on overlays do not render accurately on an FBCB2 system when created on an ATCCS computer; the resulting potential for tactical confusion in identifying the locations of the friendly and enemy forces is not satisfactory.
- There were frequent failures of the Common Message Processor and the Common Tactical Picture software in ATCCS when messages were passed between ATCCS and FBCB2. When failures did occur, the re-booting of the ATCCS computers was required, a procedure that took 20-30 minutes. As FBCB2 software is hosted on ATCCS computers at battalion and brigade TOCs, this remains an FBCB2 concern.
- The observed Mean Time Between Essential Function Failure was approximately 150 hours when the FBCB2 hardware, software, and the other critical elements of the Tactical Internet were considered.

The FBCB2 program had re-scheduled the IOT&E to take place in the spring of 2003; however, DOT&E was recently informed that operational testing of FBCB2 has been postponed indefinitely. Test and Evaluation Master Plan (TEMP) revisions were nearly finalized during FY02, and in addition to the IOT&E, the Army had included a cold-regions test in Alaska, a force effectiveness operational test at the National Training Center, and a test in restricted or complex terrain at the mock village and training area around Fort Knox. The revised TEMP, when submitted, should include rescheduling of these tests and inclusion of adequate EW/IW testing.

# Forward Area Air Defense Command, Control, Communications, and Intelligence (FAAD C3I) System

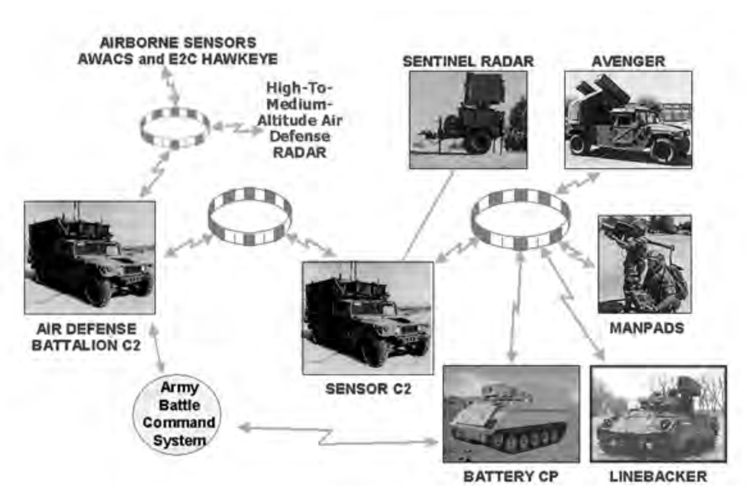
The Forward Area Air Defense Command, Control, Communications, and Intelligence (FAAD C3I) system is a network of components that connect command posts, weapons, and sensors of the Army's divisional air defense units. The Ground-Based Sensor (GBS), also called Sentinel, provides air surveillance, target acquisition, and target tracking information to the weapons in the FAAD Battalion. FAAD C3I is part of the Army Battle Command System. FAAD C3I consists of computer hardware, software, and communications that provide command, control, targeting, and other information to air defenders on the battlefield and a shared common air picture with other Army, Joint, Allied, and Coalition air and missile defense systems. FAAD C3I software performs air track and battle management processing functions and uses Single-Channel Ground and Airborne Radio System, the Joint Tactical Information Distribution System, and the Enhanced Position Location Reporting System (EPLRS) for communications. The Sentinel TPQ-36A radar is a three-dimensional radar system using a phased-array antenna and an Identification Friend or Foe device. The GBS/ Sentinel system is mounted on a High Mobility Multi-Purpose Wheeled Vehicle with a towed trailer.

## TEST & EVALUATION ACTIVITY

The FAAD C3I Limited User Test (LUT) was conducted at Orogrande Range at Fort Bliss, Texas, in February and March 2002. The LUT tested version 5.2 of the FAAD C3I system.

## TEST & EVALUATION ASSESSMENT

The FAAD C3I and GBS systems have significantly enhanced the accomplishment of low-altitude, short-range air defense missions when compared to previous capability. The ability of STINGER-equipped units to engage hostile aircraft at longer ranges, particularly before threat aircraft ordnance release, offers greatly improved protection of friendly ground units. However at longer ranges, positive identification of unknown aircraft is more difficult; and fratricide, first observed during the 1994 Initial Operational Test and Evaluation (IOT&E), continues to be a serious concern for the combined Air Defense Artillery force (Airborne Warning And Control System, F-16 aircraft, AEGIS, Patriot, Marine Corps short range air defense weapons/ crews, and FAAD C3I/Sentinel). Analysis by the Army found that many of the fratricide problems involved leadership, training, and soldier performance issues as opposed to technical system performance. However, the inability of electronic identification devices to correctly identify all friendly aircraft requires soldiers to visually identify all unknown aircraft as either friend or foe.




*The Forward Area Air Defense Command, Control, Communications and Intelligence system is a network of components that connect command posts, weapons, and sensors of the Army's short-range air defense units. It provides a shared common air picture with the Air Force, Navy, and the Patriot Missile System.*

The FAAD C3I LUT in 2002 re-examined fratricide issues and addressed several new issues that relate to the use of the Force XXI Battle Command, Brigade and Below (FBCB2) V4 computer. Army Test and Evaluation Command evaluated the FAAD C3I version 5.2 software as being operationally effective, suitable with limitations, and survivable. Upgrades from Block II version 4.0, the last time an operational test was performed, continue to enhance capabilities in both engagement and force planning operations. There were two fratricide incidents in the LUT out of 355 engagements, both attributed to operator training. Other concerns identified include a miscorrelation problem when a FAAD C3I local track intersects with an externally generated track received over the Joint Data Network from a Joint Surveillance Target Attack Radar System or Airborne Warning And Control System platform. There are also hardware and software issues with the use of the FBCB2 computer in the firing units that have been identified and must be corrected to ensure viability of the air defense mission. Other hardware and software issues remain to be corrected by the Program Office from tests conducted in 1997, 1998, and 1999.

The capability of the tactical internet to support the movement of information within an Army division in a timely manner remains an issue. In past events, the size of the tactical internet appears to interfere with getting air track information from the FAAD sensors to the FAAD shooters. During the Division Capstone Exercise 1 (DCX1) exercise in 2001, the overall message completion rate was approximately 50 percent. There were approximately 300 EPLRS radios during the DCX1 exercise. During the FBCB2 Field Test 3 in FY00, where only a slice of the network (85 EPLRS radios) was present, there was no significant degradation in message completion rates. The FY02 FAAD C3I LUT has a communications network of only 20 EPLRS radios making it impossible to resolve this issue. Recent improvements in EPLRS, specifically the use of multi-source group needlines, should allow air track data to get to the intended recipients without competing with other non-real time traffic on the FBCB2 network. The FAAD evaluation community is aware of the communications network issue and is looking at alternative sources of data such as the FBCB2 IOT&E to help address this issue.

The Air and Missile Defense Workstation (AMDWS) is a portion of the FAAD C3I system that provides data on force operations to the Army's air defense units and the rest of the Army via the Army Battle Command System. AMDWS is part of the Air and Missile Defense Planning and Control System (AMDPCS). There are several different configurations and several software versions of AMDWS in the field. The Program Office has developed software patches to make these various elements compatible. Most of the fielded AMDWS software versions have not been formally tested. The operational requirements document was approved in 1997 and has been under revision. Critical operational issues and criteria are under development, but have not been approved. As a result, there is no approved Test and Evaluation strategy nor acquisition program for AMDPCS/AMDWS.

Future upgrades to the FAAD C3I system and Sentinel radar are aimed at allowing divisional air defense units to conduct beyond visual range engagements. This new capability will rely on enhanced tracking and classification capabilities of the Sentinel and on the ability of the FAAD C3I system to perform fire control by assigning particular weapons systems to engage specific targets.

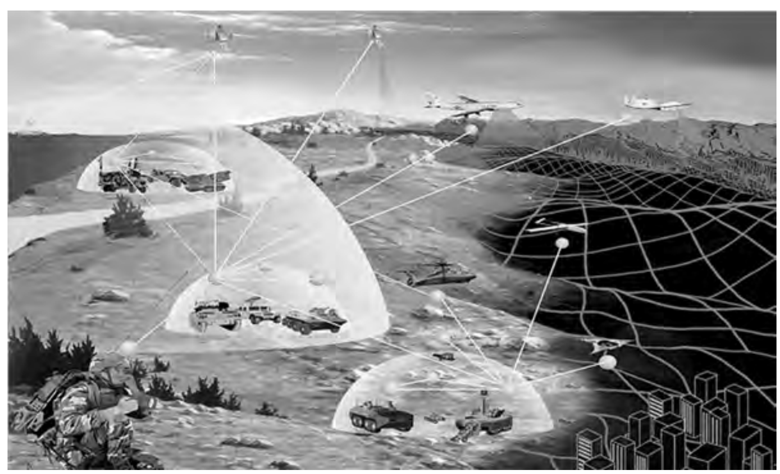
# Future Combat System (FCS)

Future Combat Systems (FCS) is a family of advanced, networked air and ground maneuver, maneuver support, and maneuver sustainment systems that will include manned and unmanned platforms. They will replace virtually every combat vehicle in the Army inventory, including main battle tanks, infantry fighting vehicles, howitzers, and mortars. This program is distinct from the Stryker family of medium weight wheeled vehicles intended to be an interim force of six brigades, while the FCS force is to be the Objective Force and to equip the entire Army (less the airborne division). A major component will be the addition of three unmanned ground robotic vehicles (one armed with a missile, one for utility/ logistics, and one man-packable) and four unmanned aerial vehicles. A new vertically launched missile for indirect fire support is also part of the FCS program. FCS will be networked via a C4ISR architecture that includes network communications, network operations, sensors, battle command system, and manned/unmanned reconnaissance and surveillance capabilities that enable situational understanding and synchronized operations. The network is known as Warfighter Information Network-Tactical and includes the Joint Tactical Radio System. It will create, send, and receive position location reports and command and control message traffic to enable the FCS vehicles to display a frequently updated common operational picture and to rapidly pass orders, overlays, and messages to and from each vehicle and command post.

FCS is intended to be the core building block of the Army's Objective Force. The Objective Force will consist of FCS battalions organized into Units of Action, which in turn will be organized into Units of Employment. The FCS unit is not intended to be a special purpose force. It is intended to accomplish all Army missions, including close combat, stand-off fires with precision weapons, urban combat, and operations in all terrain and environments.

The goal of the program is to significantly improve the deployability of the Army without sacrificing any of the current lethality or survivability and to ensure a deployable, responsive, lethal, agile, versatile, survivable, and sustainable land force. The maximum vehicle weight is intended to be between 16 and 20 tons and all variants are to be C-130 transportable.

The FCS system will require completion of a Live Fire Test and Evaluation (LFT&E) program before the full-rate production decision, now planned for mid-FY11. LFT&E will include both munitions effectiveness for the new direct and indirect fire munitions and susceptibility and vulnerability testing on the new manned and robotic vehicles being developed. Of special interest is the survivability of the crews of the manned vehicles.



*The goal of the program is to significantly improve the deployability of the Army without sacrificing any of the current lethality or survivability.*

Several FCS platforms will be equipped with weapons requiring newly developed munitions, none of which are to be developed and acquired by the FCS program. Instead, each required munition – for example, the Precision Attack Missile for the NetFires platform – will be developed separately by non-FCS program offices, which will be responsible for resourcing and conducting individual lethality Live Fire programs for each munition.

#### TEST & EVALUATION ACTIVITIES

The Test and Evaluation Master Plan (TEMP) is being prepared for submission to DOT&E in March 2003 to support the Milestone B date of

May 2003. There will be several Limited User Tests at different echelons of command leading up to an Initial Operational Test and Evaluation during FY10.

### TEST & EVALUATION ASSESSMENT

The key areas of technical risk for the program lie in the areas of ground robotic vehicles, survivability, mobility, and situational awareness and interoperability. The requirement for semi-autonomous operation of ground robots is a source of high technological risk. The development of a 155mm howitzer on a wheeled chassis weighing between 16 and 20 tons will also be a technological challenge, especially in meeting the requirement to carry 3-7 days of ammunition. The vehicles of the FCS force are intended to have the same level of survivability as the 70-ton legacy force, but within the weight structure of a 16-20 ton vehicle. Survivability will depend upon quantum leap improvements in both passive and active armor protection. FCS forces will require improved situational awareness and detection avoidance to survive but are then increasingly vulnerable to electronic warfare, mines, and attack from close-in infantry with rocket-propelled grenades. The mobility of the FCS vehicles is intended to be supplied by hybrid vehicle propulsion systems, which require development of power supplies, electronic switching technology, and fuel sources. The entire FCS concept rests upon a network of sensors, platforms, and command nodes linked by reliable, high bandwidth, and high-speed communications. Such capabilities do not yet exist and will entail significant risk in their development.

There is also considerable operational risk in the FCS program due to the changes in the concept of operations. For example, employing an artillery concept of detachable and remotely operated rockets fired from a container entails operational risk in the tactical availability of the munitions when left unattended. The reliance of the FCS force on precisely-delivered fires (especially those from joint platforms), delivered on time and in quantity to the ground force commander, depends heavily on the bandwidth in the communications network that supports it, the accuracy of the sensors that locate the targets, and the availability and timeliness of the joint munitions and platforms to support. Competition for fires will also introduce an element of risk, since in many cases the fire support platforms will not be organic to the FCS-equipped force. The FCS concept entails the creation of new Army units, under different organization than the current Army, which have to be created, manned, and trained in order to capitalize on the technological capabilities of FCS. This will entail significant operational risk as tactics and techniques have to be developed and refined in concert with the technical capabilities development.

It is highly unlikely that the current schedule for FCS development can be maintained to field threshold levels of mission performance due to the high levels of technological and operational risk. The FCS Block I development schedule calls for a series of limited user tests in FY04, yet the government asked industry to prepare proposals in April 2002, and there are currently no vehicles, test beds, prototypes, or even mature operational concepts to test. The FCS concept depends upon multiple vehicles being developed simultaneously (including unmanned robotic vehicles) and calls for a new unit organization, trained under an operational concept as yet unclear. It is extremely high risk to develop a family of highly complex vehicles and the sophisticated command and control network simultaneously under the existing schedule, and to organize, train, test, and equip a mission-capable FCS before 2010.

# Guided Multiple Launch Rocket System (GMLRS)

GMLRS is a guided rocket fired from the M270A1 or High Mobility Artillery Rocket System (HIMARS) launchers. GMLRS is a multinational program. The design accuracy is less than two mils (120 meters at 60 kilometers) without Global Positioning System (GPS) and less than 15 meters with GPS. It carries dual-purpose improved conventional munition (DPICM) bomblets or a recently funded developmental-unitary high explosive warhead to ranges greater than 60 kilometers.

The intent is that a unit equipped with GMLRS will shoot farther (60 km versus 30 km), achieve desired effects with fewer rockets (due to the improved accuracy), and have fewer duds than the currently fielded MLRS rocket. GMLRS is used primarily in general support of maneuver divisions and corps. GMLRS DPICM is employed against lightly armored, stationary targets such as towed artillery, air defense units, and communication sites. GMLRS unitary will have three fuze settings for use against personnel in the open (proximity fuze); lightly fortified bunkers (delayed fuze); or a single, lightly armored target (point detonating fuze).

GMLRS DPICM is scheduled for an April 2003 Milestone C, a FY05 full-rate production decision, and a FY06 initial operational capability. GMLRS unitary is tentatively scheduled for a FY03 Milestone B and is envisioned to be a spiral development program. Block I, with delayed and point detonating fuze settings, will be fielded in FY06. Full capabilities, consisting of all three fuze modes and other improvements, will be fielded with the Block II in FY08.

## TEST & EVALUATION ACTIVITIES

All six engineering design tests and all nine Production Qualification Tests (PQTs) have been completed for GMLRS DPICM.

Live Fire Test and Evaluation (LFT&E) of the DPICM warhead will be integrated with the Developmental and Operational Testing against surrogate targets. Individual target element damage will be assessed after each mission to determine the achieved fractional damage.

DOT&E is working with the Army to develop an adequate operational test and LFT&E strategy for GMLRS unitary.

## TEST & EVALUATION ASSESSMENT

To date, tests demonstrate that the GMLRS rocket has the accuracy and range needed to meet its requirements, however, the dud rate continues to be a concern.

The GMLRS program recently began testing the full-up rocket. Nine rockets were fired in six engineering development tests. All of the seven rockets that dispensed submunitions were well within the accuracy needed to meet effectiveness requirements. One rocket did not dispense its submunitions. An additional rocket did not launch. Fixes were identified and included in the production qualification flights, and the problems have not recurred. All nine PQTs have been completed and demonstrated accuracy was within the requirements needed to meet the effectiveness criteria. The sixth PQT identified two mechanical problems. Fixes for these problems were applied and successfully retested.

*Guided Multiple Launch Rocket System is a guided rocket fired from the M270A1 or High Mobility Artillery Rocket System launchers. A unit equipped with GMLRS will shoot farther (60 km versus 30 km), achieve desired effects with fewer rockets (due to the improved accuracy), and have fewer duds than the currently fielded MLRS rocket.*

The required dud rate (less than 1 percent) has not been achieved. The Army hoped to achieve this requirement by making adjustments to the fuze of the current DPICM bomblet. In the recent PQTs, the new bomblet had a slightly lower dud rate than the current bomblet, but the dud rates were still above the 1 percent requirement. Dud rates for the new bomblet design ranged from 1 to 5 percent, with one mission at 13 percent. The project office will explore additional bomblet design changes, but the modified bomblet may not meet the dud rate requirement. The European partners are designing and testing a bomblet with a self-destruct fuze; however, this bomblet version may not be available until after the planned GMLRS full-rate production decision. The Army has not yet decided if it will pursue the self-destruct fuze. With the current dud rate, GMLRS still has the potential to meet its operational effectiveness requirements.

Additional tests are planned to demonstrate GMLRS DPICM effectiveness against countermeasured targets and to show its interoperability. All flight tests to date have been accomplished with a modified Improved Position Determining System launcher, as opposed to an operationally representative one. Planned interoperability testing, therefore, will demonstrate that GMLRS can be fired from the M270A1 and HIMARS launchers.

# High Mobility Artillery Rocket System (HIMARS)

HIMARS, the newest member of the Multiple Launch Rocket System (MLRS) family, is intended to provide light, medium, and early-entry contingency forces an all-weather, indirect, area fire weapon system to strike high-payoff threat targets at all depths of the tactical battlefield. HIMARS units will functionally and operationally mirror current MLRS units, and will typically execute general support, general support reinforcing, and reinforcing missions.

The HIMARS launcher is self-loading with a crew cab, a hydraulic control system, and onboard fire control and navigation systems. The HIMARS fire control system, electronics, and communications units are interchangeable with the M270A1 MLRS launcher. The launcher module is mounted on a modified Medium Tactical Vehicle, 5-ton chassis. HIMARS has a three-man crew, but will be capable of one-man operation when necessary. It carries a single pod of six surface-to-surface artillery rockets or one Army Tactical Missile System (ATACMS) missile. HIMARS is transportable by C-130 aircraft for inter- and intra-theater deployment.

The HIMARS system consists of a launcher, two resupply vehicles (RSV) and two resupply trailers (RSTs). The RSV is a medium tactical vehicle truck with an on-board crane and secure radio communications. The RST is a standard M1095 five-ton trailer. Both the RSV and RST can carry two rocket or missile launch pods.

The HIMARS program was initiated in January 1995 as part of the Rapid Force Projection Initiative Advanced Concept Technology Demonstration (ACTD). Three of the four prototype launchers produced for the ACTD went to the 3rd Battalion, 27th Field Artillery at Fort Bragg, North Carolina for a 2-year extended user evaluation. The 3/27 Field Artillery retained those launchers for normal operations.

The HIMARS program entered Engineering and Manufacturing Development as an Acquisition Category (ACAT) II system following an October 1999 Milestone II review. The OSD Director of Strategic and Tactical Systems approved the HIMARS Test and Evaluation Master Plan (TEMP) on December 15, 1999. Because of an anticipated increase in production quantities and special interest in the program, OSD elevated HIMARS to ACAT ID in May 2002. The program was placed under operational test oversight in April 2002 in anticipation of this decision. This program is not under oversight for Live Fire because it does not provide crew protection; however, DOT&E is participating in the Ballistic Survivability Program.

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The Milestone C Review is scheduled for March 2003, with the Full-Rate Production Decision Review in June 2005. The Army plans to equip its first unit with HIMARS in March 2005.

## TEST & EVALUATION ACTIVITIES

- **Contractor Development Tests:** Component qualification testing is ongoing. System Integration Tests have been completed.
- **Production Qualification Tests:** Nuclear effects tests, formal qualification tests (initial software version), and the preliminary logistics demonstration have been completed.

The automotive and environmental testing are underway. However, problems with the reload system have caused the Army to defer the wartime tempo portion of the endurance testing until FY04 when it can be conducted with Low-Rate Initial Production-configured launchers. During two flight test series between November 2001 and August 2002, HIMARS fired each of the MLRS Family of Munitions. The Extended System Integration Test (ESIT), a combined developmental/operational test, was conducted with one launcher and a soldier crew in August 2002. Following the ESIT, HIMARS conducted a C-130 deployability demonstration with an H-model C130. In November and December 2002, one HIMARS launcher participated in limited operational tests at the Cold Regions Test Center in Alaska.

- **Ballistics Survivability Program:** Cab investigation and blast testing have been completed. Component experimentation started in November 2002.

### TEST & EVALUATION ASSESSMENT

The launcher mechanical and hydraulic hardware design is 90 percent stable, but has experienced problems that have led to the redesign of the reload manifold and boom extension gearbox. The launcher chassis, RSV, and RST are mature, fielded, production vehicles, and the RSV crane is a commercial item. Ninety-five percent of the software is common with the fielded M270A1 launcher, and the initial version of HIMARS software was tested during August in the ESIT. All but one of the Fire Control System line replaceable units are common with the M270A1, and that HIMARS launcher interface unit has completed component-level qualification testing. However, the M270A1 program is developing replacements for the fire control panel and the weapons interface unit that will not be available for testing until next year following the Milestone C review.

A HIMARS Project Office accuracy analysis of HIMARS flight test results suggests that there is no statistically significant difference in the accuracy of basic rockets fired from a HIMARS launcher and those fired from an M270 MLRS launcher. DOT&E will conduct its own analysis once the flight tests are complete.

Based on the results of the ESIT, during which there were no live rocket or missile firings, HIMARS reliability is approximately half of the Operational Requirements Document (ORD) required 58 hours Mean Time Between System Abort. Data from the flight tests suggest that the actual reliability when firing live munitions is probably lower than the ESIT estimate. The Army is developing a reliability growth strategy to achieve and demonstrate the required reliability before Initial Operational Test (IOT).

Because the HIMARS cab does not provide ballistic protection for the crew, the crew must rely on concealment between missions, as well as rapid displacement after missions to survive. ESIT results indicate that the HIMARS time to displace from the firing point after a mission is similar to that of the M270A1 launcher, both of which are shorter than that of the currently fielded M270 launcher. The HIMARS firing point dwell time for ATACMS missions easily meets requirements.

DOT&E is working with the Army to revise the TEMP for Milestone C. Issues of concern include an appropriate location for the IOT, the amount of live fire in the ground phase of the IOT, and the TEMP and ORD submission timeliness.

# Integrated System Control (ISYSCON) (V)4

ISYSCON is a family of systems that provide the signal commander, G-6, and S-6 personnel the capability to maximize the availability of communications and data distribution systems in support of the combat commander. The ISYSCON requirements document provides a blocked strategy for both versions of ISYSCON: the ISYSCON Version (V)1-3 and the ISYSCON (V)4. Blocks 1, 3, and 6 of the ISYSCON requirements document pertain to ISYSCON (V)1-3 and are covered under a separate program. Blocks 2, 4, and 5 of the requirements document are for ISYSCON (V)4, the program covered by this report. The Initial Operational Test and Evaluation (IOT&E) for ISYSCON (V)4 will validate that Block 4 requirements are met.

The ISYSCON (V)4 supports information operations and automation in support of the Army's digitized combat forces, their weapon systems, and the other related Battlefield Automation Systems. The ISYSCON (V)4 consists of commercial off-the-shelf, government off-the-shelf, and government-developed software applications implemented on the Force XXI Battle Command Brigade and Below (FBCB2) Appliqué hardware and the Panasonic CF-28 Toughbook. Although most functions can be performed on both hardware platforms, ISYSCON (V)4 is a bifurcated system as some functionality can only be performed on one of the platforms. At division through battalion, ISYSCON (V)4 provides signal personnel a system to manage the combat net radio based Wide Area Network (WAN) for the digitized force. The combat net radio based WAN is commonly referred to as the Lower Tactical Internet. The ISYSCON (V)4 also provides Local Area Network (LAN) management services for wired and wireless LANs at all echelons. LAN management includes planning, configuring, fault identification, and fault resolution for all LAN network devices located within the Tactical Operations Centers that support internal, as well as external, communications.

### TEST & EVALUATION ACTIVITIES

ISYSCON (V)4 participated in Field Test 4 in September and October 2001 (Development Test), as well as the FBCB2/ ISYSCON (V)4 Limited User Test (LUT) 2A in December 2001.

It completed System Segment Acceptance Testing at the contractor's facility in May 2002, and participated in the combined FBCB2/Manuever Control System(MCS)/ISYSCON (V)4 Field Test 5 in September 2002 (Development Test).

The FBCB2/MCS/ISYSCON (V)4 IOT&E was scheduled in April/May 2003, but has been indefinitely postponed due to preparations for anticipated real-world operations.

*Integrated System Control (V)4 provides the ability to maximize availability of communications and data distribution systems for the digitized force. At division through battalion, it is used to manage the combat net radio based Wide Area Network and provides Local Area Network management services for wired and wireless LANs at all echelons.*

### TEST & EVALUATION ASSESSMENT

Field Test 4 indicated that the FBCB2 and MCS programs were not ready for the scheduled FBCB2/ MCS/ISYSCON (V)4 IOT&E in December 2001. The test was downgraded to a LUT due to shortcomings with interoperability and test documentation for FBCB2 and immature software for MCS. ISYSCON is a critical enabler of the digital battlefield; without sufficiently mature systems for it to support, the Army postponed the ISYSCON (V)4 IOT&E until all three systems were ready for test.

The ISYSCON (V)4 Block 4 software successfully completed technical testing at the contractor facilities in May 2002. All three programs went to Field Test 5 in September 2002. Results of this event have not been released by the Army as of this writing. However, DOT&E observed improved stability and performance of all systems and the supporting network.

The ISYSCON (V)4 software is stable and was expected to support FBCB2 and MCS during the MCS/FBCB2/ISYSCON (V)4 IOT&E in April/May 2003 before the event was postponed.

The development of key enablers like ISYSCON has shown the importance of system-of-systems testing, and the difficulties that arise in coordinating requirements, development and fielding schedules, threats, scenarios, and test architectures. As the Army continues to move towards the Objective Force and Future Combat System, it should derive many lessons learned from these programs and the combined test events.

# Joint Computer-Aided Acquisition and Logistics Support (JCALS)

The Joint Computer-aided Acquisition and Logistics Support (JCALS) system is a multi-Service, geographically distributed client-server system designed to process all data and information required to manage, control, and produce each Service's technical manuals at designated sites. The program is developing an infrastructure to logistically support weapons systems throughout their life cycles. At its heart is the Global Data Management System (GDMS), the middleware connecting JCALS users with legacy data repositories. GDMS provides transparent access to data anywhere in the system regardless of where it is stored, how it is formatted, or how it is accessed. A System Operational Support Center provides overall system management and administration and assists users.

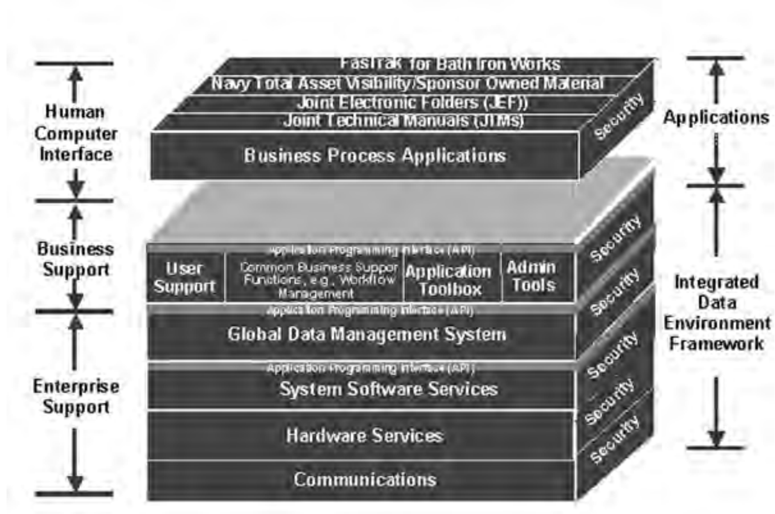
JCALS is being developed in increments called Software Packages (SWPs). The first increment, SWP 1/2, has been fielded. The second increment, SWP 3.1, has been divided into two releases: SWP 3.1.1 and SWP 3.1.2. A third planned increment, SWP 3.3, was recently cancelled. These SWPs were to contain the following general capabilities:

- SWP 1/2: A basic automated capability for accessing and exchanging technical information on weapons systems among the Services and Department of Defense agencies. Air Force sites were provided with a modification that introduced a basic Joint Technical Manual (JTM) capability.
- SWP 3.1: Replaces Army and Navy technical manual legacy systems with enhanced JTM functionality, adds a publishing capability for the Marine Corps, affords wider connectivity (more interfaces), and provides a web-based capability.
- SWP 3.3: (Cancelled) Provides the core functionality necessary for all the Services to routinely perform their JTM business practices without workarounds.

In 1998, the Army Test and Evaluation Command (ATEC), the Independent Operational Test Agency, conducted an Initial Operational Test and Evaluation of JCALS hardware and SWP 1/2, in compliance with the Test and Evaluation Master Plan (TEMP) approved by DOT&E in May 1997. DOT&E's evaluation revealed a variety of problems, and the Project Manager (PM) began to take corrective actions. Based on the follow-on assessments by ATEC, DOT&E concluded that JCALS was operationally effective and suitable for the Army, Navy, and Marine Corps, and it was deployed to those Services.

The PM then developed a "modified SWP 1/2" for the Air Force that underwent rigorous regression testing in the laboratory and follow-on evaluation in the operational environments through 1999. DOT&E subsequently found the "modified SWP 1/2" operationally effective and suitable for the Air Force and it was deployed to Air Force sites.

Overall requirements are based on a user-approved Joint Minimum Essential Requirements List, rather than an Operational Requirements Document. The TEMP was updated in April 2001. As Test and Evaluation progressed, the PM continued to refine the JCALS acquisition strategy and the definitions of the SWPs.




*Joint Computer-Aided Acquisition and Logistical Support is a multi-Service system designed to process data and information required to manage, control, and produce technical manuals. It provides an infrastructure to logistically support weapons systems.*

### TEST & EVALUATION ACTIVITY

- In the final phase of SWP 3.1 Developmental Test and Evaluation, the software was installed and tested with operational users at 13 beta sites that encompass all of the Services. The PM declared JCALS ready for Operational Test and Evaluation (OT&E) in December 2001.
- ATEC conducted OT&E on SWP 3.1 at the 13 test sites January 17- February 7, 2002.
- ATEC conducted an operational assessment (OA) and evaluation of an enhanced JCALS version (SWP 3.1.1) in a lab environment from June 3-7, 2002.

### TEST & EVALUATION ASSESSMENT

Based on the OT&E in January and February 2002, DOT&E concluded that JCALS SWP 3.1 software was operationally ineffective and operationally unsuitable. This version of SWP 3.1 became known as SWP 3.1.0, and has not been fielded past the 13 test sites. (The majority of JCALS sites are still using an earlier version known as SWP 2.6.) By the time the OT&E on SWP 3.1.0 was completed, the PM had already developed SWP 3.1.1, a "maintenance drop" that enhanced the 3.1 software. The PM further improved this version by correcting the critical deficiencies noted during the OT&E of 3.1.0 (which was not fielded). Attention was then focused on how to test and field 3.1.1.

SWP 3.1.1 contains data model changes that preclude its fielding to only a limited number of sites for the purpose of operational test. Instead, 3.1.1 will have to be deployed simultaneously to all JCALS sites (replacing 2.6 and 3.1.0) or not at all. The test community thus decided to perform operational test on 3.1.1 in the form of an OA in a lab environment, but with actual users brought in from the field. Follow-on operational test can then be conducted in the field. ATEC conducted the OA from 3-7 June 2002. Based on the results, DOT&E determined that SWP 3.1.1 is operationally effective and recommended its immediate fielding to all JCALS sites. As soon as 3.1.1 is fielded, ATEC will conduct an in-field assessment to determine whether the system is operationally suitable and whether it remains operationally effective in the field environment.

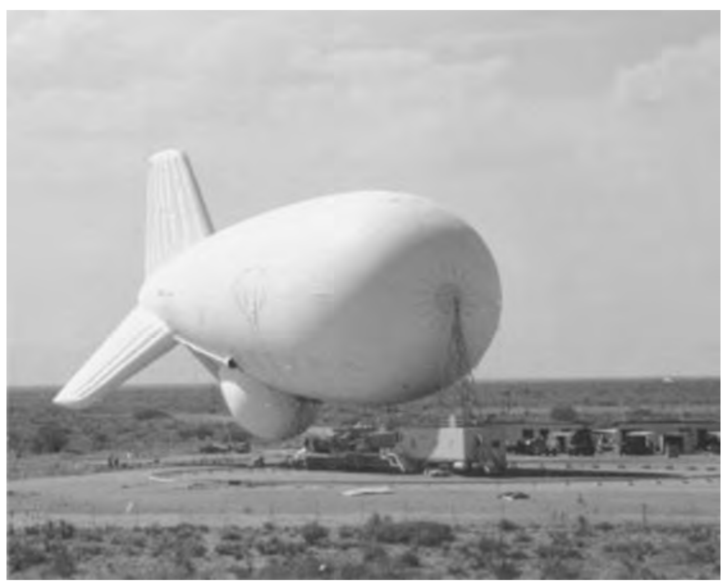
Software development complexity, integration issues, aggressive (but unmet) timelines, and many other issues have seriously impacted the JCALS acquisition for over a decade. In August 2002, the Under Secretary of Defense (Acquisition, Technology, and Logistics) and the JCALS PM agreed to cease further development of JCALS as soon as SWP 3.1.2 is fielded. The Services will then develop alternatives to the JCALS infrastructure to meet their specific requirements, as necessary. DOT&E will continue to work with the PM and the operational test agency to operationally test 3.1.2. As with 3.1.1, 3.1.2 contains data model changes that preclude a limited fielding for operational test only. Thus, the same basic OT&E plan used for 3.1.1 will be used for 3.1.2.

# Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS)

The Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS) is an airborne radar platform designed to provide surveillance and fire control quality radar data on Land Attack Cruise Missiles and other airbreathing targets. The system also acquires and tracks moving surface targets and supports detection of tactical ballistic missiles. A JLENS system consists of two aerostats, one containing a Surveillance Radar (SuR) and one containing a Precision Track Illumination Radar (PTIR). The aerostats are non-developmental 71-meter, unmanned, tethered, non-rigid aerodynamic structures filled with helium and air. Each aerostat is tethered to a mobile mooring station and attached to a processing station via a fiber optic/power tether. The SuR provides the initial target detection and then cueing to the PTIR, which generates a fire control quality track. The JLENS system is integrated into the Joint Tactical Architecture via Link 16, Cooperative Engagement Capability, Single-Channel Ground and Air Radio System, and Enhanced Position Location Reporting System. The system provides key contributions to generation of a Single Integrated Air Picture, through the fusion of high accuracy long-range tracking and target classification information with that of other sensors in the Joint Air and Missile Defense architecture. Both radar systems will include Identification Friend or Foe interrogators.

Shooters such as Patriot, Navy Standard Missile, the Marine Corps Complementary Low Altitude Weapons System, and the Army Surface Launched Advanced Medium-Range Air-to-Air Missile can use the JLENS PTIR data to engage low-flying terrain masked cruise missiles before their own ground-based sensors can detect them. JLENS supports air-directed surface-to-air-missile and air-directed air-to-air missile engagements through both the engage on remote and forward pass mechanisms.

The JLENS program is executed in two blocks. Block 1 develops the PTIR fire control radar, which includes a sector search capability. Block 2 develops the full azimuth 360 degree SuR and demonstrates its ability to hand over targets to the PTIR for engagement execution. A complete JLENS system consists of one Block 1 PTIR and one Block 2 SuR. The purchase of 18 JLENS systems consists of 18 PTIRs, 18 SuRs, 36 Mobile Mooring Systems, and 36 processing systems.



*The Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System is an airborne radar platform designed to provide surveillance and fire control quality radar data on Land Attack Cruise Missiles and other airbreathing targets.*

### TEST & EVALUATION ACTIVITIES

- DOT&E has observed a series of subsystem design risk reduction presentations and subsystem survey reviews.
- Initial test planning has commenced with the formation and convening of a JLENS Test and Evaluation Integration Working Integrated Product Team.
- A draft Test and Evaluation Master Plan has been completed.
- DOT&E has completed a final draft of the Independent Evaluation Plan and will begin coordinating it with the Army's Developmental Test and Operational Test agencies.
- The JLENS program participated in the Joint Combat Identification Evaluation Team 02 (JCIET 02) Exercise using the Prototype Processing Station to demonstrate potential JLENS value added to the war fighter.

## TEST & EVALUATION ASSESSMENT

JCIET 02 was used to provide a venue for Concept of Operations and Tactics, Techniques, and Procedures development. During JCIET 02, the JLENS Prototype Processing Station demonstrated the ability to receive tactical information via Link-16, using a Multifunction Information Distribution System terminal. After the exercise, Army Evaluation Command determined that an Air and Missile Defense Workstation operator, with minimal additional training, could conduct mission operations.

# Joint Simulation System (JSIMS)

The Joint Simulation System (JSIMS) is a single, distributed, and seamlessly integrated simulation environment that permits integration of real-world and simulated assets of the U.S. Military Services and their allies on a virtual battlefield. The JSIMS virtual battlefield is simulated by a High Level Architecture compliant federation of component models. The component models include the National Air and Space Model, Warfighters' Simulation (WARSIM), WARSIM Intelligence Model, JSIMS Maritime, the Defense Intelligence Agency's Deployable Intelligence Simulation for Collaborative Operations, Joint Signals Intelligence Simulation, and National Simulation. JSIMS is to provide a real-time simulation capability that can be configured for use in exercises of differing durations, scenarios, and complexities. It interfaces with real-world Command, Control, Communications, Computers, and Intelligence ($C^4I$) systems, providing a training environment that is transparent to the training audience. JSIMS is to include scenarios that reflect the transition of military forces into less conventional roles such as multi-national peacekeeping and humanitarian assistance. At Initial Operational Capability, JSIMS will be an accredited simulation environment to support joint training for unified combatant command staffs, joint task force (JTF) commanders and staffs, and JTF component commanders and staffs. At Full Operational Capability, JSIMS is to evolve to support professional military and senior officer education, mission planning, mission rehearsal, and doctrine development.

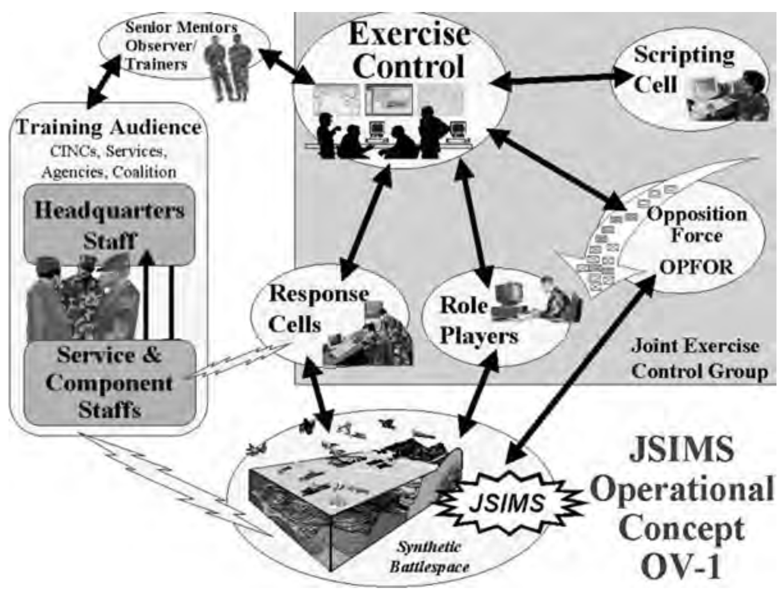
### TEST & EVALUATION ACTIVITY

The JSIMS program announced a schedule breach in June 2002 that resulted in slipping the Initial Operational Test and Evaluation from FY03 into FY04, rescheduling the various development test events, and a 6-month slip in the Joint Warfighting Center's Validation event which is now scheduled to begin in January 2003.

During FY02, the Alliance Executive Office completed the last three of five integration events leading up to the completion of JSIMS Block 1 development. Performance runs were made concurrently with development during the final integration event. Results from the performance and stability runs made in 1QFY03 supported the test readiness review (TRR) on October 31, 2002. The Program Office was unable to meet the entrance criteria at the TRR and was directed to do additional runs to show the federation could operate as intended regarding stability and performance before JSIMS could enter into the Systems Test (i.e., the government developmental test). The Systems Test is now scheduled to begin in December.

As a result of concerns expressed over small scope of the Systems Test, the JSIMS Program Office and the Joint Warfighting Center will conduct a Full Systems Test following Validation that will demonstrate the ability of JSIMS to support a typical Joint Staff exercise of the size expected in the MultiService Operational Test and Evaluation and future training events.

The Test and Evaluation Integrated Product Team revised the draft Test and Evaluation Master Plan (TEMP) to reflect changes in the schedule, Operational Test and Evaluation (OT&E) strategy, and organizational responsibilities. The JSIMS




*The Joint Simulation System is to provide a real-time simulation capability that can be configured for use in exercises of differing durations, scenarios, and complexities. It interfaces with real-world Command, Control, Communications, Computers, and Intelligence systems, providing a training environment that is transparent to the training audience.*

Program Manager submitted the draft TEMP for coordination at the end of the 4QFY02. OSD has asked the Program Office to review the TEMP again and adjust it to include recent changes in test schedules and addition of events like the Full Systems Test.

### TEST & EVALUATION ASSESSMENT

The schedule slip has had a positive impact on the OT&E strategy in that the schedule now supports a true baseline event during which performance of the Joint Training Confederation, the legacy training simulation, can be measured. DOT&E was instrumental in introducing the concept of a baseline-to-JSIMS comparison into the OT&E strategy during the initial TEMP development. The Navy's Operational Test and Evaluation Force agreed to this aspect of the strategy when they assumed the responsibility of lead operational test agency.

Integration events have proven more difficult than anticipated by the Alliance Executive Office, and significant software problems were still being identified toward the end of the final integration event for Block 1. As a result, the risk to maintaining the schedule for Block 1 development and the Full System Test remains high.

Initial performance runs have demonstrated the difficulty of initializing a large federation representative of training exercise configuration, the difficulty of operating in a classified configuration using the common security services, and the lack of stability across the network and with individual federates.

# Joint Tactical Radio System (JTRS)

The Joint Tactical Radio System (JTRS) is a family of high-capacity, programmable, multi-band/multi-mode tactical radios to provide both line-of-sight and beyond-line-of-sight communication capabilities to the warfighter. The JTRS program will eventually replace the DoD's current inventory of some 750,000 "hardwired" tactical radios of various independently developed families and versions with some 250,000 modular, programmable JTRS radios. The JTRS uses software defined radio technology to achieve flexibility, interoperability, and ease of upgrade. The Joint Requirements Council validated the updated JTRS Operational Requirements Document in April 2002.

The Software Communications Architecture (SCA), a non-proprietary open systems architecture, is an essential component of the JTRS strategy and is the basis for software waveforms. The JTRS Joint Program Office maintains the SCA and software waveforms, while the Services develop the Joint Tactical Radio (JTR) sets in Service-led acquisition efforts called clusters. The first cluster, the Army-led Cluster 1, is developing JTR sets for Army and Marine Corps ground vehicular, Air Force Tactical Air Control Party ground vehicular, and Army rotary wing applications. Although not yet fully established, the following future clusters are envisioned: Cluster 2-handheld/manpack, Cluster 3-fixed/maritime, and Cluster 4-airborne (fast mover). A cluster for space applications is also being considered.

The Joint Program Office approach to defining the SCA involved multiple steps. The final step, Step 2C, involved the production of a small number (on the order of 200) of two-channel, SCA Version 2.0-compliant radios, called JTRS Step 2C radios. The Army plans to issue the Step 2C radios to operational units as an interim solution for critical inter-Tactical Operations Center communications requirements until Cluster 1 radios are ready. This issue will depend upon the results of an operational assessment in early 2003.

### TEST & EVALUATION ACTIVITIES

Defense Acquisition Board Milestone B approved the Joint Program Office's plan to acquire software waveforms and approved the initiation of the Army-led Cluster 1 development.

OSD approved the Annex for the JTRS Joint Test and Evaluation Master Plan (TEMP) for the Cluster 1 System in May 2002. The Joint TEMP remains in Service coordination. However, prior coordination with OSD identified no significant issues.

*The Joint Tactical Radio System is a family of high-capacity, programmable, multi-band/multi-mode tactical radios to provide both line-of-sight and beyond-line-of-sight communication capabilities to the warfighter. The JTRS uses software defined radio technology to achieve flexibility, interoperability, and ease of upgrade.*

Army awarded the Cluster 1 contract to Boeing in June 2002. Major test events planned are Early Operational Assessment in FY04 using pre-Engineering Development Model (EDM) radios, Government Developmental Test and Limited User Test in FY05 using EDM radios, and Multi-Service Operational Test and Evaluation in FY06 using Low-Rate Initial Production radios.

The Army decided in September 2002 to not field the prototype JTRS Step 2C radios as an interim solution. Instead the Army will procure additional Near Term Digital Radios. The Step 2C radio development experienced significant cost and schedule growth, while the users expressed the desire for a single "interim" tactical operations center radio solution to ensure interoperability without establishment of gateways and a single logistics infrastructure for "interim" radios. However, the JTRS Step 2C went through developmental testing in the November 2002 at Fort Huachuca, Arizona. Results were not available prior to publication of this report.

### TEST & EVALUATION ASSESSMENT

The JTRS completed a Milestone B acquisition review in June 2002 for the overall JTRS program under the auspices of the JTRS Joint Program Office and the Army-led Cluster 1 development effort. The test strategies laid out in the two TEMPs should provide the data necessary to make informed acquisition decisions at subsequent milestones. However, several areas require continued monitoring and further attention:

- Schedule Risk: The Cluster 1 testing schedule, directed by the program's General Officers Steering Group, is too compressed and success-driven for the program to meet. The program manager acknowledges the risk and has prepared contingencies.
- Operational Concept and Requirements Uncertainty: The concepts of operations and the requirements for the JTRS continue to evolve. These changes affect operational test considerations such as test concept, scope, platforms, and missions.
- Number of Radios: The Multi-Service Operational Test and Evaluation planning uses 160 JTR sets as the required number. However, changes in force structure, operational concepts, scenarios, and capability of the new, undeveloped Wideband Networking Waveform could require a larger number.
- Testability of Measures and Requirements: Many of the measures and associated requirements, as currently stated, are vague and neither measurable nor testable. The Cluster 1 Program acknowledges this shortcoming and is proceeding to develop better definitions.

Early and active tester involvement enhanced the integration of testing into the JTRS program. This access provided to OSD throughout the Integrated Product Team process significantly facilitated developing an acceptable test program and gaining rapid approval of documentation for the milestone review.

# Land Warrior

The Land Warrior is a first generation integrated fighting system designed to enhance Infantry team combat power and situational awareness. It is intended to enhance small unit lethality, command and control, survivability, mobility, and sustainment. Land Warrior integrates everything that the soldier wears or carries into a system-of-systems.

Land Warrior consists of five sub-systems:

- Computer/radio sub-system including a computer, soldier intercom, leader radio and navigation/Global Positioning System.
- Integrated helmet assembly sub-system including a helmet-mounted display and a night image intensification device.
- Weapon sub-system with currently fielded M4 modular weapon system, thermal weapon sight, close combat optic, infrared aiming light, laser range finder, and digital compass capabilities.
- Software sub-system.
- Protective clothing and individual equipment sub-system including body armor; nuclear, biological, and chemical protective clothing; laser protective eyewear; and load bearing equipment.

The program integrates a combination of Land Warrior developed equipment, Organizational Clothing and Individual Equipment, and other items under development to be provided to the Land Warrior program as government furnished equipment. Land Warrior is intended to be fully interoperable with the digital command and control systems of other platforms.

The strategy of the Land Warrior program office is to acquire Land Warrior in blocks I, II, and III. Blocks I and II are also known as Land Warrior–Initial Capability (LW–IC) and Land Warrior–Stryker Interoperable Capability (LW–SI), respectively.

An Early Operational Experiment (EOE) was conducted from October to December 1996, at Ft. Benning, Georgia, with ten surrogate prototypes. This EOE provided human factors information, principally with respect to the performance of the helmet and load-bearing equipment, which supported system design reviews. Additionally, the EOE was used to aid in the development of tactics, techniques, and procedures. Land Warrior was originally scheduled to begin operational testing in FY98. Due to hardware problems encountered during technical testing in April 1998, the program manager halted further system development pending an overall program review and subsequent program restructuring. Land Warrior was placed on OSD Test and Evaluaton oversight in April 1998.

*The Land Warrior integrates everything that the soldier wears or carries into a system-of-systems and is intended to be fully interoperable with the digital command and control systems of other platforms.*

### TEST & EVALUATION ACTIVITY

No operational test has occurred to date. Land Warrior participated in the Joint Contingency Force Advance Warfighting Experiment (JCF AWE) conducted at the Joint Readiness Training Center, Fort Polk, Louisiana, in September 2000. During JCF AWE, a platoon from the 82nd Airborne Division, equipped with prototype Land Warrior systems, demonstrated the potential of Land Warrior to enhance tactical movement, survivability, and situational awareness. Combined contractor and Developmental Testing (DT) for the restructured program began in August 2002 and demonstrated the presence of LW-IC functionally while also establishing a reliability baseline for the program.

The Land Warrior Test and Evaluation Master Plan (TEMP) was approved in August 1994. A revised Land Warrior TEMP is being developed and is scheduled to be submitted to DOT&E in January 2003. The Initial Operational Test and Evaluation (IOT&E) of the LW-IC version is scheduled for FY03.

### TEST & EVALUATION ASSESSMENT

The LW-IC version of the system is mature enough to enter DT. By February 2003, the program office will evaluate whether LW-IC is ready to enter operational test for the purpose of obtaining a full-rate production decision. After adequate testing of production representative systems, DOT&E will submit a Beyond Low-Rate Initial Production report to Congress. The IOT&E for LW-IC will also be the low-rate initial production decision for LW-SI, with follow on testing and evaluation scheduled for FY05.

# Line-of-Sight Anti-Tank Missile (LOSAT)

The Line-of-Sight Anti-Tank Missile (LOSAT) is an anti-tank weapon system intended to provide lethal fire to defeat any known or projected armor system at ranges greater than 4,000 meters. It uses kinetic energy as its kill mecha nism. LOSAT, which will be mounted on a U.S. Army High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) chassis, is being developed as a supplemental anti-armor capability for fielding to light divisions currently equipped with Tube-launch Optically-controlled Wire-guided (TOW) and Javelin anti-tank systems. The basic system will consist of two HMMWVs and a high-mobility Missile Resupply Trailer. One HMMWV, called the Fire Unit (FU), will be the LOSAT missile launch platform and will carry four ready-to-fire missiles. The fire control system in the FU is based on the Improved Bradley Acquisition System, which features an acquisition system using a second-generation Forward-Looking Infrared sensor for night environments and a daylight TV. The other vehicle, the Resupply HMMWV, will tow the missile resupply trailer, which will carry eight additional missiles. The system is to be deployable by strategic (e.g., C-5, C-17) and tactical airlift (C-130), and external air transport via UH-60 and CH-47 helicopters.

The LOSAT program was designated as an Advanced Technology Demonstration in 1992 and upgraded to an Advanced Concept Technology Demonstration (ACTD) in 1997. The program was restructured in 1999 to enter an Engineering and Manufacturing Development-like phase, referred to by the Army as ACTD Plus, to prepare for a Low-Rate Initial Production (LRIP) decision planned for early FY04. The LRIP decision will be followed by Initial Operational Test & Evaluation in FY05 supporting a full-rate production decision in early FY06.

## TEST & EVALUATION ACTIVITY

During 2002, the principal test activities were the certification by the government to ensure that the system is safe for manned use in an operational environment and an early soldier involvement assessment to ensure that operator displays, controls, and other man/machine interfaces are appropriate and useful.

The Test and Evaluation Master Plan is currently under revision. The test events being planned include: 1) Dismounted Battlespace Battle Lab Demonstrations in the FY03/04 timeframe to examine tactical deployability and military utility; 2) a Limited User Test to provide information to support the LRIP decision; an IOT&E, comprised of live firings and force-on-force exercises that will be conducted in the FY06; and, vulnerability and lethality Live Fire Test and Evaluation (LFT&E) testing. The LFT&E program will assess the degree to which the LOSAT system (including the missile, both HMMWV vehicles, and the loaded trailer) is vulnerable to expected threats. This program describes critical vulnerability and lethality issues, and the scope of testing needed to address them, including the need for more than one FU vehicle in a full-up, system-level LFT&E to support the planned full-rate production decision.

*The Line-of-Sight Anti-Tank Missile is an anti-tank weapon system intended to provide lethal fire to defeat any known or projected armor system at ranges greater than 4,000 meters.*

## TEST & EVALUATION ASSESSMENT

All prior testing has been technical. Results to date indicate that the LOSAT is capable of defeating any current or projected tank it hits and that the launch effects from shock, g-load, flash, toxic gases, pressure, and sound (in and outside the vehicle) have been demonstrated to fall within the Army's acceptable ranges for human factors. Furthermore, missile firings against evasively moving and multiple targets are needed to confirm its operational effectiveness. However, the survivability of the system itself is more problematic; the Army has chosen to trade some ballistic protection for enhanced deployability (to ensure that the LOSAT system will be sling-loadable from a UH-60 helicopter).

# M829E3 120mm Armor-Piercing Fin-Stabilized Discarding Sabot-Tracer (APFSDS-T) Cartridge

The M829E3 Armor-Piercing Fin-Stabilized Discarding Sabot-Tracer (APFSDS-T) cartridge is a 120mm round designed to be fired from the Abrams tank. It is a kinetic energy (KE) round that fires a uranium alloy rod designed to penetrate and destroy enemy heavy armored vehicles. The design is driven by the need to counter KE-effective explosive reactive armor (ERA) and the desire to destroy targets at a longer range than is possible with the current M829A2.

The M829E3 is on the Test and Evaluation oversight list for Live Fire Test and Evaluation (LFT&E) only. LFT&E for this program includes both lethality and vulnerability evaluations. System lethality will be assessed with respect to expected threat tanks. The evaluation will also address the effect on Abrams tank vulnerability once the current ammunition (M829A2) is replaced with the M829E3.

## TEST & EVALUATION ACTIVITIES

Testing for the M829E3 LFT&E during FY02 included:

- Phase I Production Qualification Tests (PQT) against range targets (approximately 60 shots).
- Phase II PQT against shotline simulant targets (approximately 30 shots).
- Full-scale vulnerability tests using Abrams tank hardware and stowage plans (3 shots).

## TEST & EVALUATION ASSESSMENT

Results from the Phase I and II PQT were consistent with the preliminary data gathered during the final tests of production-representative Engineering and Manufacturing Development hardware during FY01. Specific discussion of the targets used during testing, and the results of the tests, are classified.

The provision for use of shotline simulant targets in the Phase II PQT represents an intelligent approach to realistic lethality testing, given the difficulties inherent in acquiring representative threat targets and testing with ERA and depleted uranium ammunition. An important component of the lethality evaluation will be a thorough discussion of the special considerations and limitations accepted in the design of these targets and the assessment of individual test outcomes.

*The M829E3 Armor-Piercing Fin-Stabilized Discarding Sabot-Tracer cartridge is a 120mm round designed to be fired from the Abrams tank.*

# Maneuver Control System (MCS)

The Maneuver Control System (MCS) is the command and control system for Army maneuver elements in battalion through corps echelons. MCS consists of a network of computer workstations that integrate information from subordinate maneuver units with those from other Army Battle Command System (ABCS) battlefield functional areas to create a joint common database referred to as the Common Tactical Picture. Tactical information products, such as situation maps and reports, allow the display and manipulation of this information. MCS also provides a means to create, coordinate, and disseminate operational plans and orders. MCS's role in communicating battle plans, orders, and enemy and friendly situation reports makes it a central component of the Army's ongoing effort to digitize the battlefield. MCS capabilities are being developed in blocks. The MCS Block III initiated, and the current Block IV increases, the integration between the ABCS components: All Source Analysis System, Forward Area Air Defense C3I System, Advanced Field Artillery Tactical Data System, Combat Service Support Control System, and Force XXI Battle Command, Brigade and Below.

The Army conducted the MCS Block III Initial Operational Test and Evaluation (IOT&E) in June 1998. DOT&E concluded that MCS Block III was neither operationally effective nor operationally suitable. The Army subsequently restructured the MCS program, did not field the Block III, and designated the Block IV as the version planned for testing in an IOT&E to support the full-rate production decision. In 2002, the Army reviewed the operational requirements for all of the ABCS components to better support the Army transformation to the objective force and the Future Combat System. The resulting requirements support the MCS Block IV testing and the planning for development of future MCS versions.

## TEST & EVALUATION ACTIVITIES

The MCS completed several developmental test events including a series of System Stress Tests and Field Test 5 in September 2002. The System Segment Acceptance Test originally scheduled for December 2002 has been delayed due to real-world operations. The Army has also indefinitely postponed the IOT&E, scheduled for April/May 2003.

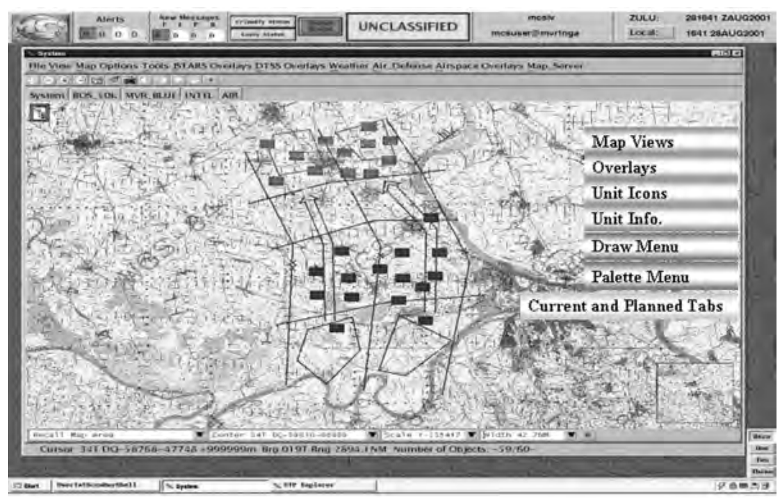
The Army is waiting for Joint Requirements Oversight Council approval of the revised Operational Requirements Document.

Due to recent changes in test scheduling, the MCS Test and Evaluation Master Plan has not been submitted to OSD for approval.

## TEST & EVALUATION ASSESSMENT

The MCS Block IV effort is complex and requires developing and integrating diverse software components including commercial and government furnished foundation products and software from the other ABCS programs. The completed Army review of MCS operational requirements, operational concepts, and acquisition strategy resulted in requirements that reflect the capabilities of the MCS Block IV.

The development testing completed in 2002 demonstrated significant progress in stability and functionality from the performance




*The Maneuver Control System is the command and control system for Army maneuver elements in battalion through corps echelons. MCS integrates information to create a joint common database referred to as the Common Tactical Picture, making it a central component of the digital battlefield.*

observed in 2001. The ability of the MCS to meet the entrance criteria to enter the IOT&E remains uncertain however.

The MCS; Force XXI Battle Command, Brigade and Below; and the Integrated System Control Version 4 IOT&Es were to be conducted as a combined event. Combining the tests provides a realistic and robust environment to assess these systems at a cost savings compared to three separate tests. However, planning and coordinating a test event of this scope are a significant challenge. Significant concerns included the unit architecture (numbers and types of systems) and the extent of electronic warfare and information warfare during the operational test.

In October the Army announced it was postponing the combined IOT&E indefinitely due to preparations for real-world operations. No alternative plans have been developed.

Testing of the individual programs comprising the ABCS requires that all of the other programs participate because of the interdependencies required to create a coherent command and control structure. However, developing and funding the components such as MCS as independent acquisition programs continue to complicate the ability to efficiently support and synchronize tests and acquisition decisions for these acquisition programs. A continuing issue is whether the failure of one component to be ready constitutes the need to delay an event or decision for other components. For instance, can the MCS proceed to operational testing and fielding if another of the ABCS component systems is not ready? The Department needs capstone approaches to development, testing, and acquisition to efficiently support and synchronize the ABCS programs such as the MCS that currently are developed and funded as independent programs.

# Multiple Launch Rocket System (MLRS) M270A1 Launcher Upgrade

The upgraded M270A1 Launcher provides an all-weather, indirect, area fire weapon system to strike high-payoff threat targets at all depths of the tactical battlefield. The M270A1 is a self-loading launcher with an onboard fire control system. The launcher is the standard U.S. Army platform for firing surface-to-surface artillery rockets and missiles. It is mounted on a mobile, tracked vehicle that carries 12 rockets in two, six-rocket Launch Pod Containers or two Army Tactical Missile System (ATACMS) missiles, which can be fired individually or sequentially.

The M270A1 program includes two major upgrades to the current M270 launcher. First is the Improved Fire Control System (IFCS), which replaces obsolete, maintenance-intensive hardware and software. It provides growth potential for future munitions and the potential for reduced launcher operation and support costs. IFCS includes a Global Positioning System-aided navigation system. Second, the Improved Launcher Mechanical System (ILMS) improves reaction times by decreasing the time to aim, fire, move, and reload the launcher. A faster drive system reduces the traverse time from the stowed position to worst-case aimpoint by approximately 80 percent and decreases the mechanical system contribution to reload time by about 40 percent.

MLRS initial operational capability occurred in 1983. To combat growing obsolescence, the Army initiated the IFCS program in FY92. In FY95, the Army began the ILMS program to address a requirement for rapid engagement of highly mobile, short-dwell targets. In FY96, the Army combined the IFCS and ILMS test programs under the M270A1 to undergo system-level testing. A Low-Rate Initial Production (LRIP) of IFCS and ILMS hardware modification kits was approved in May 1998.

In 1997 and 1998, the Army conducted a survivability program to complete survivability estimates, determine the effects of improvements on survivability of the fielded launcher, develop tactics to enhance launcher and crew survivability, and develop changes needed for the M270A1.

In July 1999, IOT&E slipped 22 months to allow the program manager time to fix problems identified in developmental testing and the Maintainability Demonstration and to include the planned replacement of the executive processors and operating system. In March 2000, DOT&E approved a revised M270A1 TEMP.

*The launcher is the standard U.S. Army platform for firing surface-to-surface artillery rockets and missiles. The program includes two major upgrades to the current M270 launcher.*

## TEST & EVALUATION ACTIVITIES

The Initial Operational Test and Evaluation (IOT&E) was conducted from August to October 2001. The IOT&E ground phase consisted of three 96-hour field exercises for one M270A1 launcher platoon, side-by-side with an M270 platoon and included the live firing of reduced-range practice rockets. The flight phase consisted of 35 M26 rockets, six extended-range rockets, and one ATACMS Block IA missile.

In October 2001, the materiel developer conducted a three-day exercise to verify that minor changes made following the IOT&E software release did not create unexpected consequences. Additional flight tests were conducted to ensure that software changes did not affect the launcher's ability to fire live munitions. Milestone III was conducted in March 2002.

DOT&E completed its assessment of the system and delivered its "Operational Test and Evaluation Report on the Multiple Launch Rocket System M270A1 Launcher" to Congress in April 2002.

**TEST & EVALUATION ASSESSMENT**

The M270A1 is operationally effective. It performs its operational functions without degrading the effectiveness of the current MLRS family of munitions. The launcher provides improved responsiveness and survivability over the M270 launcher.

The M270A1 is also operationally suitable. The launcher demonstrated better overall reliability than the current M270 launcher. The launcher can be operated and maintained by the current force structure of Military Occupational Specialty 13M operators and 27M/63Y maintainers.

The Ballistic Survivability Program determined that the M270A1 is less susceptible to indirect artillery fire because of its more rapid displacement after firing. However, both the M270 and M270A1 are equally susceptible to direct fire threats.

Payload sensitivity and reaction propagation tests demonstrated that payload rocket motors and warheads are major contributors to system vulnerability and that vulnerability could be reduced through modifications to the Launcher Loader Module and Launch Pod Container rocket tubes.

Testing and analysis concluded that the M270A1 and M270 are equally vulnerable. The M270A1 inherited vulnerabilities from the M270 that can result in functional kills (mobility and/or firepower) in many scenarios.

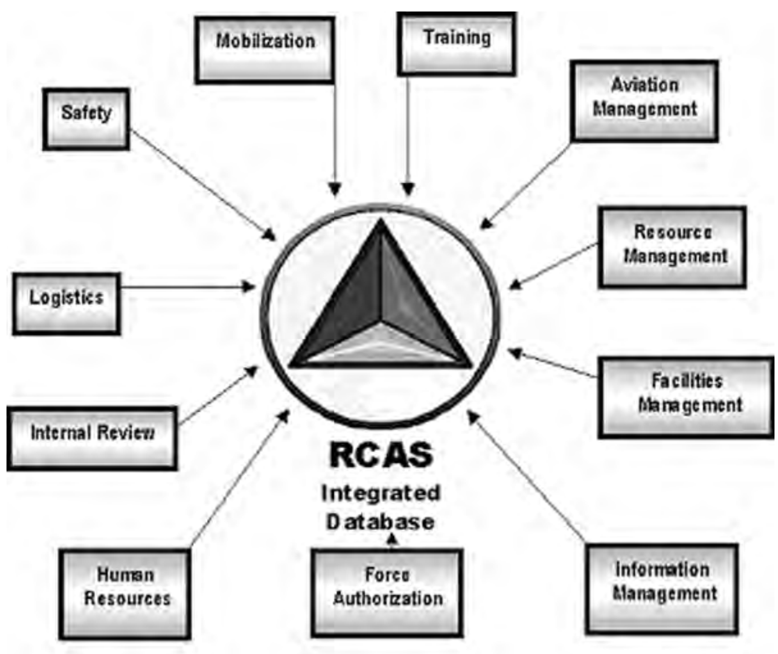
# Reserve Component Automation System (RCAS)

The Reserve Component Automation System (RCAS) is a scalable, open-systems environment, automated information system that supports commanders with information needed for Reserve Component mobilization and day-to-day administrative operations. It is a sustaining base networked system of workstations, primarily employing commercial-off-the-shelf (Microsoft Office® and Windows NT®, JetForms®, etc.) and government-off-the-shelf software applications (Unit Level Logistics System, Standard Property Book System-Redesigned, and Standard Installation/Division Personnel System Version 3, etc.). RCAS will interface with numerous Department of Defense and Army systems, and certain National Guard and Army Reserve designated standard systems. RCAS will not deploy with mobilized units, but will supply data to support mobilization.

The current acquisition plan calls for the RCAS to be developed and deployed in eight increments. Computer hardware was deployed with the first Increment in 1996, and software Increments 1 through 6 were operationally tested between 1996 and 2000 in reserve units from the lowest level to the Army National Guard and Army Reserve Headquarters. These first six increments of RCAS were found effective and suitable, and were approved for fielding.

## TEST & EVALUATION ACTIVITY

- The Army Test and Evaluation Command (ATEC) executed an operational test (labeled a Limited User Test) for RCAS Increment 7 from March 27, to May 17, 2002. The objective of the test was to determine the effectiveness and suitability of RCAS with the addition of Increment 7 software. Primary among the enhancements of Increment 7 software were three United States Army Reserve-only applications, and two general RCAS applications. The United States Army Reserve applications were related to force authorization management (RADPER), civilian personnel (CIVPER 1.0), and personnel, training and resource management functions at the regional level (RLAS Client). The other two more generalized applications were the Mobilization Planning Data Viewer (MPDV-1) and enhancements to the Safety and Occupational Health module (SOH Version 2).
- The general test concept was to observe users performing typical actions in their normal operational environment, and collect user inputs regarding the new RCAS functionalities using web-based questionnaires and direct user interviews. Additional data was collected by server-installed monitoring software and tester reviews of relevant logs, reports, and other documentation.
- The operational test units and sites for this test were the same Operational Installation Sites as were used by ATEC to evaluate Increments 4/5 and 6. Test units included the National Guard and Army Reserve Headquarters, Delaware Army National Guard (DE ARNG) and sites of the 99th Army Reserve Regional Support Command (RSC) in Pennsylvania and West Virginia.
- Regression testing was conducted on all six previous software releases to ensure that Increment 7 did not adversely affect the system's




*The Reserve Component Automation System is a networked automated information system that supports Army Reserve Component commanders with information needed for mobilization and day-to-day administrative operations.*

operation. A limited Continuity of Operations Plan (COOP) was exercised and evaluated for the United States Army Reserve at the 99th RSC.

### TEST & EVALUATION ASSESSMENT

ATEC found that the RADPER, RLAS Client, SOH, and CIVPER applications operated properly during the Limited User Test (LUT). Although two interfaces for SOH performed very poorly, those interfaces (Defense Civilian Personnel Data System (DCPDS) and Occupational Health Manager (OHM) are no longer required – they have been replaced or discontinued. However, the performance of the MPDV application was below expectations. Although the MPDV application showed no major internal flaws, it failed to improve the mobilization process as intended; in fact, mobilization efficiency was degraded when MPDV was implemented. There were two principal shortcomings observed in the operation of MPDV during the LUT: a confusing delay between soldier-entered personnel data into the local database and the appearance of the correct data in the MPDV system. This systematic delay in the automatic transfer of data from the user input into the MPDV caused some dissatisfaction of the users. Also, MPDV-I users expressed dissatisfaction regarding the relatively incomplete (31 percent) automatic population of the Soldiers Processing Checklist (SPC) by RCAS; this was exacerbated because the user had not updated much of the needed medical data prior to the test.

ATEC testers noted a significant concern with interfaces to applications needed to support mobilization: the overall success rate was only 53 percent when exchanging information with those external applications, excluding the discontinued interfaces for DCPDS and OHM. However, many of the unsuccessful transfers occurred due to a properly working data integrity filter which rejected improperly formatted data from the external interfaces. The recorded data only shows failed data exchanges, of which some could be due to other reasons. It is apparent, however, that the holders of these external interface applications need to clean up their databases, so that RCAS can reliably retrieve needed data to populate its databases.

To follow up the limited COOP effectiveness test exercise involving a ARNG unit during the Increment 6 LUT, a similar exercise was conducted for the 99th RSC, which was successful. Regression tests against previous increments' functionalities showed no degradation. ATEC raised the issue of the upcoming termination of Microsoft developer support for Windows NTª, the operating system currently used by RCAS, in June of 2003. The Program Manager and Program Executive Officer-RCAS have satisfactorily addressed this issue.

DOT&E supports the ATEC finding that RADPER, RLAS Client, SOH, and CIVPER are operationally effective, suitable, and survivable. However, DOT&E found the MPDV application operationally suitable and survivable, but only potentially effective, pending demonstrated improvements in data entry and auto-population of the SPC.

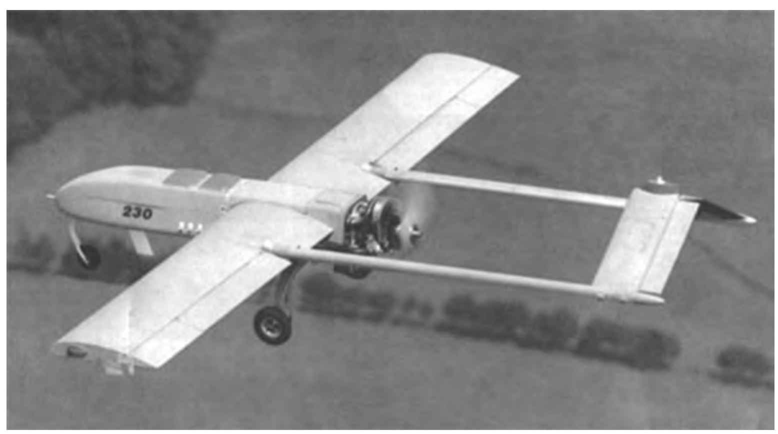
# Shadow 200 Tactical Unmanned Aerial Vehicle (TUAV) System

The Tactical Unmanned Aerial Vehicle (TUAV) system is intended to be a ground maneuver brigade commander's UAV and a critical component of the Brigade's intelligence collection package. The Shadow 200 is a small, lightweight, tactical UAV system. The system is comprised of air vehicles, modular mission payloads, ground control stations (GCS), launch and recovery equipment, and communications equipment. It will carry enough supplies and spare parts for an initial 72 hours of operation and will be transportable in two high mobility multi-purpose wheeled vehicles (HMMWVs) with shelters, and two additional HMMWVs with trailers as troop carriers. Another two HMMWVs carry the maintenance support section.

A single TUAV system includes three Shadow 200 air vehicles with a fourth air vehicle as part of the issued equipment of the maintenance section. The air vehicle has a wingspan of 12.3 feet and length of 11.2 feet. Power is provided by a commercial 38-horsepower rotary engine that uses motor gasoline. The payload has commercially available electro-optic and infrared camera and communications equipment for command and control and imagery dissemination. Onboard global positioning system instrumentation provides navigation information.

The air vehicle is intended to provide coverage of a brigade area of interest for up to four hours at 50 kilometers from the launch and recovery site. The maximum range is 125 kilometers (limited by data link capability) and operations are generally conducted from 8,000 to 10,000 feet above ground level during the day and 6,000 to 8,000 feet above ground level at night. The air vehicle uses a pneumatic launcher and is recovered by a tactical automatic landing system without pilot intervention on the runway. The air vehicle is stopped using an arresting hook and cable system.

The Army conducted a systems capability demonstration during October and November of 1999 to provide input to the TUAV source selection. In December 1999, a low-rate initial production (LRIP) contract was awarded to AAI Corporation for four Block I Shadow 200 TUAV systems. In March 2001, a second LRIP contract was awarded to AAI for four additional Block I systems. Originally, a Block upgrade program was envisioned to meet the full Operational Requirements Document (ORD) capability, however, lack of funding has reduced the scope of the Blocks. For example, the Shadow 200 TUAV has not incorporated required Tactical Control System (TCS) standards into its GCS as required by the Joint Requirements Oversight Council - approved TUAV and TCS operational requirements documents, although TCS compatibility was at one time part of the block upgrade program.




*The Shadow 200 Tactical Unmanned Aerial Vehicle is a small, lightweight tactical unmanned aerial vehicle system.*

The TUAV first entered Initial Operational Test & Evaluation (IOT&E) in April of 2001. After two crashes during the first two days of flight, the test was halted pending accident investigations. The test resumed the following week, but was down-scoped to a limited user test. After two more crashes, the limited user test was terminated and all flight operations of the Shadow 200 stopped until a complete investigation was conducted. Flight operations resumed in the Summer of 2001 and the program office awarded a third LRIP contract for five more Block I systems in January 2002.

A second IOT&E took place during April and May of 2002, and the Army authorized entry into full-rate production and deployment in October 2002. The current Test and Evaluation Management Plan (TEMP) was approved in March 2002. The TEMP is being updated for the upcoming follow-on test and evaluation phase.

### TEST & EVALUATION ACTIVITY

Between October and December 2001, the program office performed a three-phase Operational Tempo (OPTEMPO) demonstration, to gain confidence in the reliability of the system after the problems that occurred during the canceled IOT&E. Successful demonstration of the ability of the system to perform a surge OPTEMPO was an entrance criterion for the second IOT&E.

Joint Interoperability Test Command (JITC) has periodically assessed the Command, Control, Communications, Computers and Intelligence interoperability of the TUAV ground control station with the Army's Joint Tactical Architecture, Battle Command System, and Joint Surveillance Target Acquisition Reconnaissance System Common Ground Station as is required by a Key Performance Parameter. After the first IOT&E, the test unit upgraded to a beta version of the Army Battle Command System. In all, JITC conducted three developmental test events with the TUAV and the beta software. JITC also observed the second phase of the OPTEMPO event. These events were aimed at mitigating risk going into the second IOT&E.

The second IOT&E was conducted from April 23 to May 6, 2002 at Fort Hood, Texas, with systems from the first LRIP lot. The test plan called for two phases, with each phase to last for five days. A TUAV ground control station was integrated into the 1st Brigade, 4th Infantry Division (Mechanized) Tactical Operations Center. The TUAV launch and recovery elements were set up at a tactical airstrip within Fort Hood ranges. Phase I was conducted in accordance with the Operational Mode Summary/Mission Profile while Phase II was conducted in a free-play exercise environment. The manner in which the Army executed this test was not in accordance with the test and evaluation plan submitted to the Director, Operational Test and Evaluation (DOT&E).

Regression testing of a production representative system from the second LRIP lot was conducted from September 23-27, 2002, at Fort Lewis, Washington. The testing was conducted in conjunction with the 3rd Brigade, 2nd Infantry Division's TUAV capstone fielding exercise (Stryker Brigade). The purpose of this testing was to confirm that there was no degradation in capabilities between the test article evaluated during IOT&E and a production-representative system.

### TEST & EVALUATION ASSESSMENT

The TUAV successfully completed the first two phases of the OPTEMPO demonstration. The system also demonstrated 4 hours on-station at a 50 km equivalent range for a single mission (5 flight hours) three times. This was the first operational demonstration of this capability. Poor weather and airspace coordination severely limited the scope of the third phase. Of the 74 hours of on-station coverage required, the platoon was able to complete 20.7 hours. Data from the two previous phases were used to support the third LRIP production decision.

The scope of the 2002 IOT&E provided an excellent organizational environment for the TUAV platoon. The tactical scenario was representative of recent peace-keeping operations. However, test adequacy issues limited DOT&E's evaluation in some areas. For example, testers authorized the TUAV to fly over threat territory without penalty even though threat air defenses were able to detect and track the TUAV air vehicles. The unrestricted ability of the air vehicles to fly where desired eliminated the operational requirement for air vehicles to observe from realistic slant ranges and improved their opportunity to loiter over targets. Intelligence reports and artillery targeting results submitted under these conditions are most likely optimistic. In addition, because the data collected did not include all of the missions and taskings assigned to the TUAV platoon, the contribution to the commander's requirements and the overall reliability of the TUAV system could not be fully evaluated. Finally, the availability of additional air vehicles from Division and the Contractor Depot was optimistic since there will be at least three Brigade TUAV systems competing for these assets in realistic operational situations.

Results from the operational testing indicate that the Shadow 200 system is operationally effective under fair weather conditions and in the absence of an air threat for cued reconnaissance and surveillance missions. The Shadow 200 is not operationally effective for target acquisition missions. The TUAV system demonstrated the capability to contribute to the ground maneuver commander's requirement for timely and accurate reconnaissance and surveillance; 57 percent of the Shadow TUAV reports during the operational test were successful as scored against pre-determined mission success templates. However, median target location errors were determined to be in excess of 200 meters (the threshold requirement is 80 meters) and inadequate procedures to support accurate and timely artillery adjustment for second round fire for effect were observed.

Testing also revealed system performance limitations in the areas of air vehicle recovery and susceptibility to detection by threat systems. The ORD requires the TUAV to be able to move with a maneuver brigade and be able to launch and recover from an unprepared, soccer field-sized area. System limitations requiring an optimized landing site could negatively impact a maneuver commander's employment of this system.

The Shadow 200 system is not operationally suitable and may not be affordable. The TUAV executed 227 flight hours for a total of 170 hours on station during the 2002 IOT&E. Reliability has significantly improved since the first IOT&E in 2001; however, there were two AV crashes and one instance of an AV sustaining significant damage during a landing in which the tail hook missed the arresting gear and the AV went into the barrier net. The system did not meet its requirements for reliability or maintainability; inherent redundancy in the system allowed for operational availability well above the operational requirement and the system demonstrated its ability to meet the commander's sustained OPTEMPO. The frequency of occurrence of crashes, hard landings, and engine replacement raises concern that sustained operations and cost are prohibitive for the systems' intended use at this time.

The Shadow 200 TUAV is not survivable. Air vehicle susceptibility to detection was high as it was seen and heard within the effective ranges of many threat systems. Unsophisticated threats can also easily detect and locate the air vehicle and ground segment using electronic support measures. Electromagnetic environmental testing has revealed significant vulnerabilities. Finally, the system as tested has a data link with severe limitations on operating locations, and the planned upgrade to a C-band data link still has limitations in deployment locations outside the continental United States.

The JITC has not fully certified the TUAV system in accordance with DoD Directives because the testing was conducted using software versions of the required interfaces that have not been materially released. A specified interface certification was granted for only the configurations used during the operational test. Interoperability certification with the materially released fielded software versions is still necessary for compatibility with the majority of the Army in case of contingency operations.

The testing at Fort Lewis of the second LRIP lot did not have the rigor or length of an operational test. The platoon originally planned to conduct 24-hour flight operations for four days. Because of an air vehicle crash on the first day (following a crash landing the week prior), the planned schedule was not completed. If new failure modes have developed as a result of the changes to the system, they will probably not be illuminated until the system is operated in a more taxing manner over a longer period of time. Also apparent during this regression test was the fact that the personnel and training base infrastructure was not in place adequately for the successful fielding to the first units to be equipped. DOT&E continues to evaluate this finding.

# Stinger-Reprogrammable Microprocessor (RMP) Missile

The Stinger missile is the Army's system for short-range air defense. It provides the ground maneuver commander with force protection against low-altitude airborne targets, such as fixed-wing aircraft, helicopters, unmanned aerial vehicles, and cruise missiles. The Stinger is launched from a number of platforms: Bradley Linebacker, Avenger on the High Mobility Multi-Purpose Wheeled Vehicle (HMMWV), and helicopters, as well as the Man-Portable Air Defense configurations.

The Army had planned a two-phase upgrade program for the Stinger-Reprogrammable Microprocessor (RMP) missile to correct known operational deficiencies of the original Stinger-RMP missile system. The first upgrade, called Stinger-RMP Block I, made software and hardware changes, including a new roll frequency sensor, a small battery, and an improved computer processor and memory. It is currently in the Army and Marine Corps inventory. The second upgrade, Stinger-RMP Block II, added an advanced imaging array infrared seeker and additional signal processing software. The Stinger-RMP Block II missile was intended to provide improved performance against targets in terrain clutter, more advanced stealthy cruise missiles, unmanned aerial vehicles, and helicopter targets employing countermeasures, as well as improved performance during nighttime operations.

The Stinger-RMP Block II missile test program was suspended during Operation Desert Storm, and the Block I missiles were rushed into the field. Subsequently, the Army conducted tests on the Stinger-RMP Block I without DOT&E approval. It is DOT&E's opinion that this test was inadequate.

In 1999, the Army initiated the Stinger-RMP Block II program for a Milestone II decision in early FY00; DOT&E worked with the Army to obtain approval of an updated Operational Requirement Document, an updated System Threat Assessment Report and new Critical Operational Issues, and to develop a test strategy. The Test and Evaluation Master Plan was approved, but subsequently the Army canceled the Stinger-RMP Block II missile program in early FY00. There had been plans to produce approximately 11,000 Stinger-RMP Block II missiles. The Stinger-RMP Block I missiles will remain in inventory until at least 2020.

As a separate but related issue, Congress mandated that the Army evaluate the Stinger RMP Block I and the British Starstreak missiles as armaments for the AH-64 Longbow Apache.

## TEST & EVALUATION ACTIVITIES

All Test & Evaluation activities on the Stinger-RMP Block II program were suspended when the Army canceled the Block II program. No test plan or test resources have been identified for conducting the Stinger and Starstreak comparison test.

## TEST & EVALUATION ASSESSMENT

It is DOT&E's opinion that the currently fielded Stinger-RMP Block I missile was not adequately tested, because the test conditions were not representative of how the missile would be fired in combat. Thus, modifications to resolve the known operational deficiencies were not verified, and the Block I effectiveness and suitability remains unknown.

*Troops preparing to fire the shoulder-launched anti-aircraft Stinger missile.*

To date, the Congressional mandate to conduct Stinger-Starstreak comparison tests for air-to-air capability has not been performed by the Army because of concerns that the Starstreak cannot be safely fired from a helicopter due to the excessive back blast from the missile.

# Stryker Armored Vehicle

The Stryker program was formerly called the Interim Armored Vehicle program. It is a family of medium armored vehicles intended to equip the Army's Stryker Brigade Combat Team (SBCT). Based on the Light Armored Vehicle (LAV) III it consists of two basic variants, the Infantry Carrier Vehicle (ICV) and the Mobile Gun System (MGS). The ICV is, in turn, the baseline vehicle for eight additional configurations, which are based on the same platform as the ICV. These configurations are the mortar carrier (MC), the anti-tank guided missile (ATGM) vehicle, the reconnaissance vehicle (RV), the fire support vehicle (FSV), the engineer squad vehicle (ESV), the commander's vehicle (CV), the medical evacuation vehicle (MEV), and the nuclear biological chemical reconnaissance vehicle (NBCRV).

The Army initiated the Stryker program in FY00. The mission of the SBCT is to satisfy a requirement for a combined arms team with enhanced strategic deployability, capable of immediate employment upon arrival in the area of operations, while maximizing commonality among variants. The SBCT is envisioned to be more strategically deployable than existing Army heavy forces, while having greater tactical mobility than existing light forces. While the SBCT is intended to be employable across the full spectrum of combat, the Army envisions its most likely operating environment to be small-scale contingencies in complex and urban terrain against low-end to mid-range threat forces.

In November 2000, the LAV III was selected by the Army as the Stryker platform. Most Stryker configurations were assessed by the Army to be production-ready, based on LAV III vehicles being produced for other countries. Developmental work is expected for the MGS, NBCRV, and FSV. The other configurations will integrate existing equipment. Installation of Force XXI Battle Command, Brigade and Below (FBCB2) Integrated Combat Command and Control to share battle command information and situational awareness with the combined arms team is accomplished by the Army at user sites after the contractor delivers the vehicles.

## TEST & EVALUATION ACTIVITY

Stryker Test and Evaluation (T&E) activities to date have focused on Test and Evaluation Master Plan (TEMP) development to include development of an Operational Test and Live Fire Test and Evaluation (LFT&E) strategy. DOT&E approved the initial Stryker TEMP in November 2000 incorporating the details of the selected contractor's proposal and the LAV III specific configurations. An updated TEMP is currently being reviewed.

*The Stryker Brigade Combat Team is envisioned to be more strategically deployable than existing Army heavy forces, while having greater tactical mobility than existing light forces.*

The TEMP contains provisions for a battalion minus Initial Operational Test and Evaluation (IOT&E) that will be conducted with all Stryker variants and configurations not requiring significant developmental work.

The National Defense Authorization Act of 2001 required a Comparison Evaluation to be conducted between the Stryker and the M113A3. The Comparison Evaluation took place at Fort Lewis, Washington, during September 2002. Results of this evaluation are being analyzed.

The National Defense Authorization Act of 2002 requires an Operational Evaluation (OE) to be conducted. This will take place over several months, culminating with a brigade deployment to Fort Polk, Louisiana, during May 2003. The OE Plan is currently being staffed within the Army and will be submitted to DOT&E for approval in 2QFY03.

The IOT&E will be conducted with two live Stryker companys and one Stryker company in simulation. Additionally, battalion and brigade level combat support and combat service support elements such as reconnaissance, engineer and anti-tank units will participate. This task force will operate under the command and control of a brigade tactical operations center with complete Army Battle Command System (ABCS) digital C4ISR systems.

All Stryker variants and configurations should be available for IOT&E with the exception of the MGS, NBCRV, and the FSV. The MC will be available with a dismounted mortar only, as a soft-recoil mortar is under development for mounted mortar firing. Additional Operational Test events are being planned for those configurations not available for the first Stryker IOT&E.

The approved LFT&E strategy includes armor coupon testing (for base vehicle armor along with Rocket-Propelled Grenade (RPG) for add-on armor), ballistic armor characterization (non-operational production structure) to address fabrication specific vulnerabilities (seams, welds, fasteners), automatic fire extinguishing system tests, and system-level testing. For the production ready configurations, the system-level tests will employ three ICVs and one each CV, RV, ESV, MC, ATGM, FSV, and MEV.

Base vehicle armor coupon testing began in FY02 and continued through FY02 as the contractor refined its armor solutions to satisfy Army requirements. Initial RPG add-on armor engineering development tests began in FY02 while anticipated delivery of production representative add-on armor sets to support testing will begin in FY03.

System-level tests of the ICV began in FY02 with ten events completed by August 31, 2002. In addition to the direct assessment of crew casualties and system damage, the test events have included simulated crew and maintainer battle damage assessment and repair. DOT&E participated in the test planning, reviewed and approved the test plans, and observed each test event.

### TEST & EVALUATION ASSESSMENT

The Stryker T&E program is inherently challenging due to the need to test and evaluate ten different variants and configurations, each of which performs a different combat function. The Army has proposed a robust test program that includes all but three of the variants in the first Stryker Initial Operational Test (IOT). This will allow evaluation of system and unit effectiveness and suitability. The scope of testing for other variants depends on the extent to which common issues can be resolved in the first IOT. Additionally, each platform’s performance will be dependent upon the successful integration of a variety of mission packages. Of particular interest will be the integration and performance of FBCB2 digital command and control. The organizational and operational concepts for the Stryker equipped SBCT are based upon the information superiority presumed to be provided by FBCB2 as well as the other ABCS systems. The successful integration of Government Furnished Equipment mission packages such as the M707 Striker into the FSV and the Long Range Acquisition System into the RV will be essential to the Stryker program.

The development of the MGS will likely be the greatest program challenge. The integration of the 105 mm main gun on the LAV III chassis is unproven. Since the MGS will not be ready for fielding with the first brigades, the Army is pursuing a modification to the Tube launched Optically tracked Wire guided missile to give it enhanced capability against bunkers.

The Army’s assumption that the majority of the selected Stryker configurations and variants are production ready is based upon the LAV III chassis only and does not consider the total system integration of mission packages for each configuration, to include FBCB2. Much of the planned T&E effort will focus on system integration issues.

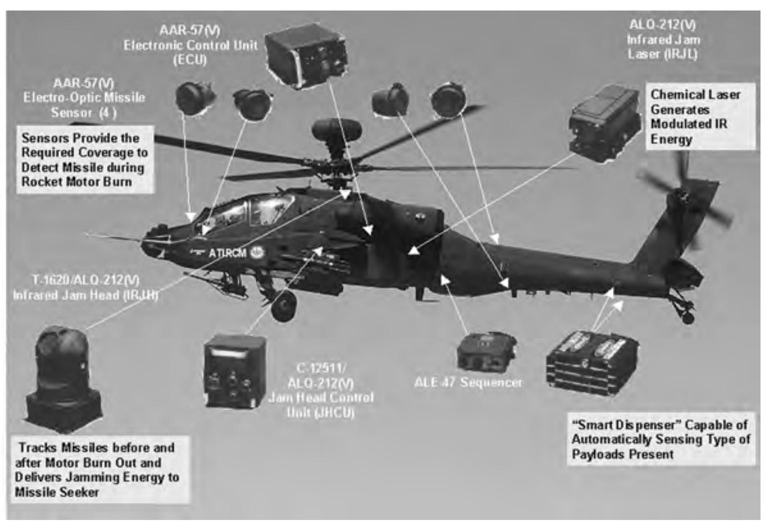
# Suite of Integrated Infrared Countermeasures (SIIRCM) and Common Missile Warning System (CMWS, AN/AAR-57) Includes: Advanced Threat Infrared Countermeasures (ATIRCM, AN/ALQ-212)

The Suite of Integrated Infrared Countermeasures (SIIRCM)/Common Missile Warning System (CMWS) is intended to enhance individual aircraft survivability against advanced infrared (IR) guided missiles. The SIIRCM concept of IR protection includes new IR flare decoys, the Advanced Infrared Countermeasures Munitions, and passive IR features. These passive IR features include host platform modifications such as engine exhaust/heat suppression and special coatings intended to reduce the platform IR signature.

The Advanced Threat Infrared Countermeasure (ATIRCM) is a sub-set of the SIIRCM program, and is specifically comprised of an active IR jammer for use on helicopters and the passive Common Missile Warning System. CMWS was originally to be used on both helicopters and fixed wing aircraft, but the Air Force and Navy have dropped out of the program. Currently, the only application of ATIRCM/CMWS will be on Army and Special Operations Command helicopters. Currently, the Army controls the funding for both the Army and Special Force's programs.

The Army's lead platforms for Engineering and Manufacturing Development (EMD) are the MH-60K and the EH-60. Previously, the AV-8B and the F-16 were the lead aircraft for the Navy and Air Force. Two ATIRCM laser jam heads are the normal configuration for most helicopters and transport aircraft, though only one jam head is currently planned for tactical helicopters. CMWS is intended to provide passive missile detection, threat declaration, positive warning of a post-launch missile that is homing on the host platform, countermeasures effectiveness assessment, false alarm suppression, and cues to other on-board systems. For the helicopter applications, the ATIRCM adds active directional countermeasures via an arc lamp and laser. ATIRCM is required to demonstrate integration with the Army's Suite of Integrated Radio Frequency Countermeasures.

The Joint Project Office (JPO) was relocated from St Louis, Missouri, to Huntsville, Alabama, during FY97 as part of a Base Realignment and Closure. After the relocation, the JPO was established and staffed as a separate Project Manager Office directly under Program Executive Officer Aviation. In 1999, CMWS sensor and jam head laser production difficulties, Operational Flight Plan development delays, and other EMD issues resulted in a cost and schedule breach and subsequent re-baselining. Performance in tests allowed ATIRM/CMWS to enter into government development testing in early FY01. In response to the September 11, 2001, attacks, and based on the positive test results on the CMWS in FY01 (described below), this sensor subsystem was recommended for accelerated fielding. Subsequently the Army awarded a limited production contract to BAE for up to 96 CMWS systems. Also, in FY01 the Army integrated the program into the Aircraft Survivability Equipment's office, under the Information, Electronic Warfare and Surveillance Office.




*The Suite of Integrated Infrared Countermeasures/Common Missile Warning System is intended to enhance aircraft survivability against advanced infrared guided missiles. It includes a laser jammer and missile warning system.*

During FY01, the program manager decided to make a change in the CMWS hardware configuration. All of the Test and Evaluation (T&E) was planned using the EMD version of CMWS. In parallel, the UK is buying a production version of CMWS that is advertised to have better performance, fewer parts, and greater reliability. Although the EMD version of CMWS has performed well, the Program Manager decided that the cost, reliability and performance advantages of the so-called production design upgrade (PDU) version of CMWS were sufficient to warrant a change late in the test program.

## TEST & EVALUATION ACTIVITY

Considerable T&E was accomplished in FY01, including false alarm tests at Eglin Air Force Base (Development Test (DT)), live fire tests at the Aerial Cable Facility at White Sands (DT/Operational Test), captive seeker tests at Fort Huachuca (DT/Operational Test), and the sled test at Holloman. The only test activity for this program in FY02 was the live fire shots against the CMWS system that was housed in a QF-4G drone. This test was required originally as part of the fixed wing operational assessment prior to the Air Force and Navy leaving the program. Since the modifications to the drone were already underway, the test was conducted. The drone tests were hampered by a number of test resource issues, resulting in a limited test, with only 8 of the planned 12 shots being executed. All the shots were declared by the CMWS, and flares were automatically dispensed. The flares successfully countered the missiles for each shot. Although a good indicator that the CMWS could be effective on fixed wing aircraft against the short range Surface-to-Air Missiles, more complete testing would be required to evaluate the system's performance against a fighter type aircraft at different aspect angles and altitudes.

Hardware-in-the-Loop (HITL) modeling capabilities are essential to providing an assessment of the operational effectiveness and operational suitability of the ATIRCM/CMWS system. Actual missile firings and drone target requirements have been reduced from nearly 400 to 175 events by developing new T&E concepts that rely on Modeling and Simulation (M&S). Contractor HITL testing in FY01 was very beneficial to validating M&S conclusions.

## TEST & EVALUATION ASSESSMENT

The ATIRCM/CMWS has demonstrated reasonably good performance to date. The tests have shown the need to modify the software for certain operational conditions and these modifications need to be re-evaluated during subsequent testing, especially with live fire shots at the aerial cable facility. Although the CMWS performance has been satisfactory to date, testing in FY01 surfaced some suitability problems with the IR jam head. Although effective, several reliability problems were experienced during the open air testing as well as during the reliability development growth test that was started and then stopped in August 2001. The jam head is undergoing a re-design to address the shortfalls.

With the changes that will be incorporated into the laser jam head and the limited testing on the newer PDU CMWS sensor, future operational test and evaluation (OT&E) needs to be performed on the system. The newer PDU sensor has performed adequately in the tests it has undergone, but it has not undergone as much testing as the previous EMD version. The PDU sensor is much lower risk than the updates to the ATIRCM jam head redesign. The first CMWS units that are produced during low-rate initial production should undergo DT regression testing; then the updated system should undergo a comprehensive OT&E to ensure that the upgrades are effective and suitable. Due to funding issues within the Army this year, the schedule for future OT&E is not firm. The Army is tentatively planning to conduct both the DT and OT&E tests in FY03, but there has not yet been a TEMP update that officially states when these tests will be conducted.

M&S are critical elements of the T&E program because the matrix of potential missile-aircraft interactions to be evaluated would require a substantial increase in the number of test firings. Modeling will be used to examine many of those interactions while simultaneously reducing program costs. The development of the end-to-end model has progressed this past year to the point that it now can be used for test predictions and some scenario evaluations. However, it is yet to be completely verified and validated. In addition, the model needs to be accredited prior to use for operational evaluation. The verification, validation, and accreditation requirement is a significant challenge.

The over riding issues for SIIRCM/CMWS is the need to conduct OT&E on the upgraded SIIRCM/CMWS and for the Test and Evaluation Master Plan to be updated to reflect the actual test schedule and planned conduct of the tests. The dates of testing will have to be decided in conjunction with the yet-to-be determined acquisition plan.

# Suite of Integrated Radio Frequency Countermeasures (SIRFC) AN/ALQ-211

The Suite of Integrated Radio Frequency (RF) Countermeasures (SIRFC) is intended to be an integrated aircraft survivability system that provides defensive, offensive, active, and passive countermeasures to ensure optimum protection for the host aircraft. Plans were to integrate the system on the AH-64D, MH-60K, and MH-47E helicopters, and the CV-22 and U-2 fixed-wing platforms. The lead aircraft for SIRFC integration and test and evaluation was the AH-64D Longbow Apache; however, the Army has decided that SIRFC is no longer required on that platform. Prior to this decision, a test installation on the Longbow Apache was developed and tested. Subsequent host aircraft platforms will undergo Follow-on Test and Evaluation to assess unique platform integration effectiveness and suitability issues.

SIRFC consists of two required sub-systems: the Advanced Threat Radar Jammer (ATRJ) and the Advanced Threat Radar Warning Receiver (ATRWR). The Advanced Airborne Radio Frequency Expendables package and the Escort Stand-Off variant are two system optional components that are currently unfunded. The system provides warning (situational awareness), active jamming (self-protection) and, when necessary, expendable countermeasures control to defeat threat radar guided weapon systems. Future integration of SIRFC with the Suite of Integrated Infrared Counter Measures (SIIRCM) on aircraft, which may be equipped with both systems, is a program objective that optimizes multi-spectral threat countermeasures. From this point on, when the name SIRFC is used, it will refer to ATRJ and ATRWR, which are major sub-systems under this program's development, and are intended to address RF (not Infrared) SAMs.

SIRFC achieved Milestone II in FY95 resulting in an Engineering & Manufacturing Development (EMD) contract to produce five test articles supporting Test and Evaluation through Initial Operational Test and Evaluation. The program underwent an acquisition plan restructure in FY00 to allow for correction of problems discovered in early testing and to better accommodate program milestones and execution of allocated program funding. A low-rate initial production (LRIP) decision to produce additional units for test and integration on follow-on platforms was made in May 2002, with Milestone III scheduled for FY04.

The first EMD test articles were delivered in FY99 and installed on the AH-64D Longbow Apache for integration testing. Upon SIRFC installation on the AH-64D Apache, the test team encountered several integration performance problems with the Operational Flight Program software. The most significant of these problems surfaced during FY00 developmental testing (DT) at the Benefield Anechoic Facility (BAF) at Edwards Air Force Base, California. The purpose of BAF testing was to evaluate SIRFC's integrated system performance as installed on the test platform. During this testing, the SIRFC system revealed significant performance problems handling threat emitters in a dense signal environment. These problems led the Program Manager to stop test efforts on the AH-64D until integrated performance issues could be resolved. An additional year was inserted into the EMD Phase to allow time in the schedule to sufficiently analyze discovered deficiencies, develop and implement corrections, and properly evaluate software performance.

*The Suite of Integrated Radio Frequency Countermeasures is intended to be an integrated aircraft survivability system that provides defensive, offensive, active, and passive countermeasures with the current primary focus on radio frequency guided missiles.*

**TEST & EVALUATION ACTIVITY**

The BAF tests were repeated in January 2001 using the same test plan as in the earlier test. Performance was significantly improved with no major deficiencies noted. Government developmental flight tests were conducted in July and August 2001, and a Limited User Test (LUT) was conducted in September and October 2001. The performance of the government DT and LUT were evaluated in FY02.

**TEST & EVALUATION ASSESSMENT**

Developmental problems resulted from continuous modifications being made throughout both contractor and government DT flight tests, and because the system was less mature when entering the LUT than would have been desired. Nevertheless, the LUT was considered a valuable opportunity to gather more information on system operation and facilitate improvements.

Analysis of the performance in the DT and the LUT indicated that, while SIRFC performance as a radar warning receiver (RWR) was superior to that of other RWRs tested, there were some deficiencies in its performance. The effectiveness of its jamming in increasing the survivability of the host aircraft in a threat environment was poor. As a result, the Army has awarded a correction of deficiencies contract to the system development contractor in order for development of corrective actions. These corrective actions will be implemented in the LRIP units for further testing. SIRFC has not yet undergone an Initial Operational Test and Evaluation. SIRFC will undergo operational testing before a full-rate production decision is made.

# Transportation Coordinators' Automated Information for Movement System II (TC-AIMS II)

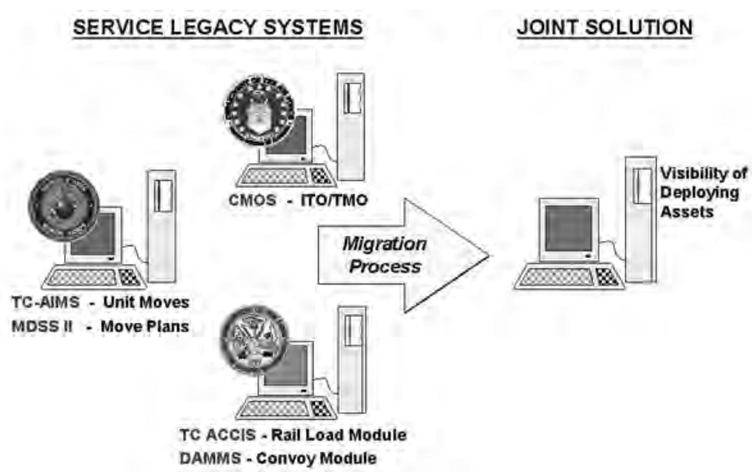
The Transportation Coordinators' Automated Information for Movement System II (TC-AIMS II) addresses critical shortfalls in the movement of materiel and personnel in support of Department of Defense operations. Developed and fielded in functional blocks, it is intended to reduce "buildup time" by merging the best business practices of the current Service-unique transportation automated information systems into a single system that combines the requirements for the Unit Movement, Installation Transportation Office/Transportation Management Office, and Theater Distribution functional areas and integrates several legacy systems of the four Services. The Joint Requirements Oversight Council approved the Operational Requirements Document (ORD) in March 1999. The Army Test and Evaluation Command (ATEC), the independent Operational Test Agency, conducted Operational Assessments on prototype systems during 1999 and 2000 that revealed numerous deficiencies. After additional development, the Program Manager (PM) completed developmental testing on Block 1and declared the system ready for Initial Operational Test and Evaluation (IOT&E) in October 2001. DOT&E approved the Test and Evaluation Master Plan on November 7, 2001.

### TEST & EVALUATION ACTIVITIES

- ATEC conducted IOT&E on TC-AIMS II Block 1 (commonly known as Basic Unit Move) in November and December 2001. The Marine Corps Operational Test and Evaluation Agency (MCOTEA) conducted the Marine Corps portion of the test.
- Four test sites were used for IOT&E, one from each Service: Shaw Air Force Base, South Carolina (Air Force); Amphibious Base, Little Creek, Virginia (Navy); Quantico, Virginia (Marine Corps); and the Heidelberg, Germany area (Army). Army participants included users from both U.S. Army Europe (USAREUR) and U.S. Army Forces Command (FORSCOM).
- In May 2002, ATEC conducted a retest of the system for the Navy at Little Creek and for USAREUR in Heidelberg.
- In August 2002, ATEC conducted a retest for Army FORSCOM at Fort Lewis, Washington.

### TEST & EVALUATION ASSESSMENT

As a result of the 2001 IOT&E, ATEC and MCOTEA determined that TC-AIMS II was not operationally effective, suitable, or survivable. DOT&E assessed the testing as adequate and recommended that the PM prioritize and correct the deficiencies and that ATEC conduct selected retesting. Somewhat more favorable (but still unsatisfactory) results had been obtained at the Navy site at Little Creek and the USAREUR sites at Heidelberg. The PM quickly fixed the problems associated with these two organizations (which use only a portion of the system's full capabilities); and following a May 2002 relook, ATEC found TC-AIMS II to be operationally effective, suitable, and survivable for the Navy and USAREUR only. DOT&E concurred and recommended an immediate, but limited, deployment to these two entities only.




*The Transportation Coordinator's Automated Information for Movement System II is designed to reduce the "buildup time" in the movement of materiel and personnel. It is intended to integrate current Service-unique transportation information systems into a single joint system.*

Meanwhile, both the PM and FORSCOM made rapid strides in preparing for general Army use of TC-AIMS II. The PM moved the system from a *Windows NT* to a *Windows 2000* platform, which markedly improved software performance. At the same time, the PM corrected the outstanding deficiencies from IOT&E that related to FORSCOM operations. For its part, FORSCOM worked hard to adapt some of its Basic Unit Move business practices to better exploit the capabilities provided by TC-AIMS II Block 1. The Army established a beta site at Fort Lewis, Washington, and in July 2002 both active duty and reserve component users were trained and began an intense period of functional operations. In August 2002, ATEC conducted another relook for the Army at Fort Lewis and in September 2002 determined that TC-AIMS II was operationally effective, suitable, and survivable for the Army. DOT&E monitored this testing, agreed with the findings, and recommended full worldwide deployment of Block 1 to the Army. Block 1 still does not contain all the initial capabilities needed by the Air Force and Marine Corps. Further Operational Test and Evaluation and fielding for these two Services has been deferred to later blocks that contain additional functionality. The PM is now proceeding with development of TC-AIMS II Block 2, and OT&E is slated for June 2003.

The TC-AIMS II acquisition has suffered from the lack of a common unit movement process across the Services and the lack of a single, authoritative user representative. The ORD was produced only after considerable negotiation, and still did not reflect requirements for joint process or incorporate viable data standards. There was not a single unit movement process even within the Army. This presented the PM with the daunting task of building a single system that had to satisfy the separate requirements of all four Services. Driven by the schedule, IOT&E took place before many users had much experience using the system. Consequently, the first system under test did not satisfactorily meet any Service's requirements and the required interfaces generally did not work.

Working together, the users, the PM, and the OTA were able to identify and incorporate rapid and effective fixes for many of these problems. Top-level Army leadership focused the effort and set the stage for user-centric solutions. The PM adopted a short-term/long-term plan that identified certain users (Navy and USAREUR) who wanted the system fielded and who had nearly achieved success in the IOT&E. These users determined the required short term fixes based on IOT&E data; the PM quickly and effectively made the fixes; and the testers immediately tested them. ATEC developed an evaluation plan based on data that addressed the fundamental ability of the system to produce timely and accurate critical mission functions, while collecting most other data by exception. Meanwhile, Army major commands were generally able to resolve internal disagreements on how to employ TC-AIMS II during functional operations at the new beta site. A similar process has been adopted for the longer term. The Services must still strive for common movement processes and a single user representative remains to be found.

# UH-60M Black Hawk

The UH-60 BLACK HAWK is a single rotor medium-lift helicopter that provides utility and assault lift capability in support of combat and peacetime missions. The BLACK HAWK is the Army's primary helicopter for air assault, general support, and aeromedical evacuation. Additionally, the BLACK HAWK can be configured to perform command and control, electronic warfare, and special operations missions. In March 2001, the Defense Acquisition Board approved the Army's proposed Acquisition Category ID program to refurbish and modernize the BLACK HAWK fleet with a digital cockpit, upgraded engine, improved rotor blades, and a new high-speed machined cabin. The prime contractor is Sikorsky Aircraft.

The Army began fielding the UH-60A in 1978. A 1989 power train upgrade resulted in a series designation change from UH-60A to UH-60L. Since 1989, the Army has procured 539 of the newer UH-60L models, but has not modernized the previously fielded UH-60A aircraft. Procurement of 60 more UH-60L BLACK HAWKs is funded through FY05. Commencing in 2002, plans are to recapitalize 193 UH-60A aircraft until these aircraft can be inducted into the UH-60M program beginning in 2006.

The March 2001 Operational Requirements Document establishes a blocked approach to development and modernization. The near-term Block 1 aircraft is intended to extend airframe service life while providing a digital cockpit, improved performance, and improved reliability and maintainability (relative to the UH-60A) for the BLACK HAWK fleet. The far-term Block 2 aircraft has requirements that are intended to significantly increased performance and survivability. The Army plans to leverage new engine technology that should provide increased lift capability, while improving fuel efficiency. Survivability of the Block 2 aircraft is intended to be enhanced by the Suite of Integrated Radio Frequency Countermeasures and the Suite of Integrated Infrared Countermeasures, both currently in development, and by improving pilot situation awareness to aid in threat avoidance.

The UH-60M digital cockpit will be a four Multi-Function Display (MFD) "glass cockpit" that is intended to improve pilot situational awareness and enhance capabilities to communicate and operate on the digital battlefield. Cockpit functionality is planned to be finalized by System Preliminary Design Reviews (PDRs) with the design being finalized by System Critical Design Reviews (CDRs). The major cockpit component, the MFD, was re-competed by the prime contractor. Rockwell Collins was selected by the prime contractor to supply the MFD.

*The Black Hawk is the Army's primary helicopter for air assault, general support, and aero medical evacuation.*

### TEST & EVALUATION ACTIVITY

In the past year, the program has completed the air vehicle PDRs and CDRs. Draft flight test plans for Combined Test Team (government and contractor) testing are being coordinated through the Integrated Product Team process. The program office and test community are planning for accreditation of the UH-60M Cockpit Test Bed resident in Redstone Arsenal's System Integration Laboratory that will provide input to the Army Test and Evaluation Command's System Assessment that will support the Milestone C/ Low-Rate Initial Production decision.

In August 2000, Under Secretary of Defense for Acquisition, Technology and Logistics waived the requirement for full-up, system level live fire test and evaluation (LFT&E) based on an alternate plan approved by DOT&E. In October 2001, the Office of the Secretary of Defense approved the Test and Evaluation Plan for Block 1 aircraft.

The LFT&E effort successfully executed ballistic testing of several flight critical main rotor drive and flight control components under static and dynamic load conditions. The Army updated earlier vulnerability models to be more representative of the latest design configuration. Sufficient test articles for the LFT&E program are being obtained from several damaged Army and Navy H-60 aircraft. A fully operational prototype YCH-60 that was recently retired from flight status will be used as a ground test vehicle.

### TEST & EVALUATION ASSESSMENT

The primary technical risk for the UH-60M is integration of the digital cockpit. The approved UH-60M test program will provide an opportunity to evaluate the effectiveness of the digital helicopter in the tactical Internet.

During UH-60A/L Wide Chord Blade (WCB) testing in 1999, the aircraft exhibited a left lateral stick migration during turns. The migration was more pronounced in right hand turns at higher loading (greater than 1.8g) and steep angles of bank (approximately 60 degrees) maneuvers at the edge of the performance envelope. It was noted in the WCB flight test report that, unless corrected, this deficiency could result in loss of controlled flight when attempting to recover from steep right-hand rolls in a dive at low altitude. Additional WCB testing was conducted in 2002. Results from the recently completed flight test with a modified left lateral limiter showed a 15 percent increase in left lateral cyclic margin and increased roll rates when recovering from high-load factor steep turns. Maneuvers from the edge of the structural and aerodynamic envelopes were recoverable with minimal altitude loss. Test results showed that the installation of the modified left lateral limiter on an UH-60A/L equipped with WCB restored the control margins to the equivalent of those on an aircraft with standard main rotor blades. The increased control margin adequately resolves the deficiency noted in the previous WCB flight test report. The current solution (the modified left lateral limiter), as flight-tested, will ensure that application of this solution to the UH-60M platform will correct the cyclic control problems identified in previously conducted WCB testing.

Presently, the contractor is tracking the projected/planned weight empty versus the specification weight empty (12,500 lbs) against a planned growth profile (through Operational Test Readiness Review #2). This weight profile is updated weekly as more detailed information is received. The detailed information includes selection of sub-systems vendors, actual component weights, and refinement of cabin structural design. The current margin predicted for external lift capability (4,500 lb requirement) is greater than 15 percent. Specific designs for the refurbishment of the airframe tail cone and cockpit sections, along with the new cabin, are being finalized as a result of the Air Vehicle PDR and CDR.

The LFT&E plan considers the vulnerability reduction features that have been incorporated into the BLACK HAWK since its initial fielding in 1978. This plan also will use combat damage experience, subsystem qualification efforts, computer modeling and simulation, as well as sister Services' testing on similar aircraft through the H-60 (Army/Navy) Combined LFT&E Integrated Product Team. The initial component static testing and system-level dynamic testing of several main rotor drive and flight controls have been completed. The completed tests include the main transmission, several gearboxes, input and quill shafts, main rotor pitch control links, and the swashplate. Test results for the improved components tested to date are showing improved survivability. Presently, the Army is preparing detailed test plans and test assets/specimens for static and dynamic testing of the main fuel system, tail rotor subsystem, and the engine in 4QFY02 and 2QFY03.

# Warfighter Information Network-Tactical (WIN-T)

The Warfighter Information Network–Tactical (WIN-T) is the Army's tactical Intranet from theater and the sustaining base down to the maneuver battalions. WIN-T, which is the Army's communications network of the future, will replace Tri-Services Tactical Communications and Mobile Subscriber Equipment. WIN-T will ensure the warfighter vertical and horizontal integration through a seamless network. WIN-T employs Mobile Battle Command and integrates dispersed operations over increased distances. WIN-T capabilities are integrated into maneuver platforms and deployed with the warfighter. The recent changes to the WIN-T Operational Requirements Document more accurately reflect Objective Force concepts.

Major WIN-T elements are network infrastructure, network management, information assurance, and user interfaces that provide voice, data, and video services to the warfighters. These four major WIN-T elements, when integrated with the Army's Tactical Internet, form the Army's Tactical Intranet. WIN-T provides wired and wireless communications for voice, data, and video by relying on commercial products and technologies as available. WIN-T supports multiple security levels from Unclassified to Top Secret/Special Compartmented Intelligence. It operates in the tactical environment and is mobile, secure, and survivable. It integrates terrestrial, airborne, and satellite-based transport capabilities into a network infrastructure to provide connectivity across the extended battlespace.

The WIN architecture initially was approved in January 1996; the requirements document for WIN-T and many of the digitalization programs were revised in 2001 to align more closely with the Objective Force. The revision did not add any new WIN-T requirements, but it did move forward many future or objective requirements to threshold requirements.

The current program has dual contractors developing the systems architecture beginning 4QFY02. Each contractor team will demonstrate its design in a separate Early User Test and Experimentation event in 2QFY05. A single contractor team will be selected in 1QFY06 to enter a 3-year low-rate production phase followed by the Initial Operational Test and Evaluation (IOT&E) in 2QFY08. The full-rate production decision is scheduled for 2QFY09.

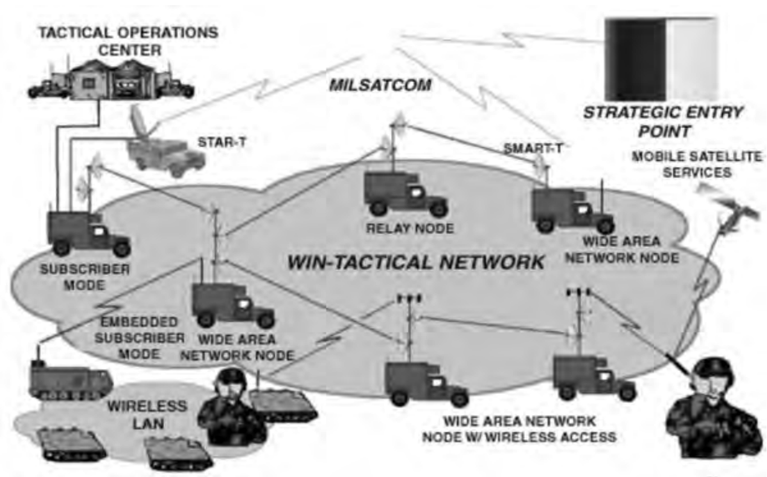
### TEST & EVALUATION ACTIVITIES

This program is pre-Milestone B. Test activities were focused on development of a viable test strategy and coordination of the Test and Evaluation Master Plan (TEMP).

### TEST & EVALUATION ASSESSMENT

Operational test strategies are currently being finalized to ensure that the IOT&E will be adequate. Operational test strategies for testing system enhancements beyond the full-rate production decision still need to be developed. The TEMP has not been submitted for OSD approval.

The current schedule does not provide sufficient time between the scheduled Force Development Test and Evaluation and the IOT&E to retrain operational test units if significant changes to tactics, techniques, and procedures are required or to correct any hardware or software deficiencies that might be discovered.




*The Warfighter Information Network-Tactical is the Army's communications network of the future. Major elements are network infrastructure, network management, information assurance, and user interfaces that provide voice, data, and video services to the warfighters.*

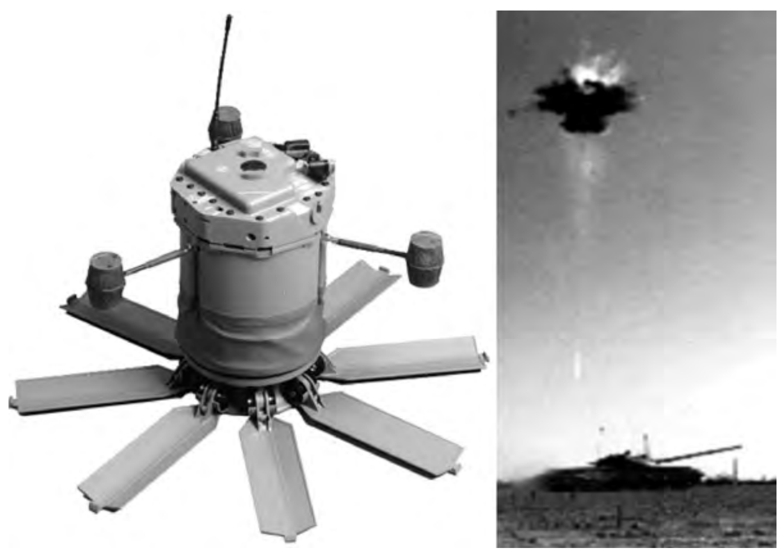
WIN-T is a system where early involvement is being implemented. Participation in Test and Evaluation working group meetings since the program's inception has helped define Critical Operational Issues and Criteria that are operationally meaningful and measurable for assessing the WIN-T contribution to operations. This early cooperation improves the quality of both the system development and test program and provides meaningful assessments for future decisions.

# Wide Area Munition (WAM) - Advanced Hornet

The Wide Area Munition (WAM) is a smart, autonomous top-attack anti-tank munition intended to defeat armored combat vehicles from a standoff distance. It uses acoustic and seismic sensors in its ground platform to detect, track, and classify potential targets, and then launches an infrared detecting submunition (sublet) over the top of the selected tracked target. Once a sublet detects a target, it fires an explosively formed penetrator (EFP) to defeat it. Threat target vehicles include tanks, engineer breaching vehicles, and lightly armored tracked vehicles. The variant currently in Low-Rate Initial Production (LRIP) is the Hand Emplaced WAM (HE-WAM), also referred to as the Hornet. Its design characteristics include the ability to be carried and emplaced by one person; the capacity for a 360-degree; a lethal radius of 100 meters; and a fully autonomous employment from final arming to target engagement.

A product improvement of the HE-WAM, called Advanced Hornet, included two types of improvements. First, communications changes were made, adding a two-way communications with status confirmation feature, a redeploy-before-arm capability, a safe passage mode, and other features designed to allow networking of emplaced munitions. Second, the current HE-WAM sublet was replaced by an adaptation of one developed for the Sensor Fuzed Weapon (SFW) pre-planned product improvement ($P^3I$) program. The HE-WAM warhead was substantially different than the Advanced Hornet warhead. In particular, the HE-WAM had a single EFP made from tantalum, while the Advanced Hornet warhead used a multiple-fragment EFP made of copper. The Advanced Hornet used an active laser rangefinder, in addition to the HE-WAM's passive infrared sensor. With these improvements, the Advanced Hornet warhead was intended to expand the WAM target set to include heavy wheeled vehicles.

The WAM Required Operational Capability (ROC) approved in March 1990 envisioned a "Family of WAM" concept of three variants: hand-emplaced, Volcano Scatterable Mine System-delivered, and Army Tactical Missile System-delivered. Only the hand-emplaced variant has been developed. In September 1996, the Army approved HE-WAM for LRIP and Advanced Hornet entered the EMD Phase of its development. Although HE-WAM was expected to enter full-rate production (FRP) at the end of 1998, the Army opted not to proceed into FRP. DOT&E submitted a Live Fire Evaluation report on HE-WAM to Congress in July 1999. The combination of test activities was adequate to support an assessment of the lethality of HE-WAM against its expected targets and to draw some inferences regarding the weapons' effectiveness. In March 2001, the Army gave HE-WAM a Conditional Materiel Release for 377 units. Work continued on development of the Advanced Hornet system with an anticipated full-rate production decision scheduled for 2004.



*The Wide Area Munition is a smart, autonomous top-attack anti-tank munition intended to defeat armored combat vehicles from a standoff distance.*

In FY00, the DoD Inspector General (IG) initiated an investigation of the WAM Program. A draft report circulated for review and comment was critical of the management of the program and recommended an OSD-level program review and that the program be placed under DOT&E oversight for operational testing.

An Operational Requirements Document (ORD) update incorporated newly required interoperability and more specific command and control, reliability, and operational effectiveness capabilities. The ORD was forwarded for approval in September 2001. Specific target dates for Milestone C and FRP decisions were established as of January 2003 and December 2004, respectively. Supporting operational tests were scheduled to begin in October 2002 and May 2004.

Funding for the program ended due to the inability of the program to demonstrate developmental progress and maintain program schedules, as well as attention resulting from the DoD IG investigation and report. The Army did not support funding this program in its FY04-09 Program Objective Memorandum. The program was terminated at the end of FY02.

### TEST & EVALUATION ACTIVITIES

No operational testing of Advanced Hornet was accomplished in FY02. Technical problems encountered during developmental testing and the lack of available troops to conduct operational testing in October 2002 resulted in the delay of the Milestone C and FRP decisions. DOT&E continued working with the Army to develop an Advanced Hornet Test and Evaluation strategy and the operationally realistic test events required to support that strategy.

The Live Fire Integrated Product Team (IPT) concluded that another lethality Live Fire program would be required for Advanced Hornet due to the warhead change and the addition of heavy wheeled vehicles to the target set. The IPT, with DOT&E participation, nearly completed an updated Live Fire Test and Evaluation (LFT&E) strategy before program termination. The only testing related to Live Fire conducted during FY02 was done by the system contractor, who determined that the multiple-fragment EFP liner used in the Advanced Hornet warhead would be identical to that in SFW $P^3I$.

### TEST & EVALUATION ASSESSMENT

Although HE-WAM entered LRIP in September 1996 it will not enter full-rate production, and no additional operational testing is planned. Advanced Hornet remained in EMD throughout 2002, but no operational assessments of Advanced Hornet communications and warhead improvements were made.

Live Fire Testing of the current HE-WAM against actual threat vehicles demonstrated its lethality when critical areas of target vehicles were struck. The damage inflicted by tower shots generally led to substantial degradation in target mobility (and sometimes catastrophic loss). In contrast, end-to-end firings of tactical HE-WAMs against moving T-72 tanks tended to hit areas at the rear and edges of the targets, where there were fewer critical components. Hence, the warhead was less effective under more realistic operational conditions. Additionally, HE-WAM was not effective out to its required range and was only marginally effective at half the required range. If the full potential of the warhead is to be realized, improvements are needed in sublet accuracy relative to the critical areas of the targets. A goal of the Advanced Hornet LFT&E program is to assess whether the lethality potential of the warhead has been achieved.

# XM29 Rifle

The XM29 Rifle, formerly the Objective Individual Combat Weapon, is a dual weapon system. It combines air-bursting munitions, secondary kinetic energy munitions, and a rugged, full solution fire control subsystem that contains a laser range finder, computer, thermal, direct view optics, and electronic compass. It is the next-generation infantry weapon and will replace the 5.56 mm M16A2 assault rifle, M4 carbine, and M249 squad automatic weapon, along with the 40mm M203 grenade launcher. The XM29 will fire new 20mm high explosive air bursting munitions (XM1018) along with fielded lightweight kinetic energy projectiles (NATO 5.56 mm). This system constitutes the weapon subsystem portion of the Land Warrior program. The Army plans to acquire the XM29 in an evolutionary process, with three block upgrades currently anticipated. Changes to the XM1018 to improve the lethality are expected with each block upgrade. Full-rate production for the XM29 Block I is planned for FY07.

The XM29 is comprised of four major subsystems:

- Primary Weapon Subsystem: This subsystem is the launch platform for the High Explosive Air Burst munitions family.
- Secondary Weapon Subsystem: This subsystem is the launch platform for the kinetic energy munitions family.
- Target Acquisition/Fire Control Subsystem: This subsystem contains the Thermal Sight, Direct View Optics, Laser Range Finder, Power Source Component, and Embedded Training and Maintenance capabilities.
- Munitions Subsystem: This includes the high explosive cartridge with airburst and point detonating fuze capability and kinetic energy projectiles.

As a result of the Live Fire Test Oversight for Small and Medium Caliber Ammunition group's meetings, the XM29 was identified as a Live Fire Test and Evaluation (LFT&E) candidate and placed under DOT&E oversight in December 1996. This program passed its Milestone I review in February 2000, transitioning from Advanced Technology Demonstration (ATD) status into its Program Definition and Risk Reduction phase (PDRR). An LFT&E strategy for XM29 was approved by DOT&E in July 2001, with dedicated Live Fire tests (Block I) expected to begin in FY06.

During an ATD demonstration test in FY99, a high explosive, airbursting munition experienced an ignition anomaly—causing an injury. A root cause analysis was completed in FY00, and a Milestone Ia decision meeting was held in March 2002, ensuring that adequate fixes had been implemented before continuing to PDRR.

### TEST & EVALUATION ACTIVITY

A revised Testing and Evaluation Master Plan will be submitted in FY03. There were no dedicated Live Fire tests during FY02. Associated test activities, such as shots to calibrate the fragmentation arena test methodology, were tracked by DOT&E. Revisions to the LFT&E strategy to reflect the blocked program approach were implemented.

*XM29 is the next-generation infantry weapon and will fire new 20mm high explosive air bursting munitions, along with fielded lightweight kinetic energy projectiles.*

### TEST & EVALUATION ASSESSMENT

The developmental test and evaluation program will serve to mitigate the technical risk and certify the readiness for operational testing. Contract award is scheduled for FY05 and Initial Operational Test and Evaluation (IOT&E) in FY06. Fully operational, production representative weapon systems and sufficient primary and secondary ammunition will be provided for the IOT&E. The XM29 will be tested in both integrated and detached configurations and be capable of integration with Land Warrior external power systems. The IOT&E will be conducted by an infantry platoon with command and control provided by its company headquarters. The platoon will perform a series of typical 96-hour missions against a realistic opposing force as well as a series of live range firing events. The LFT&E strategy for the XM29 Block I consists of 140 shots against a variety of personnel simulant and vehicle surrogate targets in various environments. A follow-on IOT&E and LFT&E strategy will be formulated for each of the subsequent block upgrades in FY10 an FY13.

Click on a title to go to that page.

## Navy Programs

# Navy Programs

# Acoustic Rapid COTS Insertion (A-RCI) Sonar System

A-RCI was initiated as Engineering Change 1000 to the AN/BSY-1 Combat System on improved *Los Angeles* class submarines. The program was expanded to provide improvements that could be backfit into all nuclear attack (SSN) and ballistic missile (SSBN) submarines totaling over 60 ship sets.

The motivation for these improvements was to provide expanded capabilities, particularly in littoral waters, for covert intelligence collection and surveillance, covert insertion, and support of Special Forces. Expanded capabilities were also for anti-submarine warfare focused on diesel-electric submarines, covert mining, and covert strike of targets ashore. Specific software improvements include passive ranging, spatial vernier processing, passive broadband improvements, full spectrum processing, dual towed array concurrent processing, low frequency active interference rejection, passive narrowband improvements, passive detection and tracking improvements, track management, on-board training, and port/starboard ambiguity resolution.

The operational test and evaluation plan for A-RCI features testing in four phases, the latter three of which correspond to hardware builds. When the program was placed under DOT&E oversight in 2001, Phase II testing was already underway. Phase II was the first implementation of the towed array improvements. A scarcity of submarine test resources for Phase II resulted in the deployment of Phase II equipped ships without operational test. The importance of the program and the lack of adequate operational testing led to DOT&E putting this Acquisition Category IV program on oversight.

Due to repeated cancelled tests and equipment failures, the Phase II testing was never completed. Software reliability and configuration management problems continued to slow the program. Finally, the Commander, Operational Test and Evaluation Force (COMOPTEVFOR) terminated the testing program until the system could be re-certified for test.

## TEST & EVALUATION ACTIVITY

Following re-certification, test and evaluation activity in 2002 centered about the operational evaluation of Phases III and IV, which are covered under separate Test and Evaluation Master Plans (TEMPs). Phase III is a major replacement of the sonar processing hardware and software for the towed arrays, the hull array, and the spherical array. Phase IV is an upgrade to the high frequency array. The Phase IV (minefield portion) test was completed in two days in a test minefield. The Phase III TEMP calls for ten days of open-ocean testing and two days on an acoustic range. All ten were planned for completion in FY02, but only three were accomplished due to cancellations, etc. In a letter to the Navy in April 2001, DOT&E stated:

> "*…The submarine force has provided insufficient test assets and time to complete planned testing before A-RCI sonar-equipped submarines have been deployed, citing lack of test assets because of higher-priority Navy tasking. Instead, A-RCI installation and deployment decisions appear to be marching independently of any Commander, Operational Test and Evaluation Force input.*"

*The AN/BQQ-10 (V) Sonar is a major product improvement that will go on all submarine classes.*

The procurements and deployments of Phase II and III systems continued resulting in the Director citing the A-RCI program in a letter to the Secretary of the Navy in August 2002 stating: "*I strongly recommend that you adopt a policy of deploying new combat systems after they have demonstrated appropriate performance during adequate operational test and evaluation.*"

## TEST & EVALUATION ASSESSMENT

Procurement and deployment of inadequately tested A-RCI systems are not in accordance with "fly before buy." The A-RCI Program Office must work with the Navy Type Commander and COMOPTEVFOR to ensure that the resources (test submarines and time) are available for the adequate Operational Test and Evaluation of A-RCI before ships are deployed with those systems. As the testing proceeds, DOT&E will review the assessments made by COMOPTEVFOR and will look for assurance that the effectiveness and suitability (primarily reliability) goals are met.

# Advanced Amphibious Assault Vehicle (AAAV)

The Advanced Amphibious Assault Vehicle (AAAV) is an amphibious armored personnel carrier that will replace the current Marine Corps assault amphibian, the Amphibious Assault Vehicle (AAV). Two variants are under development. The personnel variant (AAAV(P)) will be armed with a 30-mm cannon and a 7.62-mm machinegun and is intended to transport 17 combat-equipped Marines and a three-man crew. The command and control variant (AAAV(C)) will transport a commander and staff. An operationally configured AAAV will weigh about 38 tons and travel in excess of 20 knots in 3-foot significant wave height sea conditions, and at 43 miles per hour on a level, hard-surface road.

The AAAV is designed to provide an over-the-horizon amphibious assault capability for Marine Air-Ground Task Force elements embarked aboard amphibious ships. Once ashore, the AAAV(P) will be an armored personnel carrier providing transportation, protection, and direct fire support. The AAAV(C) will serve as a tactical echelon command post.

The AAAV entered the System Development and Demonstration (SDD) phase in December 2000. Nine months later, delays in completing Developmental Test (DT) and Operational Test and Evaluation (OT&E) resulted in a program baseline breach, which necessitated a Test and Evaluation Master Plan (TEMP) update. This update should have been forwarded to OSD for approval in December 2001. In December 2002, continued programmatic delays caused the Program Office to seek to postpone Milestone C an additional 9 to 12 months.

### TEST & EVALUATION ACTIVITY

FY02 Test and Evaluation activities included: DT (land/water mobility and firepower testing) of three Preliminary Design and Risk Reduction (PDRR)-phase AAAV(P)s; and two of three planned Early Operational Assessment (EOA) phases (land mobility testing and gunnery). The amphibious operations phase of the EOA was postponed repeatedly because prerequisite performance in DT relating to operating in the ocean, transiting surf zones, and operating sequentially in water and on land had not been demonstrated. Citing numerous planned design changes and a pressing need for using all the PDRR vehicles to complete essential DT, the Direct Reporting Program Manager (DRPM) recently cancelled the EOA's amphibious operations phase despite DOT&E's objections and advice to conduct this TEMP-required event.

*The Marine Corps' Advanced Amphibious Assault Vehicle underway at approximately 25 knots.*

Live Fire Test & Evaluation (LFT&E) activities in FY02 included ballistic validation of new armors, ballistic testing of the Automatic Fire Extinguishing System (AFES) using the Ballistic Hull and Turret (BH&T), and Revision of the LFT&E Strategy.

### TEST & EVALUATION ASSESSMENT

It is essential to note that some concerns stem from testing PDRR AAAV(P)s (which were not expected to represent fully the final configuration) and that corrective fixes have been identified by the DRPM in most cases, but are not yet demonstrated. The extent of these shortcomings was not anticipated. In particular, performance shortfalls in the areas of reliability and troop-carrying capacity appear to be the most significant.

Because of a lack of interior volume, PDRR AAAV(P)s could not effectively transport 17 combat-equipped Marines. A more realistic transport estimate is 14 or 15 Marines. Demonstrated embarkation and debarkation times are much greater than for the current AAV. Crowding is worse for loads involving infantry crew-served weapons, such as mortars. The capacity of the vehicle is at least 25 percent less than the AAV; thus, if AAAV(P)s replacement of AAVs is planned to be on a one-for-one basis, lift (in terms of personnel, their equipment, and essential cargo) will be comparably less. Vehicle modifications that have been proposed are not likely to improve this situation.

During the EOA's limited land mobility testing, the vehicle's land mobility capabilities effectively equaled the main battle tank's and the AAV's on primary and secondary roads. Neither the PDRR AAAV(P), nor the AAV, kept up with tanks in moderate cross-country conditions. The PDRR AAAV(P) broke down when traversing more challenging cross-country terrain that was passable by both tanks and AAVs.

The AAAV's weapon system appears to represent a significant advance over the capabilities currently fielded in the AAV, although this must be confirmed in operationally realistic conditions. The vehicle's thermal sight worked well under nearly all test conditions, including through smoke that completely blinded the AAV's optical sight. The PDRR AAAV(P)'s observed probability of hit was below the requirement despite benign firing range conditions. Problems with the gun's ammunition feed system significantly limited the number of rounds that could be loaded.

The vehicle's demonstrated reliability falls short of predictions, almost certainly because the system is mechanically complex and operates in a challenging environment. The Program Office continues to identify root causes and corrective actions for these failures. In the EOA, land mobility and environmental control systems have been the most problematic and led to failures to complete any of the planned operational mission profiles.

In addition to reliability, safety appears to be a major challenge affecting operational suitability. Noise levels limit the amount of time embarked Marines can remain in the PDRR AAAV(P) and require those near the vehicle to wear extra hearing protection. Carbon monoxide accumulates in the vehicle during 30-mm cannon firing unless all ventilation systems are operating properly. The temperature inside the vehicle rises to unsafe levels in high ambient temperatures, restricting troop transport and requiring that some electronic components be cooled with cooling packs to prevent overheating.

Several of the vehicle armors were changed as part of the major system redesign and weight-reduction effort that occurred early in SDD. Validation of the new armors for compliance with specifications continued throughout FY02 and is still incomplete. Further ballistic characterization of the vehicle armors, originally planned for FY02, was not conducted due to the redesign effort and the associated schedule slip. This testing is critical to support evaluation of armor performance, and is now planned for FY03.

Ballistic testing was conducted during FY02 using the BH&T to supplement results from earlier AFES DTs. Results from this testing were inconclusive, and further examination of AFES performance at the system level will be required.

Most of FY02 was spent reexamining the AAAV LFT&E Strategy approved at Milestone II. Changes are required as a result of the SDD redesign effort and the results of early DT. The strategy, which relies heavily on early developmental or specification compliance testing of components and hardware, requires extensive engineering analysis to link these results to system-level vulnerability. Based on the results of testing to date and the engineering details of the SDD redesign, LFT&E bases identified in the Milestone II LFT&E Strategy are inappropriate for the program, unlikely to lead to satisfactory results in the final full-up system-level (FUSL) live fire test phase, and inadequate to support a comprehensive vulnerability evaluation. Changes to the approved strategy discussed during FY02 include increased ballistic testing against specifically identified AAAV-unique components, more test events in the FUSL phase of the program, and addition of actual threat-based ballistic testing against the AAAV(C) configuration.

The Program Manager has agreed to additional component testing, and has identified a second SDD prototype vehicle for use in system-level testing. Remaining concerns include management provisions for the proficient conduct of an independent LFT&E and long-range test and resource planning.

In sum, the AAAV program continued to experience programmatic delays resulting in the recent announcement that the testing to support the Milestone C, Low-Rate Initial Production decision has been extended for one year. The primary causal factor has been an unexpectedly inadequate PDRR-prototype performance, which had led both to testing delays (DT and Operational Test) and to a significant SDD redesign, which will require appropriate testing and evaluation. Importantly, the AAAV(P) has not demonstrated that it can accomplish its primary mission, that is, transport combat-equipped Marines from an amphibious ship located 20 to 25 nautical miles offshore to objectives located inland without unacceptably degrading their physical condition. The Program Manager's ill-advised decision to cancel the EOA's amphibious operations phase may preclude incorporating fixes from this key early test event into the SDD vehicle design, potentially eliminating one test-fix-test cycle and greatly increasing the risk that operational deficiencies will not be found until the next OT&E phase in FY05.

The performance of an integrated AAAV(C) will also not be demonstrated during operational testing until FY05, when the first AAAV(C) prototype will be made available. This is high risk, since the AAAV(C) is the more technically challenging variant. Finally, concerns remain about the use in the vehicle of the less corrosion resistant aluminum alloy, Al 2519, and the potential impact on life cycle cost.

# Advanced Integrated Electronic Warfare System (AIEWS) AN/SLY-2(V)

The AN/SLY-2(V) Advanced Integrated Electronic Warfare System (AIEWS) was to be the Navy's next generation shipboard electronic warfare system planned for use with the Aegis Combat System and Ship Self Defense System Mark 2. It was a total replacement for the AN/SLQ-32(V) system. Increment 1 of AIEWS included the capability to detect and identify radio frequency emissions, provide precision angle of arrival information to cue hard-kill fire control system sensors, and launch self-protection decoy devices such as NULKA. Integration of Increment 1 with the ship command and decision system was to support other sensor cueing and combat identification. Increment 2 would have included additional capability.

The Navy approved the Operational Requirements Document in April 1997. The Test and Evaluation Master Plan was received by OSD in March 1998, and was returned without approval because of a fundamental disconnect between the program structure, as agreed to by the Program Executive Officer in November 1997, and the program structure reflected in the language of the Milestone II Acquisition Decision Memorandum. The program was rebaselined in FY01 as a result of cost and schedule breaches. On April 15, 2002, the Assistant Secretary of the Navy (Research, Development and Acquisition) announced that the AIEWS program was cancelled, citing continued program instability, cost growth, and development delays. Proceeding with the program was assessed as a high-risk venture with minimum potential for successful completion within acceptable costs and schedule.

## TEST & EVALUATION ACTIVITY

There was no Test & Evaluation activity during FY02.

## TEST & EVALUATION ASSESSMENT

There are no test results on which a performance assessment can be based. A significant issue with the AIEWS Test & Evaluation program was the lack of realistic threat representative anti-ship cruise missile targets, specifically, a platform with appropriate radar cross section that could carry anti-ship cruise missile active radar seekers or acceptable seeker simulators at threat-representative speeds and altitudes. The legacy Test & Evaluation platform, identified up-front by the Operational Test & Evaluation community as not meeting the requirement, is a large, slow P-3 aircraft that cannot descend to appropriate threat-representative altitudes. The use of an existing target drone, integrated with an anti-ship cruise missile active radar seeker, appeared to be an acceptable solution, but adequate numbers of these drones were never funded for Operational Test & Evaluation of AIEWS. However, these targets will have to be funded for operational evaluation of the LPD 17 soft-kill capability (provided by NULKA, an electronic decoy).

*Shown is a demonstration antenna used during at-sea engineering tests.*

# AIM-9X Sidewinder Air-to-Air Missile

The AIM-9X Sidewinder Air-to-Air missile is a follow-on to the AIM-9M short-range missile for Air Force and Navy/Marine Corps aircraft. The program was initiated in response to foreign missiles assessed to exceed AIM-9M capabilities. AIM-9X is intended to be a day/night, highly maneuverable, launch and leave missile using passive infrared guidance to engage multiple target types. A new infrared seeker, thrust-vectored tail-control actuation system, and signal processor/auto pilot are to provide a High Off-Boresight capability, countermeasures resistance and maneuverability/range improvements relative to the AIM-9M. The AIM-9X is designed to work with any on-board aircraft cueing source, including the Joint Helmet-Mounted Cueing System, which is being developed in a parallel program. The missile retains the AIM-9M warhead, fuze, and rocket motor. Threshold aircraft are the F-15C/D and F/A-18C/D. Future plans call for it to be integrated on the F-16, F/A-18E/F, F-15E, and F-22.

AIM-9X is a joint Navy/Air Force program with the Navy as the Executive Service. The prime contractor, Raytheon Systems Company, bears total system performance responsibility to meet performance specifications derived from the Operational Requirements Document. The Demonstration and Validation phase began in 1994. Operational Test and Evaluation began in August 2002 and the full-rate production decision is scheduled for FY03.

### TEST & EVALUATION ACTIVITIES

The Operational Test Plan was approved in April 2002. The following month the first operational test shot attempt was terminated for a built-in-test failure prior to launch. As a result, the missile was de-certified for operational test. The contractor implemented hardware and software solutions and the missile was re-certified in July 2002. The Air Force accomplished the first three operational test launches of the AIM-9X seven months after test plan approval. All three were successful. The Navy has yet to accomplish an operational test launch, but plans to have target assets available for a January 2003 first shot.

While minor design problems have contributed to this seven-month test program delay, the most significant delays and corresponding inability of the Navy to test have been caused by test support resource shortfalls. Availability problems with QF-4 target drones, range airspace, and test squadron aircraft continue to delay the program, particularly the Navy's portion.

The operational test Captive Carry Reliability Program (CCRP) has continued since Spring 2002. While the Air Force portion of CCRP has completed over 1200 hours, Navy operational test, due to the aircraft availability issues has fallen further behind, has accumulated only 175 hours. This has put the CCRP nearly 1000 hours behind plan and could result in a low confidence level in reported reliability and maintainability measures. Commander, Operational Test and Evaluation Force is examining other options to increase the Navy captive carry hours.


*The AIM-9X Sidewinder Air-to-Air missile is a follow-on to the AIM-9M short-range missile for Air Force and Navy/Marine Corps aircraft. It is intended to be a day/night, highly maneuverable, launch and leave High Off-Boresight missile using passive infrared guidance to engage multiple target types.*

### TEST & EVALUATION ASSESSMENT

Modeling and Simulation, in conjunction with flight testing, is key to the development and evaluation of the AIM-9X. Due to this missile's planned expanded capabilities and the high cost of launches, a family of simulations is being used to assess missile performance across a wide spectrum of engagements encompassing various threats, backgrounds, and countermeasures.

Actual missile firings are being used to validate these simulations. The simulations will be used to assess the required Probability of Kill ($P_k$) against the threat targets. Simulation initiatives allow the number of guided test missiles to be significantly reduced. The program has conducted 19 guided missile launches in developmental test and plans 22 shots in operational test. Thus far, the three successful operational test events launches appear to correlate with the models. It is essential that this small shot set continue to correlate to the model's predictions. If test results do not meet operational requirements or do not agree with simulation results, additional test missile firings will be required. DOT&E will continue to monitor this closely.

Test and evaluation support resource shortfalls continue to plague the program. First, due to spare parts, funding, and manning issues, the Navy's test squadron is having difficulty maintaining mission capable F/A-18Cs. In order to accomplish the full complement of AIM-9X test events, some test scenarios will require four F/A-18s. However, the test squadron continues to have difficulty keeping more than one mission-ready aircraft. While the squadron has requested needed funding, manning and spare parts, as of this writing they still have not received adequate resources. Additionally, there are over a dozen other test programs competing for the limited number of F-18 sorties. Second, the QF-4 full-scale target aircraft required for the Navy live shots were grounded for six months after an April 2002 manned QF-4 fatal mishap. Although the Navy re-certified the drones for one year starting October 2002 (after which they intend to close the unit), they were grounded again after an engine anomaly was discovered in the fleet that necessitated a one-time inspection prior to flight. This inspection is expected to be complete by January 2003, at which time the QF-4 operation should be ready to support AIM-9X testing. The QF-4 issue is further complicated by a lack of interoperability between the Air Force and Navy QF-4 drones and range instrumentation systems. This issue highlights a continued problem with test asset interoperability in the Department of Defense. The Air Force and Navy QF-4 drones are not interchangeable—neither can fly on the other's instrumented ranges. In addition, each service's drone fleet has unique maneuvering and telemetry capabilities. Because of these differences, the operational test program for AIM-9X had to be designed and tailored for each drone and range. Neither service's drones are able to accomplish the planned tests or gather the data that is required from the other service's targets.

# Airborne Mine Neutralization System (AMNS)

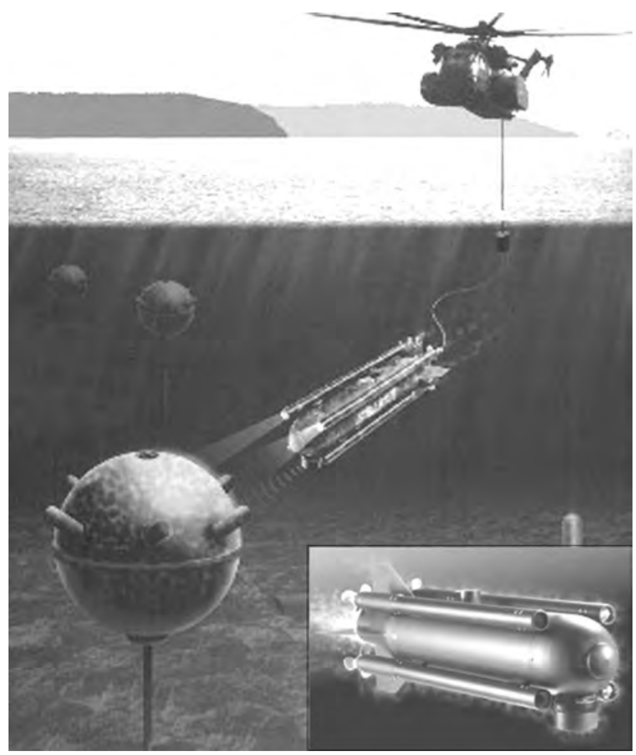
The Airborne Mine Neutralization System (AMNS) is one of five modular Airborne Mine Countermeasures systems that will be integrated into the MH-60S helicopter to provide Carrier Battle Groups and Amphibious Ready Groups an organic mine countermeasure capability. AMNS is being integrated into MH-53E helicopters in order to provide an interim capability. AMNS is derived from a system built for German Navy mine countermeasure ships, and is intended to provide the capability to relocate, identify, and neutralize bottom and moored mines directly from the helicopter. Target location information obtained from other sources will be entered into AMNS prior to take-off or while the aircraft is flying to the area of operations. The aircraft will then hover at a safe distance from the target and lower an expendable, self-propelled neutralizer device into the water. Once released, the neutralizer travels to the reported target position to search for the mine. It relays depth, position, and sensor (sonar and video) information to the operator in the helicopter via a fiber-optic cable, which is also used to send control and guidance commands to the neutralizer. Once the target is relocated and identified as a mine, the neutralizer is positioned so that its shaped-charge will detonate into the vulnerable area of the mine. A successful mine neutralization renders the mine inoperable either by rupturing its case or by sympathetic detonation of the mine charge. A reusable training version of the neutralizer is also being procured with the system. Four neutralizers can be carried in the MH-53E.

## TEST & EVALUATION ACTIVITIES

Developmental testing (DT) continued through FY02 under the direction of the Naval Surface Warfare Center, Dahlgren Division, located at Coastal Systems Station, Panama City, Florida. Live Fire Test and Evaluation will leverage DT to assess system lethality and the vulnerabilities incurred by platforms when they store, carry, and deploy AMNS. An MH-53E helicopter employed expendable neutralizers against inert moored and bottom targets during the first phase of explosive DT in September and October 2002. The second phase of explosive DT occurred in October 2002 at the Underwater Explosive Test Facility (UNDEX) at Aberdeen Test Center, Aberdeen, Maryland, where an MH-53E helicopter deployed expendable neutralizers against one live Mark 56 and three live Mark 6 moored mines. Additionally, DOT&E representatives participated in AMNS Test and Evaluation Working Groups throughout 2002 and reviewed the test plan for DT-IIB explosive testing. The AMNS Test and Evaluation Master Plan was approved in June 2002 to support initial Operational Test and Evaluation, scheduled for March through May 2003.

## TEST & EVALUATION ASSESSMENT

Completion of DT-IIB was delayed for several months during 2002 while the contractor attempted to identify the cause of unreliable communications between neutralizer vehicles and the operator console. The signal loss along the fiber optic path between the neutralizer and the console was eventually reduced to acceptable levels, and testing resumed in June 2002. Although AMNS performance has continued to improve, some system performance parameters, including the probability of successful neutralization and neutralizer reliability, were below threshold at the conclusion of DT. Some DT data will be used as part of the operational evaluation. AMNS must have a higher success rate during operational testing to counter poor performance in tests to date.



*The Airborne Mine Neutralization System is one of five modular Airborne Mine Countermeasures systems that will be integrated into the MH-60S helicopter to provide Carrier Battle Groups and Amphibious Ready Groups an organic mine countermeasure capability.*

Despite three attempts, AMNS performance in a high current environment has been poor and failed to demonstrate the required capability in that environment. If not successfully demonstrated during DT, this capability will be tested as part of the operational evaluation.

DOT&E urged the Navy to explore the feasibility of conducting explosive testing at the UNDEX facility when environmental clearance and cost issues threatened to cancel plans for DT-IIB at the ranges in Panama City, Florida, and Scotland. Subsequent investigation determined that testing could be conducted against live moored mines at the UNDEX facility. Testing against live bottom mines was ruled out because of the risk of damage to the test facility.

Three missions employing expendable (explosive) neutralizers against live Mark 6 moored mines were successfully completed in October 2002 at the UNDEX. A successful mission was also conducted against a Mark 56 moored mine. During these missions, the AMNS operator reacquired the targets, maneuvered the neutralizer into the proper firing position, and detonated the neutralizer’s shaped charge, destroying the mines. The neutralizer failed to detonate during four other missions against Mark 6 mines. Analysis of those failures is ongoing. Based on the data obtained from DT-IIB explosive testing, AMNS is lethal against threat mines that are comparable to the Mark 6 and Mark 56 moored mines when detonated in the correct firing position. Additional data will be collected during operational testing to evaluate the likelihood of correct placement and neutralizer detonation.

# Amphibious Helicopter Assault Ship (Replacement) (LHA(R))

Amphibious Helicopter Assault Ship (Replacement) (LHA(R)) is the Navy's next class of amphibious assault ships and will replace the amphibious lift capability of the retiring *Tarawa* LHA 1 Class. This class will be gas turbine-powered and will launch pre-loaded assault craft (amphibious vehicles and landing craft), tilt-rotor aircraft, helicopters, and unmanned aerial vehicles. In addition to transporting and deploying the combat ground elements of Marine Expeditionary Units/Brigades, short-take-off/vertical-landing fixed-wing and rotary wing aircraft will provide combat support to forces ashore. Furthermore, it is intended that this ship must conduct simultaneous day and night, well-deck and flight-deck operations and have Command, Control, Communications, Computers, and Intelligence capabilities sufficient to support United States Marine Corps concepts of Operational Maneuver from the Sea/Ship-to-Objective Maneuver operations.

The LHA(R) Mission Need Statement was approved in March 2001. Milestone A occurred in July 2001. Alternative ship concepts evaluated in the Analysis of Alternatives (AoA) include a slightly modified LHD 8 (Amphibious Helicopter-Dock Ship) Class Ship, larger modified LHD 8 variants (LHD-"Plug +"), a larger, more capable "dual tramline" design, and replacement with two modified LPD 17s (Amphibious Transport Dock Ships). The schedule is uncertain as of this writing; Detail Design and Construction could occur as early as FY06 or as late as FY08.

## TEST & EVALUATION ACTIVITIES

FY02 activity consisted largely of meetings between representatives from the LHA(R) program office and Navy staffs to identify in detail those operational test and Live Fire Test and Evaluation (LFT&E) program issues, including its scope, content, and approval requirements, that must be addressed in the Evaluation Strategy. This is a key document, since a Test and Evaluation Master Plan is not required until Milestone B, which could be as late as FY06, depending on the overall schedule. The Navy remains delinquent in the delivery of an Evaluation Strategy for the LHA(R) to OSD for approval.

## TEST & EVALUATION ASSESSMENT

The effectiveness of the LFT&E program for the LHA(R) will be particularly sensitive to early implementation of many of the LFT&E program elements, since significant results would impact the ship's design. In particular, four of these elements that need to be completed prior to Milestone B are surrogate testing, carried-weapons analyses and testing, Milestone B Vulnerability Assessment Report, and DOT&E approval of an LFT&E Management Plan. The decisions on how these LFT&E elements will be applied will be contained in the LFT&E Strategy.

*The Amphibious Helicopter Assault Ship Tarawa (LHA 1) underway with a full head of steam. The new gas turbine-powered LHA(R) Class will replace the current five ships of the LHA 1 Class.*

# Amphibious Transport Dock Ship (LPD 17)

*USS San Antonio* (LPD 17) will be a diesel-powered amphibious assault ship that will transport and deploy the combat and support elements of Marine Expeditionary Units/Brigades as a key component of amphibious task forces. The LPD 17 is intended to debark forces by surface assault craft, including current and advanced amphibious assault vehicles (AAAV), air cushioned landing craft, conventional landing craft, as well as helicopters and MV-22s. A flight-deck will enable the aerial transport of troops and equipment, and a floodable well-deck will permit operation of air-cushioned landing craft, conventional landing craft, and amphibious assault vehicles. The LPD 17 class is required to conduct simultaneous day and night, well-deck and flight-deck operations, and is expected to have Command, Control, Communications, Computer, and Intelligence ($C^4I$) capabilities sufficient to support Operational Maneuver from the Sea/Ship-to-Objective Maneuver.

Self-defense capabilities of the LPD 17 will include a cooperative engagement capability with other task force vessels, plus the Mk-2 variant of the ship self-defense system, rolling airframe missile (RAM), and the Nulka decoy system to provide own-ship defense against anti-ship cruise missiles (ASCMs). Defense against surface threats will be provided by two Mk-46 30-mm gun systems that are currently being developed separately by the Marine Corps for use on the AAAV. Installed $C^4I$ systems will interoperate through a modern ship wide area network. OSD approved the Test and Evaluation Master Plan (TEMP) in February 2000. This TEMP is currently being updated because of program baseline breaches. A revision, with Operational Test and Live Fire Test and Evaluation (LFT&E) updates, was expected in 1QFY02, but has not been submitted because of inadequate progress in resolving issues that primarily involve combat systems testing. A waiver from full-up, system-level testing had been granted and an alternative LFT&E plan was approved by OSD in June 1996.

The overall ship design and construction schedule was delayed 24 months due to delays in the ship design process and the shipbuilder's lack of readiness to begin construction.

### TEST & EVALUATION ACTIVITY

An Operational Assessment (OA)(Operational Test-IIB) began in FY02 and should be completed in FY04. The assessment consists largely of reviewing ship specifications and design drawings and evaluating them from the perspective of fleet experts on amphibious warfare. The assessment team is also evaluating the results of modeling and simulations that were conducted as part of the ship design process.

The Navy continued to perform component shock qualification tests. Preparations continued to conduct the Detail Design vulnerability assessment through the use of ship vulnerability models.

*Artist's conception of the new Amphibious Transport Dock Ship* USS San Antonio *(LPD 17). Twelve ships are planned to be built for this class. Operational assessments have provided key insights into design deficiencies.*

### TEST & EVALUATION ASSESSMENT

OAs provided key insights into design deficiencies, which, in some cases, were identified as early as 1995 and rediscovered in subsequent OAs. Although the Navy Program Office, PMS 317, has corrected some deficiencies, some remain unresolved either because continued unbudgeted cost growth and schedule delay have made the Navy unwilling to pursue corrective actions or because the problem affects multiple ships, thereby making it difficult for any single program office to address. Shortfalls identified during OAs are discussed below.

The LPD 17 air defense combat system's effectiveness depends on the successful integration of separate sensor, weapon, and control element programs and this task presents considerable risk. The only hard-kill system is RAM. RAM, along with soft-kill systems (Giant, Nulka, and chaff), must achieve the threshold requirement for ASCM defense. Defense against fighter/bomber-type aircraft is a concern as is the ship's capability to detect, track, and engage some classes of ASCM. Susceptibility to torpedo attack is a concern.

The most significant future T&E challenge for the LPD 17 will be assessing the ship's self-defense capability against ASCMs. Safe and effective testing requires use of a Self-Defense Test Ship (SDTS) capable of being remotely operated during operationally realistic ship air defense scenarios. Results of these tests will be used to determine operational effectiveness. Accredited modeling and simulation will be used to investigate excursions in scenarios beyond the conditions experienced in the SDTS testing. Consequently, the Navy must fund the installation of the LPD 17 combat system aboard the SDTS, the conduct of the operational testing with the SDTS, and development/validation of the M&S capability.

Shortcomings remain in the ship's $C^4I$ systems. The ship's radio communication system design does not support Internet protocol data connectivity over HF, VHF, and UHF (SATCOM) nets to shipboard landing force $C^4I$ systems. This digital connectivity deficiency compromises the capability to pass C2, logistic, intelligence, fire support, and planning information between forces ashore and command elements aboard ship.

Like the 1970s-era amphibious ships it will replace, the LPD 17 will not fully support simultaneous night and day, flight deck, and well-deck operations because of a lack of night vision device-compatible lighting and displays. Although PMS 317 is working with other Navy organizations to define and support a solution to this significant shortfall, observed progress to date makes it unlikely that a solution will be found and implemented on the ship.

The LPD 17 will have a collective protection system and a water wash-down system to mitigate the effect of a chemical/ biological agent attack. However, the ship must interoperate with landing craft and vertical take-off and landing aircraft, which might be exposed to agents during the transit ashore or while loading/unloading ashore.

Aviation-related deficiencies include the lack of the Tactical Control System needed to launch, control, recover, and receive downlink information from Unmanned Aircraft Vehicles. There are also shortfalls in supporting organizational-level maintenance for Marine Corps VTOL aircraft (related to inadequate crane capability) and safety-affecting deficiencies in the design of the helicopter control station.

Unresolved shortcomings in LFT&E require further action. The Navy's approach for consideration of carried weapons and aircraft in the ship vulnerability assessment has not been established. The Navy has not determined the method to be used for demonstrating recoverability of primary mission capabilities after each of the Full Ship Shock Trials underwater shock events. Agreement has not been reached on the process for assessing LPD 17 vulnerability with respect to terrorist threats such as encountered in the *USS Cole* incident.

# AN/AAR-47 (V)2 Missile and Laser Warning System

The original AN/AAR-47, fielded in the late 1980s, provides passive warning against infrared guided missiles directed at its host aircraft. In addition to providing warning to the aircrew, it cues an onboard expendables dispenser to eject countermeasures flares to defeat infrared guided missiles. The system consists of four sensor units oriented about the aircraft to provide 360-degree azimuth protection; a processor that analyzes the signals received by the sensors declares an incoming threat, warns the aircrew, and initiates dispensing of flares; and a control/indicator unit that provides warning indications to the aircrew and allows control of the system (in some aircraft installations control and indication are integrated into the APR-39 radar warning receiver controls and displays).

The AAR-47(V)2 upgrade is intended to provide improved sensors that eliminate sensor blackening, a known failure mode; increase temperature tolerance and provides a more uniform sensitivity; and provides a new filter to improve false alarm control. Additionally, the new sensor has a laser detector that allows the AAR-47(V)2 to provide the functionality of the AVR-2/2A laser warning systems. This added functionality will allow the Navy to retire the AVR2/2A at a considerable cost saving and provide laser warning for aircraft that did not have the AVR2/2A installed. New software, version 22.21, provides increased probability of missile detection and reduced false alarm rate, provides for laser threat correlation and classification, and revises the interface with the APR-39 Radar Warning Receiver to provide laser warning information. A new control/indicator that incorporates the laser warning capability is also provided for aircraft without an APR-39.

There are roughly 2,500 AAR-47 systems worldwide. Approximately 2,000 belong to the Department of Defense; of those, around 1,200 belong to the Navy. The Navy has 254 AVR-2s and 42 AVR-2A systems. Navy aircraft that currently have, or are planned to have, AAR-47 capability are: H-1 variants, various H-3 Type, Model, Series (TMS), CH-46E, H-53 TMS, H-60 TMS, V-22, P-3C, and C-130 TMS. Navy aircraft equipped with AVR-2s are the UH-1N, AH-1W, VH-3, and VH-60. HH-60H aircraft are equipped with the AVR-2A. The Navy's intent is to eventually replace all AAR-47s and AVR-2/2As with the AAR-47(V)2.

#### TEST & EVALUATION ACTIVITY

Developmental Test/Operational Test of the missile warning and laser warning capabilities was conducted during FY01. Test events included live missile shots at the Aerial Cable Car Facility (ACF) at White Sands Missile Range, laser warning flight tests at both White Sands and the Naval Air Warfare Center at Patuxent River, Maryland, and false alarm testing at several locations. The ACF tests used a UH-1 hulk as the test platform and all flight tests were conducted on a UH-1N. The upgraded missile warning functions with software version 22.21 were tested against a baseline system with software version 20.0. The laser warning functions were compared against the performance of the current AVR-2A. The baseline AAR-47 and/or the AVR-2A were installed in the test vehicle, along with the AAR-47(V)2 as appropriate for the test being conducted. As a result of questions concerning the results of tests against one class of laser threat during FY01 testing, tests were repeated in FY02 using a higher fidelity simulator of the threat in question than had been available for the FY01 tests.

*The original AN/AAR-47, fielded in the late 1980s, provides passive warning against infrared guided missiles directed at its host aircraft. The AAR-47(V)2 upgrade is intended to provide improved sensors that eliminate sensor blackening, increase temperature tolerance, and improve false alarm control.*

### TEST & EVALUATION ASSESSMENT

During Developmental Test/Operational Test, the AAR-47(V)2 demonstrated satisfactory performance in all aspects of the missile warning function. Using the version 22.21 software, it provided timely detection of all 12 missiles of various types fired at it during the live fire tests. The false alarm rate was considerably reduced compared to the version 20.0 baseline software. During the FY01 tests the laser warning function performed satisfactorily against one class of threat but unsatisfactorily against another. The missile and laser warning false alarm rates were acceptably low.

Based on the results of the Developmental Test/Operational Test, the Navy decided to proceed with a Low-Rate Initial Production of 207 systems while continuing to try to resolve the observed deficient performance against the one class of laser threat.

Results of the FY02 repeat of the test against the class of laser threat that produced deficient results in FY01 confirmed that the AAR-47(V)2 performance against that class of threat is not equivalent to the AVR-2A. Based on these results, the Navy appropriately decided to modify acquisition and fielding plans, and proceed to dedicated Operational Test of the AAR-47(V)2 missile warning function only. These tests were started in October 2002 and are ongoing. Many of the suitability measures of effectiveness await resolution in the remaining dedicated Operational Test phase of testing, but current assessments for logistical considerations are very promising. The system has demonstrated good reliability to date and only one built-in test false alarm was noted in 81.5 hours of operation.

# AN/APR-39A (V)2 Radar Warning Receiver (RWR)

The APR-39A (V)2 Radar Warning Receiver (RWR) is intended to improve individual aircraft survival through improved aircrew situational awareness of the electromagnetic threat environment. The APR-39A (V)2 is a multi-Service (Navy/Marine Corps and Special Operations Force) next generation RWR upgrade to the existing APR-39A (V1). The upgraded system is intended for helicopters and other non-high performance aircraft. It is capable of detecting and providing alerts to the aircrew of surface to air missile and anti-aircraft artillery associated pulsed, pulsed Doppler, and continuous wave radar activities identified from a software programmable threat library. In addition to the cockpit video display, the APR-39A (V)2 provides the aircrew with synthetic speech audio threat warnings, facilitating a "hands on/heads up" aircrew posture. The system also integrates with other elements of the aircraft survivability equipment suite and, depending on aircraft configuration, provides control and display functions for the AVR-2/2A laser warning system family, the AAR-47 missile warning system, and the ALE-39 or ALE-47 countermeasures dispenser. The system retains the former APR-39A (V)1 low band vertically polarized blade antenna. The new, more sensitive, circularly polarized spiral antennas are a form and fit replacement for the previous equipment, as is the new night vision compatible cockpit video display and the cockpit control unit.

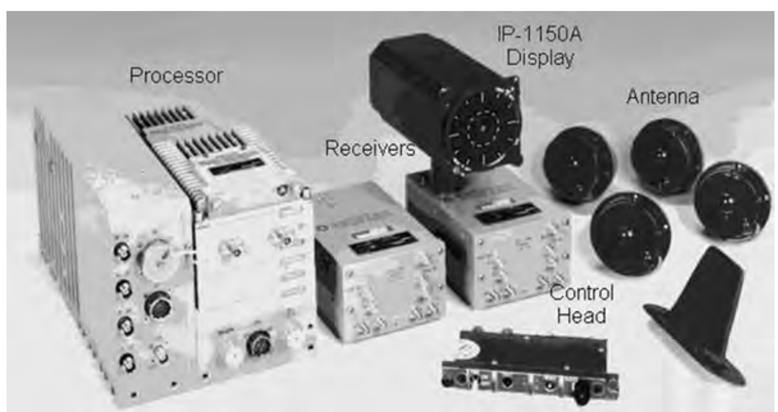
Early Navy operational testing in the Marine Corps AH-1W helicopter in FY91-92 found the system not operationally effective and potentially operationally suitable. Fleet introduction was not recommended until a subsequent operational evaluation could demonstrate satisfactory resolution of Operational Test-IIA performance deficiencies.

Operational Test-IIB in a Marine Corps UH-1N helicopter (in accordance with a DOT&E-approved Test and Evaluation Master Plan and test plan) was completed by the Commander, Operational Test and Evaluation Force (COMOPTEVFOR) in May 1995, with a finding of operationally effective and suitable and a recommendation for fleet introduction in the UH-1N. Involvement by the Operational Test community in the developmental test (DT) leading to this phase of operational test facilitated meaningful use of DT test results and allowed some streamlining of Operational Test-IIB. The Navy Milestone III was approved in FY96. APR –39A (V)2 systems are intended as the standard RWR for the UH-1N, AH-1, V-22, VH-60, HH-60, SH-60, CH-53, MH-53, KC-130, and the VH-3 aircraft.

## TEST & EVALUATION ACTIVITY

Developmental flight-testing on the AH-1W and the HH-60H was completed in FY00. The Follow-on Test & Evaluation (FOT&E) on these platforms was completed in FY01 according to DOT&E approved test plans, and analysis of the results was completed during FY02.

The APR-39A(V)2, as integrated on the MV-22, was delivered to the government as Contractor Furnished Equipment. The Electronic Warfare suite, as installed and integrated, was tested as part of the MV-22 complete airframe Initial Operational Test & Evaluation in July 2000. Within the limited scope of these tests, the APR-39A (V)2 was effective and suitable. Plans to conduct FOT&E in the HH-53 are now uncertain due to funding shortfalls, and FOT&E in the KC-130 has been postponed indefinitely due to problems observed during DT on that platform.




*APR-39A (V)2 Radar Warning Receiver is intended to improve individual aircraft survival through improved aircrew situational awareness of the electromagnetic threat environment. The upgraded system is intended for helicopters and other non-high performance aircraft.*

## TEST & EVALUATION ASSESSMENT

The APR-39A(V)2 is undergoing a multi-platform test and evaluation program, which encompasses several platforms undergoing unique phases of their acquisition life-cycle. FOT&E has been conducted on two platforms, the AH-1W and the HH-60H. Data collected and evaluated from these tests will be used in determining whether the systems should be deployed and to serve the Program Manager in executing follow-on contract award options for additional units.

Based on the results of the AH-1W and HH-60H testing, COMOPTEVFOR has evaluated the APR-39A(V)2 as installed in those aircraft as operationally effective and suitable. DOT&E's independent analysis of the results highlighted an additional concern with the poor direction of arrival accuracy, which has been well known for several years, and was previously accepted by the user. The Program Manager has initiated efforts to correct some of the performance deficiencies noted. A verification of correction of deficiencies test is scheduled for FY03. This test is to show that changes to the software program have improved detection/identification and reaction time performance. The effectiveness of these corrections should be tested and evaluated and each follow-on platform should plan on testing the integrated system's operational effectiveness and suitability and perform an assessment comparing the upgraded performance against what is currently fielded.

# Cooperative Engagement Capability (CEC)

The Cooperative Engagement Capability (CEC) is a system of hardware and software that allows ships to share radar data on air targets. Radar data from individual ships of a Battle Group is transmitted to other ships in the group via a line-of-sight, data distribution system (DDS). Each ship uses identical data processing algorithms resident in its cooperative engagement processor (CEP), resulting in each ship having essentially the same display of track information on aircraft and missiles. An individual ship can launch an anti-air missile at a threat aircraft or anti-ship cruise missile (ASCM) within its engagement envelope, based on radar data relayed to it by another ship. Program plans include the addition of E-2C aircraft equipped with CEP and DDS, to bring airborne radar coverage plus extended relay capability to CEC. CEP-equipped units, connected via the DDS network, are known as Cooperating Units (CUs).

CEC was demonstrated at sea as early as FY90. Early operational assessments were conducted in FY94, FY95, and FY97. Entry into engineering and manufacturing development was approved at Milestone II in 1995. In accordance with congressional guidance, the Navy certified Initial Operational Capability for CEC (engineering development model equipment upgraded to AN/USG-1 configuration) in late FY96. CEC was designated an Acquisition Category ID program in FY99.

Operational evaluation of the surface AN/USG-2 hardware and Baseline 2.0 software was conducted in 3QFY01. DOT&E's Test and Evaluation report was published on February 1, 2002. The acquisition decision memorandum (ADM) of April 3, 2002, approved AN/USG-2 for full-rate production and approved Low-Rate Initial Production (LRIP) for the air AN/USG-3 hardware for FY02-03. The AN/USG-2 and AN/USG-3 hardware, with associated software, were designated as CEC Block 1. The ADM further approved the Navy's plan for the next CEC upgrade, Block 2, which will be competed for development.

### TEST & EVALUATION ACTIVITY

Test & Evaluation activity consisted of engineering tests and developmental testing of AN/USG-3 equipment in E-2C aircraft in preparation for Follow-on Operational Test & Evaluation (FOT&E). Activity included planning for and conducting an operational assessment in November 2002 in the Virginia Capes Operating Area, and an operational test of AN/USG-3 in E-2C aircraft, as part of a CEC Block 1 network. The operational test will occur later in FY03-04 with location (east or west coast) dependent on availability of a CEC-configured Battle Group.

*The Cooperative Engagement Capability is a system of hardware and software that allows ships to share radar data on air targets.*

### TEST & EVALUATION ASSESSMENT

Although the surface AN/USG-2, with Baseline 2.0 software, was determined to be operationally effective and suitable, issues were identified in the following areas for further examination during FOT&E: Battle Group integration and interoperability, information assurance, maintainability, joint interoperability, production representative AN/USG-3 equipment, and new combat system integration. While the CEC Program Manager (PM) is attempting to address these issues, correction of certain issues in the area of Battle Group integration and interoperability require action on the part of PMs for the combat systems integrated with CEC. In spite of ADM direction to the Navy to fund expeditious solution of problems associated with integration and interoperability, it is unlikely that correction of these problems will be demonstrated until Block 2 of Operational Test & Evaluation (OT&E) in early FY06.

FOT&E in FY03-04, designated Operational Test-IIIB, is the equivalent of an operational evaluation of the AN/USG-3 in E-2C aircraft. The primary objective of this testing is to demonstrate improved operational effectiveness and suitability with production-representative AN/USG-3 equipment and software operating in a Battle Group level CEC network while executing air defense or, at a minimum, that the air defense mission can be executed without degradation resulting from integration of the production-representative AN/USG-3 and the E-2C radar. This testing requires a CEC-configured Battle Group detecting, tracking, and engaging credible ASCM surrogates during operationally realistic air defense scenarios with actual and simulated Standard and Sea Sparrow missiles.

The OT&E strategy for CEC Block 2 is being planned, but further definition of Block 2 is required. OT&E will be especially challenging, given the goal of increasing the network size with Block 2 and the imminent closure of the Outer Range at the Atlantic Fleet Weapons Training Facility (AFWTF), Puerto Rico. The AFWTF Outer Range has been key to adequate OT&E of CEC that involved live missile firings against threat ASCM-representative targets. OT&E of the first spiral of Block 2 (defined as Block 1 functionality plus some mid-term operational requirements) is planned for early FY06.

# CVN(X) Next Generation Nuclear Attack Carrier

The CVN(X) program is using an evolutionary acquisition strategy to develop a new class of nuclear-powered, large deck aircraft carriers. The lead ship, CVNX1 (X1), will build on the CVN-77 design and incorporate an improved nuclear propulsion plant, nearly tripling electrical power generation capacity to replace manpower intensive steam auxiliary systems. X1 will incorporate an Integrated Warfare System designed around the Multi-Function Radar/Volume Search Radar suite being developed by the DD(X) program, an Electromagnetic Aircraft Launching System (EMALS), and other refinements. The Navy expects EMALS to reduce ship manning and maintenance requirements and lower aircraft life cycle costs. X2 will incorporate further improvements in flight deck performance, survivability, service life growth allowances, and continued reduction in total ownership costs. CVN(X) will host an airwing of 75 Navy and Marine Corps aircraft, including the new F/A-18E/F and emerging aircraft systems, such as the Joint Strike Fighter and Unmanned Combat Air Vehicle – Navy.

The Navy's evolutionary acquisition approach was approved by OSD in a June 2000 Milestone I decision based on an Analysis of Alternatives that examined potential approaches and designs. X1 was authorized in the FY01 Defense Authorization Act. OSD approval to proceed from Preliminary Design into Detail Design and Construction of X1 and to obligate Advanced Procurement funds for long-lead reactor plant components is planned for Milestone B scheduled for FY03. Construction of X1 is scheduled for FY08 and the ship will enter the fleet in FY14. Construction of X2 is scheduled to begin in FY11 and complete in FY18. The Navy plans to commence construction of follow-on ships every 4-5 years thereafter.

## TEST & EVALUATION ACTIVITY

During 2002, competing contractors conducted sub-scale testing of their respective EMALS designs and began construction of half-length test facilities at Naval Air Warfare Center, Lakehurst, New Jersey, to support the commencement of full-scale testing planned for the summer of 2003.

DOT&E representatives and other members of the Test and Evaluation Working Group reviewed several drafts of the Milestone B revision to the CVN(X) Test and Evaluation Master Plan to include recommended revisions to the Program Manager and Commander, Operational Test and Evaluation Force (COMPTEVFOR). COMOPTEVFOR provided a test plan for an early operational assessment of CVN(X), which DOT&E approved on September 16, 2002.

DOT&E representatives and members of the Test and Evaluation Live Fire Test and Evaluation (LFT&E) Working Group completed development of the CVN(X) LFT&E Management Plan, that describes the testing and analyses to assess the vulnerability of the CVN(X) Class ships.

DOT&E representatives witnessed testing that evaluated protection technologies and examined weapon sensitivity characteristics. DOT&E also conducted a comprehensive review of a Navy vulnerability assessment of an X1 early baseline configuration for Milestone B.

*The program has an outstanding competitive test and evaluation program set up for an Electromagnetic Aircraft Launching System – a model for other programs.*

## TEST & EVALUATION ASSESSMENT

The technical risk for this program is moderate. This risk was initially spread over a variety of ship building programs that have either been cancelled or postponed. These changes will probably have their greatest impact on the Integrated Warfare System.

The program has an outstanding competitive test and evaluation program set up for EMALS – a model for other programs. DOT&E expects to see results from the EMALS testing at Lakehurst beginning in November 2003. A successful EMALS program will significantly reduce the complexity and space consumed by legacy steam and hydraulic systems. It could also significantly increase the life expectancy of carrier aircraft due to a much smoother launch sequence.

# DDG 51 Guided Missile Destroyer Including: AN/SPY-1D Radar and AN/SQQ-89 Integrated Surface Ship Anti-Submarine Warfare Combat System

The *Arleigh Burke* (DDG 51) class of guided missile destroyers is being constructed in groups, or flights, to incorporate technological advancements during construction. Flight I (DDG 51-71) and Flight II (DDG 72-78) configurations are described in previous reports. This report focuses on early Flight IIA ships with the AEGIS Baseline 6 Phase I computer program (DDG 79-84), which are now joining the Fleet. The AEGIS Weapon System (AWS), which includes the SPY-1D radar and SM-2 surface-to-air missiles, provides the ship's air defense capability. The Phalanx close-in weapon system, SM-2 missiles, and 5-inch gun provide self-defense against anti-ship missiles.

For undersea warfare (USW), DDG 51 uses the AN/SQQ-89 USW combat system, up to two embarked Light Airborne Multi-Purpose System (LAMPS) Mk III helicopters, torpedoes, and vertically launched USW standoff weapons. Surface warfare weapons include the 5-inch gun and LAMPS Mk III helicopters armed with Hellfire missiles. Tomahawk missiles and the 5-inch gun are used to engage shore targets. Links 4A, 11, and 16 provide connectivity to other Navy, Joint, and Allied forces.

The SPY-1D radar system is a multi-function, phased array, three-dimensional (range, altitude, and azimuth) radar that conducts search, automatic detection, and tracking of air and surface targets. The SPY-1D also transmits mid-course guidance commands for the SM-2 missile. AN/SPY-1D(V), a new variant under development for installation in later Flight IIA ships, is intended to improve performance against targets in clutter and to provide an enhanced capability to counter deceptive electronic attack measures.

The AN/SQQ-89(V) series of USW combat systems links acoustic sensors and weapon control systems with advanced data processing and information displays. The AN/SQQ-89(V)6, which is installed in Flight I and Flight II ships and other combatants, is the baseline system for ships with a towed array. It integrates the AN/SQS-53 series hull mounted sonar, the AN/SQR-19(V) Tactical Towed Array Sonar, and the AN/SQQ-28(V) LAMPS Mk III shipboard electronics with the USW Control System Mk 116 series. For Flight IIA ships, the AN/SQQ-89(V)10 removes the AN/SQR-19 towed array.


*The Arleigh Burke (DDG 51) class of guided missile destroyers is being constructed in groups, or flights, to incorporate technological advancements during construction.*

DOT&E's independent assessment of the Flight I Live Fire Test and Evaluation (LFT&E) Program will be included in the assessment of the Flight IIA LFT&E Program, scheduled for completion in September 2003. Flight II ship design survivability will be assessed as part of the Flight IIA LFT&E Program.

## TEST & EVALUATION ACTIVITIES

Several tests were conducted on the operational effectiveness and suitability of AEGIS software baselines 5.3.8 and 6.1.3, and the USW capability of baseline 6.1.5. The mine detection capability of the AN/SQQ-89 KINGFISHER sub-system, carried in all DDGs, was also tested. The Mk 45, MOD 4 gun mount and it's accompanying Mk160 MOD 8 gun computer system, outfitted on Flight IIA destroyers beginning with DDG 81, underwent Initial Operational Test and Evaluation (IOT&E) in December 2002. Additionally, DOT&E was active in test and evaluation working groups involved in planning the tests completed in FY02, and designing the tests which will evaluate the performance of Flight IIA ships with AEGIS software baseline 6 Phase III in late FY03 or FY04. DOT&E also assisted in developing TEMP revisions for DDG 51, AN/SQQ-89(V), and AN/SPY-1D(V) programs. LFT&E activities were focused on reviewing preliminary results of the Flight IIA Total Ship Survivability Trial, Shock Trial and vulnerability assessment.

### TEST & EVALUATION ASSESSMENT

As documented in prior-year reports, Flight I and II DDG 51 class ships and the AN/SPY-1D radar are assessed to be operationally effective and suitable.

DDG 51 Operational Test-IIIE was conducted on a not-to-interfere basis during a *John F. Kennedy* (CV 67) Battle Group training exercise. Since operational testers did not participate in exercise planning and had no control over exercise events, not enough useful data was generated to support a comprehensive evaluation of Flight IIA operational effectiveness.

The Flight IIA / Baseline 6.1.3 DDG 51 is effective in accomplishing the air defense mission. Except for a new computer program (AEGIS Baseline 6.1.3) and changes in the AEGIS Display System, the air defense configuration of the Flight IIA test ship was similar to that of Flights I and II. Simulated engagements of manned opposition aircraft during training exercises and data from live missile engagements prove the Flight IIA ship retains its air defense effectiveness.

The Flight IIA DDG 51 is effective in accomplishing the strike warfare mission. *USS Roosevelt* conducted 54 simulated Tomahawk Land Attack Missile (TLAM) engagements using the latest version of the Advanced Tomahawk Weapon Control System (ATWCS). ATWCS adequately supported all tasking including time-critical engagements.

Not enough data was generated during Operational Test-IIIE to support a conclusion about the effectiveness of Flight IIA in undersea warfare. Uncertainty in submarine position data precluded reconstruction of the engagements. Evaluation of Flight IIA undersea warfare effectiveness will continue in Operational Test-IIIF.

Flight IIA effectiveness against surface threats is untested. *USS Roosevelt* did not have an armed helicopter embarked during Operational Test-IIIE and there were no surface engagements. The armed helicopter is the Flight IIA ship's only weapon system capable of engaging surface threats beyond the horizon. DDG 51 gun weapon system effectiveness against surface craft has not yet been demonstrated in operational testing. The effectiveness of current variants of Standard Missile (SM-2) against surface threats is also unproven. These issues are being examined in Operational Test-IIIF.

Flight IIA survivability requires additional testing to evaluate susceptibility to realistic surface ship, submarine, and mine threats. Evaluation of joint interoperability has been deferred to Operational Test-IIIG to allow more time for developmental testing, identification of data collection requirements, refinement of measures of effectiveness, and development of analysis tools.

The Flight IIA/Baseline 6.1.3 DDG 51 tested during Operational Test-IIIE was not operationally suitable. Operational testers faulted the stability of the AEGIS Display System and identified a number of deficiencies in outfitting, logistics support, compatibility, safety, and documentation. Most deficiencies are minor. Major deficiencies included safety issues related to the limited storage space in the cramped helicopter hangars, inability to locate required technical documentation, and excessive AEGIS software restoration times. These issues will be reexamined in Operational Test-IIIF.

The DDG 51 Program Manager has a comprehensive database of deficiencies from all phases of Operational Testing and LFT&E and is aggressively pursuing identification of root causes and deficiency correction. This is an impressive, systematic program to verify correction of performance deficiencies discovered in testing. Other weapons systems would profit from a similar program and commitment. High priority changes are being injected into the ship construction program at the earliest economic opportunity and, subject to funding availability, will be retrofit into existing ships. Deficiencies that have been corrected are scheduled for reexamination in a future phase of Follow-On Test and Evaluation.

# DD(X) Land Attack Destroyer

In November 2001 the Navy restructured the DD 21 Program and re-designated it DD(X) to focus on technology development and maturation, including robust land-based and at-sea testing of transformational technologies that could be leveraged across multiple ship classes. The Navy is conducting a spiral design review to assess the merits of achieving various levels of capability in a family of multi-mission ships, including the Land Attack Destroyer, DD(X), a future cruiser, CG(X), and a Littoral Combat Ship (LCS). The destroyer class will be designed first and will draw heavily on the research and design work already performed for DD 21. The spiral development approach is intended to reduce risk by introducing desired capabilities over several flights of destroyers rather than placing all of the risk on the lead ship, as envisioned for DD 21.

DD(X) is expected to have an integrated power system that is intended to allow sharing of electrical power between propulsion motors and other mission systems. A new radar suite, incorporating both a Volume Search Radar and a Multi-Function Radar , is expected to provide state-of-the-art battle space surveillance. The Advanced Gun System (AGS) is intended to support land attack and surface mission requirements. The AGS is planned to be a single-barrel 155mm gun supplied by an automated magazine that is expected to carry a family of long-range land attack and surface projectiles. Advances in survivability and computing power are intended to significantly reduce crew size, with the introduction of additional new technology further reducing manning with each successive flight.

DD(X) will operate independently or as an integral part of Naval, Joint, and Combined maritime forces. Tailored for land attack, DD(X) is intended to provide firepower support for amphibious and other ground forces and be capable of launching precision strike weapons. DD(X) is expected to contribute to the protection of friendly forces through the establishment and maintenance of surface and undersea superiority and local air defense. The DD(X) design intends to incorporate signature reduction to enable the ship to operate in all threat environments. DD(X) is the replacement for retiring *Spruance* (DD 963) class destroyers and *Oliver Hazard Perry* (FFG 7) class frigates, which are reaching the end of useful service life.

On April 29, 2002, the Navy awarded a contract to Northrop Grumman Ship Systems to be the design agent for DD(X). Shortly thereafter, General Dynamics filed a protest with the General Accounting Office. The Navy issued a stop work order to Northrop Grumman pending protest resolution. The GAO denied the protest on August 19, 2002, and Northrop Grumman resumed work under the contract.

### TEST & EVALUATION ACTIVITY

Although Test & Evaluation activity has been restricted because of the award protest, DOT&E has participated in development of the Surface Combatant Family of Ships capstone requirements document that will guide the development of requirements for DD(X), CG(X), and the LCS. DOT&E has also participated in Multi-Function Radar test planning meetings and the planning for a weapons effects test involving the Ex-*Caron* (DD 970). The draft Test and Evaluation Master Plan is under review. The draft Live Fire Test and Evaluation Management Plan is expected to be ready for review in March 2003.

*In November 2001 the Navy restructured the DD 21 Program and re-designated it DD(X) to focus on technology development and maturation, including robust land-based and at-sea testing of transformational technologies that could be leveraged across multiple ship classes.*

### TEST & EVALUATION ASSESSMENT

Both the requirements and the design are in flux. Plans for extensive prototyping of the new technologies to be introduced in DD(X) in land-based and shipboard engineering development models are expected to provide a rich environment for early operational testing of key DD(X) features. Although still early in DD(X) system design, use of the self-defense test ship will probably be the most effective way to operationally test the ship's defense against anti-ship cruise missiles.

# Defense Integrated Military Human Resources System (DIMHRS)

The objective of the Defense Integrated Military Human Resources System (DIMHRS) is the automation and integration of personnel and pay entitlement business processes into a standard single point of entry system. DIMHRS will provide a fully integrated military personnel and pay system for all components of the Military Services. It will replace 17 legacy systems including all currently operating Service-specific pay and personnel systems. It is being developed based upon commercial-off-the-shelf applications. Extensive reengineering of business practices that capture the best of both private and public sectors is expected.

The initial core system of DIMHRS will provide support to processes that are common to all Services. This core system shall collect, store, pass, process, and report personnel and pay data for all DoD Active Duty, Reserve, Guard, and retired personnel. DIMHRS will support the responsibilities and requirements of the individual Military Service Departments and, in time of war, the Coast Guard. Common software and databases are the foundation of DIMHRS.

The Services will retain their structure management command and control functions to ensure personnel operational readiness. Personnel and pay organizations will use DIMHRS at all echelons of command to support personnel and pay functions. Managers and analysts in the Office of the Secretary of Defense, the Joint Staff, and other federal agencies will also use DIMHRS data for planning and reporting purposes.

DIMHRS was conceived to address deficiencies impacting the personnel and pay entitlement support provided to military commanders. The Joint Requirements Oversight Council approved Mission Needs Statement identified the following five requirements that DIMHRS must address:

- Provide Commanders-In-Chief with accurate and timely personnel data needed to assess operational capability.
- Employ standard data definitions across Services.
- Correctly track mobilized reservists.
- Provide accurate personnel tracking into and within a theater of action.
- Simplify data entry, system maintenance, and resolution of pay discrepancies.

DIMHRS was initially managed by the Navy Reserve Information Systems Office, but was transferred to a Joint Program Management Office operating under the Navy Space and Naval Warfare Command in early 1999. The initial acquisition strategy developed by the Program Management Office was flawed, and the strategy was suspended by the Joint Requirements and Integration Office under the Office of the Under Secretary of Defense for Personnel and Readiness. A viable strategy was defined during FY01 and the program is moving forward to implement that strategy. An Acquisition Strategy Plan was released in March 2002.

*The Defense Integrated Military Human Resources System will provide a fully integrated military personnel and pay system for all components of the Military Services.*

## TEST & EVALUATION ACTIVITY

The PMO held several test and evaluation integrated product team (T&E IPT) meetings in FY01-02. Other than these T&E IPT meetings, there have been no test events for this program to date. The last T&E IPT meeting was held in July 2002 at the program management office in New Orleans, Louisiana. Various flaws were identified in the draft Test and Evaluation Master Plan (TEMP) at that meeting, and a revised version was released shortly after. Currently, the draft TEMP shows an initial operational evaluation scheduled for the first increment in 2QFY04.

## TEST & EVALUATION ASSESSMENT

This program has gone through several false starts. Working initially with a non-validated acquisition strategy, the program test director(s) have struggled to define a viable test strategy and develop supporting documents. There has been notable turnover in the test program staff at the PMO, leading to several restarts for the TEMP development. This appears to be resolved, and the latest attempt to produce a usable TEMP is showing promise.

The Operational Test Agency for each of the Services plans to evaluate DIMHRS in their respective Service environment, coordinated by the lead Operational Test Agency (OTA), Operational Test and Evaluation Force. The Army is scheduled to be the first Service to field DIMHRS for operational test purposes. The coordination of the Service-specific OTA efforts has been difficult for the PMO, as seen in conflicting test approaches.

# Dry Cargo/Ammunition Ship (T-AKE 1)

The Dry Cargo/Ammunition Ship program provides a new multi-product ship class for resupply to Navy combat forces at sea. The ships will replace the existing auxiliary replenishment (AFS-Stores and AE-Ammunition) ships and will provide ammunition, spare parts, and provisions (dry, refrigerated, and frozen). The primary mission of T-AKE 1 class ships is to provide logistics lift from friendly ports or from specially equipped merchant ships to the battle group replenishment station ships. In its secondary mission, the T-AKE 1 will be capable of remaining on station with the battle group to fill the station ship role in conjunction with a T-AO (Fuel-replenishment)-class ship.

By 2007, the entire Navy's current eight-ship AFS 1 class and eight-ship AE class will have reached the end of their 35-year design life. The proposed 12-ship T-AKE 1-class is intended to replace these ships. The acquisition strategy prescribed a two-phased program. Phase I was to identify innovative concepts for efficiencies with on-board material handling and cargo flow and to propose life cycle cost savings through reduced manning and improved ship design. That phase has been completed. A contract for Phase II, the detailed design and construction of the ships, was awarded in October 2001. The ship design is progressing well and contracts for three ships have been awarded.

## TEST & EVALUATION ACTIVITY

During FY02, DOT&E continued to participate in the program's integrated product teams and approved a Test and Evaluation Master Plan to guide planning for a three-phase operational test, assessment, and evaluation strategy.

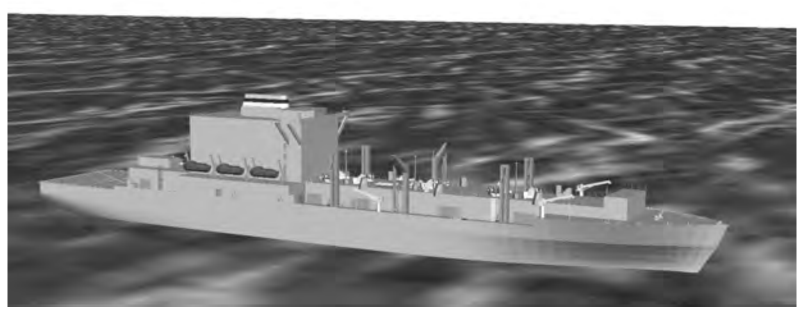
The first Operational Assessment (Operational Test-IIA), which focuses on cargo movement and ship survivability, commenced in August 2002. DOT&E representatives witnessed testing of fire detection equipment and overhead and bulkhead cooling water spray systems for the protection of multipurpose cargo stowage spaces.

Both of these testing efforts were part of a Live Fire Testing and Evaluation investigation into potential vulnerabilities of the T-AKE ordnance stowage spaces to weapons-induced fires.

## TEST & EVALUATION ASSESSMENT

A three-phase operational test, assessment, and evaluation strategy consists of two Operational Assessments (OAs) and an Initial Operational Test and Evaluation (IOT&E) for the lead ship of the class.

The first OA (Operational Test-IIA) focuses on the adequacy of planned cargo handling capabilities and ship survivability. Risks associated with flight operations for vertical replenishment will also be assessed. Because the ship will use existing Navy standard replenishment rigging, inter-ship replenishment capability is a low risk. Furthermore, the ship hull is based on existing commercial designs; therefore there is a low risk of serious hull and propulsion deficiencies. This initial OA has achieved accreditation of modeling and simulation programs by the Navy's Operational Test and Evaluation Force. DOT&E will continue to work with the Navy to ensure that the initial OA provides assessment results that identify any design modifications from an operational perspective.



*Artist's conception of the new Lewis and Clark T-AKE 1 Class Dry Cargo and Ammunition Ship currently under construction.*

Testing of fire detection equipment during OT-IIA demonstrated that Navy standard

Heat Sensing Devices were unable to provide adequate detection capabilities for initiation of installed water sprinkling systems to meet Navy functional requirements, nor were they able to detect large adjacent space and below deck fires. As a result of this testing, the T-AKE will include ionization smoke detectors in all multipurpose stowage spaces and in the spaces adjacent to them. The T-AKE Program Manager conducted a rigorous program to develop and test a combined overhead and bulkhead cooling water spray system to meet a variety of Navy and regulatory requirements. The system was developed using performance-based testing and will result in a fire protection system for T-AKE that reduces the required water application rate (and thus the system impact on the ship design) while achieving performance superior to existing systems currently in use in the Navy. Current Navy fire detection systems and sprinkling systems may not meet Navy functional requirements. The Navy should ensure all new ship programs have improved fire detection systems and develop and install performance-based sprinkling systems. The Navy should also examine the feasibility of installing these systems in existing ship classes paying particular attention to magazines.

The second OA (Operational Test-IIB) will be conducted during the ship construction phase and will focus on the projected performance of the ship's cargo management capability and other areas not considered in Operational Test-IIA. The IOT&E (Operational Test-IIC) will be conducted under realistic at-sea conditions, including replenishment of an aircraft carrier battle group.

# E-2C Advanced Hawkeye

There are currently two E-2C configurations in the Hawkeye procurement program- the Hawkeye 2000 and the Advanced Hawkeye (AHE) which includes a Radar Modernization Program (RMP).

Hawkeye 2000 is an umbrella term for multiple improvements to the Group II E-2C. The key objective of this series of modifications is the integration of Cooperative Engagement Capability (CEC). The integration of CEC into the E-2C will increase the air and surface surveillance, detection, and airborne object tracking capabilities of the battlegroup and land-based CEC-capable Joint systems such as the Marine's AN/TPS-59. The improvements include the replacement of the current mission computer with a commercial-off-the-shelf (COTS) computer (Mission Computer Upgrade (MCU)) and replacement of the control and display consoles with COTS workstations (Advanced Control Indicator Set); the integration of the airborne variant of the CEC system; an upgraded cooling system, UHF Satellite Communications (SATCOM); replacement of the current Passive Detection System with an Electronic Support Measures (ESM) system; and development of a Mission Information Transfer System. To carry and employ CEC, the E-2C requires increased mission computing and display capabilities, as well as an offset in weight and volume. The modifications will be incorporated into new E-2C aircraft production. The Navy plans to retrofit these improvements into older E-2C aircraft. An upgraded inertial navigation system has also been added.

The Navy is starting the AHE/RMP for the E-2C. This program will replace the E-2C's radar with an UHF-Active Electronically Scanned Array radar. This radar is intended to provide significantly increased detection performance over the current radar, particularly in overland and littoral operations. The AHE program also includes a number of other modifications including integration of a modular communications system and glass cockpit. AHE/RMP might also include a new mission computer and new operator workstations.

## TEST & EVALUATION ACTIVITIES

Hawkeye 2000 testing will be completed incrementally as the various modification components become available for testing. The MCU Operational Evaluation (OPEVAL) was conducted from November 2000 to April 2001. CEC E-2C OPEVAL is scheduled for 4QFY03 during aircraft carrier workups. During the CEC testing, both SATCOM and ESM developmental and operational testing will occur. The AHE/RMP has begun test flights using the radar technology demonstration system developed for Mountain Top installed on a C-130. AHE/RMP test planning has included formation of a Test and Evaluation Working Integrated Product Team and development of a draft Test and Evaluation Master Plan (TEMP). DOT&E will draft an Independent Evaluation Plan for RMP.

*The Advanced Hawkeye/Radar Modernization program will replace the E-2C's radar with an UHF-Active Electronically Scanned Array radar to provide significantly increased detection performance over the current radar, particularly in overland and littoral operations.*

Due to its importance to fleet air operations, the survivability of the E-2C will be evaluated for expected combat missions. The Navy has developed a comprehensive survivability evaluation plan to ensure the needed data and information is available. The E-2C upgrades were reviewed and are not covered product improvement programs requiring Live Fire Test and Evaluation. This determination was based on multiple factors, including the intended role and missions of the aircraft, combat experience to date, and concept of operations.

#### TEST & EVALUATION ASSESSMENT
During FY01, operational testing on the MCU, a major component of the Hawkeye 2000 configuration, was completed. There was no E-2C operational testing in FY02, but some CEC E-2C developmental testing occurred.

A Beyond Low-Rate Initial Production Report was not required for the MCU OPEVAL. The Navy Operational Test Agency, Commander, Operational Test and Evaluation Force (COMOPTEVFOR) rated the MCU integration as operationally effective but not operationally suitable. DOT&E concurred with the findings. Of the five Effectiveness Critical Operational Issues (COIs) evaluated, four were found satisfactory: Tracking, Survivability, Tactics, and System Management. COMOPTEVFOR found the Joint Interoperability COI to be partially resolved. Of the 11 Suitability COIs, COMOPTEVFOR evaluated six as satisfactory: Reliability, Maintainability, Availability, Compatibility, Human Factors, and Safety. COMOPTEVFOR evaluated Logistic Supportability, Training, Documentation, and Built-In-Test (BIT) Performance as unsatisfactory. COMOPTEVFOR also found Interoperability problems to be partially resolved.

DOT&E did not concur with all of COMOPTEVFOR's evaluation of the COIs. DOT&E found the COIs of Joint interoperability unresolved instead of partially resolved since there was no test event in which the MCU-equipped E-2C demonstrated that it could effectively interface and operate with corresponding systems or units of other U.S. forces in the execution of its intended operational mission.

Per MCU TEMP approval memo, signed July 27, 2000, the TEMP would be updated within 90 days to define MCU Follow-on Test and Evaluation (FOT&E), which will include ESM and SATCOM. In July 2002, DOT&E informally received a draft of the MCU TEMP, which includes the FOT&E, ESM, and SATCOM testing. This TEMP has yet to be formally submitted to DOT&E.

A critical aspect of E-2C RMP operational testing will be Joint Interoperability, an area that was unresolved in the MCU OPEVAL. The Joint Air and Missile Defense Organization is coordinating significant resource investment by OSD in a 2010 theater air and missile defense architecture. In addition to RMP, this effort includes other upgrades, such as the Block 40/45 upgrade to the E-3, and new platforms, such as Army's Joint Land Attack Cruise Missile Defense Elevated Netted Sensor system. Additionally, the Single Integrated Air Picture System Engineering Task Force is coordinating an effort to improve the quality of the air picture available to the Joint Forces Air Component Commander and to his forces conducting and fighting the air battle through improvements in the available data links. Joint interoperability will be key to OSD achieving its theater air and missile defense goals. Therefore, testing the joint interoperability of the participating platforms will be a critical part of their Operational Test and Evaluation.

# EA-6B Upgrades

The EA-6B Prowler is a four-person, carrier capable, twin turbojet tactical aircraft. Its primary mission is the interception, analysis, identification, and jamming of radio frequency transmissions of enemy weapons control and communications. The crew includes one pilot and three electronic countermeasures officers. The EA-6B carries the ALQ-99 Tactical Jamming System (TJS), which includes a receiver, processor, and various mission-configured jammer pods, carried as external stores. The EA-6B has the USQ-113 Communications Jammer, and may also be armed with the high-speed anti-radiation missile for enemy surface-to-air radar destruction and suppression. The EA-6B is a key contributor to the Suppression of Enemy Air Defenses Electronic Attack mission.

Operational since 1972, the EA-6B has undergone a number of upgrades: Expanded Capability, Improved Capability (ICAP), ICAP II, and Block 89A. Another significant upgrade, Advanced Capability (ADVCAP), reached Full Scale Development in FY93 but was cancelled for financial reasons. Initial Operational Test and Evaluation of ADVCAP was completed in FY94 and provided the technical basis for much of the current upgrade program.

Improvements to the ALQ-99 jamming pod capability include the Universal Exciter Upgrade (Full-Rate Production in FY96), Band 9/10 transmitter (Initial Operational Capability (IOC) FY00), a prototype Band 7/8 jamming capability, and the development phase for a Low Band Transmitter (LBT) upgrade.

ICAP III, which is the most significant upgrade, includes a new receiver that is intended to provide a reactive jamming capability. ICAP III systems integrate many of the above mentioned warfighting enhancements with the addition of new controls and displays. It includes provisions for Link-16, via the Multi-Functional Information Distribution System. ICAP-III builds upon the Block-89A improvements to achieve a reactive jamming/targeting and geolocation capability for active emitters. The Navy's procurement plan is to transition all EA-6B aircraft to the ICAP III configuration by 2010. Addition of the Multi-Mission Advanced Tactical Terminal and the Improved Data Modem capability improves battlefield situational awareness for the crew. The program is also integrating Aircrew Night Vision Devices to enhance night capabilities.

## TEST & EVALUATION ACTIVITY

Developmental ground and flight testing have been underway at the Naval Air Warfare Center, Patuxent River and China Lake test ranges since February 2002, in preparation for an Operational Assessment (OA) test period. The OA will include Nevada Test and Training Range flights. Recent delays have rescheduled the OA for FY03. Developmental testing at Patuxent River has been focused on meeting entrance criteria for the OA. Specific performance interests are response times, geolocation key performance parameters, suitability estimates of Built In Test, and reliability measures.


*Improved Capability III is a significant upgrade and includes a new receiver intended to provide a reactive jamming capability. Improved Capability III also has new controls and displays, Link-16, and geolocation capability for active emitters.*

The Navy re-baselined the LBT jamming pod program upgrade to the ALQ-99 jammer in September 2000, slipping IOC from FY04 to FY06. Milestone III was delayed to FY05. Engineering Development Models (EMDs) and Developmental Test and Evaluation activities continue to progress. Environmental Stress Screening was started during FY02, to identify manufacturing faults. Ground tests to qualify the EDMs for flight environments started in August 2002 to prepare for the first flight at the Patuxent River Test Center in August 2003, an OA in January 2004, and a low-rate initial production decision targeted for May 2004.

There was no formal USQ-113 communications jammer Test and Evaluation (T&E) activity in FY02. While completing installation of the 63 sets already procured, the Navy is developing a plan for product improvement and possibly acquiring a larger number of units for deployment.

### TEST & EVALUATION ASSESSMENT

For the major EA-6B upgrade, the ICAP III, program risk is centered on adequate performance of the LR-700 receiver. The LR-700 is the key subsystem in the overall ICAP III upgrade. It is planned to provide a much needed reactive jamming and accurate emitter geolocation capability in full azimuth coverage. An OA prior to the operational evaluation (OPEVAL) should add very beneficial time for test, analyze, and fix efforts. Software and hardware trouble (malfunction) report listings were generated during FY02 ground and flight testing, and were dominated by software problems. Hardware failures resulting from flight tests have been minimal; however, in-plant Reliability Demonstration Tests under stressed vibration and temperature cycling for the LR-700 receiver system are on the critical path to success. Software problems involving in flight system lock ups, as well as active emitter display redundancies, are causing a delay in start of OA flight to 2QFY03.

The LBT program continues in the developmental phase and is being closely monitored by the program office. Recent problems with antenna switch components and radiated power have been reported. The capability to test the system at full power (its only mode) is hampered by the Federal Communications Commission restrictions and is considered a risk that may impact an adequate operational test.

The USQ-113 Version 3 completed OPEVAL and provides a greatly needed replacement for Version 2, which is becoming mission incapable due to a lack of replacement parts. There was no Operational Requirements Document generated before the USQ-113 V3 received its congressional plus-up funding. This led to complications as to what capabilities should be included. The most significant operational impact, documented during the OPEVAL, was the difficult operator interface. A working group has been established to determine the best fixes to improve the interface software. Before any additional units are purchased, the shortfalls documented in the OPEVAL should be addressed, and significant improvements to the software should be implemented. Testing at required frequencies is denied because of the impact on civilian sector usage of certain frequency bands. Those same frequency bands are the ones that the enemy will plan to use because of the ready availability of cheap and effective equipment. This inability to test at all required frequencies in other than remote test locations complicates adequate testing. Testing at remote locations is being explored, but such an approach will require transportable real or simulated target/victim equipment and associated diagnostic instrumentation. Some of these same testing challenges similarly apply to the LBT.

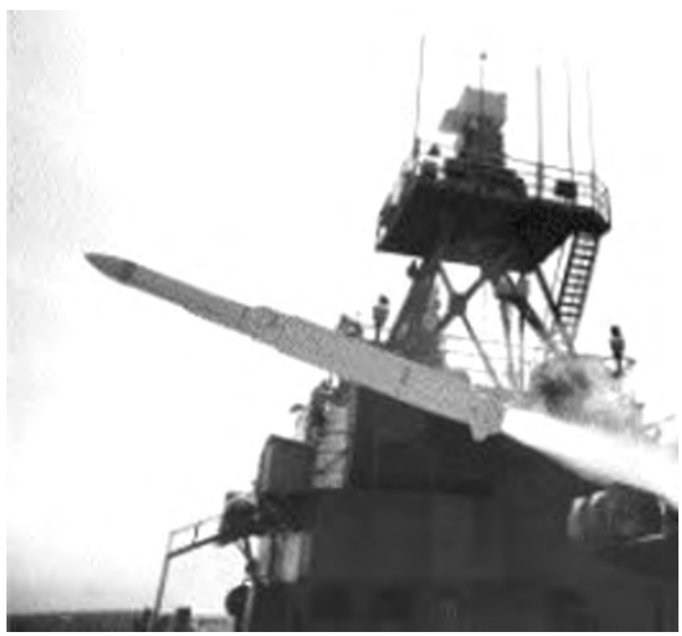
# Evolved Sea Sparrow Missile (ESSM)

The Evolved Sea Sparrow Missile (ESSM) is a short-range missile intended to provide self-protection for surface ships. On Aegis ships, ESSM will be launched from the MK 41 Vertical Launch System. Four missiles are stored, with tail fins folded, in each launcher cell. (The number of cells is either 90 or 96 on an Aegis destroyer and either 122 or 128 on an Aegis cruiser.) Vertical launch requires a thrust vector control system on the ESSM rocket motor. Guidance will be by up-linked commands until the ESSM is near the target, at which time guidance will transition to semi-active homing on reflected radar signals from the target. ESSM may also be launched in a home-all-the-way mode (no up-linked commands). At this time, ESSM installation is funded for Aegis ships only. On non-Aegis ships (aircraft carriers, amphibious assault ships, other surface combatants), ESSM will be fired from other launch systems and guidance will be in homing all the way to intercept. ESSM uses an 8-inch diameter modified guidance section and a new warhead section. This forebody is attached to a new 10-inch diameter rocket motor, which provides higher thrust for longer duration than predecessor Sea Sparrow missiles. ESSM is a cooperative development effort by 13 participating governments.

The Milestone II review was conducted in November 1994. During 1998, the program was restructured to add an operational assessment (Operational Test-IIA) based on missile flights at White Sands Missile Range (WSMR), New Mexico, to support the first low-rate initial production (LRIP) decision. A second LRIP decision was added and will be supported by results of operational testing (Operational Test-IIC) with the Self Defense Test Ship (SDTS). The full-rate production decision will be supported by an operational evaluation (OPEVAL), planned for FY03, conducted with an Aegis destroyer. Subsequent to program restructuring, the Test and Evaluation Master Plan (TEMP) was revised and approved by the Office of the Secretary of Defense in March 2000. Live Fire Test and Evaluation (LFT&E) component/section level ground testing, conducted in FY96-98, included arena warhead tests against fragmentation mats and components of U.S. and foreign targets.

## TEST & EVALUATION ACTIVITY

FY02 activity included the final ESSM firing for the developmental Aegis S-Band testing at the WSMR to demonstrate ESSM guidance via Aegis up-link commands. Additionally, the remaining at-sea ESSM firings were conducted on the SDTS at the Naval Air Warfare Center Weapons Division sea range. Both the S-Band and SDTS tests were conducted in accordance with a DOT&E-approved TEMP and test plan. The TEMP is being revised in preparation for the FY03 OPEVAL.



*The Evolved Sea Sparrow Missile is a short-range missile intended to provide self-protection for surface ships.*

## TEST & EVALUATION ASSESSMENT

S-Band Testing (Operational Test-IIB): The Aegis S-Band testing demonstrated missile launch from the MK 41 vertical launching system with mid-course guidance provided by up-linked S-Band commands from a simulated Aegis radar. Semi-active homing provided ESSM terminal guidance. The third and last missile flight test was conducted successfully against a subsonic, low altitude, non-maneuvering drone.

·Self Defense Test Ship Phase (Operational Test-IIC): The combat system installed on the SDTS is intended to approximate that on non-Aegis ships that use the MK 29 rail launch system. However, the combat system on the SDTS has limitations that constrain ESSM capability against some operationally realistic threats. As a result of better understanding the impact of these limitations, certain missile firing scenarios planned for the SDTS phase are being modified and moved to the OPEVAL with an Aegis destroyer. The TEMP is being updated to reflect these modifications.

Fifteen ESSMs were launched at various targets for this phase of operational test and evaluation (OT&E) in FY02. Targets included maneuvering and non-maneuvering, subsonic, low altitude drones, as well as a supersonic high diving target and supersonic, low altitude, non-maneuvering targets. Problems were discovered during flight tests, solutions were implemented, and corrections were demonstrated. For example, the first two ESSM firings conducted from the SDTS experienced in-flight failures caused by failure of the locking pins that were designed to keep the unfolded tail fins erect. This resulted in redesign of the locking pins with successful operation demonstrated during later firings. Also observed during the initial ESSM firing from the SDTS was severe noise introduction into the signal processor as a result of rear reference signal modulation by the rocket motor exhaust plume. This resulted in relocation of the rear reference antenna, with successful operation demonstrated during subsequent firings.

·OPEVAL and Follow-on OT&E (FOT&E): Adequacy of the FY03 OPEVAL is dependent upon operational realism of the scenarios, particularly anti-ship cruise missile (ASCM) threat representation. Given the low and dwindling inventories of threat-representative targets (maneuvering supersonic sea-skimmers and supersonic high divers), such targets may not be available for the OPEVAL, and without them, the test plan will not be approved for adequacy. Since ESSM is a short-range air defense missile and the OPEVAL entails launches from a manned ship, there is a challenge in balancing Range Safety requirements against operationally realistic scenarios.

For FOT&E, a new ASCM threat has appeared for which there is no credible surrogate target. The time required to obtain such a surrogate is expected to be an issue for FOT&E. Additionally, limitations in the Aegis Weapon System Baseline 6.3 computer program and shipboard illuminator radars will preclude testing ESSM's capability against surface targets. Although this is not a requirement, it is a capability provided by predecessor Sea Sparrows on non-Aegis installations.

ESSMs are intended to provide close-in defense of Aegis ships against ASCMs, with Standard Missile providing interceptor capability at longer ranges (both self defense and defense for other ships.). There are circumstances in which the Aegis Weapon System could be controlling ESSMs and SM-2s simultaneously. This is primarily an Aegis Weapon System (Baseline 6.3) issue that requires operational testing under the DDG-51 program's FOT&E.

·LFT&E: The LFT&E strategy is structured around component/section level ground testing, actual missile firing results against ASCMs and surrogates, computer modeling and simulation analyses. Ground testing has been completed. Missile firing tests against ASCMs and surrogates have been conducted, but firings for the technical evaluation and OPEVAL remain.

# EX-171 Extended Range Guided Munition (ERGM)

The EX-171 Extended Range Guided Munition (ERGM) is a 5-inch diameter, precision-guided, rocket-assisted, naval gun projectile. It uses a special high-energy propelling charge intended to achieve a threshold range of 41 nautical miles from the MK 45 Mod 4, 5-inch/62-caliber gun. The ERGM uses a coupled Global Positioning System–Inertial Navigation System for guidance and aerodynamic flight control surfaces to steer the projectile to the pre-selected impact point.

The ERGM is intended to provide highly responsive naval gunfire in support of U.S. Marine Corps (USMC) and U.S. Army ground combat forces operating ashore, prior to the establishment of organic fire support assets, and to supplement organic field artillery once it is ashore. Naval Surface Fire Support (NSFS) is critical to support USMC war fighting concepts of Operational Maneuver from the Sea and Ship to Objective Maneuver.

The ERGM Operational Requirements Document (ORD) and Test and Evaluation Master Plan (TEMP) were approved in FY96, prior to a Milestone II decision that also occurred that year. The program has encountered significant technical hurdles, which have delayed development. The program notified the acquisition executive that it expected to breach the acquisition program baseline in FY98. The program was restructured, and a new acquisition decision memorandum was issued in FY00. During FY02, the program office began redesign of the ERGM warhead from the developmental submunition configuration to a new unitary warhead with height of burst (HOB) and point detonating (PD) fuze capabilities. The ERGM ORD is currently undergoing revision to reflect the change to a unitary warhead. A revised TEMP has not been submitted for approval since the program was placed on DOT&E oversight in FY01.

## TEST & EVALUATION ACTIVITIES

ERGM is currently conducting developmental testing. During FY02, testing included the launch of a control test vehicle and the launch of a guided gunfire round. The guided gunfire test was the first firing at the tactical gun launch acceleration of 10,100 G's. Both test vehicles achieved their goals.

FY02 developmental testing associated with system lethality included static arena tests of two prototype unitary warhead configurations. The program office has met with DOT&E several times to discuss the TEMP and the scope of testing necessary to support the lethality evaluation of the unitary warhead.

## TEST & EVALUATION ASSESSMENT

The redesign of ERGM to a unitary warhead allows a telemetry package to be included in the round. In FY02 DOT&E helped draft a Memorandum of Agreement between the Central Test and Evaluation Investment Program (CTEIP) Element Manager, Hardened Subminiature Telemetry and Sensor System (HSTSS) Project, and the Naval Surface Fire Support (PMS-529) Program Office to integrate a warhead-compatible HSTSS into the ERGM projectile. The CTEIP will fund the engineering and development required to integrate HSTSS into the ERGM operational evaluation rounds. If the HSTSS approach proves successful, it will enhance the evaluation of specific operational test events (successes and failures) and may reduce the number and cost of separate tactical and instrumentation rounds required for operational evaluation.

*The EX-171 Extended Range Guided Munition is a 5-inch diameter, precision-guided, rocket-assisted, naval gun projectile.*

The system lethality testing assessment has not been completed. Discussions with the program office have identified the fundamental data requirements for the ERGM Live Fire Test and Evaluation (LFT&E). The importance of demonstrating the effects of the HOB fuze function variation, terrain, and projectile angle of fall for this relatively small warhead were also discussed. The program office understands these concerns, and expects to complete a draft LFT&E Strategy in early FY03.

At-sea naval gunfire range safety limitations allow ERGM to engage targets only at mid and maximum ranges (beyond 35 nmi) because of the large hazard footprint. DOT&E is examining alternative analytical evaluation approaches proposed by the Commander, Operational Test and Evaluation Force as well as continued development of the Virtual At Sea Training (VAST) system. VAST is a set of hydrophone buoys that can be set up at sea as a mobile firing range. The buoys can score the fall of shot on a virtual range based on the sound the shot makes entering the water. Although promising, there are still several challenges VAST must overcome to be effective in evaluating an over-the-horizon gunfire support system such as ERGM.

# F-35 Joint Strike Fighter (JSF)

The F-35 Joint Strike Fighter (JSF) intends to develop a family of strike aircraft to meet an advanced threat (year 2010 and beyond), while maintaining a focus on affordability. This family of strike aircraft will consist of three variants: Conventional Takeoff and Landing; Aircraft Carrier Suitable; and Short Takeoff and Vertical Landing (STOVL). The System Development and Demonstration (SDD) phase will develop, acquire, and test the F-35 weapon system in a series of block upgrades. To accommodate the phased integration of capabilities and functionality, interim blocks will be tested by the Integrated Test Force and the Operational Test Agencies, and may be deployed by the Services for limited use. The first three blocks are intended to deliver an aircraft that is Joint Operational Requirements Document threshold-compliant. As SDD progresses, the users are expected to develop requirements for additional capabilities for future block upgrades to respond to new threats and to leverage emerging technology to address those new threats or to further improve the reliability and maintainability of the aircraft.

Approximately biennial Operational Assessments will determine potential operational effectiveness and suitability with a focus on programmatic voids, areas of risk, testability of requirements, significant trends in development efforts, and the ultimate ability of the program to support an adequate period of evaluation during the dedicated Operational Test. Operational Assessments will not substitute for the independent period of dedicated Operational Test necessary to support decisions on full-rate production.

The F-35 qualifies as a covered program requiring both lethality and vulnerability Live Fire Test and Evaluation (LFT&E). The JSF Program will conduct full-up, system-level (FUSL) Live Fire Testing of the STOVL variant using one of the flight test aircraft from the SDD phase that has reached the end of its operational flight lifetime.

### TEST & EVALUATION ACTIVITY

DOT&E has continuously participated in JSF Operational Test and Evaluation (OT&E) and LFT&E planning activities since June 1995. Integrated Product Team meetings have been held to coordinate the integrated program of Developmental Test and Evaluation, OT&E, and LFT&E planned during SDD phase. The Combined Test Working Group provides a single forum for the member services, OSD, and the weapon systems contractors for all Test and Evaluation related matters.

*Joint Strike Fighter Family of Aircraft*

The Test and Evaluation Master Plan (TEMP) was updated on September 19, 2002, and is being reviewed by the Services. The revised TEMP reflects the additional fidelity of requirements and resources now available following the selection of Lockheed Martin Aeronautics Company as the SDD contractor.

Live fire testing continued this year with additional component-level testing of the fuel tanks and canopy. The first test series of a multi-phase, hydrodynamic ram damage mitigation test program has been completed and the results are currently being analyzed to identify promising design configurations. Development of a successful damage mitigation technique for the fuel tanks is essential to achieving the desired vulnerability objectives.

## TEST & EVALUATION ASSESSMENT

The F-35 program enjoys support from three services and a financial investment from more than a dozen foreign governments. As a result of this broad support, the JSF engineering development team and test activities are well staffed and have established open lines of communications. Both of these factors increase the likelihood that the transition from Developmental Testing to Operational Testing to individual Service introduction will be more efficient and that the variants of the aircraft delivered to the Services will be effective and suitable. The challenge to the Joint Program Office will be to maintain focus on quality staffing and open discussions throughout the SDD effort.

The JSF is expected to have significantly improved interoperability and information warfare capabilities, as well as a very highly evolved set of sensors, all of which will be integrated with the avionics systems. These systems will provide the F-35 with some of its most distinctive and important operational capabilities. Adequately testing these advanced capabilities at an operational mission level will be a challenge to the test program.

The JSF will employ some new technologies and these must be identified early in the program so that they can be monitored during the test program. As one example, the method of providing vertical thrust to the STOVL variant represents a significant advance over current operational systems and thus carries a corresponding risk, and special attention should be given to this sub-system. Another area that should be given extra attention is the performance and maintenance requirements of the Low Observables (LOs) and other classified capabilities on the JSF, particularly in the shipboard environment. Current LO systems have experienced difficulties after being fielded, and the JSF test program should endeavor to identify these potential problems during early testing so that any required corrections can be completed prior to fielding the system.

The current planning for dedicated OT&E includes 14 Low-Rate Initial Production flight test aircraft in block two plus several ground test articles. While this large number of aircraft is adequate for the conduct of a thorough operational test, it is not excessive since three different aircraft configurations must be tested in the accomplishment of a variety of missions. In block three, six additional jets, two of each variant, will be added to allow for additional operational test requirements.

# FA-18 E/F Super Hornet

The FA-18E/F Super Hornet is a multi-mission, day/night strike fighter aircraft that provides precision strike capabilities to Joint Task Force and Carrier Battle Group Commanders. The aircraft features improvements in range, endurance, carrier bring-back, weapon payload, and survivability. It also provides in-flight tanking for other tactical aircraft, and additional room for growth and upgrades. The FA-18E is a single seat aircraft while the FA-18F is a two seater.

Three major upgrades to the aircraft are planned: an Active Electronically Scanned Array (AESA) radar with an Advanced Crew Station (ACS) in the rear seat of the FA-18F aircraft; an Advanced Targeting and Designating Forward Looking Infrared (ATFLIR) system, and a Positive Identification System (PIDS).

AESA, the APG-79 radar, is intended to significantly increase E/F capabilities. It is designed to improve aircraft lethality, survivability, and enhance signature characteristics. It corrects current APG-73 radar deficiencies, including a lack of capability for growth, while allowing near-simultaneous operation of different radar modes. Because of the potential significance of AESA, DOT&E placed it on oversight for both Operational Test and Evaluation (OT&E) and Live Fire Test and Evaluation (LFT&E). AESA Milestone B was conducted in February 2001. Milestone C is planned for summer 2003 with an Initial Operating Capability (IOC) in FY07. AESA requires several significant structural changes to the aircraft's forward fuselage and cooling system. An umbrella LFT&E program that evaluates the modified aircraft structure with all changes incorporated is under consideration.

In conjunction with the ACS, AESA permits new workload strategies within the two-seat "F" cockpit by allowing each crewman to perform different mission functions independently. For example, the pilot might concentrate on air-to-air while the Weapon Systems Officer (WSO) concentrates on air-to-ground. The two-seat FA-18F was initially designed and produced as a trainer for single-seat FA-18E pilots. Aft cockpit displays and controls replicated those of the front cockpit so that an instructor pilot had the same information as the front-seat student pilot. ACS introduced design and structural changes to the FA-18F aft cockpit when the Navy decided to retire the two-seat F-14 and replace it with the FA-18F. The most significant ACS change decouples rear seat displays and functions from the front seat so that the WSO can perform functions independently of the front seat pilot. A redesign of the main instrument panel increases multi-function display area. A Digital Video Map Computer provides a high-resolution map on the 8 x 10 display to increase WSO situation awareness. Secondary Hardware-Software Integration, the situational awareness format, and secondary sequence lines allow independent control in each cockpit. The pilot and WSO can independently view maps giving each crewmember the display needed to perform separate but complementary functions, particularly in a combat environment. The first flight of an ACS aircraft is scheduled for FY03, with installation beginning in Lot 26 aircraft to be delivered in CY04 and fleet deployment in Lot 27 aircraft in late CY05.

*The operational effectiveness and operational suitability of the aircraft has improved due to the correction of deficiencies observed in OPEVAL. Testing also highlighted several issues relating to missing or deficient systems that require further attention or funding.*

ATFLIR represents the latest generation of technology in infrared targeting capabilities, including navigation Forward Looking Infrared (FLIR), laser spot tracker, air-to-air laser ranging, electronic zoom, geographic-point targeting, and

Electro-optics. The existing F/A-18 FLIR pod has documented deficiencies in high altitude magnification and resolution that degrade and, in some instances, preclude target location and precise aimpoint selection. ATFLIR incorporates sensor technologies designed to correct these deficiencies. This next-generation technology is designed to provide three fields of view, incorporate a larger detector array, and allow flight operations up to 50,000 feet altitude.

PIDS is intended to provide the E/F with the ability to positively identify friendly aircraft. The system is essentially an airborne radar transponder/interrogator consisting of a single electronic "black box" in the avionics bay linked to two dedicated external antennas.

### TEST & EVALUATION ACTIVITY

Operational Evaluation (OPEVAL) on the E/F was conducted from May to November 1999. In April 2000, DOT&E's Beyond Low-Rate Initial Production (BLRIP) report to Congress found that the E/F was operationally effective and operationally suitable.

**Follow-on Test and Evaluation (FOT&E)(1) — First Period of Aircraft FOT&E:**

The Commander, Operational Test and Evaluation Force (COMOPTEVFOR) conducted the first of several FOT&E(1) of the E/F with new tactical software (SCS-18E) from September 2001 to May 2002 in accordance with a Test and Evaluation Master Plan (TEMP) and Test Plan approved by DOT&E.

Aircraft FOT&E(1) began September 24, 2001, and finished May 23, 2002, accumulating over 800 sorties, 1,280 flight hours, and 52 carrier arrested landings.

The objectives of FOT&E(1) were to:

- Determine the operational effectiveness and operational suitability of the E/F aircraft with SCS-18E installed.
- Evaluate items that were waived from OPEVAL that are now ready for test.
- Evaluate corrections to deficiencies identified in OPEVAL.
- Complete evaluation of Critical Operational Issues that were only partially resolved during OPEVAL.
- Investigate potential new tactics for use with the E/F.

For OPEVAL, the Navy had approved 50 waivers to the testing of required capabilities. For FOT&E(1), 30 of those waivers were declared ready to test with no additional waivers. FOT&E(1) also initiated operational test of two new systems in addition to SCS-18E: a PIDS and the Joint Helmet-Mounted Cueing System (JHMCS).

In November 2002, COMOPTEVFOR's Report on FOT&E(1) concluded that the E/F with SCS-18E installed is operationally effective in the non-electronic attack environment and operationally suitable.

- AESA - Developmental Test and Evaluation: During 2002, AESA conducted developmental testing focusing on a number of prototype modules or components to reduce specific design risks that had been identified by the several Integrated Product Teams that are responsible for specific AESA components. This testing supported the conduct of a series of design reviews for each of the major subsystems, culminating in the successful conduct of a Critical Design Review in October 2001 for the integrated AESA design.

- ATFLIR - Operational Assessment Period: First flight of the ATFLIR occurred in November 1999. COMOPTEVFOR conducted an operational assessment (OA) of ATFLIR from January to April 2002, based on 37 sorties and reported in August 2002 that ATFLIR is potentially operationally effective, and potentially operationally suitable. Due to 100 percent contractor support of the ATFLIR, COMOPTEVFOR did not assess ATFLIR's reliability, maintainability, availability, or logistic supportability. This OA supported a Navy decision for an early operational capability deployment of ATFLIR with the first FA-18E deployment (VFA-115) in July 2002. OPEVAL of ATFLIR is planned during CY03.

- PIDS - Operational Test and Evaluation: During FY02, PIDS completed its OPEVAL (October 1, 2001 to March 21, 2002). The OPEVAL consisted of 91 dedicated sorties, comprising approximately 170 flight hours, and an additional 2,400 flight hours of "piggy-back" testing concurrent with the F/A-18E/F's first period of FOT&E(1). A final test report from COMOPTEVFOR has not yet been received by DOT&E.

## TEST & EVALUATION ASSESSMENT

DOT&E's assessment is informed both by operational testing activities conducted during the past year as well as by a visit conducted by DOT&E personnel to Fifth Fleet and VFA-115 aboard the nuclear aircraft carrier *USS Abraham Lincoln* (CVN-72) in the Persian Gulf in late October 2002, to evaluate the aircraft's performance under deployed conditions.

**FOT&E(1) — First Period of Aircraft FOT&E:**

FOT&E(1) of the aircraft confirmed that the operational effectiveness and operational suitability of the aircraft has improved due to the correction of deficiencies observed in OPEVAL, the addition of upgraded tactical software (SCS-18E), and the addition of several new systems.

Testing also highlighted several issues relating to missing or deficient systems that require further attention or funding:

- For OPEVAL (November 1999), not all stores combinations intended for use by the E/F were cleared for carriage and release. While the configurations available were extensive for this phase of testing, there were numerous restrictions involving weapon type, weapon quantity, release interval, multiple release, and mixed loads that were not available during OPEVAL. At the conclusion of FOT&E(1), COMOPTEVFOR reported that, "While the FA-18E/F demonstrated weapon carriage capability and recoverable carrier load flexibility, the mixed weapon load maturity of the aircraft has not progressed enough to support an FA-18E/F exclusive carrier air wing."

- During OPEVAL, due to an increased noise and vibration environment discovered under the wing of the E/F during developmental testing, a variety of stores and air-to-air missiles, in particular, required additional and more frequent inspections to help ensure acceptable reliability. The FOT&E(1) final report found "Weapon carriage and release limitations continue to affect the capability to effectively employ the full spectrum of Naval air-to-ground ordnance. The FA-18C is required to fulfill employment roles in support of Standoff Land Attack Missile – Expanded Response, 500 lb (GBU-12), and penetrator (GBU-24B/B) variants of the laser guided bomb family."

- Following OPEVAL, DOT&E's BLRIP Report found that the full potential of the E/F will be realized only after the incorporation of several new subsystems on the Navy's roadmap for the aircraft, especially the JHMCS, the AIM-9X missile, and ATFLIR. While OPEVAL has been conducted on the JHMCS and an OPEVAL is currently underway on the AIM-9X, a mismatch appears to exist in procurement and integration of these systems into the F/A-18E/F, such that the first E/F squadrons will deploy for several years with only part of their high-off-boresite combat envelope. The Navy will not realize the full air-to-air combat potential of the E/F until it corrects the funding mismatch and conducts adequate FOT&E of the E/F with JHMCS and the AIM-9X missile.

DOT&E's BLRIP Report noted that one of the principal reasons underlying the upgrade to the E/F is the capacity for growth to accept further improvements and to correct deficiencies in key subsystems of the FA-18C/D. DOT&E also reported that the E/F must incorporate several key improvements to realize its full potential and operational capabilities. FOT&E(1)'s confirmation of a wide array of improvements indicates that the necessary growth process is underway, but the aircraft's maturity in air-to-air and air-to-ground weapons and air-to-ground sensors (ATFLIR) has not progressed as rapidly as projected at the end of OPEVAL.

**Aircraft Upgrades:**

- AESA is on track to increase performance of the E/F. Developmental Test activity to date includes laboratory bench testing of prototype array modules and an assessment of the anticipated array performance using modeling and simulation of a completed array using the bench testing results. Simulation results indicate that AESA will meet requirements. The accuracy of this simulation in a similar antenna program has been demonstrated. DOT&E will monitor this effort as hardware becomes available for operational test assessment. Early operational test involvement supports full integration and compatibility of five new systems or modifications: the Advanced Mission Computer & Displays, Fiber Channel Network Switch, Software Configuration Set High Order Languages, Advanced Crew Station and the structural modifications to the aircraft's avionics cooling system. The LFT&E evaluation of the Common Block 2 E/F AESA aircraft effort will be an incremental LFT&E update based on the E/F Engineering and Manufacturing Development aircraft program.

- ATFLIR. VFA-115 deployed with 3 pre-production ATFLIR pods and two contractor technical representatives as part of an "early operational capability" initiative. The FA-18E with ATFLIR was not allowed to participate in Operation Enduring Freedom due to concerns about ATFLIR reliability. ATFLIR was highly effective when it worked. Documentation showed that the ATFLIR pod had a Mission Capable rate between 33 percent (1 pod available for daily ops) and 66 percent (2 pods available for daily operations).

- PIDS. Results of the OPEVAL appear to indicate the system to be effective and suitable with some areas of concern remaining. In effectiveness, interrogator azimuth accuracy remains below Operational Requirements Document (ORD) threshold values in some restricted portions of the operational envelope. On average, under typical conditions, interrogator azimuth accuracy is within ORD threshold. A second effectiveness issue where the system fails to meet requirements is in "false ID". Here again this discrepancy is restricted to a segment of the operational envelope. In suitability issues, the system will probably be assessed unsatisfactory for logistical supportability and training. Analysis of OPEVAL data by DOT&E is ongoing as of this writing and will be updated upon receipt of the final OPEVAL report form COMOPTEVFOR.

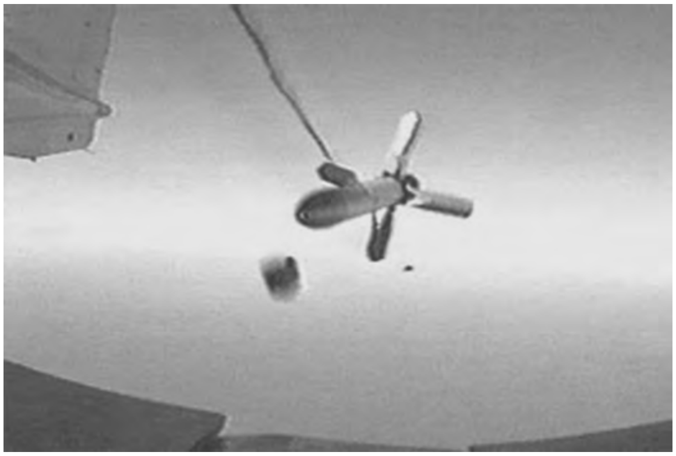
# Integrated Defensive Electronic Countermeasures (IDECM)

The Integrated Defensive Electronic Countermeasures (IDECM) is intended to provide increased self-protection and survivability for tactical aircraft, against radio frequency and infrared surface-to-air and air-to-air threats. The major hardware components being developed are the radio frequency countermeasures (RFCM) system and the ALE-55 Fiber Optic Towed Decoy (FOTD). The FOTD is trailed behind the aircraft to optimize RFCM techniques against threat missiles and tracking/targeting systems. The RFCM consists of an on-board receiver/processor/techniques generator that stimulates either the FOTD via fiber optic cable or the on-board transmitters. The FOTD is intended to be deployed from the same controller currently used with the ALE-50 towed decoy. The IDECM lead aircraft (F/A-18E/F) will integrate the radar warning receiver, a missile warning system, the chaff/flare dispenser, and an off-board decoy launch controller/dispenser. With the onboard jammer, even if the limited number of FOTDs carried is depleted, the aircraft will still have some self-protection capability.

IDECM Block I is currently deployed, and is an interim system consisting of the ALQ-165 Advanced Self-Protection Jammer (ASPJ) and the ALE-50 towed decoy. The Navy plans to use the Block I for the first three F/A-18 E/F carrier deployments; the first one is currently underway. IDECM Block II, a second interim configuration, will replace the ASPJ with the ALQ-214 (V)2, providing onboard jamming capability, planned for deployment in 2003. This configuration is planned for the fourth and fifth F/A-18 E/F carrier deployments. IDECM Block III will be the final configuration and will consist of the ALQ-214 V2 RFCM and an upgrade to the ALE-55 FOTD.

United States Air Force (USAF) requirements for a common FOTD and techniques generator were included in the IDECM RFCM engineering and manufacturing contract. USAF selected components of IDECM RFCM for the B-1B Defensive System Upgrade Program and intends to add them to the F-15 electronic warfare suite. In 1998, IDECM was re-baselined to fund an 87 percent development cost overrun. In 1999, technical difficulties and cost overruns resulted in a second restructuring.

IDECM Block I Developmental Testing (DT), a combined DT/Operational Test, and an independent Operational Test were completed successfully in 2000 on the F-18 E/F. The operational effectiveness criterion was a measurable reduction in the lethality of the attacking missile when compared to an F/A-18 C/D equipped with its standard ALQ-126B, and when compared to no jammer. Block 1 was found to be effective and suitable.



*The Integrated Defensive Electronic Countermeasures is intended to provide increased self-protection and survivability for tactical aircraft against radio frequency and infrared surface-to-air and air-to-air threats. Current efforts are focused on radio frequency threats.*

Block II completed a limited Operational Assessment (OA) in March 2000, in which it was assessed to be potentially operationally effective and potentially suitable. The OA consisted of hardware-in-the-loop and flight tests at China Lake. By design, the flight test was limited to a non-production representative installation on a test bed aircraft using a non-operationally representative reel-out, reel-in external pod to conserve decoys.

Late in FY01, due to poor test aircraft availability, continued difficulties with fast deployment of the FOTD decoys, and unplanned software iterations, the Navy decided to focus testing primarily on the Block II, restructuring the FY02 DT/Operational Test and subsequent Operational Evaluation (OPEVAL). The majority of Block III operational testing will be conducted in FY04 and FY05. Block II and III testing were originally planned to happen concurrently.

## TEST & EVALUATION ACTIVITY

Block II/III performance in test and evaluation during FY02 was beset by continued technical difficulties with the FOTD and FOTD launcher assembly, the receiver signal tracking capability, and with system integration. DT revealed that deploying and towing the FOTD over the entire desired flight envelope, and IDECM component interoperability issues were more difficult than expected. System integration (particularly with the ALR-67 (V)3 radar warning receiver), optimization of the receiver signal detection and response, and operator interface led to multiple delays in the DT/Operational Test and OPEVAL, including a six-month re-baselining in March 2002. Fast deploy (a rapid ejection and reel out to a specific distance behind the aircraft) testing was carried out on the F/A-18 E/F and B-1B. Multiple iterations of the canister and towline were evaluated.

A multi-service tiger team was formed to address some of the fundamental issues related to towed decoy deployment and towing. The initial report from this group indicated that the decoy and canister were still high risk and needed further development and testing. The most recent flight tests on both the F/A-18 E/F and the B-1B have demonstrated an increased ability to deploy and successfully tow the decoy more consistently and over a larger part of the flight envelope. Developmental flight-testing continued through the end of the fiscal year. The re-baselining effort mid-way through the year appears to have provided the necessary time to resolve the most severe integration issues. The development and testing of Block III will be covered in a subsequent Annex update to the Test and Evaluation Master Plan.

## TEST & EVALUATION ASSESSMENT

The three Block development strategy and test planning have successfully mitigated some of the risk incurred over the last four years of IDECM evolution. Block I will be deployed on the first three F-18E/F deployments, the first of which was aboard the USS *Abraham Lincoln* in 2002. The IDECM Block I system, by virtue of being an interim solution, has limited logistic supportability for the fleet. Follow-on IDECM Blocks II or III need to produce an effective and suitable replacement to the Block I suite before its available logistics support expires. Block II performance results in DT look promising, but operational tests are not complete. Suitability performance results in DT are promising; however, a number of repeated system Built in Test (BIT) failure indications have been removed from scoring because corrective actions are underway to solve them. BIT failures and aircraft integration issues are still considered moderate risk and will be are being examined in the ongoing Block II OPEVAL. For Block III, the deployment of the FOTD and the durability of the towline are still high risk. In the lab environment, the Block III RFCM and FOTD have proven to be highly effective and close to predicted performance.

Several test range limitations have hampered all blocks of IDECM testing. Some threat simulators intended for use during IDECM flight-testing were not operationally realistic. Limitations of the threat simulators and flyout models have made analysis of the results difficult and less useful.

# Joint Mission Planning System (JMPS)

The Joint Mission Planning System (JMPS) will provide basic mission planning capability for support of military aviation operations supporting unit-level mission planning of all phases of military flight operations, including fixed and rotary wing aircraft, weapons, and sensors, including precision guided munitions (PGMs), cruise missiles, and unmanned aerial vehicles. It will provide necessary mission data for the aircrew and will also support the downloading of data to electronic Data Transfer Devices for transfer to aircraft and weapon systems. A JMPS for a specific aircraft type will consist of the basic operating framework, common software components, and a basic mission planner, mated with a software module called a Unique Planning Component (UPC). UPCs are to be provided primarily by aircraft programs and computer hardware is to be provided by the Services.

As a cooperative development between the Air Force and Navy, JMPS is being built using the spiral development process for expansion of mission planning capabilities. JMPS Version 1.0 (JV1) provides capabilities for basic flight planning, building initially on the functionality of the existing Portable Flight Planning Software (PFPS) used currently by all the Services. JMPS Combat One (JC1), the first operational JMPS version to be fielded, will add PGM planning capability to JV1; enable mission planning in a networked, server environment; enable "walkaway" mission planning; interface with critical data sources (weather, threat data, Strike Planning Folder); and provide Global Positioning System (GPS) functions. It is Defense Information Infrastructure Common Operating Environment (DII COE) compliant with hardware, principally of commercial off-the-shelf computers, provided separately by each Service.

The JMPS program began in 1997. Logicon, now known as Northrop Grumman Information Technology (NGIT) was selected to develop the JV1 framework and common component software. NGIT is also delivering a Generic UPC and a Software Development Kit that can be used by independent developers to develop aircraft-specific and other common UPCs.

Development of JV1 is proceeding in a series of five Beta releases, each with added functionality and culminating in the full functionality of a basic mission planning system. Beta 5.2, the first JMPS release to have all the functionality of JV1, was released on September 23, 2002. The scheduled November 15, 2002 release of Beta 6.0, was delayed to allow time to fix problems discovered during developmental tests on Beta 5.2. Beta 6.0 will be the end product of the JV1 contract and is now scheduled for a February 7, 2003 release.

*A cooperative development between the Air Force and Navy, the Joint Mission Planning System will provide basic mission planning capability for support of military aviation operations supporting unit-level mission planning of all phases of military flight operations.*

Parallel activity under a separate Navy contract with NGIT has begun to develop JC1, which augments JV1 with crypto key support, GPS almanac capability, and other functions. When integrated with UPCs for PGMs, F-14, F/A-18, and E-2C, JC1 will be the planning system to support carrier-based aircraft. JC1 is scheduled to enter Operational Test & Evaluation (OT&E) in September 2003 and be fielded by March 2004.

### TEST & EVALUATION ACTIVITY

DOT&E approved a Test and Evaluation Master Plan (TEMP) for the JMPS program in June 1999; however, at that time mission planning operational requirements, the JMPS design, and the JMPS development schedule were not fully known. Consequently, test resource requirements, test design, and test implementation schedules could not be fully defined. An update to the TEMP was required within one year, but has not yet been submitted for OSD approval.

OT&E consists of combined Developmental Test (DT)/Operational Test, followed by dedicated OT&E of each JMPS suite for particular aircraft types. The DT/Operational Test activity includes evaluations by the JMPS Test Team of each Beta release and feedback to the developing contractor. To date, four JV1 Beta releases have occurred. Air Force Operational Test and Evaluation Center (AFOTEC) conducted an Operational Assessment (OA) on JV1 Beta 4 from October through December 2001. In October 2002, Operational Test and Evaluation Force (OPTEVFOR) monitored an enhanced "DT Assist" evaluation of Beta 5.2. The DT Assist was conducted at Naval Air Warfare Center Weapons Division China Lake and Pt. Mugu, Marine Air Wing Test Squadron One, and Space and Naval Warfare System Center's $C^4I$ Office in Philadelphia, using fleet personnel.

OT&E of JC1 will be performed by OPTEVFOR at the various test sites, followed by testing at field/fleet sites. Tests will include developing end-to-end mission plans and analyzing them for accuracy and usability. Field/fleet testing will include in-flight verification of JMPS products using test sorties and test crews.

#### TEST & EVALUATION ASSESSMENT

AFOTEC focused on security, interoperability, DII COE compliance, and software performance during their OA of JV1 Beta 4. Operational aircrews employed the software in a variety of scenarios to assess progress toward meeting mission planner needs. Overall, JV1 was found to be making satisfactory progress toward meeting mission planners' needs, leading to a rating of potentially effective. Users were able to plan flight routes using both graphics tools and text inputs. Charts, imagery and airfield information could be displayed and manipulated effectively.

Because of the following concerns raised during the OA, AFOTEC rated JV1 as potentially not suitable:

- Beta 4 was slower than currently fielded software (PFPS).
- DII COE software was extremely cumbersome, difficult to install, and may preclude users from loading some unit-level applications.
- JV1 Beta 4 fails interoperability certification because the system does not provide error detection on Air Tasking Orders.
- System administrators' workload will increase over current planning systems.
- Aircraft route file sizes may exceed the 1.44-megabyte limit of the standard floppy disk, making a transfer between systems difficult.
- Progress toward defining and meeting security requirements and implementing security features was unsatisfactory.

However, it was noted that all the issues reported were amenable to being fixed before the end of development.

Beta 5.0 was released by NGIT on May 27, 2002. A Navy team, along with a team from the Air Force, conducted tests on the Beta release, using test cases to validate compliance with the System/Subsystem Specification. The testing took six weeks. Priority for the test was given to mapping, route planning, and the threat data interface. Among other problems, Beta 5.0 was found to be too slow in operation. Much of the recent activity has been directed at working on this problem and on correcting stability problems (i.e., crashes). At the end of July 2002, there were 224 deficiency reports written against the Beta release. Of these, the majority of high priority deficiency reports were against the mapping tools.

The integration of UPCs with JC1 is likely to be a very complicated task. Development of UPCs is being conducted in parallel with the basic JC1 system and on very aggressive schedules. Although NGIT is responsible for JC1 core capabilities, the aircraft UPC developers will be responsible for the performance of the final planning systems for operational use.

The planned test program for JV1 and JC1 appears to be adequate to determine effectiveness and suitability. However, the details of these plans have yet to be documented in approved TEMPs or test plans. Considering the status of JV1 and JC1, a TEMP for JC1 is overdue. Drafts have been prepared and circulated; however, further progress is dependent on resolving issues with the Navy and Air Force Operational Requirements Documents, which are also overdue for completion.

# Joint Standoff Weapon (JSOW)

The Joint Standoff Weapon (JSOW) is a family of kinematically efficient (~12:1 glide ratio) 1,000-lb class, air-to-surface glide weapons intended to provide for low observable, standoff precision engagement and launch-and-leave capability against a wide range of targets during day/night, all weather conditions. All three JSOW variants employ a tightly coupled Global Positioning System/Inertial Navigation System (GPS/INS). JSOW is employed for interdiction of soft/medium fixed, re-locatable and mobile light and heavy armored targets; massed mobile armored targets; anti-personnel; and air-to-surface threats. JSOW primarily functions in a preplanned mission mode. The system will allow pilot manual inputs of up to eight targets as well as third party targeting as long as the targeting system can meet JSOW's targeting requirements. The weapon is planned for land- and carrier-based operations.

Mission planning is accomplished using the Navy's Tactical Automated Mission Planning System and the Air Force Mission Support System. Integration of operations with the Joint Mission Planning System is planned. JSOW will be employed on the following aircraft: F/A-18C/D and E/F; F-16C/D; F-15E; JSF; B-1B; B-2A; and B-52H. The weapon comes in three operational variants:

- AGM-154A (JSOW Baseline) – Air Force and Navy: The payload of the AGM-154A consists of 145 BLU-97/B submunitions. The BLU-97/B is a combined effects munition. The bomblets consist of a shaped charge for light armor defeat capability, a fragmenting case for material destruction, and a zirconium ring for incendiary effects. JSOW Baseline is designed to conduct pre-planned attacks on stationary soft targets such as air defense sites, parked aircraft, components of airfields and port facilities, command and control antennas, stationary light vehicles, trucks and artillery, and refinery components.
- AGM-154B – (JSOW BLU-108) – Air Force and Navy: The payload for the AGM-154B is the BLU-108 submunition from the Air Force Sensor Fuzed Weapon (SFW). JSOW carries six BLU-108s, each of which dispenses four warheads, or skeets. Each skeet carries an infrared or dual-mode sensor, and upon detecting a target, detonates to create an explosively formed penetrator that impacts the target. This system is an interdiction weapon. The target set consists of tanks, infantry fighting vehicles/armored personnel carriers, and trucks in a tactical road march formation.
- AGM-154C (Unitary Variant) – Navy only: The AGM-154C, in addition to the common GPS/INS guidance, will use an autonomous imaging infrared seeker for target acquisition and terminal guidance. The AGM-154C will carry the British Aerospace multiple warhead system (Broach), and is designed to attack point targets such as industrial facilities, logistical systems, and shipping locations.

*The currently deployed hardware and software variant did not undergo an adequate operational test prior to deployment.*

**AGM-154A, Baseline Variant**

The JSOW program incorporated a new control section and guidance unit into all variants in FY01. This change is a cut into the full-rate production of AGM-154A. However, a redesign of this control section is currently under development to enable the F-16 to employ the weapon throughout the entire F-16 operational envelope.

A shortfall in JSOW software's ability to accurately assess wind effects was identified during combat employment. An update to rectify this shortfall is currently under development and testing.

DOT&E submitted a combined AGM-154A Operational and Live Fire Test and Evaluation (LFT&E) Report to Congress to support a Milestone III decision in October 1998.

**AGM-154B, BLU-108 Variant**

Low-rate initial production of the AGM-154B was approved in FY99. Continued developmental tests ceased in FY00 during production verification due to numerous system performance shortfalls. The Air Force and Navy plan to withdraw support for AGM-154B. Review of the program is underway and the program office intends to operationally test the variant.

LFT&E of AGM-154B is based upon live fire testing conducted for the SFW program. AGM-154Bs will incorporate the SFW Preplanned Product Improvement BLU-108.

**AGM-154C, Unitary Variant**

An operational assessment to support the AGM-154C Milestone III decision is planned for FY03.

In September 2000, the Under Secretary of Defense (Acquisition, Technology and Logistics) approved incorporation of the developmental Broach warhead. Due to incorporation of the new warhead, LFT&E is required. LFT&E and Initial Operational Test and Evaluation (IOT&E) are planned for FY03.

## TEST & EVALUATION ACTIVITY

**AGM-154A, Baseline Variant**

The currently deployed JSOW hardware and software variant did not undergo an adequate operational test prior to deployment. Although a Navy-only Quick Reaction Assessment was conducted to support a decision to release the new software variant to the fleet, this test was only a subset of the test plan already approved as minimally adequate. Tests to date demonstrate accuracy within prescribed requirements. These tests occurred under moderate wind conditions with releases in the heart of the JSOW employment envelope. Future tests are planned to validate the operational edge of this employment envelope and the robust nature of the new software. Currently, test operations are suspended, pending examination of apparent release envelope inaccuracies in JSOW software.

The redesign of the JSOW tail section is scheduled to conclude in FY03. Operational test of this redesign is planned for FY03.

**AGM-154B, BLU-108 Variant**

Operational test is delayed due to JSOW common technical issues outlined above and the incorporation of the redesigned tail section. Multiservice Operational Test and Evaluation is planned for FY04. Although the Air Force and Navy intend to withdraw support for AGM-154B, the program office intends to evaluate this weapon in operational test.

**AGM-154C, Unitary Variant**

The program conducted developmental tests, to include guided flight tests, in FY02. An operational assessment is planned for FY03, along with a combined IOT&E/LFT&E.

## TEST & EVALUATION ASSESSMENT

**AGM-154A, Baseline Variant**

DOT&E's evaluation of the results of Navy Operational Evaluation and Air Force IOT&E confirmed that the AGM-154A, in the Low-Rate Initial Production (LRIP) configuration, is operationally effective and suitable.

Developmental tests during FY02 of weapons that encounter repeated carrier launch and recovery operations resulted in reliability failures. No cause-and-effect relationship has been yet identified for these failures. Further tests during the current Follow-on Test and Evaluation (FOT&E) with such weapons are planned.

Preliminary test results of the full-rate production JSOW, with the new hardware and software, are inconclusive, due to the minimally challenging nature of wind conditions during recent tests and the small data size to date. Tests of the new configuration are also planned for a non-permissive GPS environment during FOT&E.

The F-16 is currently unable to employ JSOW throughout its entire operational flight envelope. Operational test with the redesigned tail section are planned for FY03.

In FY02, the contractor identified software anomalies that affect JSOW flight profiles and jeopardize JSOW's ability to reach the target when released at high altitudes, at the low end of tactical employment speeds, and in the face of stiff headwinds. Examination of these anomalies for effects on deployed weapons, as well as effect on AGM-154B and C, are also being evaluated.

**AGM-154B, BLU-108 Variant**

The capacity for AGM-154B to demonstrate its ability to perform adequately in an operationally realistic battlefield is dubious. Concepts of operation validation tests are yet to be conducted.

**AGM-154C, Unitary Variant**

Developmental testing continues. Free-flight test of the AGM-154C to evaluate basic seeker performance occurred in FY02 and static tests of the Broach warhead are planned for FY03. An operational assessment to support an LRIP decision is also planned for FY03.

An operational evaluation of AGM-154C is planned for FY03. However, planning to date does not provide for an adequate minimum of live weapons nor a sufficient number of end-to-end, free flight test events sufficiently counter-measured. End-to-end, free flight tests of the AGM-154C in a non-permissive GPS environment must also occur for the operational evaluation to be adequate.

The draft AGM-154C LFT&E strategy includes static arena tests of the Broach warhead, all-up-round sled tests, and live warhead flight tests against realistic targets. The arena and sled tests should provide characterization of warhead performance at the component level. Flight tests against realistic targets will provide an end-to-end, system-level demonstration of lethality. DOT&E agrees with this basic structure for the LFT&E proposed by the program office.

To support LFT&E, the program office proposed arena tests based on simultaneous detonation of both components of the Broach warhead. Since the Broach warhead may function in one of two modes, either simultaneous detonation of both warheads or sequential detonation with the follow-through-bomb (FTB), data on simultaneous detonation only is insufficient. Test-supported characterization of the blast and fragmentation characteristics of the FTB will be required to support LFT&E.

The program office has identified two, of as many as seven, possible targets for live warhead flight tests. The adequacy of data collection for LFT&E hinges on the number and fidelity of these targets, the extent of their instrumentation, and the quality of the post-test damage assessment. Discussions about these important details continue.

# KC-130J Airlift Aircraft

The KC-130J is a medium sized, four-engine turboprop aircraft modified to perform its primary United States Marine Corps (USMC) mission Aerial Refueling of fixed and rotary wing aircraft. Secondary missions include Rapid Ground Refueling, assault transport, logistics support, and special warfare while preserving personnel and cargo transport capabilities. The KC-130J will perform the same missions as the aircraft it will replace, the KC-130F, KC-130R, and KC-130T aircraft.

Procurement of the KC-130J is proceeding under a commercial-off-the-shelf acquisition strategy, instituting catalog pricing and commercial payments through the United States Air Force's C-130 System Program Office. The C-130J upgrades the basic C-130 by incorporating a full glass, two-person flight station; digital avionics; a new electrical system; new digitally controlled engines; high-speed doors and ramps; and composite propellers. The KC-130J also has a modified aerial refueling system (fuselage fuel tank, fuel manifold, and pylons/pods) and supporting avionics. Additional equipment is provided to refuel vehicles, aircraft, and equipment on the ground.

The KC-130J Navy/USMC test program is designed specifically to address differences in aircraft configuration and mission employment from the baseline United States Air Force (USAF) C-130J. The program is intended to build upon Lockheed Martin Aero Marietta, Federal Aviation Administration, and USAF test efforts and data collection rather than duplicate effort. The USAF effort has been ongoing since 1995.

USMC/Navy combined Developmental Test (DT)/Operational Test and Operational Evaluation Testing is ongoing and will span seven months consisting of approximately 640 flight hours. The Test and Evaluation Master Plan is in coordination and will be submitted for approval in the next few months. The Marines have taken limited acceptance of nine aircraft and have not accepted two.

### TEST & EVALUATION ACTIVITY

The Navy/USMC test and evaluation program requires five test aircraft. KC-130J DT will be conducted primarily by Naval Air Warfare Center-Aircraft Division. Operational Test and Evaluation Force (OPTEVFOR) team members include a designated Operational Test Director and designated fleet personnel (trusted agents). DT flight crews will consist of both qualified test pilots and fleet aircrew/maintainers. A combined DT/Operational Test period will be followed by an independent Operational Evaluation conducted by OPTEVFOR. The KC-130J Integrated Product Team is located at Naval Air Station Patuxent River, Maryland.

*The KC-130J Marine Corps mission aerial refueling of fixed and rotary wing aircraft.*

DOT&E approved the Live Fire Test and Evaluation (LFT&E) Plan for the KC-130J in June 2002, 2002. The vulnerability of the KC-130J will be evaluated using the following information: existing applicable Joint Live Fire test results for earlier versions of the C-130 aircraft; available combat experience and incident reports; applicable data from the USAF C-130J LFT&E program; component, subsystem, and system-level testing of the air refueling system; and live fire testing of an earlier model of the C-130 aircraft modified to represent the KC-130J aircraft's production configuration for the areas to be tested. Test articles will be configured to assess vulnerability effects, including fire, explosion, structural integrity, and functionality. Data also will be used to compare to vulnerability models and simulations.

Measurements of the conditions inside the refueling system will be taken during actual mission profiles flown during scheduled flight-testing in FY02-FY03. This information will be used to plan the ballistic tests, currently scheduled for execution in FY04.

### TEST & EVALUATION ASSESSMENT

The KC-130J aerial refueling system has not been qualified to refuel. It is a safety of flight and operational capability issue. There have been incidents of "uncommanded pull-outs" where the refueling hose disengages from the aircraft being refueled. This problem has caused a one-year slip in testing from the original schedule. Until this problem is corrected, the aircraft cannot perform its primary refueling mission. Testing will continue next year.

A second issue is an Operational Requirements Document requirement for a rendezvous distance of 100 nautical miles (NM), similar to the legacy systems capability. The new system is predicted to only achieve a rendezvous distance of 40NM; however, this has not been tested. Operational test will assess the mission impact of the reduced capability after the discrepancy with the refueling pod is resolved.

The LFT&E program is adequate and fully resourced. In addition, instrumentation to measure ullage composition and explosivity inside fuel tanks and lines is being developed and safety-certified for in-flight use. This capability will be extremely valuable in other programs.

# MH-60R Multi-Mission Helicopter

The MH-60R Multi-Mission Helicopter program originally consisted of a Service Life Extension Program (SLEP) for existing SH-60B, SH-60F, and some HH-60H aircraft. Aircraft remanufacture, avionics improvements, and new or improved mission sensors were the major system changes until cost considerations in FY01 resulted in redefinition of the program to include new production aircraft. The program includes the AN/AQS-22 Airborne Low Frequency Sonar with increased sonobuoy acoustic signal processing capability intended to improve undersea warfare mission effectiveness against submarines in both deep and shallow water environments. The program also includes the AN/APS-147 Multi-Mode Radar with Inverse Synthetic Aperture Radar imaging and periscope detection modes of operation. Other improvements include the AN/ALQ-210 electronic support system, a fully integrated self-defense system, the AN/AAS-44 Forward-Looking Infrared sensor with laser designator, and the ability to launch Hellfire missiles. The MH-60R will have the Common Cockpit that consists of multi-functional displays and a complex client-server based tactical data processing system. The program represents a significant avionics modification to the SH-60 series of aircraft intended to enhance undersea and surface warfare, surveillance and identification, and power projection.

The program entered Milestone II development in FY93 with the requirement to combine the missions of both the SH-60B and SH-60F aircraft into the MH-60R mission configuration. A 1999 Operational Assessment of an advanced development model AN/AQS-22 sonar system installed in an SH-60B test aircraft concluded that the system was potentially operationally effective and suitable. Two prototype YMH-60R test aircraft have supported contractor and developmental testing from early FY00 through FY02. The tests have focused on the Common Cockpit system and each of the developing mission systems.

The Assistant Secretary of the Navy, Research, Development and Acquisition, approved the current Acquisition Program Baseline schedule on March 14, 2002, to include the decision for new production aircraft instead of remanufactured aircraft.

DOT&E designated the MH-60R as a covered system in 1998 for Live Fire Test and Evaluation (LFT&E). The Assistant Secretary of the Navy (Research, Development and Acquisition) (ASN(RDA)) granted a LFT&E waiver to the MH-60R under an extension of a July 1996 memorandum. Ongoing analyses of H-60 aircraft and recommendations of subject-matter experts identified voids in the LFT&E database for the H-60 family of aircraft. The Army and Navy established a joint LFT&E test program for the UH-60M, MH-60S, and MH-60R development programs to address the data voids. The joint effort recognized the high degree of commonality among the H-60 variants' structural and dynamic components. The two Services provided components and an airframe to be used as test articles and initiated static and dynamic testing in 2001. The joint LFT&E program will continue into FY05.

*The MH-60R multi-mission helicopter will combine the missions of existing SH-60B and SH-60F helicopters into a single aircraft.*

## TEST & EVALUATION ACTIVITIES

The second of three phases of contractor/Navy developmental tests began in FY01 and continued into FY02. The tests focused on the radar, electronic support measures, and Common Cockpit software systems' maturity growth. The third phase of contractor/Navy developmental tests began in November 2002 and will be followed by an Operational Assessment from April through July 2003. A six-month Operational Evaluation is scheduled to begin in May 2004. The Army and Navy joint LFT&E test program has conducted both static and dynamic tests on aircraft components and on the YCH-60 test aircraft. This testing was conducted at the Army's Aberdeen Proving Ground, Aberdeen, Maryland, and at the Naval Air Warfare Center, China Lake, California. Approved revisions of the March 1992 Operational Requirements Document and the January 1994 Test and Evaluation Master Plan are expected in mid FY03.

## TEST & EVALUATION ASSESSMENT

Integration of mission systems with the Common Cockpit program software has proven difficult. The two pilots and sensor operator can be easily overwhelmed if the auto-detect, auto-classify, and tactical operator aids do not function correctly. Development of mature stable software in the radar, electronic support system, acoustic sensor system, and Common Cockpit has been more complex than originally estimated. The development and test effort has found and corrected problems, but this has resulted in test-fix-test periods that may eventually impact the schedule. The testing process identified immature technology limitations in the Automatic Periscope Detection algorithm development for the radar. This radar feature was postponed and will be added in the future as a preplanned product improvement.

Design problems in the radar traveling wave tube amplifier (TWTA) have limited the Navy to two systems to support contractor proof of compliance testing and Navy developmental testing. The quality of repair of the single source TWTA components has been poor. Periodic shortages of mission computers have also adversely impacted the development schedule.

The joint LFT&E program is adequately resourced and will provide the required information to adequately evaluate the survivability of the MH-60R.

# MH-60S Fleet Combat Support Helicopter

The MH-60S Fleet Combat Support Helicopter is the replacement for the current CH-46D, most of which have exceeded their original service life. The primary mission of the baseline MH-60S configuration is to provide the Navy's Combat Logistic Force with: responsive vertical replenishment, vertical onboard delivery, ship-to-shore airhead support, and Amphibious Task Force search and rescue. Secondary missions include Special Warfare Support (over water), aero medical evacuation, and noncombatant evacuation. A second MH-60S configuration planned for FY06, the Armed Helicopter, will support Combat Search and Rescue, Anti-Surface Warfare, and Aircraft Carrier Plane Guard missions. A third MH-60S configuration also planned for FY06 will support the Organic Airborne Mine Countermeasure mission.

The MH-60S is an Army UH-60L Black Hawk airframe incorporating more rugged Navy Seahawk GE T700-401C engines, transmission/drive train, stabilator, flight controls, and a folding rotor head and tail pylon. It uses the Common Cockpit design that consists of multi-functional displays and an open architecture client-server based tactical data processing system. MH-60S avionics include: dual UHF/VHF transceivers, dual embedded Global Positioning System/ inertial navigation systems, and night vision device-compatible heads-up displays. The Armed Helicopter configuration will also include tactical moving maps, a forward-looking infrared sensor with a laser range finder/target designator, crew-served side suppression weapons, Hellfire missiles, forward firing guns/rockets, and an integrated self-defense system. The Airborne Mine Countermeasure configuration will incorporate a Tactical Common Data Link, a sensor workstation, a winch and tether/towing system, and one of five mine detection sensors or destructors currently under development.

## TEST & EVALUATION ACTIVITIES

The Operational Evaluation of the MH-60S baseline configuration was conducted from October 24, 2001, through March 7, 2002. Two dual aircraft detachments accumulated 124 flight hours of test from aircraft carriers, amphibious-assault ships, and combat logistics ships. An additional 210 flight hours of test occurred at land-based test and operating sites. Both static and dynamic tests were conducted on aircraft components and the YCH-60 test aircraft as part of the joint Live Fire Test and Evaluation (LFT&E) program. Testing was conducted at the Army's Aberdeen Proving Ground, Aberdeen, Maryland and at the Naval Air Warfare Center, China Lake, California. A revision of the Operational Requirements Document (ORD) for Airborne Mine Countermeasure aircraft has been approved. A revision of the Test and Evaluation Master Plan to reflect the updated ORD is in progress.

*The primary mission of the baseline MH-60S configuration is to provide the Navy's Combat Logistic Force with: responsive vertical replenishment, vertical onboard delivery, ship-to-shore airhead support, and Amphibious Task Force search and rescue.*

## TEST & EVALUATION ASSESSMENT

The Operational Evaluation of the MH-60S was considered an adequate test of the helicopter and its ability to complete assigned missions. The MH-60S was determined to be operationally effective and survivable, but not suitable. The baseline-configured MH-60S successfully accomplished primary and secondary missions, constrained only by its 350-gallon fuel capacity. DOT&E recommended in the August 2002 Beyond Low-Rate Initial

Production (BLRIP) Report that sufficient quantities of 200-gallon, internal auxiliary fuel tanks be procured by the Navy to accomplish current missions requiring extra fuel, as directed by Task Force Commanders.

The LFT&E results and legacy H-60 databases indicate that the MH-60S baseline configuration is operationally survivable in its intended operational environment. The MH-60S is a damage-tolerant aircraft that can withstand multiple small-arms projectile hits, continue to fly, and often complete its mission in spite of incurred damage. The data from the joint LFT&E program are adequate to evaluate the survivability of the MH-60S while conducting its other wartime missions.

The MH-60S was not operationally suitable due to excessive administrative and logistic delay time experienced awaiting spare parts to repair legacy and MH-60S-unique component failures. The aircraft was reliable during the conduct of Operational Test & Evaluation; however, when failures did occur, necessary spare parts were not readily available. DOT&E recommended in the BLRIP Report that the Navy take action to correct the deficiency and ensure adequate logistics were available to support the intended rapid introduction of the MH-60S into the Fleet.

# Mk 48 Mods

The Fleet baseline torpedo Advanced Capability (ADCAP) is designated the Mk 48 Mod 5. A 1995 upgrade, designated Mk 48 Mod 6, features an improved Guidance and Control section and a Torpedo Propulsion Upgrade. Development of a follow-on hardware change to the Mod 6 ADCAP, called the Advanced Common Torpedo Development Vehicle, has been delayed for several years. It will be incorporated into the next-generation torpedo, the Common Broadband Advanced Sonar System (CBASS), planned for FY05.

Three software builds are currently under oversight. Block Upgrade III is the final tactical software upgrade to the Mod 5. Block IV was designed to extend Block III capabilities and apply them to the Mod 6 weapon. The more sophisticated CBASS software is planned to follow Block IV. In lieu of future Block Upgrades, the program plans to employ a series of Advanced Processor Builds (APBs) to both the Mod 6 and Mod 7 weapons, as a more flexible means of introducing software changes.

The Mod 6 ADCAP, intended to address open issues from previous Operational Test and Evaluation (OT&E), was tested in 1995 and reported in the 1996 report. DOT&E assessed the Mod 6 ADCAP to be both operationally effective and suitable. Although the reliability was marginally below threshold, DOT&E identified the Mod 6 ADCAP as producing a total performance much better against the expected threat than the Mod 5 ADCAP.

Follow-on Test and Evaluation (FOT&E) on the Block IV software was completed in FY00. DOT&E determined that Block IV was not operationally effective because it did not provide the shallow water performance improvements originally promised.

## TEST & EVALUATION ACTIVITY

In May 2002, the Navy conducted a Verification of Correction of Deficiencies (VCD) to address deficiencies identified in the Block IV FOT&E. A sink exercise (SINKEX ) was conducted against ex-*OKINAWA* (LPH 3) in June 2002. Numerous ADCAP torpedo exercises were performed. These included four Prospective Commanding Officer exercises, one of which was conducted jointly with the Royal Australian Navy.

*Advanced Capability torpedo being loaded on a submarine.*

## TEST & EVALUATION ASSESSMENT

The Block IV VCD testing consisted of a small number of torpedo firings at shallow water sites near Maui, Hawaii. While the program is under oversight, the VCD is an internal Navy activity and was not subject to DOT&E approval. The VCD was intended to focus entirely on technical issues affecting torpedo performance, rather than overall operational effectiveness. Given the small sample size and limited test conditions, the VCD (at Maui) was inconclusive. Neither the technical nor operational level performance provided conclusive evidence that the original deficiency had been corrected. In addition, the fact that the test was not conducted at the same site as the FY00 Operational Test, raised concerns regarding the impact of acoustic conditions on the validity of the VCD results. More shots for the VCD are planned for the Southern California exercise area.

During the June SINKEX, a submarine sank ex-*OKINAWA* with a single Mk 48 Mod 5 ADCAP. Although safety considerations severely limited the realism of the engagement, the test was an impressive demonstration of the lethality of a modern heavyweight torpedo.

Torpedo reliability, as described in previous Annual Reports, remains a concern. These failures highlight the overall problem of ADCAP reliability, which continues to run in cycles. In addition to the issues discussed above, work force reductions at the weapon's depots may also threaten the fleet's ability to process weapons quickly and accurately.

As cited in previous reports, performance questions remain unresolved due to inadequate T&E resources and funding. For open-ocean shallow water exercises, the tested torpedo's internal monitoring equipment is the only source of data, resulting in post-run analysis biases and errors. Development of an inexpensive mobile test range, or other independent instrumentation, is necessary to alleviate shallow water testing shortfalls. As a more permanent solution, given the high priority of the diesel submarine threat, an instrumented shallow water test range would help hasten maturation of littoral Anti-Surface Warfare (ASW) tactics and improvement in shallow water ASW torpedoes. The cumbersome nature of open ocean torpedo firings, coupled with seasonal marine mammal habitat restrictions at Cape Cod, Massachusetts, has significantly lengthened development cycle times. Congressional funding support for a viable instrumented shallow water test range is strongly recommended.

DOT&E supports the flexibility of the APB approach, but will continue to insist upon complete and rigorous testing of all upgrades.

Side-by-side test and evaluation of ADCAP software variants, although on the surface more expensive, might be more cost-effective in the larger scheme because less time might be lost if side-by-side test and evaluation were performed. Right now, disagreements between operational testers and developers are attributable to results taken in arguably different and difficult-to-reconcile environmental and tactical conditions. Side-by-side testing would narrow that gulf, and is DOT&E's expectation for future OT&E.

# Mobile User Objective System (MUOS)

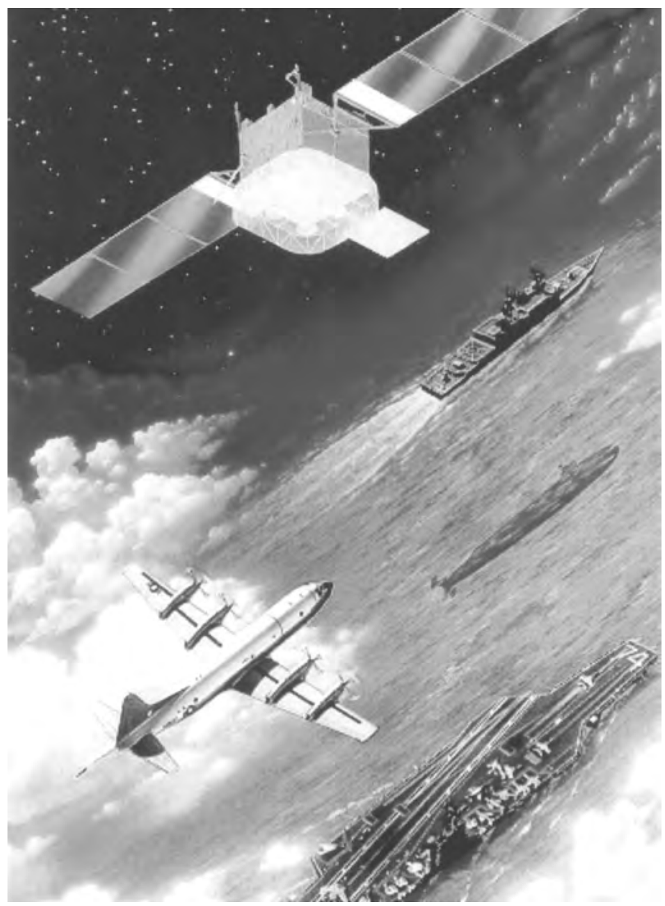
The Mobile User Objective System (MUOS) will be a satellite communications network designed to provide a worldwide, multi-service population of mobile and fixed-site terminal users with narrowband Beyond Line of Sight (BLOS) communications services. Capabilities will include a considerable increase from current narrowband Satellite Command (SATCOM) capacity, as well as significant improvement in availability for small, disadvantaged terminals. The MUOS will provide graceful transition from the current UHF Follow-On (UFO) narrowband SATCOM system.

The MUOS will consist of a network of advanced satellites and the ground equipment necessary to manage the information network, control the satellites, and interface with other elements of the Global Information Grid. Specifically, the MUOS is partitioned into the following segments: the transport segment (space and ground), the user entry segment, the network management segment, the satellite control segment, and the ground infrastructure segment.

Three acquisition phases are planned for the procurement of MUOS, each utilizing full and open competition. The first phase, a 21-month Concept Exploration phase, has been completed. Six industry teams, consisting of commercial and DoD contractors, studied and recommended system concepts and architectures to meet MUOS Operational Requirements Document needs. The second phase, Concept Advanced Development, is a planned 14-month task using two contractor teams selected to conduct system risk reduction and architecture refinement. The third phase is the System Development and Demonstration with transition into the Production and Deployment phase planned for one contractor team, with system Initial Operational Capability achieved in 2008.

### TEST & EVALUATION ACTIVITY

- Evaluation Strategy has been written by a Combined Test Force (CTF) and is in the signature coordination process; DOT&E has reviewed the draft Evaluation Strategy and finds it adequate.
- The CTF will conduct government insight of the commercial developmental testing following commercial practices, and will conduct combined Developmental Test/Operational Test as appropriate.
- Dedicated operational test and evaluation will take place after the launch of the first satellite in FY08.



*The Mobile User Objective System will consist of a network of advanced satellites and ground equipment necessary to manage the information network, control the satellites, and interface with other elements of the Global Information Grid.*

# Multifunctional Information Distribution System - Low Volume Terminal (MIDS-LVT)

The MIDS-LVT is a communications terminal that provides Link 16 digital data link, digital voice and, for fighter aircraft, Tactical Air Navigation (TACAN) capabilities when integrated into the host platform. Link 16 is a Joint and Allied digital data link that operates on an anti-jam waveform and uses standardized message sets to exchange theater tactical information such as air tracks, engagement orders, targeting information, and platform status. MIDS-LVT provides host platform interoperability with legacy Class 2 Joint Tactical Information Distribution System equipped host platforms.

There are two MIDS-LVT variants: MIDS-LVT 1 for aircraft and shipboard integration and the MIDS-LVT 2 for Army land-based host platform integration. MIDS-LVT 1 has two competing production contractors: Data Link Solutions, Incorporated (Inc.) (DLS) and Via Sat, Inc. The Army has designated Via Sat, Inc. as the sole manufacturer of MIDS-LVT 2.

The MIDS-LVT 1 and MIDS-LVT 2 are planned for integration into 13 separate host platform types. The F/A-18 is the lead host platform for MIDS-LVT 1 integration and requires 53 percent of the total planned MIDS-LVT 1 acquisition of 1,880 terminals. The integration of the MIDS-LVT 1 into the F/A-18 will serve as the primary basis for the MIDS-LVT 1 Initial Operational Test and Evaluation (IOT&E). The F-16 (Blocks 40 and 50) requires 35 percent of planned MIDS-LVT 1 terminals and is approximately one year behind the F/A-18 in terms of integration and test schedule.

The MIDS-LVT 1 replaces the analog AN/ARN-118 TACAN to provide a digital TACAN function for the F/A-18 and F-16 fighter aircraft. This installation is reversible in the F/A-18 allowing reinstallation of the AN/ARN-118 TACAN should the need arise. The installation of MIDS in the F-16 is permanent. The TACAN function provides air-to-ground and air-to-air modes of navigation information.

The Patriot Information Coordination Central (ICC) is the lead host platform for integration of the MIDS-LVT 2; however, the Patriot Battery Command Post (BCP) will require the majority of MIDS-LVT 2 terminals. Since Link 16 integration into the BCP is phased, the integration of MIDS-LVT 2 into the Patriot ICC and BCP Phase One (Link 16 not integrated into host sensors and Link 16 receive only) served as the basis for the MIDS-LVT 2 IOT&E.

*The Multifunctional Information Distribution System-Low Volume Terminal is a communications terminal that provides Link 16 digital data link, digital voice and, for fighter aircraft, Tactical Air Navigation capabilities when integrated into the host platform.*

## TEST & EVALUATION ACTIVITIES

- DOT&E conducted an independent evaluation of F/A-18 MIDS-LVT maturity in support of the Defense Acquisition Board's (DAB) Low-Rate Initial Production (LRIP) Lot 2, Order 2 authorization deliberations.
- DOT&E conducted an independent assessment of the maturity of the integration of the MIDS-LVT TACAN function into the F-16 in support of DAB LRIP 3 authorization deliberations. DOT&E also provided an updated assessment of the resolution of the 13 major issues identified in the June 2001 Operational Assessment (OA) Report.
- The Army completed MIDS-LVT 2 IOT&E during June 2002. This testing supported the full-rate production and fielding decision for MIDS-LVT 2.
- DOT&E completed an independent OA of F/A-18 MIDS-LVT 1 integration maturity during September 2002.

## TEST & EVALUATION ASSESSMENT

DOT&E and the Navy's operational test squadron, Air Test and Evaluation Squadron Nine (VX-9), agree that the F/A-18 MIDS-LVT 1 air-to-ground TACAN function performance is not stable and is unacceptable for aircraft carrier approach operations. Deficiencies include frequent loss of magnetic bearing and range information while in marshal and approach patterns. VX-9 assessed the instability as a Category I deficiency. VX-9 evaluated corrective actions by the vendor and found that the deficiency was sufficiently mitigated to allow commencement of operational testing, October 18, 2002.

DOT&E, the United States Air Force's F-16 MIDS-LVT Developmental Test squadron, and the Air Force Operational Test and Evaluation Center agree that the F-16 MIDS-LVT 1 integration test data indicates occasional range extrapolation errors while operating the air-to-air TACAN mode. This indicates false range separation information to the pilot and is assessed as a Category I (safety of flight) deficiency. The F-16 MIDS-LVT air-to-ground TACAN mode operates correctly with the DLS, Inc. MIDS-LVT 1. Flight test data has yet to be provided for Via Sat, Inc. MIDS-LVT 1 TACAN performance in the F-16.

DOT&E concluded that 4 of the 13 major F/A-18 MIDS-LVT integration issues identified in the June 2001 OA report had been fully or partially resolved by the Navy. Major issues that remain and additional issues that pose risk to a successful IOT&E outcome include:

- Navigation, including TACAN and relative navigation, instability.
- Deficiencies with Multi-Sensor Integration and non-correlation of Link 16 data with on- and off-board sensor data and track reports and identification.
- Excessive Interference Protection Feature alerts and the inability to reset some of them.
- Intra-Navy and Joint Link 16 interoperability. Inability to demonstrate the exchange of all required mission assignment information between the E-2C Hawkeye Airborne Early Warning system and the F/A-18 using Link 16 messages. F/A-18 MIDS-LVT 1 inability to exchange ground target information between the E-8 Joint Surveillance Target Attack Radar System and accurate ground target coordinates with F-15E Strike Eagle.
- Adverse mission and aircrew task loading impacts due to persistent problems related to F/A-18 MIDS-LVT initialization and network entry by aircrew in preparation for flight.
- Difficulties of mission planning of MIDS-LVT Link 16 with the Navy's Tactical Aircrew Mission Planning System.
- Excessive Built-In Test (BIT) False Alarms. Nearly every F/A-18 and F-16 MIDS-LVT test flight has one or more BIT false alarms.

The Army IOT&E and preceding Developmental Tests (DT) indicated MIDS-LVT 2 and Patriot ICC host platform integration issues that could lead to loss of Link 16 data exchange. The Army Program Manager demonstrated software fixes during IOT&E that indicate the issue has been resolved. The IOT&E scenario was, however, not as robust as the Large Force Exercise (LFE) venue used by DT to identify this issue. The Army's fielding plans for MIDS-LVT 2 do not include the ICC platform. Nevertheless, installation and integration of the MIDS-LVT 2 into the ICC host has been demonstrated and could, if the Army desires, be fielded to the ICC. Unless further testing of the ICC host is conducted there will remain some level of uncertainty regarding the MIDS-LVT 2 and ICC compatibility.

The F-16 MIDS-LVT 1 integration should not proceed to IOT&E until the critical issue of air-to-air TACAN range extrapolation errors has been addressed.

The Army should employ the Patriot ICC MIDS-LVT 2 in a LFE to determine if, during periods of high data throughput, the data exchange halts have been resolved.

# Navy Extremely High Frequency Satellite Communications Program (NESP)

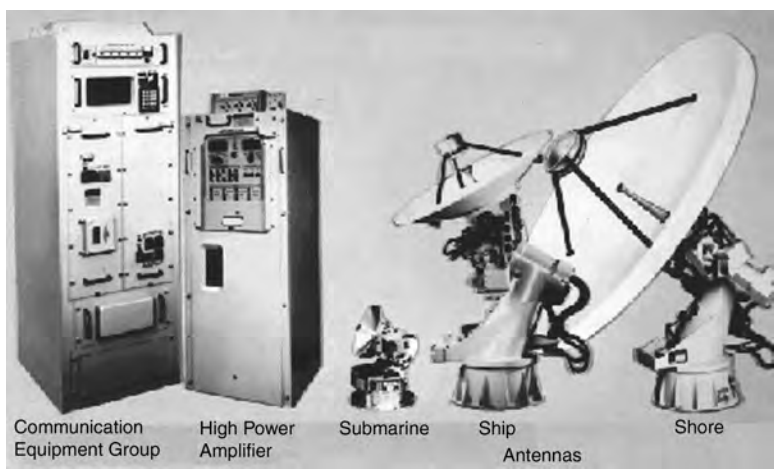
The Navy Extremely High Frequency (EHF) Satellite Communications Program (NESP) terminal connects ship, shore, and submarine platforms to the Military Strategic, Tactical, and Relay (MILSTAR) satellite constellation. The NESP terminal supports survivable, endurable, and flexible worldwide command and control communications to strategic and tactical Naval forces through all levels of conflict. The NESP terminal provides minimum essential secure communications in stressed environments that require anti-jam and low probability-of-intercept capabilities.

There are three different configurations of the NESP terminal corresponding to surface ship, shore, and submarine platforms. Although each terminal has the same basic capabilities, their antennas and other peripheral equipment vary by platform. The NESP terminal has been upgraded to add a tactical medium data rate (MDR) capability to the existing strategic low data rate (LDR) capability. A limited number (64) of the existing NESP ship and shore terminals are being upgraded with an MDR appliqué to achieve the combined low/medium data rate MILSTAR capability. All existing NESP terminals will be replaced with the Follow-On Terminal (FOT), which provides the same functionality as the MDR appliqué, but offers technology upgrades in terminal hardware and software. The submarine LDR terminals are also undergoing MDR upgrades, including installation of a new mast with a 16" antenna, as well as addition of super high frequency and Global Broadcast Service capabilities.

The Navy is developing two new communications controllers, the Navy EHF Communications Controller (NECC) and the Time Division Multiple Access (TDMA) Interface Processor (TIP). The NECC and TIP are baseband interface units that allow more efficient use of MILSTAR satellite resources. The NECC supports LDR data networks, while the TIP supports MDR data networks.

### TEST & EVALUATION ACTIVITY

Testing of the NESP MDR terminal began with Developmental Test/Operational Test events associated with on-orbit testing of Milstar Flights 4 and 5, occurring from March-July 2001, and January-March 2002, respectively. These tests demonstrated compatibility and interoperability with the low and medium data rate payloads in orbit. Tests included satellite acquisition; simultaneous network operations; interoperable network and point-to-point calls with Army, Navy, and Air Force terminals; and antenna and network control functions.




*The Navy Extremely High Frequency Satellite Communications Program is a general purpose terminal designed to accommodate secure voice, teletype, data systems, and extremely high frequency uplink for the fleet broadcast.*

Anti-jam and Low Probability Intercept (LPI) are two important characteristics of the NESP MDR terminal; MDR Operational Test and Evaluation (OT&E) is employing modeling and simulation, rather than testing, to evaluate the terminal's ability to meet requirements. Model validation testing of both the anti-jam and LPI models was conducted in 2001, and additional validation testing was conducted. Analysis of test data is on going, and the models will be accredited pending the results.

The NESP terminal with the NECC participated in a Navy developmental test in

FY01. OT&E of the NESP terminal with the NECC was planned for September 2001, but it was not certified for OT&E due to reliability concerns. This test will use on-shore and at-sea terminals to determine NECC operational effectiveness and suitability, and due to resource scheduling issues, test will not occur until 2QFY03/3QFY03.

The MDR OT&E for the NESP terminal with the MDR appliqué was conducted from April 22 to May 10, 2002, in ships and shore stations in San Diego, California, and Pearl Harbor, Hawaii. This test was conducted to support a fielding decision on the MDR appliqué. Commander, Operational Test and Evaluation Force determined that the MDR appliqué is operationally effective and operationally suitable, and recommended fleet introduction.

Operational test of the FOT was scheduled to begin in October 2002, but was delayed due to poor reliability. It is now scheduled to occur in December 2003. A separate test will also be conducted to address the TIP (still under development) and any other issues not fully resolved. The submarine MDR terminal operational test schedule will be integrated into the overall MILSTAR and NESP terminal test schedules to the greatest extent possible, consistent with submarine terminal progress. Current plans are to conduct submarine terminal testing jointly during operational testing of the NESP ship and shore terminals.

### TEST & EVALUATION ASSESSMENT

At the completion of the LDR IOT&E, DOT&E concluded that the ship and shore NESP terminals were operationally effective, suitable, and supported full fleet introduction. Although the MILSTAR LDR submarine terminal does meet the technical and operational requirements for LPI, operational tests showed that the submarine had a substantially higher probability of signal intercept than developmental tests had indicated. These LPI results reinforce the role of operational testing in providing the warfighter with the most accurate operational performance information possible.

The ship and shore terminals with the MDR appliqué are operationally effective and operationally suitable. However, no assessments can be made regarding joint interoperability, anti-jamming, and LPI until further testing is conducted later this year. DOT&E has recommended additional at-sea testing of MDR LPI performance of the submarine terminal to mitigate the risk associated with the model to be used for Operational Test.

# Navy-Marine Corps Intranet (NMCI)

The Navy-Marine Corps Intranet (NMCI) is an information technology (IT) services contract to provide reliable, secure, and seamless information services to the shore-based components of the Navy and Marine Corps. NMCI infrastructure and services will not extend to afloat or deployed units. It is required to support new processes and enable new initiatives such as knowledge management, distance learning, and telemedicine to improve the quality of life for Department of the Navy employees and support personnel. NMCI will provide IT services using a seat management contract that delivers comprehensive information services through a common computing and communications environment. Upgrades, modernization, and technology refreshment will occur over the NMCI contract life cycle.

The architecture will support Navy and Marine Corps bases, camps, stations, and activities in the Continental U.S., Alaska, Hawaii, Puerto Rico, and Guantanamo Bay, Cuba, for an estimated 411,000 seats. The NMCI is not intended, nor designed, to provide direct support to Navy units afloat or deployed, as they are supported by the Defense Information System Network. However, the NMCI will connect with and provide network access service to Navy ships docked in the NMCI-supported areas. It is currently anticipated that in order to meet the Service Level Agreements and provide service for the estimated user base, a total of 72 server farms, 6 Network Operations Centers, and 2 Help Desk Centers will be required.

The NMCI initiative differs from a traditional DoD acquisition program where a system is typically purchased and the government assumes configuration control and life cycle maintenance and management responsibility. The NMCI contract is for the procurement of IT services (not systems) based upon a commercial model of service level agreements. Under this model, the emphasis is placed on the verification, validation, and monitoring of the end-user services and not on the underlying infrastructure or systems.

Due to the large scale and complexity of the NMCI initiative, implementation will take several years to reach full operating capability.

### TEST & EVALUATION ACTIVITY

The contractor, in conjunction with Commander, Operational Test and Evaluation Force (COMOPTEVFOR), conducted a Baseline System Assessment (BSA) in FY01 on the pre-NMCI IT configuration, including hardware, software, security, and current performance levels at four Naval aviation sites. This data collection consisted of three qualitative surveys and a series of quantitative measurements. The results of the BSA have been evaluated and will be referenced against the “to-be” system evaluated during Operational Evaluation (OPEVAL) to measure improvements provided by NMCI.

*The Navy-Marine Corps Intranet will provide reliable, secure, and seamless information services to the shore-based Navy and Marine Corps.*

The Navy completed developmental testing on the initial IT network and local installations during the first two quarters of FY02. The developmental testing, known as Contractor Test and Evaluation (CT&E), consisted of three phases of test events conducted by an agent of the prime contractor. The CT&E testing evaluated the technical performance of the NMCI infrastructure at the component (phase 1), system (phase 2), and mission relation (phase 3) levels.

The Test and Evaluation Strategy Plan (TESP) for NMCI was updated and approved by DOT&E on

September 4, 2002. Further, an Operational Assessment (OA) was planned to assess readiness for OPEVAL and to support further initial deployment. This OA was conducted for three weeks in September 2002 at five operational sites, including four NAVAIR units and Fleet Forces Command, under a DOT&E-approved test plan. The OA was monitored by DOT&E and the results are now being evaluated.

An OPEVAL is planned for 2QFY03 to assess the operational effectiveness and operational suitability of NMCI at five test sites: Naval Air Facility Washington, DC; Naval Air Systems Command Headquarters, Patuxent River, Maryland; Naval Air Station Lemoore, California; Naval Reserve Center Lemoore, California, and an aircraft carrier yet to be determined.

### TEST & EVALUATION ASSESSMENT

A review of the CT&E results was carried out by an Independent Review Team, which found the results generally positive, but questioned the thoroughness of the test execution. For many issues, inadequate data was collected.

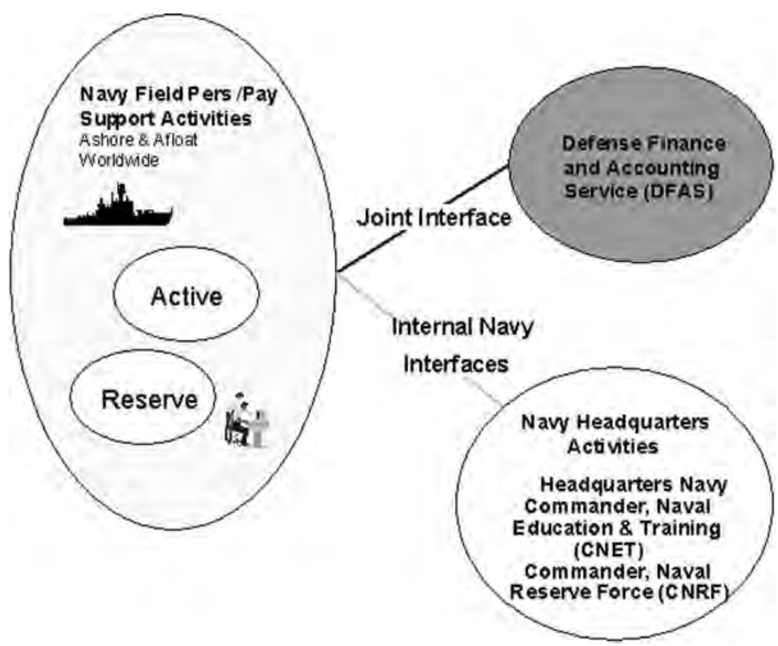
The results of the operational assessment are currently under review.

# Navy Standard Integrated Personnel System (NSIPS)

The Navy Standard Integrated Personnel System (NSIPS) is to consolidate the Navy active and reserve field source personnel data collection systems, both ashore and afloat. The objective is to produce a standard, single point-of-entry system for all personnel and pay information. The primary interfaces for NSIPS will be with systems of the Defense Finance and Accounting Service (DFAS). NSIPS was to provide pay and personnel functionality for the Navy reserve force in Release 0, and for the Navy active force in Release 1. The client-server architecture will have information stored at the local level and at the regional level. A corporate-level database will be used for planning and analysis purposes.

In 1997, the PM developed a prototype system to prove out the planned architecture and "user friendliness" of the graphical user interface. *PeopleSoft®* was selected as the basic human resource software package. This Release 0 package was customized to address the Navy reserve requirements. The Release 0 operational evaluation (OPEVAL) began in mid-September 1999. Many deficiencies were noted, including inaccurate transmittal logs, missing e-mail functionality, corrupted reports, and inadequate training. The Program Manager immediately developed a plan of actions to address these shortcomings. Beginning in October 1999, three separate software builds were installed to fix the problems and OPEVAL resumed in November 1999. In January 2000, DOT&E concurred with the Commander of Operational Test and Evaluation Force's (COMOPTEVFOR) conclusion that NSIPS Release 0 is operationally effective and operationally suitable, and recommended approval for fleet introduction. NSIPS Release 0, which replaced the Reserve Standard Training, Administration, and Readiness Support (Manpower and Personnel) System, is currently operational at 260 reserve sites.

In June 2000, the PM announced a four-month schedule slip in software development and proposed that Release 1 be delivered in two separate increments. The first increment (Release 0.2) would address personnel actions and the second increment (Release 1) would address pay actions for the Navy active force. OPEVAL of Release 0.2 was conducted from April 23 to May 4, 2001. The results indicated that two effectiveness and eight (of ten) suitability critical operational issues were resolved satisfactorily. Interoperability and documentation were found unsatisfactory. Corrections were subsequently made and a follow-on verification of corrected deficiencies was conducted in July 2001. Test results indicated that previously identified deficiencies had been corrected. NSIPS Release 0.2 was approved for fleet introduction in September 2001.




*The Navy Standard Integrated Personnel System is to consolidate the Navy active and reserve field source personnel data collection systems, both ashore and afloat.*

## TEST & EVALUATION ACTIVITY

OPEVAL of NSIPS Release 1 was conducted from June 10 through July 12, 2002, at the following operational test sites: *USS Coronado*; Personnel Support Detachment (PSD) Gulfport, Mississippi; PSD Great Lakes, Illinois; PSD Newport, Rhode Island; PSD Point Loma, California; PSD Whidbey Island, Washington; and PSD Guam. VR-54 was used as a regression site to evaluate any interference with or previously installed elements of NSIPS.

The OPEVAL was conducted during normal working hours five days a week for five weeks, concurrently at all seven operational test sites. The Naval Security Group Activity Pensacola tested system security, while testers from the Joint Interoperability Test Command evaluated interoperability issues.

### TEST & EVALUATION ASSESSMENT

OPEVAL results showed that while NSIPS Release 1 was able to meet many of its required performance thresholds, it did not meet the key performance parameter of 98 percent accuracy in processing personnel or pay transactions (only 89 percent accuracy was achieved in each of these two areas). Of the 13 external system interfaces, only 6 were certified as interoperable by the JITC testers, leading to a finding of unsatisfactory for the Interoperability Critical Operational Issue.

Furthermore, NSIPS Release 1 did not provide all the pay data collection functionality in the legacy Uniform Microcomputer Disbursing System (UMIDS) as stipulated in the Operational Requirements Document. As a consequence, UMIDS cannot yet be replaced by NSIPS. Because of these and other deficiencies, COMOPTEVFOR considered NSIPS Release 1 operationally ineffective and operationally unsuitable for fleet introduction. DOT&E concurred. After all the identified deficiencies are rectified, a follow-on OPEVAL is required to determine NSIPS Release 1's effectiveness and suitability.

# Rolling Airframe Missile (RAM)

The Rolling Airframe Missile (RAM) program provides surface ships with a low-cost, lightweight, self-defense system to defeat anti-ship cruise missiles (ASCMs). RAM Block 0 uses dual mode, passive radio frequency/infrared (RF/IR) guidance. RAM Block 0 enhances ship self defense against several RF-radiating ASCMs while RAM Block I extends that defense against non-RF radiating missiles. The launching system and missiles comprise the weapon system.

Most current RAM weapon system installations are integrated with the AN/SWY-2 or -3 combat system. RAM is integrated with the Ship Self Defense System (SSDS) Mark 1 on the LSD 41/49-class of amphibious ships. AN/SWY-2 installations use RAM as the only hard-kill weapon. AN/SWY-3 installations use both RAM and NATO Sea Sparrow systems as the hard-kill weapons. RAM will be integrated with the SSDS Mark 2 on LPD 17-class and CVN 68-class ships (the NATO Sea Sparrow was also on the latter).

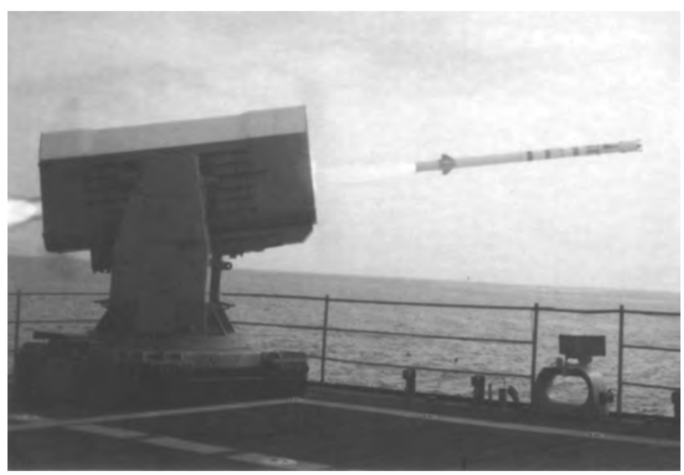
RAM was developed jointly by the United States and the Federal Republic of Germany. Block 0 Initial Operational Test & Evaluation was completed in FY90. The RAM Block 1 operational evaluation was conducted on the Self Defense Test Ship (SDTS) and on a fleet ship in 1999. In 1997, the resource sponsor requested that the Program Manager determine what RAM capability existed against helicopters, slow aircraft, and surface targets (HAS). This request stipulated that Block 1 anti-ASCM capability was to be retained, but was not accompanied by operational requirements for the additional target set. RAM HAS will be integrated with the SSDS Mark 2.

## TEST & EVALUATION ACTIVITY

This past year's activity consisted of contractor testing that included firing a RAM Block 1 missile with HAS software against a subsonic drone in June at the Naval Air Warfare Center/Weapons Division sea range to ensure that capability against this class of targets had not been degraded. The RAM Test and Evaluation Master Plan was modified to incorporate the RAM HAS Test & Evaluation (T&E), but it has not been approved within the Navy.

## TEST & EVALUATION ASSESSMENT

- RAM Block 1: RAM Block 1, as supported by an LSD 41-class combat system, is operationally effective against most current ASCMs . RAM Block 1 is operationally suitable and is lethal against most current ASCMs. Follow-On Test & Evaluation for Block 1 still needs to address missile capability against the threat category that was not tested during the operational evaluation (OPEVAL); missile capability against a supersonic, maneuvering sea-skimmer under more stressing conditions; and missile capability against ASCMs under conditions of electronic jamming of the combat system sensors, low visibility (high aerosol environment), and presence of other IR sources.



*The Rolling Airframe Missile program provides surface ships with a low-cost, lightweight, self-defense system to defeat anti-ship cruise missiles.*

For the threat category not tested in OPEVAL, the Navy's subsonic target upgrade program should deliver targets in FY05 that will be adequately representative of the threat. The Program Manager considers examining missile capability against ASCMs under conditions of electronic countermeasures against the combat system sensors to be an area beyond his control and does not wish to fund such T&E. Overall testing of RAM will be inadequate without such testing, and the fleet users of the system will not be informed about their capability to defend themselves in that environment.

- RAM HAS Mode: The program sponsor has not issued detailed performance goals for RAM HAS. From an Operational Test & Evaluation perspective, the absence of operational requirements undermines objective assessment of operational test results and hampers the Program Manager's ability to understand the impact of performance trades on mission accomplishment and operational effectiveness. The current proposal is to conduct combined Developmental Test/Operational Test (DT/OT)of Block 1A rounds (Block 1 rounds upgraded with HAS software) against ASCMs in FY03 on the SDTS to demonstrate retention of capability. DT will be conducted in FY03-04 with the same missile round configuration against a small number of representative HAS targets from an upgraded RAM launcher, operated in a standalone mode. DT/OT will be conducted from a manned ship against an aerial target drone in FY04, accompanied by a maintenance demonstration and evaluation of the Mod 3 launcher. This will be followed by DT/OT in FY05-06 from a manned ship, with RAM HAS fully integrated with SSDS Mark 2, against HAS targets.

During the June 2002 contractor regression testing to ensure retention of capability against a subsonic, low altitude ASCM surrogate, the software did not perform properly and the target presentation was not at low altitude. That test will be repeated after software correction.

RAM Block 0 and Block 1 Live Fire T&E (LFT&E) evaluated lethality against various ASCMs. RAM HAS was designated for lethality LFT&E oversight based on its new target set. There is little data on RAM warhead lethality against those targets. Testing is needed to gather information on the lethality of the weapon and to develop simulations that can be used to predict lethality/effectiveness against threats under a variety of scenarios. The LFT&E strategy for RAM HAS should include ground testing of the warhead against whole targets and/or components, flight testing, and simulation-based analyses.

# *Seawolf* SSN 21 Class Attack Submarine and AN/BSY-2 Combat System

The *Seawolf* (SSN 21) Nuclear Attack Submarine is intended to rapidly deploy to hostile ocean areas and deny their use to the enemy, clear the way for strikes by other friendly forces, and engage and destroy enemy submarines, surface forces and land targets. Secondary missions are mine and special warfare. *Seawolf* is intended to be a quiet, fast, heavily armed, and survivable submarine.

*Seawolf* began initial sea trials in July 1996. Following delivery, *Seawolf* completed acoustic trials in November 1997. *Connecticut* (SSN 22) went to sea in 1998. The third and final *Seawolf* class submarine, *Jimmy Carter* (SSN 23), is under construction with delivery scheduled in FY05. *Jimmy Carter* will be uniquely outfitted with an additional hull section lengthening the ship for special missions and Research and Development projects.

## TEST & EVALUATION ACTIVITY

In accordance with the *Seawolf* Live Fire test and Evaluation plan (LFT&E), underwater shock tests of major components, hull whipping analyses, and shock qualification testing of vital internal components have occurred since 1995.

The approved LFT&E Plan for *Seawolf* featured a full ship shock test (FSST) of the completed ship. The FSST was not accomplished initially because funding for it was used to correct design deficiencies discovered in testing. Subsequent legislative action prohibited the Navy from sending money to support the FSST.

The Navy prepared a *Seawolf* Class Vulnerability Assessment Report (VAR) in accordance with the approved LFT&E strategy. The VAR, completed in January 2001, provides an overall assessment of vulnerability to threat weapons that may be encountered in combat. Although the VAR is a highly detailed analytical assessment of ship vulnerability, the lack of an FSST to validate it will yield only a partial survivability picture of the ship class.

The Navy based its VAR on component and subsystem tests, surrogate tests, and analyses. The fact that the FSST did not occur prevents the Navy from fully addressing all the agreed upon LFT&E issues and gaining a better understanding of ship survivability characteristics, leaving the overall *Seawolf* LFT&E program incomplete.

Seawolf *Submarine Underway*

The *Seawolf* Operational Evaluation (OPEVAL) was completed in December 2001. Warm water and cold water testing was performed by *USS Seawolf*. Minefield testing was conducted by *USS Connecticut*. *Connecticut* then deployed for five weeks to the Arctic and surfaced at the North Pole in June 2001. In September 2001, *Connecticut* completed a test of the missile strike capability while performing as launch platform for a Cruise Missile Program Operational Test Launch. Commander, Operational Test Force has written its final OPEVAL report. DOT&E is in the process of completing its own evaluation of *Seawolf* operational effectiveness and suitability.

## TEST & EVALUATION ASSESSMENT

The *Seawolf* submarine is operationally effective and operationally suitable.

The *Seawolf* OPEVAL demonstrated that many capabilities of this class of submarine are superior compared to the Improved *Los Angeles* Class (688I).

The improved quietness of the *Seawolf* directly translated to superior tactical effectiveness. *Seawolf* repeatedly proved capable of covertly and accurately targeting and tracking its adversary. The management of *Seawolf's* noise transients was superior to that of the *Los Angeles* Class. The noise from weapons launches was also quieter than previous classes.

The ability of the *Seawolf's* BSY-2 Fire Control and Sonar system to satisfactorily place weapons on target was superior to that of the 688/688I class submarines, the baseline system against which it was tested. The *Seawolf* was able to "shoot first" in an overwhelming number of cases, a key test in the effectiveness of a submarine.

This was the first OPEVAL of an entire Submarine and its Weapon system. The methods used in testing for the various segments of the OPEVAL were successful in evaluating this complex weapons system. The *Seawolf* was adequately tested in regard to the threat considering the ships and sensors that were used against it during the OPEVAL.

In the Anti-Submarine Warfare role against nuclear submarines, *Seawolf* was evaluated in Clearance, Intercept, Surveillance and Forward Areas roles in cold water, warm water, and arctic environments. The warm water area was the Atlantic Fleet Weapons Training Facility in Puerto Rico, which was used to conduct littoral testing. The Strike warfare capability was evaluated in two ways. An actual Operational Test Launch of one Tomahawk missile was conducted, followed by an 8-missile spin-up to simulate a large salvo launch.

A classified version of this report discusses *Seawolf's* performance in the Arctic. The classified version also discusses two systems that were found to be unsuitable by Operational Test and Evaluation Force.

Not all operational requirements were met by the *Seawolf*. More details are contained in the classified version of this report.

Many new steps were made in this OPEVAL as compared to previous testing. An extensive use of "free play" scenarios was employed as compared to "canned" scenarios of the past. Extensive submarine recordings were obtained and taken back to laboratories ashore to see how the submarine crew functioned compared to the system's capabilities. Finally the submarine was tested in many different environments and in an "end to end" manner against realistic opposing forces.

The *Seawolf* Class VAR addresses the LFT&E issues and provides an overall assessment of vulnerability to threat weapons that may be encountered in combat. LFT&E issues addressed include the ship's vulnerability to underwater explosions, torpedoes and mines, and the ship's ability to maintain hull integrity and perform its mission after exposure to specified levels of underwater shock intensity. The VAR applies to both SSN 21 and SSN 22, but it does not apply to *Jimmy Carter* (SSN 23) because, with approximately 100 feet in extra length and 2,500 tons added displacement, it is a much different ship. The Navy is developing a VAR Supplement to the *Seawolf* Class VAR to address unique *Jimmy Carter* (SSN 23) considerations.

# Ship Self Defense System (SSDS)

The Ship Self Defense System (SSDS) is designed to expedite the detect-through-engage process on amphibious ships and aircraft carriers against anti-ship cruise missiles (ASCMs). SSDS, consisting of software and commercial off-the-shelf hardware, integrates sensor systems with engagement systems. SSDS will not improve capability of individual sensors, but enhances target tracking by integrating the inputs from several different sensors to form a composite track. Similarly, SSDS will not improve capability of individual weapons, but expedites the assignment of weapons for threat engagement and provides a "recommend engage" display for operators, or if in automatic mode, initiates weapons firing, electronic jamming, chaff or decoy deployment, or some combination of these.

The SSDS variant in development is the Mark 2 system. The original Mark 1 system was designed to provide an automated and integrated detect-to-engage capability against ASCMs. The SSDS Mark 2 system expands upon this capability by subsuming the command and decision functionality of the Advanced Combat Direction System (ACDS) Block 1. Thus, SSDS Mark 2 is responsible for command and control and combat direction encompassing the multi-warfare missions of Air, Surface, Undersea, Strike, and Command, Control, and Communications Warfare. Since SSDS Mark 2 is being installed with the Cooperative Engagement Capability (CEC), the tracking functionality of CEC is being used, thereby leveraging the sensor integration capabilities of this new system.

The SSDS Mark 2 system will be the combat direction system for all CV/CVN class aircraft carriers and LPD 17 class large deck amphibious ships. The predecessor Mark 1 system has been introduced into the Fleet in dock landing ships (LSD 41/49); full production of SSDS Mark 1 was authorized in March 1998. SSDS Mark 2 has three planned variants. Mod 0 is installed in *USS Nimitz* for one deployment. Mod 2 will be installed in all carriers, including *USS Nimitz*, beginning with *USS Reagan*. Mod 2 will be installed in all LPD 17 class ships, beginning with *USS San Antonio*. The major differences in the Mods are in the sensors and weapons for the ship classes.

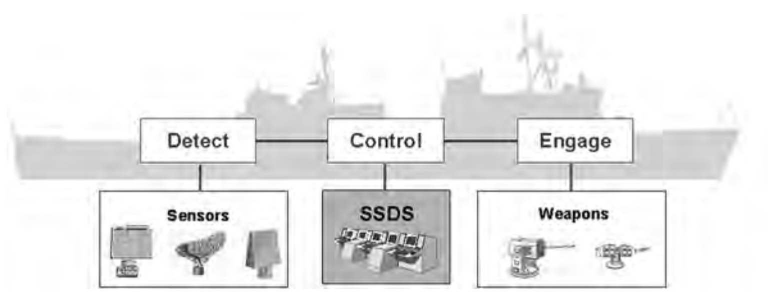
## TEST & EVALUATION ACTIVITY

Activity focused during FY02 on further definition of the overall Mark 2 Test and Evaluation (T&E) program, work on a Test and Evaluation Master Plan (TEMP) for Mark 2, and engineering and developmental testing of the Mod 0 version at the Ship Combat Systems Center, Wallops Island, Virginia, and also on board *Nimitz.*

## TEST & EVALUATION ASSESSMENT

SSDS Mark 2 Mod 0 engineering and developmental testing for *Nimitz* has been conducted without an approved TEMP. There has been no operational testing. Although it appeared that the *Nimitz* Battle Group would be included in Follow-on Test & Evaluation (FOT&E) of the CEC Block 1 and provide an opportunity to demonstrate Mark 2 Mod 0 capability, the Navy's decision to accelerate deployment left too little time to conduct the FOT&E.

Because it incorporates ACDS Block 1 functionality, SSDS Mark 2 will require assessment of performance in several warfare areas, depending on the ship class. These warfare areas include Air, Surface, Strike, Amphibious, and others. Further, the Air Warfare area T&E requires an additional phase to assess ship self defense against ASCMs. This requires Mark 2 integrating the sensor and engagement subsystems of the applicable ship class combat systems while engaging ASCMs or acceptable surrogates as targets. Since the systems on these ships are short-range air defense systems, safe and effective Operational Test & Evaluation (OT&E) requires use of a Self Defense Test Ship (SDTS) capable of




*The Ship Self Defense System is designed to expedite the detect-through-engage process on amphibious ships and aircraft carriers against anti-ship cruise missiles.*

being remotely operated during operationally realistic ship air defense scenarios. Given that the LPD 17-class ship is the first forward-fit installation using SSDS Mark 2, this OT&E of Mark 2 needs to be combined with the SDTS phase of the LPD 17 operational evaluation, projected for FY06.

Through FY02, the Navy warfare sponsors for LPD 17 and SSDS Mark 2 resisted funding realistic operational testing of the LPD 17 combat system air defense, including SSDS Mark 2, on a SDTS due to the cost of installing SSDS Mark 2 and the associated radars and Rolling Airframe Missile (RAM) on a SDTS, plus the cost of targets, RAMs, and associated test range support. Without such testing, the LPD 17 operational evaluation and SSDS Mark 2 OT&E would be inadequate. In early November 2002, progress was made in solving this impasse, with the Program Executive Office for Integrated Warfare Systems (PEO(IWS)) agreeing that the LPD 17 combat system needed to be tested on the SDTS against threat ASCM-representative targets. Details of how representative the combat system on the SDTS must be are still being worked out. DOT&E requires the AN/SPS-48E radar on the SDTS since it will be one of the two primary radars that will be on LPD 17, but the PEO is recommending that it not be included on the SDTS.

# SSGN-26 *Ohio* Class Conversion

As four *Ohio* Class nuclear ballistic missile submarines (SSBNs) became eligible for retirement from their strategic role, the Navy decided to reconfigure them as tactical platforms. The SSGN program entails the refueling and conversion of the four SSBNs to dedicated cruise missile launch submarines (SSGNs) to support the Land Attack/Strike mission. The new Multiple All-up-round Canister (MAC) launchers, each containing seven Tomahawk land-attack missiles (TLAMs), are designed to fit within the existing Submarine Launched Ballistic Missile (SLBM) vertical launch tubes. Each SSGN could possibly accommodate up to 22 MACs, for a total of 154 TLAMs.

The SSGN will also support Special Operations Forces (SOF) missions. Two of the large vertical launch tubes will be converted to SOF lockout chambers, and the ship will feature dedicated accommodations for SOF personnel and their equipment. The SSGN will be capable of hosting the Advanced SEAL Delivery System (ASDS) and Dry Deck Shelter (DDS) on its upper deck.

In the future, the extensive payload capacity of the SSGN may be used to support other offboard systems, including large unmanned and autonomous underwater vehicles, as well as alternate weapons systems.

## TEST & EVALUATION ACTIVITIES

The SSGN Operational Requirements Document (ORD) and Test and Evaluation Master Plan (TEMP) have been completed. DOT&E participated in the review and drafting of both documents.

DOT&E and SSGN Program Office (PMS 398) held frequent meetings to develop meaningful test and evaluation plans, beginning with the formation of the Test and Evaluation Working Integrated Product Team in September 2001 until the issuance of the Live Fire Test and Evaluation (LFT&E) Management Plan. This plan includes shock qualification tests and analysis of components, a modified Total Ship Survivability Trial, and a series of three vulnerability assessments.

In May 2002, DOT&E approved a waiver from full-up, system-level live fire testing of the SSGN in accordance with Title 10, Section 2366.

## TEST & EVALUATION ASSESSMENT

DOT&E's primary concern is that the thorough and realistic Operational Test and Evaluation of the MAC be conducted. While the Navy has extensive experience with vertical launch of TLAMs from Improved *Los Angeles* Class SSNs and submarine launched ballistic missiles (SLBMs) from SSBNs, the MAC represents an entirely new launch system. Specifically, the MAC includes up to seven separate all-up round (AUR) TLAM canisters placed within a single vertical tube with a single hatch. The launch concept includes risks, such as the effects of launch debris on the ship and associated systems, launch damage to adjacent AURs, and the effects of the SSGN's hydrodynamic flow field on the missiles. DOT&E supports the program's Demonstration and Validation plan as an important technical test and risk mitigation effort. Based on DOT&E desires, the current Strike operational test plans include the launch of five TLAMs from a single MAC, spaced as closely as possible over several days. While the firing rate will be too slow to accurately replicate a true salvo, DOT&E believes that the cumulative stress on the system will be representative. In addition, a full set of 32 AURs will be loaded and spun up as part of the at-sea testing of the weapons control system.

*Artist Conception of SSGN*

For both the Strike and SOF mission operational tests, the conduct of realistic operations against a capable opposing force is essential. The SSGN program is predicated upon the existing stealth of the SSBN platform. However, DOT&E emphasizes that the SSGN missions will involve new concepts of operations and take it into new environments, including the littorals. The SSGN must demonstrate the ability to execute its missions effectively while maintaining survivability. DOT&E is particularly interested in the ability of the sonar and combat systems to support the situational awareness necessary to accomplish these new missions.

Original *Ohio* Class vulnerability requirements must be reevaluated in light of current events and a radically changed set of missions as set forth in the ORD, which recently reinstated mines as a specific threat. Because of the necessarily rapid nature of progress on this high-visibility, transformational weapons system, all parties with LFT&E responsibility must necessarily stay consistently engaged, to ensure maximum benefits in the areas of ship vulnerability and crew safety and escape are achieved.

# SSN 774 *Virginia* Class

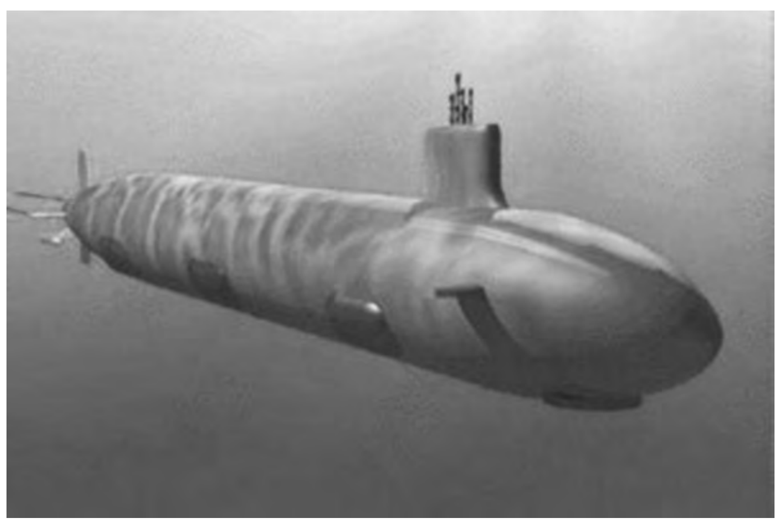
*Virginia* will replace the aging fleet of *Los Angeles* (SSN 688) Class submarines. It is intended to be a submarine comparable in most respects to its immediate predecessor, the *Seawolf*, but in a more affordable configuration. The missions of *Virginia* include Covert Strike Warfare, Anti-Submarine Warfare, Covert Intelligence Collection/ Surveillance, Covert Indication and Warning and Electronic Warfare, Anti-Surface Ship Warfare, Special Warfare, Covert Mine Warfare, and Battle Group Support.

*Virginia* is required to be capable of targeting, controlling and launching Mk 48 Advanced Capability Torpedoes, mines, and Tomahawk missiles. Its sonar capability is expected to be similar to *Seawolf's*, and its electronic support suite and combat control system represent improvements over legacy systems. The external communications system is required to be an improvement over *Seawolf* and legacy systems, providing full, high data rate interoperability with U.S. and allied forces. These characteristics support intelligence and strike capabilities.

The Milestone I Defense Acquisition Board (DAB) approved *Virginia* to enter Phase I in August 1994. To support Milestone II, an Early Operational Assessment was conducted, concluding that *Virginia* was potentially operationally effective. The Milestone II DAB approved entering Phase II in June 1995.

DOT&E recommended, and the Secretary of Defense approved, a waiver from full-up, system-level live fire testing of *Virginia* in accordance with Title 10, Section 2366. DOT&E approved the alternative Live Fire Test and Evaluation (LFT&E) plan submitted in lieu of full-up, system-level testing in June 1995. This plan includes shock qualification tests and analysis of components, surrogate underwater shock tests, a Total Ship Survivability Trial (TSST), a Full Ship Shock Trial, as well as a series of vulnerability assessments.

The *Virginia* Class (SSN 774) submarine combat control system is being integrated outside of the ship's hull. For instance, sonar displays and processors, ship control, navigation, and combat control stations, radio room and electronic support measures (ESM) equipment, and the horizontal large scale display are being electronically integrated on a rafted system that will be inserted into the *Virginia* hull. This construction technique has afforded the Navy Commander of Operational Test and Evaluation Forces (COMOPTEVFOR) a unique opportunity to conduct early operational testing (designated Operational Test-IIB) of the command and control system module (CCSM) at the CCSM Off-hull Assembly and Test Site (COATS) at the Electric Boat Corporation in Groton, Connecticut. Upon completion of testing, the CCSM will be placed on the building way, hull sections will be welded around it, and the assembly will be integrated into the rest of the hull.



*Artist Conception of* Virginia *Submarine*

## TEST & EVALUATION ACTIVITY

For Operational Test-IIB, the combat system module was stimulated on the factory floor by an on-board trainer and simulation/stimulation system that provided the required interfaces. Most of the data were synthetic representations of acoustic, Radio Frequency, and visual scenarios of combat situations. Navy officer and enlisted operators were trained in the system operations and were free to operate the "ship" (choose ship courses, speeds, and depths, and simulate weapon firings) in a manner that they chose to defeat the enemy.

The Navy continued its vulnerability assessment work for LFT&E. DOT&E reviewed and commented on the interim vulnerability assessment report. DOT&E continued to participate in *Virginia* LFT&E Senior Working Group meetings and TSST Planning Group meetings to review Live Fire data and provided advice on Navy plans for other planned LFT&E activities. DOT&E witnessed component shock qualification tests, and reviewed with the Navy the results of completed Live Fire component and surrogate tests.

### TEST & EVALUATION ASSESSMENT

The COATS test (Operational Test-IIB) included a variety of warfare scenarios, including Anti-Submarine Warfare, Anti-Surface Warfare, strike, and surveillance. A number of different test sites, acoustic environments, and weather conditions were simulated. There was generally good coordination in the simulation of the radar, visual, and ESM signatures associated with the targets of interest.

Based on Operational Test-IIB testing, early assessments of the operability and interoperability of sonar, fire control, navigation, and photonics mast subsystems were completed by COMOPTEVFOR. Overall, the test was well conceived and professionally executed, and provided timely results that should be utilized to improve the system.

COATS testing focused on the electronics systems, but a group of experienced submariners in the CCSM provided for an informal assessment of the ship's spaces and fittings. The universal complaint was about the cramped layout. The control room and associated spaces were constructed as a freestanding module, instead of built into the hull itself and some internal volume is lost to the module framework, reducing overall usable volume. The cramping is especially obvious in the berthing area on the upper deck of the CCSM. There, the passageways have been reduced to a mere 18 inches, which may constitute a safety hazard in the event of a casualty.

The Navy has evaluated six damage scenarios for the detail design vulnerability assessment report using linear extrapolation to 10 percent above the design level. The assessment at this level of shock intensity resulted in very limited damage and few lessons learned. The Navy is planning to use a "Meaningful Drill Concept" derived from Fleet tactical readiness evaluation drills in developing the post-delivery TSST damage scenarios that will be linked with the six shot lines.

As with *Seawolf*, there is a deficiency in the LFT&E plan for *Virginia* regarding the availability of survivability data for reactor plant systems. The Director, Naval Nuclear Propulsion Systems and DOT&E continued work toward an agreement to provide sufficient information for DOT&E to perform its statutory requirement to assess the survivability of the entire ship.

Additional LFT&E concerns include: the approach for Verification, Validation, and Accreditation of LFT&E computer models has not been described; and *Virginia*'s ability to surface after exposure to an underwater burst at the hull integrity shock factor level may not be assessed.

# Standoff Land-Attack Missile - Expanded Response (SLAM-ER)

The Standoff Land-Attack Missile - Expanded Response (SLAM-ER) is a precision tactical weapon deployed that is intended to provide Joint Force and Carrier Battle Group Commanders with a standoff precision strike capability launched from carrier battle group aircraft. An advanced derivative of its predecessor (SLAM), the SLAM-ER is intended to have: longer range, reduced susceptibility to countermeasures, increased probability of kill against hardened targets, and improved guidance with an integrated Global Positioning System and Inertial Navigation System. Improved user interfaces for mission planning and an automated target acquisition (ATA) capability to aid the pilot in finding and killing targets are being retrofitted to both SLAM and SLAM-ER.

SLAM-ER seeks to provide incremental improvements in range and penetrating lethality. Terminal guidance to the target relies heavily on a man-in-the-loop (MITL) mode. ATA is designed to provide a pilot with an additional target cue in cluttered scenes, marginal weather, and countermeasures environments. This is accomplished by employing scene-matching technology (hardware and software modifications). The ATA could be used in a stand alone mode when MITL is not feasible or desirable. SLAM-ER uses a newly developed titanium-cased warhead to achieve greater hard target penetration and lethality.

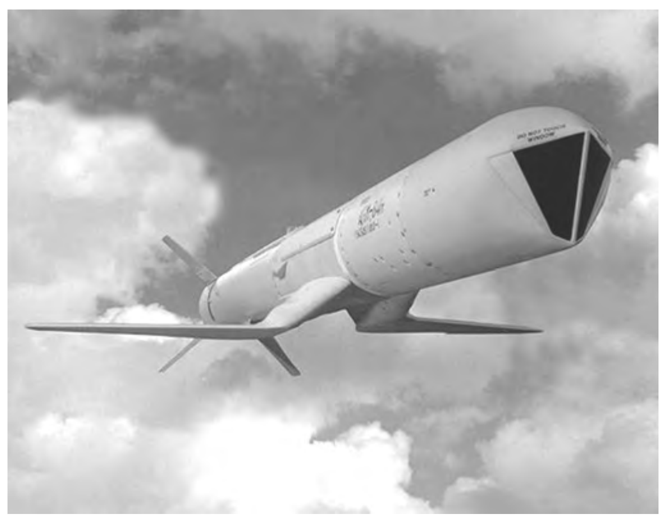
SLAM-ER entered Engineering and Manufacturing Development after a Milestone IV/II decision in FY95. The Navy decided to procure the FY96 buy of SLAM in the SLAM-ER configuration avoiding future retrofit costs. The Low-Rate Initial Production (LRIP) I decision was made in April 1997, with LRIP II decision in April 1998. Operational Evaluation (OPEVAL) was conducted from August 1998 to May 1999. As detailed in the 1999 Annual Report to Congress, DOT&E assessed SLAM-ER to be not operationally effective and not operationally suitable as tested in OPEVAL. An LRIP III decision was made in August 1999. These three production decisions totaled over 100 missiles. The program corrected deficiencies and a Verification of Correction of Deficiencies Phase examined all corrected deficiencies to ensure the fleet had an operationally effective and suitable system upon introduction. Milestone III and the full-rate production decisions were approved in May 2000.

### TEST & EVALUATION ACTIVITY

Follow-on Test and Evaluation (Operational Test-IIIA) began in September 2001 to evaluate the ATA capability. The test plan incorporated one developmental test flight, three developmental/ operational test flights, and one operational test flight. Initial testing included several captive carry flights of the missile with positive assessments by the operational test pilot. Initial developmental tests suffered from missile system failures not related to ATA: first a hang fire and then failure of the missile wings to deploy after launch. These failures were followed by five effective tests.

### TEST & EVALUATION ASSESSMENT

DOT&E approved the test plan and monitored the final operational test flight and found the missile with ATA to be operationally effective and operationally suitable. The missile flew an extended attack profile



*While Standoff Land-Attack Missile - Expanded Response with automated target acquisition does not yet provide a reliable "launch and leave" capability, it does provide cueing that can increase a pilot's confidence that the missile will hit the target.*

against a simulated aircraft hangar. ATA provided the pilot with cueing to the target. The pilot used this cueing to guide the missile to the desired impact point on the target.

While SLAM-ER with ATA does not yet provide a reliable "launch and leave" capability, it does provide cueing that can increase a pilot's confidence that the missile will hit the target.

# Strategic Sealift Program (SSP)

The Strategic Sealift Program (SSP) acquired nineteen Large, Medium Speed (LMSR), Roll-on/Roll-off (RO/RO) vessels in the following four phases: the National Steel Shipbuilding Company (NASSCO) conversions, Avondale Industries new construction, Newport News Shipyard conversion ships, and NASSCO new-construction. These ships are designed to transport or provide afloat pre-positioned combat equipment for a projected military force. The notional cargo per ship has equipment for one-third of a heavy Army brigade task force and its supporting supplies. The LMSRs are 950 feet long, 106 feet wide, and have a displacement of 55,000 long tons. They are diesel-powered and are capable of operating at 24 knots. The sealift ships are capable of self-sustained RO/RO and Lift-on/ Lift-off (LO/LO) operations at a pier and also at anchorage. In addition, they must provide an In-The-Stream (ITS) capability using their stern and side port ramps for delivery of RO/RO cargo to lighterage via a RO/RO Discharge Facility. The LMSR ships are not armed and do not have a combat system. They do have a C3I suite sufficient to perform their intended mission in conjunction with other naval vessels.

As authorized in the acquisition strategy, developmental testing has been limited, focusing on production assurance testing by government agents in conjunction with the builders. Navy, U.S. Coast Guard, and American Bureau of Shipping representatives witnessed systems and integration testing.

The Initial Operational Test and Evaluation (IOT&E) (Operational Test-IIA) for the NASSCO-conversion LMSR ships was conducted during September 1996, aboard United States Naval Ship (USNS) SHUGHART in Savannah, Georgia, at sea, and at anchorage in Hampton Roads, Virginia. The test was conducted in conjunction with a planned Army sealift deployment exercise, which moved a representative load of Army equipment (over 1,000 pieces including tanks, trucks and various helicopters) for the 3rd Infantry Division. Limited ITS operations were also conducted.

## TEST & EVALUATION ACTIVITY

The IOT&E (Operational Test- IIB) for the Avondale Industries new construction LMSRs, originally scheduled for July 1998, was delayed by several production issues and by the difficulties of providing sufficient Army unit equipment for the test. After extensive coordination with the Commander, U.S. Central Command (CENTCOM), USNS SEAY was selected as the test platform to conduct the Operational Test- IIB while supporting CENTCOM's BRIGHT STAR 01/02 Exercise.

Due to leakage of hydraulic fluid from one of the ship's controllable reversible propellers and the events of September 11, 2001, the Operational Test-IIB was postponed until October 2001. The test was halted in December 2001 because of a failure of auxiliary propulsion equipment, which prevented the ship from attaining the required 24-knot transit speed; the test will be completed in early FY03. Additional testing of ITS discharge of cargo was conducted in FY02.

*Strategic Sealift Ship preparing to embark tracked and wheeled vehicles through its extended stern cargo ramp.*

## TEST & EVALUATION ASSESSMENT

The early phase IOT&E (Operational Test-IIA) revealed the NASSCO conversion LMSR to be operationally effective and potentially operationally suitable. No significant deficiencies were observed from the operational testing, which focused on ship capabilities. Only limited operations in low sea-states were conducted during this test. Deficiencies were identified in compatibility, interoperability, and training. Considerable data has been collected in the Operational Test Agencies' assessments of the Newport News Shipyard conversion ships and the NASSCO new-construction LMSR, but the reports of those assessments have yet to be delivered.

ITS RO/RO operations (doctrine, training, expected offload flow rate, and stern ramp operations) and LO/LO capabilities, including control of the lift crane pendulation, have not been comprehensively tested because the sea states encountered during testing have typically not been stressing.

It is highly probable that LMSR ship mission performance will be hindered by existing deficiencies in the Strategic Sealift System. Shortfalls in the sea state 3 lighterage system (capability, inventory, interoperability and doctrine) and RO/RO discharge facility equipment may adversely affect our ability to project power in a timely manner in situations where adequate port facilities are not available. World-wide, there are a total of only 113 ports identified as having sufficient depth of water and length of berth to allow pier side offload of an LMSR and only 31 of these are in locations other than the Americas, Europe, Australia, and Japan. ITS offload of small vehicles has been satisfactorily demonstrated through sea state 2, but a tactically representative equipment load has not been demonstrated under operationally stressing conditions. Additional testing of ITS offload capability in sea state 3 must be performed when sea state 3-capable lighterage connectivity with RO/RO Discharge Facility equipment is developed.

# Tactical Tomahawk Missile

Tomahawk is a long-range cruise missile designed to be launched from submarines and surface ships against land targets. Three primary variants are currently operational: Tomahawk Land Attack Nuclear (TLAM-N) (not deployed); Tomahawk Land Attack Missile-conventional (TLAM-C); and Tomahawk Land Attack Missile-conventional submunition (TLAM-D). Engagement planning, missile initialization, and launch control functions are performed aboard the launch platform by a Combat Control System (submarines) or Tomahawk Weapon Control System (TWCS) (surface ships). Targeting, mission planning, and distribution of Tomahawk tactical data are supported by the Tomahawk Command and Control System (TC2S).

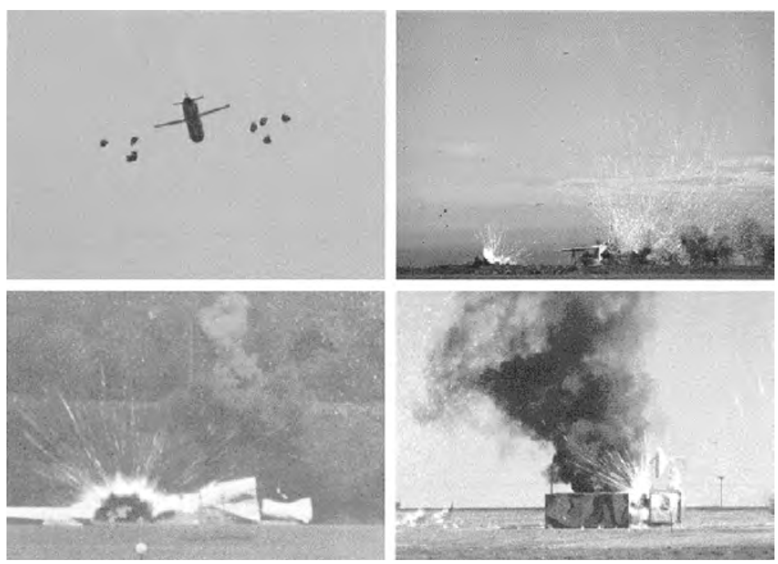
The Tactical Tomahawk program began in FY98 as a restructure of the earlier (FY94-98) Tomahawk Baseline Improvement Program. Tactical Tomahawk represents a considerable leap forward in technology compared with Block III Tomahawk. Designated $C^3$ nodes will be able to communicate with the missile in-flight and direct it to pre-planned alternate targets or change its mission plan to attack new targets. While in flight, the missile will be able to transmit its health, status, and limited imagery to the $C^3$ nodes.

The Tactical Tomahawk retains the same WDU-36/B warhead as the Block III Tomahawk. Differences between Tomahawk Block III and the Tactical Tomahawk Baseline IV including significant structural modifications to the missile airframe and engine as well as modified terminal engagement parameters that could significantly affect system lethality. Therefore, live fire testing is required. The Tactical Tomahawk Test and Evaluation Master Plan (TEMP) was approved in FY02.

The fielded Baseline III Tomahawk Weapon System continues to receive incremental upgrades. The principal improvements are fire-control system (Advanced Tomahawk Weapon Control System (ATWCS)) and mission planning system (TC2S) software. These upgrades are undergoing Follow-on Test and Evaluation before release to the Fleet.

## TEST & EVALUATION ACTIVITIES

There were two completed test phases in FY02. TC2S software release TMPC 3.2 was tested during Operational Test-IIIF. Software version TMPC 3.2 introduced the capability to plan operational missions using a steep terminal dive maneuver. This release also added software tools to aid the user in designing and planning missions. TMPC 3.2 is an evolutionary improvement on predecessor versions.



*Designated $C^3$ nodes will be able to communicate with the Tactical Tomahawk in-flight and direct it to pre-planned alternate targets or change its mission plan to attack new targets.*

ATWCS software release 1.7.1 was evaluated during Operation Test-IIIL. This software version incorporated a new operating system, a new inter-network coordination and management capabilities, interfaces with the Global Command and Control System – Maritime (GCCS-M) and the Battle Force Tactical Trainer (BFTT). There were also new features to assist operators in planning launch and over-water flight operations more efficiently.

Test event Operational Test-IIIG, evaluating TC2S software release 3.3, was begun in FY02 but has not yet been completed. This software introduces client-server architecture to the Precision Targeting Workstation (PTW) and re-hosts the Mission Distribution System to personal computers (PC-MDS). The PTW changes support improved image display and manipulation, access to integrated mission databases, access to GCCS-M, and improved accuracy in measuring geographical coordinates. The addition of PC-MDS enables more flexible command and control, and in particular, allows launch platforms to distribute mission plans to other launch platforms and to command-and-control nodes.

Test event Operational Test-IIA, an Operational Assessment (OA) of Tactical Tomahawk, was begun in FY02 but has not yet been completed. Key test events include a Functional Ground Test (FGT), completed on May 17, 2002. The FGT exercised most facets of missile operation while the missile was confined to a test stand. The OA will also use data derived from the first two missile flight tests (DT-0 and DT-1). Both flights are launched from fixed sites with the prime contractor assuming primary responsibility for test conduct. DT-0 was completed on August 23, 2002. DT-1 was completed on November 10, 2002. The OA will also utilize data collected during developmental testing of the TTWCS and TC2S.

No testing supporting Live Fire Test & Evaluation (LFT&E) was conducted during FY02.

### TEST & EVALUATION ASSESSMENT

The testing conducted during phase Operational Test-IIIF resulted in findings that TC2S software version TMPC 3.2 is operationally effective and operationally suitable. Testing was extensive, with 19 operational missions and three flight test missions planned and validated using accredited simulations. One of the flight test missions was exercised in Operational Test Launch 262, which successfully demonstrated the steep dive capability. The TMPC 3.3 software did not meet certain mission-planning timeline requirements, but the user community found the software acceptable despite this shortcoming.

There is a discontinuity between the Operational Requirements Document (ORD) requirements and the capabilities of operational environment. This discrepancy has little-to-no operational impact. Revision of the ORD would remove the apparent discrepancy. DOT&E has requested a revision or a formal clarification of the ORD from the Navy.

The Operational Test-IIIL test resulted in the ATWCS software version 1.7.1 being declared operationally effective and operationally suitable. Only minor discrepancies were observed and can be avoided with specific procedures and training. Corrections are scheduled for incorporation in upcoming software releases.

Tactical Tomahawk began testing in FY02 with the FGT. The FGT event proved to be extremely beneficial as it uncovered a number of anomalies that would otherwise have been discovered only in flight tests. In the first FGT attempt, the missile's wings and fins did not deploy and the cruise engine shut down almost immediately after start. In the second attempt, a timing issue unique to the test stand caused a Built-In Test (BIT) failure in the missile guidance set. This BIT failure prevented the booster from firing. In the third attempt, these problems were overcome and a useful end-to-end test event was conducted. There were, however, anomalies that required resolution before the program could proceed to flight test. Specifically, the Global Positioning System receiver failed to acquire satellites and the missile failed to log on to Tomahawk Strike Network (TSN). The TSN is the satellite communication network used by the firing platform and command and control nodes to communicate with Tactical Tomahawk all-up-rounds. After correction of discrepancies and thorough internal review, a readiness review panel determined that the missile was ready for flight-testing. Ground tests such as the FGT prove invaluable at discovering and correcting problems prior to actual flight-testing. DOT&E strongly encourages programs to conduct of this type of testing.

The test configuration proposed by the Program Executive Officer (PEO) for the Initial Operational Test and Evaluation, the test phase that supports the initial operational capability and Beyond Low-Rate Initial Production decisions, is inadequate. The current plan does not offer a realistic level of operationally representative stress for the TSN. The PEO has proposed limited live communications with the TSN (one flight all-up-round plus three hardware-in-the loop all-up-round simulators), to be supplemented with more extensive scenario work in a laboratory, where the communications paths would be simulated and the all-up-rounds would be represented by all-software simulations. The laboratory does not adequately replicate the operational environments aboard the launch platforms and other participating C2 nodes (battle group staff and higher commands). Options for satisfying these concerns are currently under discussion.

The live fire testing outlined in the approved Tactical Tomahawk TEMP is sufficient to reveal any significant changes in system lethality from that predicted for the Block III Tomahawk missile. The focus of the Tactical Tomahawk LFT&E is on the potential effects on lethality of different warhead-airframe-target interactions due to changes between Tactical Tomahawk and Block III missile airframes and different terminal engagement envelopes in the diving attack mode. The programmed detonation live warhead flight test will not contribute to this evaluation objective. Since the dive attack mode is the more important of the two terminal attack modes, this test should be conducted first, allowing for the second live warhead flight test to be flown in this mode if necessary.

# Unmanned Combat Aerial Vehicle - Navy

The Unmanned Combat Aerial Vehicle - Navy (UCAV-N) is an aircraft carrier-based, signature-controlled aircraft with an airborne endurance goal of 12 hours. It is intended to perform three missions: penetrating surveillance/reconnaissance, strike, and suppression of enemy air defense.

The Defense Advanced Research Projects Agency (DARPA) and the Office of Naval Research (ONR) lead the UCAV-N Advanced Technology Program that has been active since February 2000. The goal of the program is to demonstrate that a carrier-based, survivable, multi-mission platform is technically feasible and to develop technology capable of transitioning to the Navy's UCAV-N acquisition program.

Two contractor teams have been funded to participate in the program: Boeing and Northrop Grumman Corporation (NGC). The science and technology (S&T) program has two phases. Phase I ended in March 2002. Both contractors developed an Operational System Concept (OSC) and entered Phase IIA to further refine their OSCs. Presently, there is sufficient funding for only one contractor to enter Phase IIB where a system will demonstrate carrier landings/takeoffs from a shore based test facility. The Phase IIB system is intended to be a technology demonstrator, not an operational prototype suitable for direct entry into system development and demonstration.

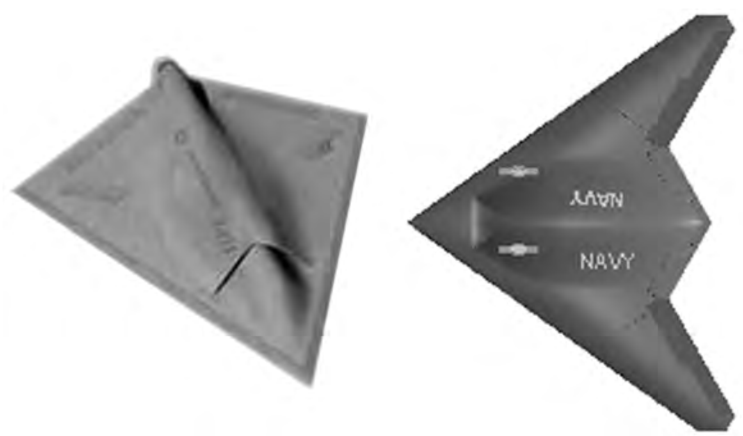
Currently, the Navy intends to stand up an acquisition program and obtain a Milestone A decision in FY04, leading to an initial operational capability in 2015. Full and open competition is anticipated for the System Design Study (Concept Exploration) phase with sufficient funding requested for participation of three contractor teams. No additional funding has been requested to "catch-up" competitors other than Boeing and NGC in the existing DARPA/ONR Advanced Technology Program.

## TEST & EVALUATION ACTIVITY

Presently no UCAV-N vehicle exists. NGC produced a UCAV-N related "flying demonstrator" – Pegasus X-47A – that conducted taxi tests in September 2002 with plans for a high speed taxi tests in December 2002 and a possible flight in 2003. NGC provided 90 percent of the funding necessary to produce the Pegasus X-47A with the Navy or DARPA providing the remaining 10 percent.

## TEST & EVALUATION ASSESSMENT

Funding and joint coordination were the primary constraints to UCAV-N development during CY02. The Navy has taken steps to significantly increase funds in FY06 in order to meet requirements for Milestone B in FY07. DOT&E concurs with the assessment by Navy acquisition authorities that additional S&T funding is required to ensure that UCAV-N has a robust demonstration program that sustains competition in preparation for the acquisition program.




*Funding and joint coordination were the primary constraints to Unmanned Combat Aerial Vehicle-Navy development during CY02.*

# USMC H-1 Upgrades

This program combines upgrades of two USMC H-1 aircraft: the AH-1W Cobra attack helicopter and the UH-1N light utility helicopter. The common elements of the two will be identical twin engines, drive trains, a new four-bladed rotor, tail sections, and integrated digital cockpits. In addition, the AH-1 attack helicopter will gain an upgraded targeting system, and the UH-1 will have an upgraded night navigation system. The upgrade will extend the lives of the two H-1 models well into the 21st century.

The upgrade of the AH-1W is referred to as the AH-1Z, and the upgrade of the UH-1N is referred to as the UH-1Y. Collectively, the AH-1Z/UH-1Y effort constitutes the USMC H-1 Upgrades Program.

## TEST & EVALUATION ACTIVITY

Test planning was the major Test and Evaluation (T&E) activity this year. The approved Test and Evaluation Master Plan calls for the T&E program to be conducted in two phases: integrated contractor/government developmental testing called Integrated Test (IT) and Operational Testing. Each aircraft model (AH-1Z and UH-1Y) will participate in Operational Test and Evaluation (OT&E) and Live Fire Test and Evaluation (LFT&E).

To provide feedback early in development, the operational testers have formed a team to monitor IT and to provide Marine maintainers to assist with aircraft maintenance and validate maintenance documents and procedures. Concurrent with IT, the operational testers will conduct two operational assessments that will provide data to support two Low-Rate Initial Production decisions. OT&E for both aircraft will be conducted prior to the full-rate production decision in FY06.

Live Fire testing continued in accordance with the approved LFT&E strategy. During this past year, three component ballistic qualification tests series were completed for the tail rotor blades, main rotor cuff, and main rotor blade. Following component testing, Live Fire Testing will progress to system-level of the UH-1Y and full-up, system-level Live Fire Testing of the AH-1Z. These tests are intended to show platform survivability and performance of vulnerability reduction features that can only be adequately demonstrated with higher-fidelity targets.

## TEST & EVALUATION ASSESSMENT

An Integrated Test Team consisting of government and contractor flight test engineers and pilots is conducting the IT program. The contractor demonstrates safety of flight of the Engineering and Manufacturing Development aircraft prior to the participation of government personnel in flight testing. Funding constraints continue to threaten the overall scope of testing. Recent program upheaval caused by increased costs and poor performance by the avionics integration subcontractor triggered an ongoing review of the program baseline, resulting in a total program restructure this year. The program Test Integration Working Group (TIWG), in which DOT&E participates, is actively seeking to develop an integrated T&E program that should resolve all critical technical and operational issues before production.


*The plan to use mature development model aircraft for the dedicated operational evaluation in FY04 came into question this year. After considerable discussion and investigation, DOT&E concurred with the Program Manager's position that the four test aircraft were production-representative.*

The plan to use mature development model aircraft for the dedicated operational evaluation in FY04 came into question this year. After considerable discussion and investigation, DOT&E concurred with the Program Manager's position that the four test aircraft were production-representative.

An LFT&E Integrated Product Team (IPT), which includes representatives from DOT&E, the program management activity, the Naval Air Systems Command, and the prime contractor, has been formally established under the TIWG. This group has implemented changes in the component test procedure to ensure that an adequate get-home capability is demonstrated following hits to critical components. The IPT is identifying opportunities for a battle damage repair team to participate in the component-level tests as well as the full-up and full-up, system-level live fire testing.

A total of 12 of the 18 component-level ballistic qualification test series have been completed. So far, these tests have demonstrated that the components of the UH-1Y and AH-1Z will retain the same degree of damage tolerance found in their predecessors. The test results have been used to improve survivability. For instance, the fire protection for the dry bays adjacent to the fuel tanks has been changed to prevent fires encountered during testing.

# V-22 Osprey

The V-22 Osprey is a tilt-rotor vertical/short takeoff and landing (VSTOL) multi-mission aircraft developed to fill multi-Service combat operational requirements. The MV-22 will replace the current Marine Corps assault helicopters in the medium lift category (CH-46E and CH-53D). The Air Force requires the CV-22 provide a long-range VTOL insertion and extraction capability and to supplement the Special Operations Forces MC-130 aircraft. The tilt-rotor design combines the vertical flight capabilities of a helicopter with the speed and range of a turboprop aircraft, permits aerial refueling, and allows for worldwide self-deployment. The current design also affords a greater degree of survivability than existing medium lift helicopters.

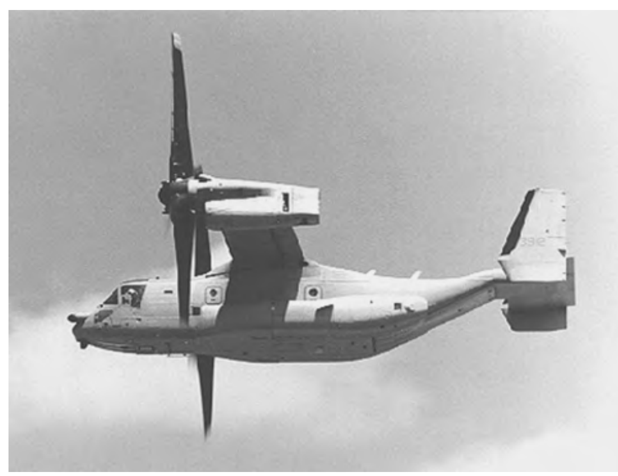
## TEST & EVALUATION ACTIVITY

DOT&E completed an independent evaluation of test adequacy, operational effectiveness, suitability, and survivability and submitted the required Beyond Low-Rate Initial Production (BLRIP) and Live Fire Test and Evaluation (LFT&E) reports to the Secretary of Defense and congressional defense committees in time to support the Milestone III decision planned by the Navy in November 2000. Based on the findings in these reports, the Navy delayed the Milestone III decision. The Milestone III decision was delayed indefinitely after a V-22 mishap in December 2000. All V-22 flying was halted following the December 2000 mishap and resumed in May 2002.

During the non-flying period the program conducted complete design reviews of all critical V-22 systems and designed an extensive developmental and operational test program to lead to the Fleet's return to flight. DOT&E participated in these reviews.

The first MV-22 returned to flight on May 18, 2002. Flight progress was deliberate at first, with flights interspersed with a rigorous schedule of inspections for mechanical defects. In August, the CV-22 returned to flight at Edwards Air Force Base, following a similar pattern of flights and inspections. As of December 1, 2002, three aircraft have returned to flight, amassing a total of more than 100 flight-test hours.

The approach to return the V-22 to operational flight is event-based, with high rate of descent (HROD) flight-testing the first order of business after a thorough ground test of the flight control software in laboratories and simulators and flight validation. As soon as the first aircraft was modified with system safety changes, developmental flight-testing resumed. An Operational Assessment will be done in conjunction with that Developmental Test and Evaluation. After confirmation of the safe flight envelope in the HROD tests, the Navy plans to issue a limited flight clearance to operational V-22 units which will allow training flights to prepare for a second phase of operational evaluation (OPEVAL) to address the issues raised in the BLRIP Report (testing not conducted, waived items, and correction of deficiencies). DOT&E plans to issue a second BLRIP and LFT&E Report containing an assessment of test results and the design changes.



*Results from Operational Test-IIE indicate that the V-22 will provide major range, speed, and payload improvements to meet Marine Corps and Special Operations Forces requirements. Overall degree of mission accomplishment by a sea-based Marine Expeditionary Unit equipped with MV-22 aircraft will be evaluated in OPEVAL Phase Two, scheduled to begin in late 2004.*

The design changes made to the aircraft since November 2000 were reviewed to determine if they affect aircraft survivability. A trade study evaluated various designs to address fires in the mid-wing nacelles, the main landing gear bay, and underfloor areas. Over 20 fire protection configurations and design alternatives were considered to extend onboard fire protection to these areas.

**TEST & EVALUATION ASSESSMENT**

In the November 2000 BLRIP Report, DOT&E concluded that testing had been adequate to determine the MV-22's operational effectiveness, operational suitability, and survivability. However, additional testing was needed to verify correction of deficiencies, the effectiveness and suitability of waived items, and to investigate the phenomenon of vortex ring state. The MV-22 was assessed by DOT&E as operationally effective, but not operationally suitable. Results from Operational Test-IIE (OPEVAL) indicate that the V-22 will provide major range, speed, and payload improvements to meet Marine Corps and Special Operations Forces requirements. The V-22 offers significant maneuverability and handling advantages compared to conventional helicopters (e.g., rapid deceleration upon arrival at a landing zone and rapid acceleration during departure). When tactics are fully developed, these capabilities should provide substantive advantages in mission accomplishment and survivability. Overall degree of mission accomplishment by a sea-based Marine Expeditionary Unit equipped with MV-22 aircraft will be evaluated in OPEVAL Phase Two, scheduled to begin in late 2004.

The effectiveness of the V-22's vulnerability reduction features was demonstrated during the LFT&E program. A continuous process of design refinements has been an integral part of the overall system engineering effort since the start of live fire testing, and several design changes have been made based on the test results, such as revising the sponson fuel tank structure. This process continues, with particular emphasis on addressing the concerns outlined in the November 2000 LFT&E report.

Our survivability assessment of the design changes and efforts to address the results of the original LFT&E program are:

- Fire protection can be effectively provided to the mid-wing nacelles, main landing gear dry bays, and underfloor areas.
- The design changes to the hydraulic system made since November 2000 have a negligible impact on the aircraft's vulnerability.
- The aircraft battle damage repair program continues to experience delays due to insufficient funding.
- The addition of internal mission auxiliary fuel tanks and countermeasure dispensers, and improvements to the engine nacelles, require further study.

Click on a title to go to that page.

## Air Force Programs

# Air Force Programs

# Advanced Extremely High Frequency (AEHF) Satellite Communications System

The Advanced Extremely High Frequency (AEHF) satellite communications system is designed to provide secure, survivable communications to the U.S. warfighters during all levels of conflict. It will follow Milstar as the protected backbone of DoD's Military Satellite Communications architecture.

In lieu of an additional Milstar satellite to replace Flight 3 (which placed the satellite in a nonoperational orbit), the first flight of the AEHF satellite program, named Pathfinder, will be programmed to operate initially as a Milstar II satellite. The second flight will then be launched as a fully capable AEHF satellite. After it is operational, Pathfinder will be reprogrammed on-orbit as an AEHF satellite.

The first three program phases, AEHF Technology, Engineering Models, and System Definition, have been completed. At Milestone B, the Defense Acquisition Board authorized fabrication and assembly of the first two satellites (SV1, SV2), development and deployment of the ground command and control segment, and advanced procurement for three additional satellites (SV3, SV4, SV5) within the Future Years Defense Program. A separate tailored Milestone C was anticipated, following completion of the system-level Critical Design Review, to provide final authorization for production of SV3, SV4, and SV5. The first launch is scheduled for 1QFY07 and the second launch for 1QFY08.

The approved Milestone B acquisition strategy, had provided for a three-year delay before the third launch, but on December 28, 2001, the Deputy Secretary of Defense issued guidance to accelerate procurement of SV3 from FY06-FY07 to FY03-FY04. The guidance also directed a comprehensive study to look at alternate architectures. The Transformational Communications Study is addressing alternative approaches to satisfy the AEHF full operational capability. It is anticipated that the study will either recommend going back to a five satellite AEHF program or a three satellite AEHF program with a new start representing a revised architecture.

## TEST & EVALUATION ACTIVITY

- The Air Force Operational Test and Evaluation Center (AFOTEC) performed an Early Operational Assessment (EOA) and Operational Impact Assessment (OIA) in support of the Milestone B decision in 4QFY01.
- An Operational Assessment will look at the results of the Developmental Test/Operational Test performed on the Pathfinder satellite to verify its full capability to function as a Milstar II Low Data Rate/Medium Data Rate satellite.
- Multi-Service Operational Test and Evaluation (MOT&E) will evaluate whether the entire system, including equipment, personnel, procedures, training, and logistics support, is effective and suitable based on the operational requirements.
    - The test will exercise satellite-to-satellite cross-links to evaluate theater-to-theater communications, network control, satellite control, and interoperability.

*The Advanced Extremely High Frequency satellite communications system follows Milstar as the protected backbone of DoD's Military Satellite Communications architecture.*

## TEST & EVALUATION ASSESSMENT

The AFOTEC performed an EOA and OIA based on results of the engineering model tests, the contractor system design review presentation, modeling and simulation, and a review of program documents. Satisfactory progress is being made on the four major technology risk areas: nuclear hardening and shielding, performance of the nuller spot beam, performance of the phased array antenna, and electric propulsion. The contractor should minimize the use of turbo coding because of its susceptibility to nuclear fading.

The lack of terminal synchronization is both a void in the program and a risk to successful MOT&E. The following risks to the test program were identified: pressure to reduce the minimum developmental testing as defined in the Test and Evaluation Master Plan, insufficient software testing, the need for a payload simulator that is common for all the terminal development programs, and availability of Pathfinder for MOT&E after it has become an operational asset. It is imperative to monitor the fidelity of the AUST-T terminal simulator and the payload simulators. If their configurations do not remain standardized and consistent with the true payload, the new terminals will not be compatible with the payload or with each other.

In addition to those items identified by the AFOTEC, the program office has identified a high program risk associated with the development of the cryptographic capability to support the AEHF data rate. This includes the manufacture of a highly complex Application Specific Integrated Circuit (ASIC). To reduce the probability of a first-pass manufacturing failure of this ASIC, the foundry process is being exercised initially with a test chip that represents 90 percent of the final ASIC design.

# AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM)

AIM-120 is an all weather, radar guided, air-to-air missile with launch-and-leave capability in both the beyond-visual-range and within-visual-range arenas, enabling a single aircraft to simultaneously engage multiple targets with multiple missiles. The U.S. Air Force and Navy, as well as several foreign military forces use the AIM-120. Currently employed by the F-15C, F-15E, F-16, F/A-18C/D, and F/A-18E/F, AIM-120 will also be employed by the F/A-18E/F, F-22, and Joint Strike Fighter.

The AIM-120C variant was developed to reduce missile size to allow for increased internal carriage in the F-22. Lethality improvements have been incorporated into the missile, culminating in a new warhead and lengthened rocket motor. All current U.S. deliveries are of the AIM-120C configuration. The program's acquisition strategy is to incrementally improve missile capability through software and hardware modifications that are grouped in three Pre-Planned Product Improvement ($P^3I$) phases, the first two of which have completed development and are fielded.

The third phase of the development program is underway to improve weapons system effectiveness and lethality. The Phase 3 missile, scheduled to begin production in FY04, will include new guidance section hardware and software. The antenna, receiver, and signal processing portions of the system are being upgraded to handle the requirements to counter new threats, and will be compressed to create room for future growth. Some existing software will be re-hosted to a new Higher Order Language (C++), some existing software will be re-hosted and modified to function with the new hardware, and some additional software algorithms are being written to react to the new Phase 3 threats.

A Follow-on Test and Evaluation of the $P^3I$ Phase 1 missile was completed in 1999. This was a joint Air Force and Navy evaluation, emphasizing testing of lethality improvements in early missiles and later culminating with the new warhead and rocket motor. The Live Fire Test and Evaluation program for the new warhead included characterization of the new contact fuze and arena testing of the warhead.

## TEST & EVALUATION ACTIVITY

The Navy and the Air Force continue to conduct free-flight and captive-carry operational testing of the $P^3I$ Phase 2 missile using production weapons. The Phase 2 operational testing was planned for completion in December 2002. The Navy was unable to complete planned operational testing due to aerial target test resource and test missile limitation issues that the service and program office are attempting to resolve.

*The program's acquisition strategy is to incrementally improve missile capability and integration on F-16, F-15, and F/A-18 fighter aircraft.*

The Test and Evaluation Master Plan (TEMP) for the $P^3I$ Phase 3 missile was approved by DOT&E in June 2002. Developmental Test and Evaluation (DT&E) of the Phase 3 missile has begun with a small number of captive carry missions and hardware-in-the-loop testing. The Air Force's Air Combat Command, and Navy's Air Test and Evaluation Squadron, will conduct the operational test and evaluation under the oversight of the Air Force Operational Test and Evaluation Command and the Navy's Commander Operational Test Force in FY04. The operational test and evaluation will consist of captive carry, simulations using the contractor's model, and ten guided free flight evaluations against threat representative targets. The evaluation will include integration on F-15, F-16, F/A-18C/D, and F-/A-18E/F aircraft. In accordance with the TEMP, free-flight events will be repeated as necessary to ensure that missile capabilities in the discrete scenarios are fully evaluated.

### TEST & EVALUATION ASSESSMENT

The Phase 3 $P^3I$ missile is largely a new missile with distinct capabilities from previous variants of the AIM-120. Hardware and software changes in the guidance section are significant. The improvements sought by the user are intended to increase air-to-air combat capability of both services. However, as acknowledged in the TEMP, the program will not deliver all of the Phase 3 requirements called for in its joint operational requirements document. In the upcoming follow-on operational test and evaluation, DOT&E will independently assess the impact of any required capability that is not developed and operationally tested when reporting the operational effectiveness and suitability of performance of the missiles actually tested.

# AN/ALR-56M Radar Warning Receiver (RWR)

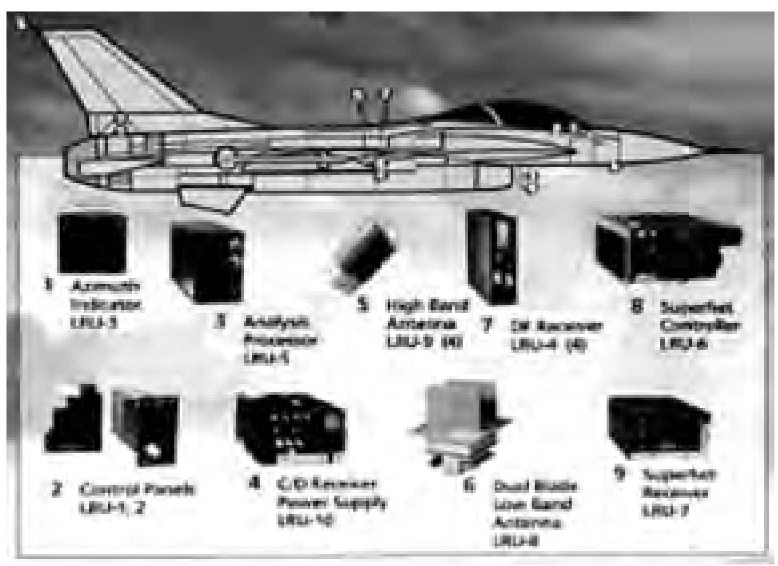
The AN/ALR-56M Radar Warning Receiver (RWR) is intended to contribute to individual aircraft survival through improved aircrew situational awareness of the radar guided threat environment. It includes a fast scanning superhet receiver, superhet controller, analysis processor, low band receiver/power supply, and four quadrant receivers. It provides inputs to the ALE-47 Countermeasure Dispenser System to enable pilot selectable and threat specific chaff and flare dispensing programs for aircraft self-protection. The AN/ALR-56M, by comparison to earlier RWR systems, is intended to provide improved performance in a dense signal environment, as well as increased detection and display features for threat systems with advanced capabilities. The AN/ALR-56M is intended to be a form fit replacement for the AN/ALR-69 RWR in specific models of the F-16 aircraft. In addition to the F-16, the AN/ALR-56M is employed on C-130 aircraft and was chosen for integration into the open architecture Defensive System Upgrade Program for the B-1B bomber Conventional Mission Upgrade Program.

A December 1992 DOT&E Beyond Low-Rate Initial Production (BLRIP) report stated that AN/ALR-56M was operationally effective and suitable. In addition, the 1992 DOT&E BLRIP report recommended Follow-on Test and Evaluation (FOT&E) "because of the deferral of tactics verification testing and the concern about bearing errors and delayed deletions during extensive maneuvers." The current Test and Evaluation Master Plan (TEMP) calls for additional AN/ALR-56M testing as part of continuing Block 40 and Block 50 F-16 follow-on testing.

FOT&E has been conducted by the United States Air Force Air Combat Command (ACC), Air Warfare Center on subsequent software versions. ACC has continued routine upgrades to Mission Data Table software to keep pace with the changing electronic order of battle priorities for various geographical areas of operation. However, tactics verification testing during FOT&E resulted in notations in the AN/ALR-56M User's Handbook concerning the operational significance of the performance problems considered to be training issues. Training is required to ensure that aircrews understand AN/ALR-56M performance during maneuvering.

Some of the major operationally significant changes associated with the latest software upgrade, Operational Flight Program (OFP) 0040, include the following:

- Reduced ambiguities between the Surface to Air Defense System X Target Tracking Radar and airborne interceptor radars.
- Reduced number of multiple threat symbols associated with burst-ranging radars.
- Repeats of the missile launch audio warning instead of a one-time initial warning.
- Threat symbol age-out as soon as a break-lock occurs during excess maneuvers, and re-display as soon as a new lock-on occurs.
- Improvements to the ALE-47 expendable countermeasure dispenser system, and the interface with it.
- System initialization, reset, and internal communications deficiencies.




*The AN/ALR-56M Radar Warning Receiver is intended to contribute to individual aircraft survival through improved aircrew situational awareness of radar guided missiles.*

Requirements for changes to the fielded OFP software include correction of deficiencies noted in previous testing, desired enhancements targeted at handling evolving threats, and man-machine interface improvements directed at improving pilot situational awareness. Desired changes to the fielded OFP are a culmination of user requirements consolidated and prioritized by Headquarters, ACC. A broad summary of those software changes include: update of Mission Data threat parameters; improved threat information interface with the ALE-47; and improved detection of emitters with complex waveforms.

### TEST & EVALUATION ACTIVITY

Developmental Laboratory and Flight Testing of AN/ALR-56M 0040 configuration, the latest hardware and software version upgrade, was conducted by the 416th Flight Test Squadron at Edwards Air Force Base, California, during FY98 and FY99, and encompassed a variety of Air-to-Air and Air-to-Ground flight profiles. The system transitioned to the 36th Electronic Warfare Squadron at Eglin Air Force Base, Florida, where it entered Phase I Operational Testing (Familiarization & Training) during FY99. Several significant performance deficiencies were discovered in both Developmental Test (DT) and Operational Test, and the program was halted for corrections in FY00. New, corrected software for DT was delivered in FY00, followed by a combined DT/Operational Test at Eglin Air Force Base in FY01. The system was certified for entry into dedicated FOT&E at the end of FY01, and DOT&E approved the FOT&E test plan at that time. FOT&E was conducted in FY02. FOT&E was reduced in size by carefully tracking data collected. This reduction was followed by DOT&E and did not adversely affect test adequacy, but did save redundant costs. FOT&E consisted entirely of flight tests; however the final assessment will include hardware in the loop and DT/Operational Test results as well. The final United States Air Force report is expected in FY03.

### TEST & EVALUATION ASSESSMENT

The FOT&E was a well designed side-by-side comparison of the upgraded AN/ALR-56M hardware and software with the 0026 configuration previously tested. Although budgetary and technical issues caused extensive delays in the test and evaluation, it appears that the AN/ALR-56M is effective and suitable. The United States Air Force test plan specified 20 features to be added and/or problems to be resolved, and initial inspection of the test results indicates that all were accomplished successfully. Comparison to the baseline performance of the now six-year-old system software indicates that systems effectiveness was maintained for the most part, though some additional features in the latest build did result in increased signal processing time. One item from the DOT&E 1992 BLRIP report was addressed during this test: the effect of maneuvers on symbol age-out time. Initial results of the test indicate that the display is now much more responsive to changes in the threat radar’s track of the aircraft while the aircraft is maneuvering, improving pilot situational awareness. Suitability has been maintained, and the upgraded processor should improve logistic supportability in the long term.

# B-1B Conventional Mission Upgrade Program (CMUP)

The B-1B Lancer is a variable-geometry heavy bomber. The aircraft has four afterburning turbofan engines and its maximum takeoff weight is 477,000 pounds. With air refueling, the B-1B's four-man crew can deliver approximately 50,000 pounds of conventional bombs or precision-guided weapons to targets anywhere in the world at penetration speeds up to Mach 1.2.

Initial Operational Test and Evaluation (IOT&E) of the B-1B was conducted from 1984 through 1989. The B-1B achieved Initial Operating Capability as a nuclear bomber in FY87. Starting in 1993, the Conventional Mission Upgrade Program (CMUP) marked the aircraft's transition from a nuclear to a conventional role. Initial conventional load was limited to 84 Mk-82 500-pound general-purpose bombs. To date, block changes carried out under the CMUP have upgraded the aircraft's capabilities as follows:

- Software upgrades to offensive and defensive systems (Block B).
- Capability to deliver CBU-87/89/97 cluster bombs (Block C).
- Communications system upgrades, addition of Global Positioning System navigation, and capability to deliver GBU-31 Joint Direct Attack Munition (JDAM) (Block D).

The following remaining blocks of CMUP are intended to enhance conventional weapons delivery capabilities and improve supportability:

- Upgrade computers for increased weapon flexibility and better supportability and integrate Wind Corrected Munition Dispenser (WCMD) capability (Block E).
- Add Joint Stand-Off Weapon and Joint Air-to-Surface Standoff Missile (JASSM) weapon capability.
- Upgrade the defensive avionics suite by removing most of the existing AN/ALQ-161 and replacing it with an AN/ALR-56M radar warning receiver and portions of the Navy's AN/ALQ-214 Integrated Defensive Electronic Countermeasures (IDECM) system, including a fiber-optic towed decoy (Block F).

### TEST & EVALUATION ACTIVITY

Developmental Test and Evaluation (DT&E) of Block E began in December 2000 and concluded in August 2002 at Edwards Air Force Base. A total of 124 Developmental Tests (DTs) and DT/Operational Test sorties were flown, accumulating more than 482 flight hours and approximately 1,234 planned test points. Tests were conducted by a Combined Test Force and included participation of the SEEK EAGLE office for stores certification. Two Operational Test certification flights were conducted at the end of the DT/ Operational Test program.

*The primary Block E objectives of increased weapons flexibility and additional capability to deliver WCMD weapons were demonstrated. The military utility of these enhanced capabilities were also demonstrated.*

DT&E testing of the Block F defensive system has included hardware-in-the-loop testing at the Nevada Test and Training Range, system integration laboratory testing at the Integrated Facility for Avionics Systems Testing, and aircraft installed-systems testing at the Benefield Anechoic Facility at Edwards Air Force Base, California. Block F DT&E flight-testing began in August 2001. Early testing evaluated aerodynamic aspects of deploying the IDECM towed decoy from the aircraft.

Block E began IOT&E in September 2002. Testing is scheduled to conclude in December 2002. A full-rate production decision is scheduled for FY03.

Aeronautical Systems Center (ASC) at Wright-Patterson Air Force Base, Ohio, conducted Live Fire Test & Evaluation (LFT&E) of Block D using large assemblies cut from production aircraft #1. ASC is leveraging on the previously conducted Block D LFT&E to support LFT&E of Block E. All ballistics testing was completed to support Block D Milestone III. An LFT&E report was submitted to Congress in January 1999. LFT&E will be evaluated by analysis for Block E. ASC is currently updating the Air Force Block D LFT&E report to reflect Block E configuration changes and analysis methodology improvements.

## TEST & EVALUATION ASSESSMENT

**Block E**

Block E flight tests of computers and software for all flight conditions and weapon employment functions revealed relatively few anomalies, and the software is stable. The primary Block E objectives of increased weapons flexibility and additional capability to deliver WCMD weapons were demonstrated. The military utility of these enhanced capabilities were also demonstrated.

WCMDs released from all bays experienced pitch downs and inconsistent tail fin deployments. Test results indicate that there will be restrictions on the WCMD delivery envelope and quantities that can be carried as compared to Operational Requirements Document (ORD) objectives. However, ORD threshold requirements will be met. These factors cause the Launch Acceptability Regions (LARs) for B-1B releases of WCMDs to be smaller than for those of other aircraft types.

Additionally, as reported last year, there is a problem with planned Block E design of cockpit controls and displays to support weapon delivery from the aircraft. Concerns about the Block E design are based on crew assessments in simulations and have been verified in flight test. Simulator study results and crew subjective opinions indicate that the planned display of LAR may not provide adequate steering cues to enable flying the aircraft to the correct weapon release zone when the aircraft is not on the planned route or when operators experience heavy workload. The System Program Office and Air Combat Command are currently working short- and long-term situational awareness upgrades to address this problem.

Reliability and maintainability of Block E upgrades were marginal during DT as mean time between maintenance and mean time between failures did not meet requirements. However, a positive growth trend was observed and requirements in this area may eventually be met. Aircraft systems diagnostics were also marginal because of poor fault isolation and high false alarm rates.

During DT&E, several additional issues were identified that may affect the success of Block E in IOT&E. These include:

- Poor accuracy of the radar's ground moving target tracking mode resulting in target coordinate generation errors. To mitigate these errors, a significant increase in the number of WCMDs employed per target may be required to achieve the desired probability of kill.
- Mk-82 weapons released with Air Inflatable Retarders may not achieve the accuracy seen by earlier B-1B blocks without further modifications to ballistic tables.

IOT&E results through November 2002 confirm that problems discovered in DT&E continue to hinder performance in Operational Test and Evaluation.

**Block F**

The Block F development schedule encountered delays in FY02, primarily due to poor performance of the IDECM towed decoy during DT&E. Setbacks were also caused by delays in Block E avionics software development and problems in the Navy's IDECM program, the latter resulting in late delivery of IDECM hardware and software to the B-1B program.

Although risks were diminishing as DT&E progressed, continued management attention was necessary to solve technical problems, correct deficiencies, and conduct thorough testing of CMUP functions. Current Block F deficiencies could prevent or delay meeting operational effectiveness and suitability requirements. As a result, the Air Force recently cancelled Block F and intends to invest funds to sustain the current defensive suite, exploit stand-off capability by integrating JASSM-ER, and restore B-1 sustainment engineering levels to the command standard. An operational evaluation of this new integrated approach is necessary to adequately assess the viability of the B-1B under this envisioned role.

# B-2 Spirit

The B-2 *Spirit* is a land-based, long-range bomber capable of delivering both conventional and nuclear munitions. The aircraft features a flying wing design and incorporates advanced "stealth" technology to reduce its radar observability and its infrared (IR) signature. The crew consists of two pilots, one of whom serves as the mission commander.

B-2 initial operational test and evaluation (IOT&E) concluded in June 1997. However, the aircraft did not fully meet operational requirements at the conclusion of IOT&E. Several deficiencies identified during IOT&E were described in the DOT&E FY01 annual report. Since then, the B-2 development program initiated a series of upgrades aimed in part at correcting these deficiencies.

Additional upgrades have been initiated, but are not yet ready for DT&E. These initiatives are intended to enhance capability and improve the aircraft's operational effectiveness and suitability. These enhancements include additional low observable (LO) improvements and LO diagnostic tools, Guided Bomb Unit (GBU) 38 and enhanced GBU (EGBU) 28 capability, Link 16, Extremely High Frequency Satellite Communication, and an upgrade to the aircraft's radar frequency. Planning for the B-2 radar upgrade began in FY02.

## TEST & EVALUATION ACTIVITY

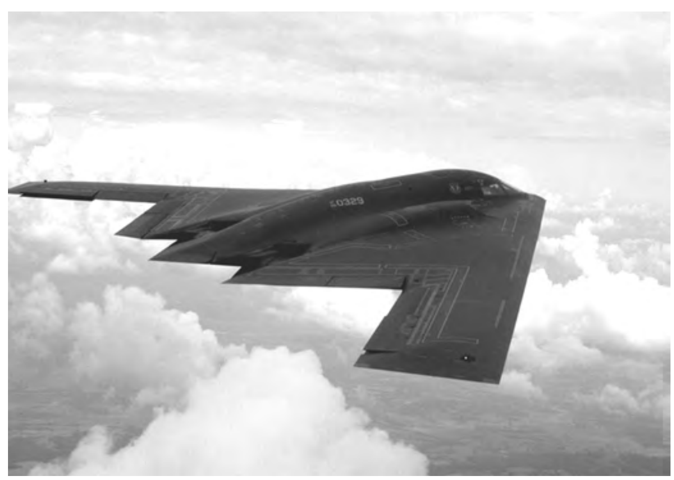
B-2 follow-on test and evaluation continues. FY02 efforts focused on the evaluation of upgrades to the aircraft operational flight program software, the mission planning system, weapon delivery capability, aircraft survivability to specific threats, and the reliability and maintainability of LO systems. Test planning for the B-2 radar upgrade began in FY02.

A test and evaluation master plan (TEMP) to support the B-2 sustainment phase was submitted to OSD in July 1999. The TEMP was returned to the Air Force with comments and has yet to return to OSD for approval. The Air Force plans to submit a revised TEMP to serve as a capstone document and submit a TEMP appendix on the B-2 radar upgrade.

## TEST & EVALUATION ASSESSMENT

Although enhancements to B-2 capability occurred in FY02, overall effectiveness and suitability of the B-2 have not noticeably improved. Enhancements include:

- Combat Track II, providing beyond line-of-sight secure communications and situational awareness.
- Mission planning and Common LO Auto Router performance to enable faster mission planning with advanced weapon capability (e.g., Joint Air-to-Surface Standoff Munition).
- Integrated Functional Capability updates, providing Time Sensitive/Flexible Targeting capabilities.
- New Defensive Mission System (DMS) mission data files tailored to key areas of responsibility.



*Although enhancements to B-2 capability occurred in FY02, overall effectiveness and suitability of the B-2 have not noticeably improved.*

Assessments, based on DOT&E review of Force Development Evaluations, are provided for each of the five B-2 Critical Operational Issues (COIs):

**Rapid Strike:** This COI is assessed to be marginally satisfactory. Time to prepare and launch the B-2 is considered marginally satisfactory based on generation exercises conducted in FY02. If aircraft are allowed to accumulate a large number of LO discrepancies, generation times cannot be met. Nevertheless, since aircraft with LO defects can still be flown, training schedules can be met. Operational commitments are supported by holding a number of aircraft ready on the ground, while conducting training with the remaining aircraft.

**Sustained Operations:** This COI again does not meet requirements. Some improvements have already been fielded, but the most promising near-term improvement to LO maintainability (advanced high frequency materials or AHFM) has neither undergone Operational Test and Evaluation (OT&E) nor reached the operational squadrons. AHFM may improve LO reliability and maintainability, but testing in an operational environment must occur to validate its effectiveness and suitability. Although the B-2 proved to be an effective weapon delivery platform capable of striking targets anywhere in the world, it is unable to support the operations tempo originally envisioned and specified by Air Combat Command, primarily because of continuing unreliability and difficulty in maintaining LO systems.

Mission Capable Rate (MCR) for FY02 continues to fall short of ORD requirements. Although improvement occurred in FY02, MCR has consistently been below standard. Improvement in FY02 cannot be regarded as significant unless sustained over a longer period of time. The required deployed sortie generation rate has yet to be demonstrated and is unlikely to be achievable without substantial improvement to reliability and maintainability of all B-2 systems.

**Mission Survivability:** This COI is satisfactory except for DMS. The DMS does not provide adequate situational awareness to avoid pop-up threats. A new mission data file was implemented in FY01 but did not improve performance. In addition, rapid reprogramming of mission data files to accommodate new geographic areas of responsibility or new threat systems is a time consuming process and not very responsive. More funding and personnel are required to make this DMS feature truly rapid and responsive.

Survivability assessments continued in FY02. These assessments included evaluation of the effectiveness of standoff jamming platforms in support of B-2 employment. Although the B-2's LO signature is considered satisfactory in the present configuration, introduction of new LO materials (e.g., AHFM) require continued testing to update or validate signature templates.

**Weapons Effectiveness:** This COI is satisfactory except for the Joint Stand Off Weapon (JSOW-A). Launches of four JSOW-A weapons as part of weapons integration tests were conducted in FY02. However, JSOW-A testing was suspended in August 2002 pending resolution of potential JSOW-A employment shortfalls discovered during the modeling of releases within the typical B-2 operational envelope. Further testing is needed before B-2/JSOW effectiveness can be stated with confidence.

Operational flight program software corrected anomalies seen in earlier Joint Direct Attack Munition (JDAM) tests and during operational employment. Ten JDAM weapons were dropped in FY02. Miss distances for these weapons were well within required values.

**Reliability, Maintainability, and Deployability:** This COI is assessed as unsatisfactory, due to poor reliability and maintainability of B-2 systems (particularly LO systems), and because deployability remains undemonstrated.

A number of improved materials and processes were introduced in prior years to improve LO reliability and maintainability. Several LO improvement and durability initiatives are partially fielded and show promise. B-2 Maintenance Man Hours per Flight Hour has improved over the past several years, largely because of more efficient management of LO maintenance.

The most significant LO improvement initiative is the AHFM configuration. However, this configuration has been applied only to the B-2 test aircraft at Edwards Air Force Base. Development tests were performed, but further assessment of AHFM must await operational testing at the main operating base. If tests in an operational environment validate expectations, AHFM should provide significant maintainability, sortie generation, and support cost improvements over current B-2 aircraft materials.

A deployable B-2 Shelter System was tested at Whiteman Air Force Base in FY01. Five follow-on production versions have been ordered and two are being erected at a potential deployment site. However, B-2 capability to conduct sustained operations in a deployed environment has yet to be demonstrated. A deployment evaluation exercise is planned for FY03.

# C-5 Avionics Modernization Program (AMP) and Reliability Enhancement and Re-Engineering Program (RERP)

The current C-5 fleet operates throughout the Active, Reserve, and National Guard components in various missions and environments. C-5 missions include strategic airlift, emergency aeromedical evacuation, airland transport of a brigade-size force in conjunction with other organic aircraft, transport of outsize and oversize cargo, and multi-ship Special Operations Low Level II. The C-5 aircraft must perform missions at night and in adverse weather, and it may employ aerial refueling during intercontinental missions.

The C-5 Avionics Modernization Program (AMP) and Reliability Enhancement and Re-engineering Program (RERP) is denoted as the C-5 AMP/RERP. The C-5 AMP/RERP upgrades the avionics, the aircraft propulsion system and includes a number of reliability improvements. Commercial engines, nacelles, thrust reversers, and pylons will be integrated into the existing C-5 airframe. These performance improvements are designed to optimize cargo carrying capabilities to allow fully loaded take-offs and landings on relatively short runways, and to meet the performance requirements of the Global Air Traffic Management (GATM) initiative. Additionally, re-engineering is intended to provide significant reliability, maintainability, and availability improvements. A commercial engine support concept (two levels of maintenance, warranties, etc.) will be integrated into the C-5 logistics support system infrastructure. Other candidate sub-systems for reliability enhancement include the flight controls, hydraulics, environmental, electrical, and fuel systems. Specific upgrades and the extent of the expected reliability improvement will be identified from recently completed trade studies.

The C-5 was developed and procured prior to the implementation of Live Fire Test and Evaluation (LFT&E) statutory requirements. The basic aircraft has never completed a live fire evaluation. The RERP modification is an Acquisition Category I program and constitutes a covered program for LFT&E. LFT&E testing has begun.

The C-5 AMP/RERP Test and Evaluation Mast Plan (TEMP) was approved October 2001 in support of a Milestone B decision.


*The C-5 Avionics Modernization Program/Reliability Enhancement and Re-Engineering Program upgrades the avionics, the aircraft propulsion system, and includes a number of reliability improvements.*

## TEST & EVALUATION ACTIVITY

A combined test force (CTF) is located at the contractor facility at Marietta, Georgia. The CTF includes the contractor and government personnel working developmental and operational testing. Co-locating personnel from all three organizations allows for greater test efficiency and less duplication. Both laboratory and flight testing has begun. Test planning has determined the number of ground and flight tests required along with an estimated timeline. DOT&E has been an active participant in the development of the TEMP update, in the review and revision of the acquisition strategy, and in the DoD Integrated Product Team process.

LFT&E activity has focused on identifying potential LFT&E issues, developing an LFT&E strategy, and updating the TEMP to incorporate LFT&E requirements. To support the LFT&E strategy, the Air Force is conducting modeling and simulation to evaluate C-5 survivability against man-portable air defense systems (MANPADS). Several models are being used. DOT&E has supported a request for a waiver from full-up, system-level testing since testing a complete, combat configured system would be unreasonably expensive and impractical. The LFT&E plan was approved in October 2001.

The first flight of a C-5 AMP (a B model) aircraft was accomplished on December 21, 2002. A second C-5 (an A model) is currently in modification.

### TEST & EVALUATION ASSESSMENT

The schedule risk for the C-5 AMP development and test programs is moderate. Four aircraft were initially designated to be used for both developmental and operational testing. Currently, only three aircraft have been identified due to funding constraints. The C-5 RERP operational test may not be adequate without the fourth aircraft. Four aircraft were to be utilized to a conduct a “surge” of the system prior to the full-rate production decision. The operational test team is assessing the schedule risk and test adequacy associated with only using three aircraft for test.

# C-17 Globemaster III Airlift Aircraft

The C-17 is a four-engine turbofan aircraft capable of airlifting large payloads over intercontinental ranges without refueling. It is intended to allow delivery of outsize combat cargo and equipment directly into austere airfields. The C-17 is required to deliver passengers and cargo between continents, provide theater and strategic airlift in both airland and airdrop modes, and augment aeromedical evacuation and special operations missions. Initial Operational Test and Evaluation (IOT&E) of the C-17 was conducted in three phases from May 1992 to August 1995. Based upon results of IOT&E and live fire testing, DOT&E submitted an Operational and Live Fire Test and Evaluation Report to Congress to support the Beyond Low-Rate Initial Production Report (BLRIP), or Milestone III decision, in November 1995. The report assessed the operational effectiveness and suitability of the aircraft to conduct operational missions within the context of the existing airlift system. The C-17 was judged to be operationally effective (with limitations) and operationally suitable. Survivability was not adequately evaluated to make an assessment. A formal, three-year phase of Follow-on Test and Evaluation (FOT&E) started in October 1995. Since the completion of that phase, various periods of combined Developmental Test and Evaluation (DT&E) and FOT&E, involving the contractor, the Flight Test Center, Air Mobility Command, and the Air Force Operational Test and Evaluation Center (AFOTEC) have occurred on a nearly continuous basis.

## TEST & EVALUATION ACTIVITY

C-17 follow-on tests and program developments that affect operational limitations, identified in the BLRIP report to Congress, are being monitored. These include the On-Board Inert Gas Generating System (OBIGGS), introduction of the composite material horizontal tail, an extended range fuel containment system (ERFCS), crew protection armor, liquid oxygen bottle design, and changes related to the Strategic Brigade Airdrop mission. Efforts to include dual-row cargo/equipment airdrop are in progress to reduce vulnerability and the drop zone delivery time.

One high visibility test item still in progress involves improvements to the OBIGGS. High failure items (e.g., compressor, air separation module and bleed pressure regulator) are tracked on a weekly basis to ensure adequate spare parts exist. FY03 funding is planned to initiate a two-stage effort to improve OBIGGS. In stage one, reliability upgrades will be implemented for high failure rate items in the current OBIGGS system. In stage two, OBIGGS will be redesigned for improved reliability. The first production aircraft scheduled to be delivered with the redesigned OBIGGS is aircraft 138, planned for delivery in FY05.

*The C-17 carries outsize cargo and equipment over intercontinental ranges and is capable of delivery to austere airfields.*

DT&E will continue at Edwards Air Force Base as part of the Follow-On Flight Test Program. The AFOTEC-Detachment 5 at Edwards Air Force Base will maintain involvement through ongoing communication with the Program Office and the combined contractor/Government C-17 Test Team resident at Edwards Air Force Base.

DOT&E has initiated a review of all changes made to the C-17 since November 1995. Since completion of initial LFT&E testing, two major structural modifications have been incorporated that require further analyses and additional testing. The horizontal tail has been changed to a composite material construction, and the ERFCS has been added in the center-wing area of the fuselage. These changes will be assessed by the Air Force and DOT&E for potential impacts on aircraft survivability.

### TEST & EVALUATION ASSESSMENT

The C-17 TEMP is four years out of date. An update to the Test and Evaluation Master Plan (TEMP) must be submitted to better address continuing flight tests, particularly the Follow-On Flight Test Program at Edwards Air Force Base and operational testing by AFOTEC and the 33 Flight Test Squadron at McGuire Air Force Base. The TEMP must also define the future LFT&E program. In addition, an updated Operational Test plan must be submitted. The updated plan must define the scope of testing for the next four years and delineate responsibilities.

Challenges to developmental and operational flight-testing in 2003 and beyond include constraints to individual project budgets, test resources, and aircraft availability for test. The only dedicated aircraft for developmental flight-testing is not production representative. Requests for flight test time on operational aircraft are in competition with high operational mission demands. Also, the large numbers of aircraft undergoing planned modifications limits the available aircraft to perform operational missions, training, and testing. These challenges have affected the depth and duration of testing conducted following aircraft modification and upgrade.

The C-17 aircraft are delivered in a “Block” configuration with each block containing approximately fifteen aircraft. The next block will have software modifications and station keeping equipment (utilized in flying formation) with testing to complete in 2004. The following block will contain an avionics modernization package and a weather radar modification with testing to be completed in 2005. The next block is planned to contain the upgraded onboard inert gas generating system along with navigation and safety modifications. Additional enhancements, modifications, and corrections to existing deficiencies are concurrent and include a fuel system retrofit, main landing gear (three major issues) deficiency correction, and a wheel brake and tire cost saving initiative. Detailed developmental and operational test planning is underway.

# C-130 Avionics Modernization Program (AMP)

The purpose of the C-130 Avionics Modernization Program (AMP) is to lower the cost of ownership of the U.S. military's C-130 fleet, while complying with the Air Force Navigation and Safety Master Plan, required navigation performance requirements, and other applicable Global Air Traffic Management (GATM) requirements. This will be done through a cockpit modernization program that replaces aging, unreliable equipment, and adds equipment necessary to meet Navigation/Safety and GATM requirements. New equipment is intended to lower the cost of ownership by reducing cockpit crew manning, increasing aircraft reliability, maintainability, and sustainability. The C-130 AMP is intended to provide an improved precision airdrop capability for the combat delivery fleet, meet Night Vision Imaging System (NVIS) requirements, and improve the C-130's precision approach and landing capability. This program provides the interfaces necessary to integrate real time information in the cockpit. A standard cockpit layout is planned allowing crewmembers to be trained to fly in one aircraft type and required to undergo mission qualification only when reaching their new units - unlike the current situation.

A C-130 AMP/Common Avionics Architecture for Penetration (CAAP) Test Planning Working Group has been established to provide a forum for all cognizant test organizations to participate in the C-130 AMP/CAAP test planning process. The using commands and the Air Force Operational Test and Evaluation Center (AFOTEC) will provide crew members, as required, to support ground and flight-tests during combined Developmental Test/Operational Test and dedicated Operational Test and Evaluation (OT&E). The Program Office will manage the Live Fire Test and Evaluation (LFT&E) program.

The Milestone II decision resulted in the Boeing Company being awarded the C-130 AMP contract in July 2001. Contractor ground tests will be conducted at the Boeing facility in San Antonio, Texas, the plant at Long Beach, California, and Edwards Air Force Base. Following a series of shakedown flights at the contractor facility, initial prototypes will transition to Edwards Air Force Base for the start of formal Developmental Test and Evaluation (DT&E). DT&E flight-tests will be accomplished by a combined government and contractor integrated test team. AFOTEC personnel will participate as part of the government contingent.

### TEST & EVALUATION ACTIVITY

The program is in the very early stages of contractor development and preliminary design reviews. A Test Planning Working Group and a LFT&E integrated team have been created to formulate the specifics of the LFT&E program and the Test and Evaluation Master Plan (TEMP).

The updated C-130 AMP TEMP was approved by DOT&E in September 2002. An update will be required due to program funding changes that will impact the currently planned test schedule.

*C-130 Avionics Modernization Program cockpit modernization program.*

### TEST & EVALUATION ASSESSMENT

The entire C-130 AMP/CAAP program is being restructured due to funding changes. The primary proposal is to cancel the previously planned Risk Reduction effort (18 months of flying a development radar in a special operations forces (SOF) Combat Talon I aircraft and tested at a government range) for feasibility studies on the new radar, new data processing algorithms, and enhanced situational awareness features for Terrain Following/Terrain Avoidance missions with Low Probability of Intercept. Elimination of the planned Risk Reduction raises the SOF C-130 AMP/CAAP from a medium risk (technical, schedule, and cost) to high risk for success. This is a change in both the acquisition and the test and evaluation strategies that were approved at Milestone B for this program.

The successful testing of AMP components across a broad range of aircraft configurations and mission requirements (see table below) will always be a significant challenge. The concept is feasible; however, it is essential that the various users commit to a unified fleet management approach for the modification of all aircraft. Fleet management of more than 700 aircraft is one of the keys to success. A tentative plan calls for some aircraft being retired, others being moved from one unit to another to manage structural life, some sent to depot, and still others used for test purposes. In addition, concurrent development of different mission design series modifications will add risk to the schedule.

The following lists the different Mission Design Series (MDS) of the C-130s to be modified and some of the special test requirements for them:

**<u>C-130's and Special Test Requirements by MDS</u>**

| MDS | Nomenclature | Special Tests |
|---|---|---|
| C130E/H/H1/H2/H3 | Combat Delivery | Global Air Traffic Management, Terrain Collision Avoidance System, Terrain Awareness Warning System, Night Vision Imaging System, Flight Management System |
| AC-130H/U | Gunship | Gunfire Accuracy, Enhanced Situational Awareness, Defensive |
| EC-130E | Airborne Battlefield Command & Control Center | Mission Unique |
| EC-130H | Compass Call | Mission Unique |
| HC-130N/P | Combat Rescue | Mission Unique |
| MC-130E | Combat Talon I | Terrain Following/Terrain Avoidance Navigation |
| MC-130H | Combat Talon II | Terrain Following/Terrain Avoidance Navigation, Enhanced Situational Awareness, Defensive |
| MC-130P | Combat Shadow | Mission Unique |
| LC-130H | Ski | Mission Unique |

# C-130J Airlift Aircraft

The C-130J is a medium-range, tactical airlift aircraft designed primarily for the transport of cargo and personnel within a theater of operations. The cargo area can adapt to accommodate a combination of passenger, cargo, and/or aeromedical airlift missions. Variants of the C-130J will perform missions such as weather reconnaissance (WC-130J) and aerial refueling (KC-130J). The KC-130J is addressed in a separate report; the WC-130J is discussed in this report.

The C-130J retains many structural characteristics of the C-130H, having the same overall interior/exterior dimensions. However, the C-130J is more than 70 percent unique, relative to previous models. Significant differences include an advanced integrated digital avionics system, a redesigned flight station intended to facilitate a two-person cockpit, a new propulsion system intended to provide improved take-off, climb and cruise performance, and cargo compartment enhancements.

Contractor Developmental Test and Evaluation began in spring 1996 and will likely continue past 2006. The C-130J aircraft procurement is proceeding under a commercial acquisition strategy.

The Federal Aviation Administration (FAA) awarded Lockheed Martin a Type Certificate for a commercial version of the C-130J-30 aircraft (this version is longer than the C-130J) in 1998. However, significant C-130J and C-130J-30 military requirements were not included in the original FAA certification and Lockheed has not sought FAA certification of deficiency corrections and modifications. This necessitates additional testing by the Air Force and other U.S. government users.

DOT&E designated the C-130J aircraft for Live Fire Test and Evaluation Oversight in May 1995. Threats include man-portable air defense systems (MANPADS), surface-to-air missiles, anti-aircraft artillery, air-to-air missiles, rockets, and small arms. The C-130J LFT&E program addresses wing dry bay fire, composite propeller ballistic vulnerability, engine and engine bay fire, vulnerability to MANPADS threats, and mission abort vulnerability. The Test and Evaluation Master Plan (TEMP) describing the program was approved by DOT&E in July 1999.


*The C-130J is a medium-range, tactical airlift aircraft designed primarily for the transport of cargo and personnel within a theater of operations.*

### TEST & EVALUATION ACTIVITY

Qualification testing for mission software Version 5.3.1 was completed in Spring 2002. A number of deficiencies were identified for corrective action and retest. Operational testing of Version 5.4 is now scheduled for late CY05. The Operational Test team will test the interim versions as they are released. The Operational Test plan is being revised to reflect the current structure of the test program.

Live Fire Test and Evaluation Phase 2 (composite blade testing) finished ballistic testing in October 2001. Fatigue testing is currently in progress. Phase 3 (MANPADS assessment) is also complete. Battle damage assessment and repair evaluation of wing damage was completed in December 2001, and the residual strength evaluation of wing fuel tank hydrodynamic ram testing in March 2002. Planning for engine nacelle fire suppression system (phase 4) ballistic testing has begun.

**TEST & EVALUATION ASSESSMENT**

**C-130J**

Major issues confronting the C-130J program include: funding of logistics support and training systems; hardware, software, and technical order deficiencies; manufacturing quality; sub-system reliability; failure to meet required measures of system effectiveness and suitability; and resolution of documented deficiencies. The United States Air Force is now taking an active role in resolution of these issues.

Based on the evaluation of test results conducted from Phase 1A and Phase 1B (airland portion of the combat delivery mission), the aircraft is not operationally effective. The airdrop mission cannot be evaluated until deficiency corrections are implemented and the developmental tests are completed in FY06. Aircrew workload issues, software discrepancies, and cargo loading and constraint requirements are still major issues. The using command is unable to verify manpower requirements to field this system until the crew workload evaluation is complete.

In addition, the aircraft is assessed as not operationally suitable. The evaluated reliability, maintainability, availability, and logistics supportability during Phase 1B were below operational requirements. Deficiencies were noted with on-aircraft integrated diagnostics and fault isolation systems, portable maintenance aids, maintenance technical orders, and availability of spare parts. Additional contractor field service representatives will be required to assist in the maintenance of the aircraft for the foreseeable future.

Although Block Upgrade 5.3 showed improved navigation functions, flight displays, technical publications, and reduced nuisance faults, there remain a large number of open deficiency reports that need to be resolved to achieve operational capability. Testing of full operational capability will not occur until the delivery of the Block 5.3.2. Block 5.4 will be tested to evaluate the defensive systems and some Global Air Traffic Management capability in FY04-05.

Results of the wing fuel tank hydrodynamic ram live fire test indicate that the wing is vulnerable to hydrodynamic ram damage. This potential vulnerability is not limited to the C-130J, but could affect all models/variants of the C-130E/H/J as they share a common wing design and internal structure. Final assessment on the results of the ballistic testing of composite propeller blades awaits post-damage fatigue testing.

Test limitations on the composite propeller blade evaluation severely affected realism. The test facility could not accommodate ballistic testing of dynamically rotating propellers. The initial compromise was to test a statically loaded propeller blade and perform a dynamic post-damage evaluation. If the results were not conclusive, the agreement was to conduct dynamic tests. The program has not resolved the details of how the dynamic evaluation will be done.

The evaluation of hydrodynamic ram effects continues to be problematic. Current predictive techniques are inadequate for evaluating damage to and structural response of large aircraft wing fuel tanks subjected to hydrodynamic ram damages. Test facilities need to be upgraded to accommodate large aircraft ballistic testing.

**WC-130J**

Major issues confronting the weather reconnaissance aircraft are: the radar's inability to perform the weather mission, continuous satellite communications not achieved, propeller delamination, and excessive vibration in the auxiliary crew members station.

The Low Power Color Radar was designed as a "weather avoidance" radar but sold as a "weather penetration" radar; the radar does not meet mission requirements. The program office has developed, but not funded, a spiral improvement plan to correct this deficiency. Additional software modifications will be tested in late 2003 (storm season) and hardware modifications (if required) will be tested in late 2005. Since the WC-130J cannot perform its primary mission the correction of this deficiency is critical. The secondary impact is that the ten older WC-130H models that currently perform the mission were to be converted to tankers and transferred to Air Combat Command where they are needed. That will not occur until the WC-130J is fully operational.

Proposed fixes to the satellite communications, propeller delamination, and the excessive vibration is planned to be tested in the fall storm season 2003.

# Combat Survivor Evader Locator (CSEL) System

The Combat Survivor Evader Locator (CSEL) is a survival radio/personnel locator system designed to provide survivor/evader (S/E) location and two-way communication between S/Es and rescue forces. It is designed to enable command elements and search and rescue forces to locate and maintain contact with CSEL-equipped personnel. It is intended to replace current PRC-90 and PRC-112 survival radios. Although interest in upgrades to these systems has always been high, the global war on terrorism and Middle East tension have further elevated the requirement. U.S. Central Command and U.S. Special Operations Command officials have requested acceleration of deployment of upgraded capabilities to the field.

The CSEL includes radios, unmanned base stations, and rescue center workstations. It relies on support from UHF Satellite Communications (UHF SATCOM), Secret Internet Protocol Network (SIPRNET), National Systems, Search and Rescue Satellite Aided Tracking System (SARSAT), and the Global Positioning System (GPS). The Hand Held Radio (HHR) uses line-of-sight UHF/VHF voice, beacon, GPS, and Over-the-Horizon (OTH) data modes for worldwide coverage. The OTH segment includes unattended UHF Base Stations (UBSs) that control SATCOM links with HHRs and interface with National Assets, SARSAT, and Joint Search and Rescue Centers (JSRCs) on the SIPRNET. The ground segment displays and prepares messages for transmission to/from the HHR via UBSs.

In response to an unfavorable Air Force Operational Test and Evaluation Center Operational Assessment (OA) in 1998, the Air Force restructured the program and adopted a spiral development approach. Over the next three years, two more spirals were added to address deficiencies and to respond to additional requirements levied on CSEL. One such requirement, added by the Joint Chief of Staff, was the GPS Selective Availability Anti-Spoofing Module (SAASM). A FY01 OA supported a decision to buy 376 HHRs—35 with old SAASMs and the rest with improved SAASMs to be tested in Multi-Service Operational Test and Evaluation (MOT&E). The full-rate production decision is planned for 4QFY03.


*The Combat Survivor Evader Locator is a survival radio/personnel locator system designed to enable command elements and search and rescue forces to locate and maintain contact two-way communication with CSEL-equipped survivor/evaders.*

### TEST & EVALUATION ACTIVITIES

CSEL Developmental Testing was conducted throughout FY02 at joint operating locations in varied climates and environments. Suitability and reliability testing was conducted at Fort Huachuca, Arizona; cold weather suitability at Eielson Air Force Base/Fort Richardson, Alaska; and suitability, reliability, and Concept of Operations (CONOPS) validation testing at Fort Bragg, North Carolina. The Developmental Test (DT) events covered a wide range of locations and produced valuable lessons. However, the HHRs used in these DT events were developmental articles and were not production representative.

Combined DT/Operational Test in Joint and Multinational venues was conducted to evaluate effectiveness and interoperability with potential CSEL users and recovery forces. DT/Operational Test was conducted at Exercise Northern Edge, Eielson Air Force Base, Fort Richardson, Alaska; and with the USS *Abraham Lincoln* Task Force Exercise (afloat). Joint/Multinational interoperability DT/Operational Test was evaluated at Exercise Desert Rescue, Naval Air Station Fallon, Nevada. $C^4$I systems integration was tested at Millennium Challenge and the Joint Expeditionary Forces Experiments, Nellis Air Force Base, Nevada. Combined Testing produced valuable lessons in operational coordination and interoperability with international partners in both the S/E and recovery force role.

MOT&E, originally scheduled for October 2002, is now delayed until 2003 to support a September 2003 full-rate production decision. Difficulties with HHR software stability and the SASSM equipped GPS have caused numerous slips in Operational Test. The sliding nature of CSEL readiness to test has caused problems with the Operational Test Agencies obtaining and maintaining hard to get test assets and units. This has also made publishing a test plan difficult and thus far, there is no DOT&E approved test plan.

### TEST & EVALUATION ASSESSMENT

While CSEL was potentially effective and suitable in the second OA, it was not ready for operational employment. At that time, several areas required corrective action prior to MOT&E: CONOPS, battery reliability, and plans for training, manning, fielding and communications. Since the last OA, the contractor believes that all system deficiencies generated from the OAs are corrected. However, stable production-representative HHRs have yet to be delivered.

Overall, test events this year were more operationally realistic than in previous testing. CSEL was tested in joint and coalition environments, and better integrated into end-to-end combat rescue scenarios with operationally representative Survivor/Evaders, Joint Search and Rescue Centers, rescue forces, and threat systems and forces. CSEL has made progress in the past year, but still has significant issues with employment concepts, training, information assurance, and National Asset support, and most importantly- HHR readiness to test. Thus far the contractor has not delivered an HHR with software that is stable and reliable enough to certify as production representative and ready for Operational Test. The CSEL Program Office and developer are working to ensure the system is stable for the last DT event prior to MOT&E.

# E-3 Airborne Warning and Control System (AWACS)

The E-3 AWACS is a commercial Boeing 707-320C airframe modified with an AN/APY-1 or AN/APY-2 radar. It is equipped with generalized and specialized mission computers, multipurpose displays, and clear and secure multiple-voice and data link communications. The United States has 33 E-3s assigned to Pacific Air Forces and Air Combat Command. AWACS has been employed in support of joint and multi-national operations around the world. NATO, United Kingdom, France, and Saudi Arabia also operate variants of the E-3. Finally, Japan operates a variant of the E-3 installed on a 767.

Block 40/45 will replace the aging AWACS computer system and the operator terminals with a network of commercial-off-the-shelf (COTS) operator workstations linked to several COTS computers. A Gigabit Ethernet Local Area Network that adds digital communications for control of the radios, and for internal communications, will connect these computers. Block 40/45 will improve E-3 reliability and availability, providing theater commanders significantly enhanced surveillance and control capabilities while contributing to information superiority needed to control the battlespace.

The Air Force is currently studying alternatives for the Block 40/45 AWACS upgrade. This upgrade will enable the Air Force to incorporate several necessary improvements to AWACS functionality including multi-source integration, increased electronic support measures system memory, integration of the Intelligence Broadcast System, and data link infrastructure. These improvements will be achieved by new tracking algorithms, software control of the communications subsystem, improved human-machine interfaces, and reduced data link latency. The Block upgrade, which supports continued improvements to E-3 information correlation functions that will enable the E-3 to support the Single Integrated Air Picture, will extend AWACS capabilities through the 2025-2035 timeframe.

### TEST & EVALUATION ACTIVITIES

The United States Air Force has established a Block 40/45 Test and Evaluation Working Group Integrated Product Team that has produced a draft Test and Evaluation Master Plan.

### TEST & EVALUATION ASSESSMENT

Rehosted radar software led to problems during the E-3 Radar System Improvement Program (RSIP). The problems were due to inadequate protection of aircraft radar hardware under certain operating conditions and degradation of the long-range detection and tracking performance of the Beyond-the-Horizon radar. Both issues have been corrected, and steps were taken in both the ground and air test procedures to prevent recurrences. However, numerous in-flight failures of software routines, which resulted in low Mean Time Between Failure, remain a concern for RSIP, now nearing completion of fielding. The Block 40/45 program will require rehosting significantly more software. DOT&E will work with the Air Force Operational Test and Evaluation Center and the 40/45 program to prevent a repetition of the types of problems experienced with the RSIP program.

*Block 40/45 will improve E-3 reliability and availability, providing theater commanders significantly enhanced surveillance and control capabilities while contributing to information superiority needed to control the battlespace.*

# Evolved Expendable Launch Vehicle (EELV)

The Evolved Expendable Launch Vehicle (EELV) program will fulfill government satellite launch requirements currently served by Delta II, Atlas II, Titan II, and Titan IV. The EELV will be DoD's only medium, intermediate, and heavy payload space launch capability after current heritage inventories are exhausted. The transition from current launch systems begins in FY03. EELV is expected to provide launch services through 2020.

DoD will acquire launch services. Production and launch operations responsibilities, and ownership of all EELV flight hardware and launch pad structures remain with the contractor. Launch pad real property and other on-base facilities required for operations are leased to the contractors. The government will maintain an ongoing competition between two contractors, Boeing and Lockheed Martin, rather than down-select to one. Boeing's EELV family of launch vehicles is designated the Delta IV, and Lockheed Martin's family of launch vehicles is designated the Atlas V. The contractors share development costs with the government to satisfy both DoD/civil launch requirements and commercial launch needs.

The EELV system includes launch vehicles, infrastructure, support systems, and interfaces. Payload interfaces, launch pads, and infrastructure will be standardized so all configurations of each contractor's EELV family can be launched from the same pad and so payloads can be interchanged between vehicles in the same class (i.e., medium, intermediate, or heavy). The EELV program will maintain current mass-to-orbit capability while increasing launch rate and decreasing costs. Potential savings will be generated through the commercial launch market and shared development by government and commercial customers.

The 1998 EELV Test and Evaluation Master Plan (TEMP), which is currently outdated and in need of revision, describes a test strategy that relies almost exclusively on combined developmental/operational testing. Due to the current acquisition strategy, there are no scheduled dedicated operational test events. The test strategy includes extensive use of models and simulations to predict individual sub-system and total system performance. Despite the commercial nature of the program, the government needs to evaluate system performance, interoperability, standardization, and the ability of each launch system to support launch requirements using only two national launch ranges.

An Operational Assessment was completed in late 2002. DOT&E continues to advocate additional system performance analysis. DOT&E is working with the Air Force to ensure that data sufficient to evaluate the operational effectiveness and suitability of the EELV system will be made available to DOT&E for independent analysis, after the Air Force Operational Test and Evaluation Center's (AFOTEC) test activity ends. Specifically, DOT&E requires an operational 'test' phase that encompasses several launches presently planned for from each contractor and will include Medium Launch Vehicles, Heavy Launch Vehicles, East Coast launches, and at least one West Coast launch.

*The Evolved Expendable Launch Vehicle is a launch services program fulfilling government satellite launch requirements currently served by Delta II, Atlas II, Titan II, and Titan IV. The EELV will be DoD's only medium, intermediate, and heavy payload space launch capability after current heritage inventories are exhausted.*

## TEST & EVALUATION ACTIVITY

- Early in FY02, Boeing and Lockheed Martin continued conducting qualification testing at the component and sub-system level for their respective families of launch vehicles.
  - Government insight was provided by the EELV System Program Office (SPO).
  - The SPO has made very little of this data available to the DoD test community, citing a lack of contractual requirements for formal reporting of the results due to streamlined acquisition and the attendant difficulties of assembling products suitable for external distribution due to the competition sensitivity of the program.
  - As first launch approached, the contractor testing progressed to the system level, culminating in Wet Dress Rehearsals (WDRs).
- DOT&E participation to date has consisted of:
  - Participation in periodic, SPO-conducted, government-only reviews of the entire program as well as integration activities.
  - Attendance at several WDRs, contractor lead system reviews, users' conferences.
  - Visits to production/launch facilities of both contractors.
- DOT&E also participated in Test Integrated Product Team meetings, with the goal of establishing a process for updating the TEMP and ensuring critical documentation and data are available for independent review and analysis.
- AFOTEC conducted an EELV Operational Assessment II from April 2001 to December 2002 to support the first government launch.
- DOT&E witnessed the first two commercial EELV launches; an Atlas V with a commercial payload, and a Delta IV with a commercial payload.

## TEST & EVALUATION ASSESSMENT

Based on DOT&E's participation in the periodic program reviews and insight into contractor-conducted test activities, there does not appear to be any insurmountable problem areas affecting the EELV program as a whole. There is, however, critical documentation that needs to be evaluated by DOT&E prior to the first government payload launch on Delta IV, now scheduled for February 2, 2003. Most important are the Technical Operations Review (TOR) and the TEMP. The TOR has not yet been released from the SPO for outside review, and the TEMP, as stated above, is in need of revision.

Operational Assessment II was completed by AFOTEC on December 18, 2002, and found the system to be a potentially effective and potentially suitable launch service which can support the requirements of the National Launch Forecast. Operational Assessment II supported Air Force Space Command's launch readiness review for the first government payload launch, a Defense Satellite Communications System payload scheduled for February 2, 2003. Areas that were rated as making less than Satisfactory Progress included Vehicle Design Reliability, Logistics Supportability, Number of Payload Interfaces, and Information Assurance.

Successful launches with the Atlas V and Delta IV boosters mated to commercial payloads took place in August and November 2002, respectively. Post flight analysis for the Atlas V indicates that first and second stage engine performance and orbital insertion were nominal. Initial indications are that all was successful. The Delta IV's first and second stage engines and Graphite Epoxy Motors (strap-on solid rocket motors) performed as expected.

DOT&E will base its assessment of readiness for the first government launch on having observed the first two commercial EELV flights and having attended the contractor-run post-flight data reviews. DOT&E is still awaiting the SPO's Delta IV first-flight final assessment, which is due prior to the first government launch, now scheduled for February 2, 2003.

# F/A-22 Advanced Tactical Fighter

Key features of the F/A-22 include low radar observability (with internal weapons carriage) and supersonic cruise capability in non-afterburning power, combined with superior maneuverability and excellent handling qualities. Other features critical to the F/A-22 concept of operations are an integrated avionics suite incorporating wide field-of-regard offensive and defensive sensors, an electronically scanned, active element radar array, and an advanced electronic warfare system with a variety of identification and countermeasures capabilities. Enhanced logistics features include an Integrated Maintenance Information System (IMIS) and advanced Diagnostics and Health Management (DHM) to achieve high sortie rates, reduced maintenance manpower, and improved deployability. Basic armament consists of six AIM-120C radar-guided air-to-air missiles, two AIM-9 infrared guided missiles, and a 20mm cannon. Alternatively, two 1,000 pound Joint Direct Attack Munition precision-guided bombs can be carried internally along with two AIM-120s and two AIM-9s.

Development of the F/A-22 started as the Advanced Tactical Fighter with Milestone 0 completed in 1983 and Milestone I in 1986. The F-22 program completed its Milestone II Defense Acquisition Board (DAB) and entered Engineering and Manufacturing Development (EMD) in July 1991. Since then, the program has undergone several major changes due to schedule delays, budget reductions, and cost growth. An independent Joint Estimating Team identified significant cost growth in EMD and recommended program restructuring. This restructure was approved by a February 1997 DAB. A primary element of the restructure was elimination of the four Pre-Production Vehicles. As a result, two EMD test aircraft and two Production Representative Test Vehicles (PRTV 1) were assigned as Operational Test aircraft. EMD was also increased by nine months to allow more time for avionics testing. The EMD flight test program began on September 7, 1997, with first flight of Aircraft 4001 at Edwards Air Force Base. In December 1999, a DAB delayed the Low-Rate Initial Production (LRIP) decision and designated the next block of six aircraft Production Representative Test Vehicles II (PRTV II).

F/A-22 testing progressed slowly during CY00, mainly due to late aircraft deliveries. In addition, aircraft deficiencies, including structural issues requiring onsite modifications, further delayed demonstrating performance in developmental test. The scheduled December 2000 LRIP DAB was deferred to allow additional time to complete Exit Criteria. The F/A-22 TEMP was approved in January 2001. In June 2001, in an attempt to improve executability of the program, the Air Force restructured the test program. The outcome was deferral of some testing to beyond the start of Initial Operational Test and Evaluation (IOT&E). In addition, planned IOT&E start date was delayed from August 2002 to April 2003. All LRIP Exit Criteria were completed and the DAB was held in August 2001. Initiation of LRIP was approved along with an increase in the F/A-22 production cost cap. To compensate for the cost increase, production quantity was reduced to 295 aircraft with the caveat that the Air Force could increase this quantity if production improvement programs yielded significant payoffs in reducing cost.


*F-22 is designed to employ internally carried armament.*

The F/A-22 Live Fire Test & Evaluation (LFT&E) plan includes evaluation of hydrodynamic ram structural damage, dry bay fire, and critical component separation. Aircraft 4001, previously used in the flight sciences testing, was transferred to serve as a Live Fire Test (LFT) target. LFT to date has included hydrodynamic ram vulnerability testing of the wing and aft fuel tanks; fire vulnerability testing of the wing attachment, aft side of fuselage, main landing gear (MLG), and airframe mounted accessory drive (AMAD) dry bays; and penetration vulnerability testing of avionics bays. High explosive threat effect tests were performed to evaluate component separation adequacy. In May 1999, the Air Force relaxed the vulnerability specification by 30 percent to accommodate increases in vulnerability determined as a result of LFT&E. Testing of wing leading edge dry bay fire, forward fuselage fuel tank hydrodynamic ram damage, and the performance of the on-board inert gas generating system are yet to be completed.

### TEST & EVALUATION ACTIVITY

During CY02, additional test aircraft were delivered to the test force and progress was made in flight sciences and logistics testing. However, persistent fin buffet at higher angles of attack and a canopy "howl" phenomena added flight test points and delayed envelope expansion efforts. Avionics testing fell far behind the planned schedule due to slow deliveries of derivative software packages incorporating advanced functionality needed for IOT&E. Avionics testing was further hampered by the fact that delivered software was immature leading to in-flight instability and system shutdowns. The Air Force convened separate Fin Buffet and Avionics Red Teams in the spring/summer of 2002 to address these issues and then decided to again delay the planned start date of IOT&E from April 2003 to August 2003 in order to have more time to deal with known system deficiencies and problems in these and other areas.

Performance of the F119 engine has generally been excellent and all testing necessary for its Initial Service Release approval was completed by May 2001. Full-scale airframe static testing using airframe 3999 and the first of four planned fatigue lifetimes of testing using airframe 4000 have been completed and second fatigue life testing is in progress. Expansion of flight testing into the high-speed, high g-load regions of the performance envelope is ongoing with the only flight test aircraft (4003) that has the structural modifications and test instrumentation necessary to conduct this testing. Flight envelope expansion is critical to weapons integration and avionics test progress since the envelope must be opened to complete necessary testing in those areas. The program also continues to work to understand and identify appropriate modifications for higher than predicted aft fuselage temperatures and thermal management system deficiencies.

F/A-22 aircraft avionics flight test began in January 2001. The APG-77 radar met its detection range performance parameter and radar testing continues in conjunction with the Communications, Navigation, and Identification (CNI) and Electronic Warfare (EW) subsystems that provide the other components of integrated closed loop tracking. However, instabilities and problems with EW and CNI software have seriously hampered the progress of the avionics flight test program. Resolution of these instabilities and performance problems are essential to continued progress and have received major focus. The Flying Test Bed (FTB) assisted with in-flight data-link and missile launch detector development. It continues to play a role in the integration of avionics software and hardware components prior to their being tested on the F/A-22. The Avionics Integration Laboratory (AIL) in Seattle, the Tactical Avionics System Integration Laboratory (TASIL) in Fort Worth, and the newly activated Raptor AIL (RAIL) in Marietta, along with the FTB are key elements in the process that should eventually culminate in a stable, operationally effective, and suitable F/A-22 avionics suite being delivered to flight test and IOT&E.

Safe separation unguided missile launches have been conducted with both AIM-9 and AIM-120 missiles and were expanded into the supersonic flight regime during 2002. The first guided AIM-120C launch from the F/A-22 occurred in September 2001 with the missile guiding to within lethal radius of the target. Supersonic guided launches, essential to validate the F/A-22's supercruise combat capability, began in November 2002 with an AIM-9M and an AIM-120C being successfully launched in separate flight tests.

Testing of F/A-22 stealth characteristics has included measurements of both radar and infrared signatures and evaluations of stability over time and logistics testing. Measured radar signatures have been extremely consistent between test aircraft and are generally meeting system specifications. Stealth sustainability testing is in progress and several planned 50-hour Low Observability (LO) maintenance test blocks have been completed. Environmental risks in the LO area have been reduced and maintenance processes for restoration of Radar Cross-section have been developed.

Wing fuel tank hydrodynamic ram ballistic test and evaluation was completed in January 2002. Engine nacelle fire suppression system ballistic testing was started in May 2002 and was completed in late 2002. A realistic forward fuselage test article was manufactured to conduct forward fuselage fuel tank hydrodynamic ram damage ballistic tests.

**TEST & EVALUATION ASSESSMENT**

The 1991 Milestone II DAB directed an Operational Assessment (OA) to support the F/A-22 LRIP decision. The Air Force OA began in January 1998 and the report documenting results was published in April 2001. Numerous issues including main landing gear strut settling, environmental control system problems, intra-flight data link shortfalls, and missile launch detector performance, were identified. Aircraft brake and arresting tail hook design difficulties were highlighted as creating a potential for the F/A-22 to be forced to operate from longer airfields. The amount of specialized support equipment that may be necessary to maintain stealth performance could adversely affect mobility support requirements. The greatest risks to certification of F/A-22 for IOT&E were identified as avionics test progress, software development, flight envelope expansion, and test aircraft configuration. DOT&E concurs in this assessment that has been further reinforced by the ongoing F/A-22 flight test program.

During moderate to high angle of attack maneuvering vortices from the leading edge of the fuselage, engine inlets, and wings buffet the tail fins causing responses that could have serious strength and fatigue implications. Since only one F/A-22 flight test aircraft incorporates the structural modifications and special instrumentation to enable the flight envelope to be fully cleared to its airspeed, altitude, and g-load design limits, the program maintains a high schedule risk in clearing the required flight envelope prior to the Air Force's planned start of IOT&E in August 2003 while also characterizing and resolving the fin buffet issue. All test aircraft today have multiple operating limitations. All are monitored during flight for unacceptable loads/stresses. Missions have been terminated early as a result of exceeding monitored load and/or temperature limits. IOT&E requires both an adequate flight envelope and unmonitored flight clearance (without control room support to monitor loads/stresses during uninhibited maneuvering typical of visual "close-in" air combat and air combat training). The fin buffet issue could add additional restrictions (pitch and roll rates, angle of attack and g-loads, altitude thresholds for maneuvering).

Avionics software has encountered problems in processing and "fusing" information from multiple sensors tracking multiple targets resulting in shutdowns that necessitate operationally unacceptable restart procedures. This instability problem contributed to avionics test inefficiencies and limited the ability of developmental test to measure integrated system performance. Resolving avionics system instabilities and functionality issues requires development of numerous software fixes and extensive regression testing due to changes to software configuration, architecture, etc. Additional software problems are sometimes created during the resolution process, further complicating efforts to achieve the planned software development schedule. The current schedule may not allow sufficient time to incorporate and validate all necessary stability and functionality-related avionics modifications prior to the Air Force's planned start of IOT&E in August 2003. In an attempt to come to grips with this issue, OSD convened an independent Avionics Technology Red Team to assess F/A-22 avionics development status and plans in December 2002. This team is scheduled to provide its findings and recommendations in late January 2003.

Development and integration of fully integrated diagnostics has slipped to a software block that delivers after the Air Force's planned start of IOT&E in August 2003. Fully capable integrated diagnostics cannot be available until after a planned architecture change is implemented to add a "health and status" monitor function — necessary to allow maintenance personnel to operate the interface between planned support equipment and aircraft systems. Fully integrated diagnostics will not be available until Lot 2 aircraft, or later, when new common integrated processors are used. DHM is required for an adequate IOT&E suitability assessment. Without integrated diagnostics, maintenance carried out in accordance with the current F/A-22 maintenance concept will not be possible and contractor logistic support, to include special test equipment and personnel, will be required. Current indications are that some contractor-operated Special Test Equipment will be required to maintain the aircraft during IOT&E.

Initial guided missile launches were conducted at non-operationally realistic (slower) airspeeds as engineering build-ups to the Test and Evaluation Master Plan (TEMP) scenarios. Supersonic guided launches using TEMP scenarios have now begun. Some fully integrated guided missile test launches will be done concurrently with IOT&E or as part of a post-EMD effort. The Air Force intends to demonstrate that the captive-carry instrumented test vehicle (ITV) version of the AMRAAM missile is a valid Operational Test evaluation tool. The TEMP was revised to reflect the option to use ITV data in lieu of actual live launches in certain scenarios if approved by DOT&E; however, DOT&E has yet to approve this option. DOT&E believes that the largest F/A-22 development risk, from both a technical and schedule perspective, lies in the integration and validation of the advanced avionics suite with realistic air-to-air weapons employment. An event-driven start to IOT&E would have to include sufficient time to correct known deficiencies in fire control/weapons employment in order for the IOT&E to be adequate and credibly measure operational effectiveness and suitability.

A major part of the F/A-22 IOT&E evaluation will be based on results from the Air Combat Simulator (ACS), currently in development at the prime contractor's facility in Marietta, Georgia. The ACS must model four-ship employment in the dense surface-to-air and air-to-air threat and electronic signal environment that is impractical or too costly to generate in open-air trails. Development of the ACS, consisting of four domes and ten manned interactive cockpit stations, continues but slow progress in integrated avionics flight test affects Verification, Validation and Accreditation (VV&A) activities, necessary prior to initiation of IOT&E. Since the planned flight test program may not provide all data required for accurate ACS system characterization, the Air Force plans to use FTB and ground hardware-in-the-loop laboratory data to supplement flight test data in the ACS VV&A effort. A successful conclusion to IOT&E and F/A-22 EMD is dependent on the commitment of adequate resources to complete the necessary ACS development.

Technical and schedule risk are high, as is the probability that a successful IOT&E can begin as scheduled in April-October 2003 with an effective and suitable production-representative weapon system. Significant operational capability is being deferred until after the start of IOT&E and completion of EMD. Deferred testing includes ferry configuration, external stores, and JDAM carriage and release, full gun employment envelope, full use of the speed brake function, and numerous system specification compliance test points. Deferred mission avionics capabilities include JDAM employment, AIM-9X integration, helmet mounted cueing system integration, Joint Tactical Information Distribution System transmit capability, and transition to the production version of the Common Integrated Processor, with attendant changes to avionics core processing.

Results of the wing fuel tank hydrodynamic ram test indicate that, in the area tested, the redesigned wing performed as predicted and successfully withstood hydrodynamic ram effects. The accurate prediction of damage and residual strength for this test supports the analysis that predicts wing fuel tank vulnerability to hydrodynamic ram in critical structural components elsewhere on the wing.

Limitations on loading the aircraft to represent realistic flight loads with representative airflow were overcome using computer controlled hydraulic jacks pushing against the wings to simulate flight loads of a maneuvering airplane. A battery of five jet engines blew high velocity air across the wing, and the fuel tanks were filled with fuel. As a result, the test was conducted as if the aircraft were in flight and hit by an anti-aircraft artillery round.

# Global Broadcast Service (GBS)

The Global Broadcast Service (GBS) will augment and interface with other communications systems and provide a continuous, high-speed, one-way flow of high-volume data, audio, imagery, and video information streams at multiple classification levels to deployed and garrisoned forces across the globe.

GBS consists of a space segment, fixed and transportable transmit suites, and fixed and transportable receive suites. The space segment of the current phase of GBS consists of four GBS transponders on each of three Ultra High Frequency Follow-On (UFO) satellites and leased commercial satellite transponders as required to meet demand. Transmit suites build broadcast data streams from various sources of information, including command, weather, and intelligence agencies and commercial television programming. They manage the flow of selected information through the uplink broadcast antenna to the orbiting satellites for broadcast to the appropriate theaters of operation. The receive suites extract the appropriate information for distribution by existing systems to the appropriate end users within selected areas of operation.

The GBS acquisition strategy was conceived as a three-phase program based on an evolutionary system design supported by commercially available technology. The program is currently in Phase II. GBS Phase I, conducted from FY96 to FY98, was used to develop the user requirements and concepts of operations. GBS Phase II, scheduled for completion in FY06, will develop near-worldwide GBS core operational capability and further refine operational requirements and employment concepts. GBS Phase III, scheduled to begin in FY06, is being addressed as part of the Advanced Wideband System program.

Technical problems with transmit suite software and transportable and fixed receive suite design and subsequent program delays led to a Joint Requirements Oversight Council (JROC) decision to defer a small subset of capabilities, field the system with non-deferred capabilities, and then incrementally field upgrades until all the Operational Requirements Document (ORD) thresholds are met. Initial Operational Capability (IOC)1 for the core system will most likely be declared in June 2003, based on combined multi-service Developmental/Operational Test, Army Operational Test, and Operational Assessments (OA) by the Air Force Operational Test and Evaluation Command (AFOTEC) and the Commander, Operational Test and Evaluation Force. The deferred capabilities of full broadcast history, classified video, and remote enable will be fielded in two additional builds. Finally, the more lightweight rugged Transportable Ground Receive Station (TGRS) configuration will be released in FY04. An IOC 2/3 declaration for these deferred capabilities is tentatively scheduled in the draft APB for September 2005.

*The Global Broadcast Service will provide a continuous, high speed, one-way flow of data, audio, imagery, and video information streams at multiple classification levels to deployed and garrisoned forces across the globe.*

At the onset of the GBS program, direct broadcast television was the dominant commercial model and the GBS architecture followed that model using commercial Asynchronous Transfer Mode (ATM) equipment with customized government application software. Over the last three years, satellite Internet service using Internet Protocol (IP) has evolved to where IP-based equipment now dominates the commercial satellite market. GBS functionality has been demonstrated using available off-the-shelf IP-based equipment, which does not require custom software. It appears that the most cost-effective approach to satisfy the deferred ORD requirements and complete GBS Phase II is to shift to an IP-based architecture for the remainder of the equipment to be purchased. GBS's IP-based architecture has now been funded by the Air Force; with the adoption of the IP architecture, the Air Force is scheduled to approve a new APB for an IP-based GBS program in Feb 2003. There will be an orderly transition to IP-based equipment and a phasing-out of the present ATM-based equipment.

### TEST & EVALUATION ACTIVITY

- An updated Phase II Test and Evaluation Master Plan (TEMP) is in coordination that reflects the incremental fielding and testing requested by the JROC and the May 2001 revised ORD.
- AFOTEC has briefed DOT&E on the operational test approach.
- A Combined Test Force was formed to coordinate the planning of all GBS testing.
- Combined Developmental/Operational Test #1 was conducted in January 2001 at contractor and government developmental facilities on the U.S. East Coast.
- Developmental/Operational Test #2 was conducted in June 2001 in the Pacific Theater. MOT&E had been projected for 2QFY02, but the Operation Assessment based on Developmental/Operational Test #2 indicated that system was not sufficiently mature for a successful MOT&E in FY02.
- Additional Developmental/Operational Test performed in FY02 indicated that the system would be ready for the MOT&E. The Developmental/Operational Test performed in FY02 consisted of three major activities: Navy Developmental Test and an OA of Shipboard Receive Suites (SRS) and Subsurface Receive Suites (SSRS), Air Force led joint testing of fixed and transportable receive suites, and Army Developmental Test and an OA of the Theater Injection Point (TIP).

### TEST & EVALUATION ASSESSMENT

The GBS system has made very substantial progress from a very elementary capability demonstrated during Developmental/Operational Test #1, and from a system that was almost mature at Developmental/Operational Test #2, to a system that played a substantial role in information distribution during Operation Enduring Freedom. The incremental combined Developmental/Operational Test strategy has worked in concert with the incremental fielding and evolutionary release of software builds to effectively bring the system to its present condition. Testing performed during FY02 has supported fielding and materiel release decisions while identifying the major issues that remain to be solved.

During Developmental/Operational Test #1, the Satellite Broadcast Manager (SBM) was successful in building daily broadcast schedules and beam plans as well as in broadcasting video, audio, and File Transfer Protocol (FTP) classified and unclassified products. However, the Transmit Planning and Scheduling software was immature and several problems were identified for correction. The SBM software used in Developmental/Operational Test #2 was vastly improved from its performance during Developmental/Operational Test #1; however, it was still immature and several new deficiencies were identified. The Receive Broadcast Managers were able to receive video, audio, and FTP Secret, ROKUS, and unclassified products. Developmental/Operational Test #2 and Developmental/Operational Test #1 were very similar in that, at both test events, an inconsistency with product reception success was observed throughout the test sites.

During the second and third quarters of FY02, the Air Force led combined Developmental/Operational Test of the broadcast software, the Navy tested its surface and submarine receive suites, and the Army led testing of the TIP.

Pre-certification testing, conducted jointly by AFOTEC and the 46th Test Squadron to assure readiness to enter MOT&E in 2003 will now most likely be reported as an Operational Assessment. COMOPTEVFOR will likely perform an OT event on the current ATM-based shipboard hardware due to the fact the hardware will be on Navy assets for up to four years. A Multi-service Operational Test and Evaluation (MOT&E), tentatively scheduled for FY05, will support the IOC-2 and 3 decisions on the IP-based equipment.

**Broadcast software and overall system performance**. Reception reliability was computed at 97 percent overall, which exceeds ORD requirements (90 percent threshold, 95 percent objective). From an operational perspective, the Theater Informational Managers have become integrated into the process. Several new capabilities were introduced, including Immediate File Delivery (broadcast of a limited number of high priority files not included in the broadcast schedule), ability to transmit up to TS/SCI data using concept called "Black Cell," and broadcast of Common Operational Picture. Problems still exist with dynamic tuning, loss of permanent virtual circuits with cryptography equipment, and reliability of the Low Noise Blocks.

**Navy Receive Suites**. The Navy Operational Assessment determined that the SRS and SSRS are potentially effective and suitable. The system met all SRS-specific ORD requirements except availability, which was 89 percent (threshold 92 percent). Weather conditions in the Norfolk operating area, which can block Super High Frequency transmissions, played a significant part in the low availability results. In addition, product reception rates for the SRS were 77 percent for unclassified products and 82 percent for classified products, below the ORD threshold of 90 percent. The OA combined with the preceding Developmental Test identified several significant problems that have been identified for correction. Problems that are unique to the Navy receive suites include dual antenna blockage, antenna tracking during maneuvers, and vibrations due to flight operations and missile launching.

**Theater Injection Point**. Developmental/Operational Testing with the TIP took place in three phases: Ku band testing (6-17 May 2002); Logistics Maintainability Demonstration (20-22 May 2002) and Ka band testing (10-21 June 2002). Results in the TIP testing are fair. Generally, testing went well with the Ku band broadcast but significant problems occurred during the Ka band broadcast. Hardware issues persist, and there is no trained crew capable of operating the TIP without extensive support from a Raytheon contractor. Due to these deficiencies, Joint Forces Command stated the TIP should not be deployed until fixes are implemented.

Users need to finalize their CONOPS before the GBS system will be able to enter MOT&E. AFOTEC will not test without a CONOPS. Additionally, the program office must ensure timely installation of an EHF terminal at Sigonella for direct satellite beam control. This is an ORD Key Performance Parameter and an essential capability, enabling the SBM to exercise frequent beam movement precisely coordinated with the broadcast schedule.

# Global Command & Control System - Air Force (GCCS-AF)

The Global Command and Control System – Air Force (GCCS-AF) consists primarily of the Theater Battle Management Control System (TBMCS), with additional functionality provided under the umbrella of the Air Operation Center Weapon System (AOC-WS) program. TBMCS provides hardware, software, and communications interfaces to support the preparation, modification, and dissemination of the force level Air Battle Plan (ABP). The ABP includes the Air Tasking Order and Airspace Coordination Order. TBMCS unit level operations and intelligence applications provide Air Force Wings the capability to receive the ABP, parse it, and manage wing operations and intelligence to support execution of the ABP.

TBMCS supports the development and sharing of a common relevant operational picture of theater air and surface activity. TBMCS common applications and interfaces provide a network for Joint Force data sharing. The TBMCS intelligence and targeting applications at the theater Joint Force Air Component Commander level and at the Air Support Operations Center (ASOC) and Direct Air Support Center supports the coordination of Precision Engagement fires, safe passage zones, and near real time warnings of impending air attack. The air and surface surveillance and weapons coordination engagement options enable synchronized operations and employment of the correct weapons for each target to generate the desired results. All TBMCS network participants have access to engagement intentions and results assessments, which contributes to improved decision-making by commanders.

TBMCS fielding includes every theater air component, all Navy aircraft carriers and command ships, all Marine Air Wings, and all Air Force flying wings and ASOC squadrons. Army Battlefield Coordination Detachments also interface with TBMCS.

The TBMCS has been in development since 1994. During 1999, TBMCS came under OSD oversight. The Program Management Office is the Air Force Electronic Systems Center at Hanscom Air Force Base, Massachusetts. The Air Force Operational Test and Evaluation Center (AFOTEC) became the lead test organization and has coordinated the planning and conduct of two TBMCS Version 1.0.1 Multi-Service Operational Test and Evaluations, as well as operational tests of Version 1.0.2 and 1.1. Version 1.1.1 was operationally tested late October 2002.

Since coming on oversight, the TBMCS program has made significant improvements and is compliant with the acquisition requirements for Major Automated Information Systems. There is an Operational Requirements Document (ORD) approved by the Joint Requirements Oversight Council and an approved Test and Evaluation Master Plan to accompany the new ORD. Coordination among the Services for defining Service-unique requirements is improving, and the Service Operational Test Agencies (OTAs) all work well together on this program.

*Since coming on oversight, the Theater Battle Management Control System program has made significant improvements and is compliant with the acquisition requirements for Major Automated Information Systems.*

The AOC-WS program is new and was without a funding line for FY02. Test activity has not been under DOT&E oversight, and has been primarily limited to small, but high priority improvements needed to support U.S. Central Command efforts in the Middle East. Both TBMCS and AOC-WS are being combined to form GCCS-AF, and testing processes involving Service OTAs may need adjustment.

### TEST & EVALUATION ACTIVITY

- TBMCS 1.1 (Force level) Combined Developmental Test (DT)/Operational Test, February 2002.
- TBMCS 1.1.1 (Force level) and AOC-WS 10.0.2 Combined DT/Operational Test, October 2002.
- TBMCS Unit-level Operations (UL-OPS) Spiral 5 Government in-plant testing, February 2002.
- TBMCS UL-OPS Spiral 6 Field Development Evaluation (FDE), September 2002.
- TBMCS Unit-level Intelligence (UL-Intel) Spiral 5 FDE, April 2002.
- TBMCS UL-Intel Spiral 6 FDE, December 2002.
- AOC-WS 10.0.1

### TEST & EVALUATION ASSESSMENT

TBMCS 1.1 was assessed as effective and suitable, with significant improvements noted in suitability. There were significantly fewer problems for the users to work around, and this also greatly reduced the workload of the system administrators. Intermittent communications problems between the shore-based and ship-based systems caused a significant problem, but users still produced the Air Tasking Order on time. Training has been showing steady and significant improvement.

The TBMCS 1.1 test clearly showed that it is important to keep the number of cautions and warnings that users have to deal with to a minimum. Not only did users perform better, but it also greatly reduced the workload of the system administrators.

During the TBMCS 1.1 test, AFOTEC employed significant performance-monitoring systems to capture performance data. Licenses for these monitoring systems are expensive and are not delivered as part of the system. Therefore, to ensure operational realism, the system administrators were not allowed to benefit from this information during the test. These systems were able to show, in real time, performance problems that could have been fixed by system administrators, thereby improving overall system performance and especially response times seen by the users. Use of such performance monitoring systems is encouraged, especially in air operations centers performing critical real-world missions.

The spiral development philosophy used by the UL-Ops community is workable, but if consecutive releases are cancelled due to critical problems found during testing, then the user can wait a long time for desired functionality upgrades. For this reason, if this approach is taken, then about every third release needs to be developed with lower risk and higher probability of success during Operational Testing. The schedule for every third release would therefore need extra fix time added between DT and Operational Test events.

The lower risk spiral development philosophy used by the UL-Intel community is working well, they are entering Operational Test with mature systems, and they are fielding their releases on schedule. Eventually, the force-level and both unit-level systems will all be more closely integrated, so testing schedules in the future will be more difficult to coordinate.

TBMCS UL-OPS is using a fixed 6-month spiral development approach. If one spiral encounters significant problems, fix actions are made to the next spiral, rather than trying to slip the entire schedule and fix the spiral with problems. Early testing of Spiral 5 indicated the spiral should not be continued, the program office made the correct decisions, and fixes were planned for Spiral 6. Spiral 6 DT testing is showing a significantly more mature product and has been recommended for fielding.

TBMCS UL-Intel is using a 9-month spiral development approach in which time is programmed in the schedule for fixing problems found during early testing. During Spiral 5, this approach worked very well, and problems found during DT were fixed before the system entered FDE. As a result, the FDE went very smoothly, and the system was assessed to be effective and suitable.

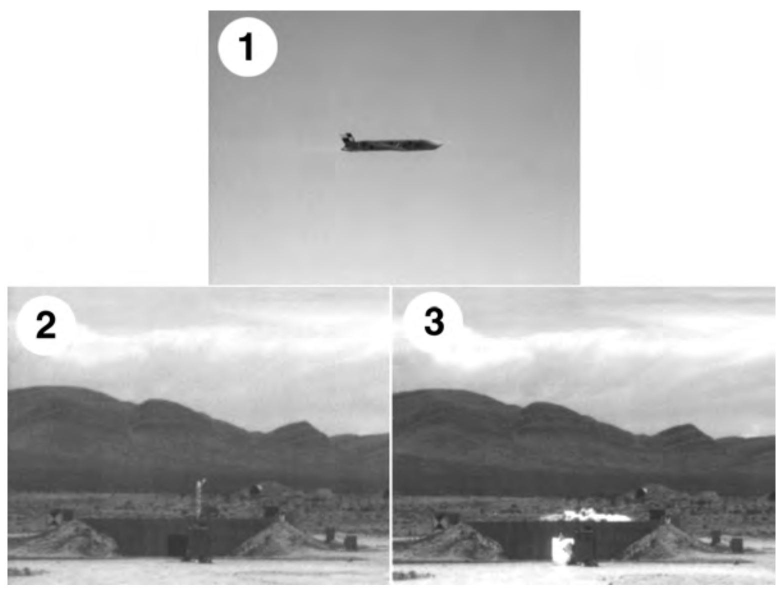
Testing of AOC-WS 10.0.1 focused primarily on a special targeting toolkit, and this product was found to be acceptable for fielding. AOC-WS 10.0.2 was tested in conjunction with TBMCS 1.1.1 in October 2002. Preliminary indications are that the incorporated hardware and software changes will be operationally suitable, operationally effective, and interoperable.

# Joint Air-to-Surface Standoff Missile (JASSM)

The Joint Air-to-Surface Standoff Missile (JASSM) is a cruise missile which is launched from beyond area air defenses in order to kill hard, medium-hardened, and soft/soft-distributed targets. It will attack fixed and relocatable targets using an Inertial Navigation System/Global Positioning System for enroute navigation and an Imaging Infrared seeker for terminal guidance. Threshold integration aircraft are the B-52H and F-16C Block 50. However, software upgrades to the F-16 will prevent completion of operational test on that aircraft until after the Milestone III full-rate production (FRP) decision. Therefore, a Follow-on Test and Evaluation (FOT&E) after Milestone III will be executed to evaluate the F-16 operational JASSM capability. JASSM Key Performance Parameters are Missile Mission Effectiveness (MME) (ability to survive and kill a defined target set), Interoperability, Range and Aircraft Carrier Operability. Due to funding limitations and F/A-18 E/F test platform availability, the Joint Requirements Oversight Council approved deferring the Carrier Operability Key Performance Parameters until after Milestone III. Therefore, F/A-18 E/F integration will be evaluated in an FOT&E in FY04 or later.

In 1996, the services performed an Analysis of Alternatives and validated a JASSM requirement versus a proposed Stand-Off Land Attack Missile-Expanded Response Plus (SLAM-ER+). A 1998 Milestone II decision approved Engineering and Manufacturing Development entry and the Low-Rate Initial Production (LRIP) entrance criteria. Flight-testing began in FY00. In December 2001, the program was approved for LRIP and designated an Acquisition Category 1C with the Air Force as the lead for a November 2003 FRP decision. The U.S. Air Force plans to buy 3,700 units over 13 years. Navy quantities are to be determined. The FRP rate is planned for 360 units per year. Early in JASSM development, the Joint Chief of Staff directed programs with Global Positioning Service to use the Selective Availability Anti-Spoofing Module (SAASM) by 2002. To avoid delays, OSD approved a plan for JASSM development and testing without SASSM, while concurrently developing a final production missile with SASSM, designated Lot 2.

The JASSM test strategy has featured early Operational Test involvement with the continued use of modeling and simulation to gain Test and Evaluation (T&E) efficiencies. Operational units are being used in T&E to minimize training time once JASSM is fielded. Government test aircraft, instrumentation, and ranges support the contractor-run Developmental Testing (DT). The Live Fire Test and Evaluation (LFT&E) strategy calls for lethality to be evaluated using all developmental and operational test attacks. To accommodate the two-lot development approach, four Lot 2 missiles will be tested in DT. After successful completion of the DT, there will be four Lot 2 Operational Test shots to validate the modifications.




*The Joint Air-to-Surface Standoff Missile is a cruise missile to be launched from beyond area air defenses in order to kill hard, medium-hardened, and soft/soft-distributed targets. It will attack targets using an Inertial Navigation System/Global Positioning System for en route navigation and an Imaging Infrared seeker for terminal guidance.*

### TEST & EVALUATION ACTIVITIES

Developmental testing continued in FY02 with six launches, five of which were successful. In October 2002, the third Lot 2 missile on the sixth DT mission departed controlled flight after launch and spiraled to the ground. Contractor analysis found a control actuator jammed due to overlapping design clearances. In response, all JASSM wing assemblies will be retrofitted with new actuator hardware and will be tested in a final DT flight tentatively scheduled for FY03.

Since JASSM Operational Test Certification in April 2002, there have been three Operational Test missions. The first was successful, the second was declared a test error, and the third is under investigation. During the second mission, JASSM unexpectedly deviated from its pre-planned course and was intentionally destroyed as it approached a range boundary. Contractor analysis determined the missile performed as designed and the deviation was caused by the compounding errors of the test team planning a narrow launch envelope and then inadvertently launching the missile slightly out of that envelope. Although it was determined the missile reacted appropriately, training materials, mission-planning software, and cockpit presentations will be modified to avoid this situation when JASSM is operational. In October 2002, the third Operational Test mission flew as planned, accurately impacted the target, but did not detonate. The Program Office has reported initial findings indicating this failure was not related to two other fuze/arm failures experienced during previous testing. The final determination of this failure is pending.

Robust reliability and maintainability testing continues. Extensive captive-carry, environmental and aircraft loading evaluations are being conducted on both the F-16 and B-52 aircraft. During these events, it was discovered that rainwater was collecting inside both the protective ground covers and the missile itself, causing paint bubbling and electrical failures. In response, the contractor will redesign the covers and install additional drain holes in the missile body.

In response to the issues and failures experienced in flight and reliability testing, the JASSM Program Executive Officer (PEO) placed all free flight testing on hold in October 2002. In January 2003, an Independent Review Team will consider the issues and retrofits to provide a recommendation to the PEO concerning readiness to resume all flight-testing. The program office is planning for Operational Testing to resume in March 2003, assuming re-certification and the final DT event are complete.

The U.S. Air Force has unveiled plans to develop and field a JASSM-ER (Extended Range). To increase the missile's range, as a minimum the engine and fuel system will be modified. DOT&E is working with the Air Force Operational Test and Evaluation Center and the JASSM Program Office to develop a T&E program for this new capability.

### TEST & EVALUATION ASSESSMENT

Single-shot kills have been achieved against a communications van, radar, weapons bunker, and medium-hardened bunker. A hardened bunker was defeated in two shots, exceeding predictions that three shots would be required. Thus far, when the system functions properly, the warhead has proven lethal against its target set. MME will be evaluated against a set of 17 targets. However, not all 17 will actually be attacked/destroyed. Instead, MME will be derived from models validated using live fire data from a 7-target subset of the 17. Since the models are being developed as the live shots are taken, DOT&E will closely monitor model maturity. Furthermore, while planned in Operational Test, survivability has yet to be evaluated. Survivability of JASSM against a realistic and current threat matrix is critical in the overall MME determination and will continue to be a priority in Operational Testing.

Discoveries in the JASSM program have proven the value of robust and comprehensive Operational Testing. With Operational Testing less than half complete, testing has uncovered issues that could have caused arming/detonation failures, flight control jamming/departures from controlled flight, paint bubbling and cracking, circuitry shorts, and unexpected course deviations. None of these issues surfaced in developmental testing, and in the case of the control actuator binding, was undetected during over 20 previous releases. While none of these problems appear to be unsolvable or prevent eventual JASSM fielding, each one has proven significant enough to warrant an adjustment or retrofit. Absent the testing accomplished to date, many of these problems would not have been discovered until operational combat crews employed JASSM.

# Joint Direct Attack Munition (JDAM)

The Joint Direct Attack Munition (JDAM) is a low cost, autonomously controlled, adverse weather, accurate guidance kit for the Air Force/Navy 2,000-pound Mk-84 and BLU-109 general-purpose bomb and the 1,000-pound Mk-83 and BLU-110 general-purpose bomb. The JDAM tail kit and wind strake assemblies are also to be adapted to the Mk-82 500-pound bomb. There are no planned design changes to the bombs. However, the existing inventory of weapons will be configured with JDAM guidance kits and wind strake assemblies. Guidance is accomplished via an Inertial Navigation System aided by the Global Positioning System (GPS).

The JDAM kit is required to yield a delivery accuracy of less than 13 meters when GPS is available and less than 30 meters when GPS is absent or jammed after release. JDAM is employed by a variety of fighter/attack and bomber aircraft, allowing precision engagement from all altitudes under adverse environmental conditions. The primary aircraft for integration and operational testing of the 2,000-pound JDAM were the B-52H and the F/A-18C/D. The F-16, F-14B, F/A-18E/F, B-1, and B-2 are also operational users of JDAM. The 1,000-pound JDAM is to be tested and integrated initially on the F/A-18C/D, AV-8B, and F-22. The 500-pound JDAM is to be tested and integrated initially on the F/A-18C/D and B-2.

Low-Rate Initial Production (LRIP) of the 2,000-pound variant was approved in April 1997. However, due to numerous problems with the design, the Under Secretary of Defense (Acquisition and Technology) approved the delay of Milestone III to 3QFY99. A total of four LRIP decisions were rendered before a Milestone III approval in March 2001.

JDAM completed operational test of the 2,000-pound variant in August 2000. Operational tests were adequate to evaluate the operational effectiveness and suitability of the 2,000-pound variant. Test results demonstrated the 2,000-pound variant is operationally effective, but not operationally suitable. However, the high degree of effectiveness and substantial increase in targeting and weapon delivery flexibility were sufficient to justify fielding the 2,000-pound variant. The “not suitable” assessment resulted from shortfalls in container durability, system reliability, and a failure to meet mission-planning timelines. Although improvements were demonstrated during the test period, deficiencies remain that will affect operational employment. The redesign of the container, as well as system reliability, continues to be tracked and will be evaluated through Follow-on Test and Evaluation (FOT&E) and lot acceptance tests. Mission planning time should not adversely affect JDAM effectiveness and will be evaluated during FOT&E and again during the 1,000-pound variant Multi-service Operational Test & Evaluation (MOT&E).

JDAM was determined to be operationally effective only in combination with existing fuzes, specifically the FMU-139 and FMU-143. Testing is required, but not completed, with the FMU-152 Joint Programmable Fuze, due to numerous arming failures and subsequent decertification of FMU-152/JDAM combinations for both Air Force and Navy use. To address unresolved and unsatisfactory issues from MOT&E, a dedicated FMU-152 Joint Programmable Fuze/ JDAM FOT&E is planned for FY03.

*A quick reaction assessment of the 1,000-pound variant concluded in FY02. DOT&E determined that the 1,000-pound variant is potentially operationally effective and potentially operationally suitable.*

#### TEST & EVALUATION ACTIVITY

A quick reaction assessment (QRA) of the 1,000-pound variant concluded in FY02. DOT&E determined that the 1,000-pound variant is potentially operationally effective and potentially operationally suitable.

MOT&E of the 1,000-pound variant began in July 2002 and is planned to conclude in FY03. A full-rate production decision for the 1,000-pound variant is planned for FY03. Integration tests on the F-22 are planned to begin in FY04.

Developmental flight test of the 500-pound variant began in FY02. MOT&E is planned for FY03 with the F/A-18C/D and FY04 with the B-2. A full-rate production decision on the 500-pound variant is planned for FY05.

### TEST & EVALUATION ASSESSMENT

The potential effectiveness and suitability of the 1,000-pound variant mirror that of the 2,000-pound weapon system. However, items were noted during the QRA that need to be resolved. Limited data from the QRA indicates there may be a problem with rate capture algorithms for the 1,000-pound kit. However, follow on testing to date, and a review of rate capture anomalies during the QRA indicate that recurrence of rate capture anomalies by the 1,000-pound variant remain low. Based on the limited sample size, confidence in the weapon's capability is low. Although only a few contributors to system reliability deficiencies were evident, additional data to further characterize overall system reliability is required. This data is currently compiled in conjunction with the 19 weapon, 1,000-pound variant MOT&E. The MOT&E report will combine the results from both the QRA and the MOT&E to make a recommendation.

MOT&E results to date confirm results of the QRA. Accuracy, in most cases, falls within the requirements. However, five weapon events remain. Planning timelines are improved and now fall within requirement document parameters. Expectations are that results will continue to be fairly representative of the QRA.

# Joint Helmet Mounted Cueing System (JHMCS)

The Joint Helmet Mounted Cueing System (JHMCS) is a modified HGU-55/P helmet that incorporates a visor-projected Heads-Up Display to cue weapons and sensors to the target. This new cueing system is intended to improve effectiveness in both Air-to-Air and Air-to-Ground missions. In close combat, a pilot must currently align the aircraft to shoot at a target. JHMCS allows the pilot to simply look at a target to shoot it. This system projects visual targeting and aircraft performance information on the back of the helmet's visor, enabling the pilot to monitor this information without interrupting his field of view through the cockpit canopy. The system uses a magnetic transmitter unit fixed to the aircraft canopy rail and a magnetic receiver unit mounted on the helmet to define helmet pointing positioning. A Helmet Vehicle Interface interacts with the aircraft system bus to provide signal generation for the helmet display. This system represents a significant improvement to close combat targeting and engagement capability.

The JHMCS system will be employed in the FA-18C/D/E/F, F-15C/D, and F-16 Block 40/50 and with a design that is 95 percent common to all three platforms. The United States Air Force (USAF) has eliminated funding for JHMCS in the F/A-22. When used in conjunction with an AIM-9X missile, JHMCS is intended to allow a pilot to effectively designate and kill targets in a cone more than 80 degrees to either side of the nose of the aircraft, or High Off-Boresight.

## TEST & EVALUATION ACTIVITY

DOT&E approved the JHMCS Test and Evaluation Master Plan and the USAF and United States Navy initial operational test plans for the system. Multi-Service Operational Test and Evaluation (MOT&E) of JHMCS began in June 2001 for the USAF and October 2001 for the United States Navy and ended in June 2002.

## TEST & EVALUATION ASSESSMENT

Initial tests for both the F/A-18C/D and F-15C revealed significant reliability deficiencies. The device that connects the helmet to the aircraft (helmet vehicle interface) was particularly unreliable. An operational assessment of the systems for the F/A-18C/D and F-15C found the JHMCS potentially effective and potentially not suitable due to numerous breaks in the helmet vehicle interface. Initial F-15C flight tests revealed that the legacy computer was slow in providing necessary data to JHMCS. This slow data input to the helmet coupled with normal aircraft buffet during dogfights made it difficult for the pilot to designate the target.

Since these initial tests, several corrections have been introduced but have not improved reliability to an acceptable level. Based on MOT&E data collected from June 2001 to June 2002, the commanders of Air Force Operational Test and Evaluation Center and the Navy's Operational Test and Evaluation Force determined that JHMCS was operationally effective, but not operationally suitable. Both the Navy and USAF recommended to delay full-rate production until deficient areas are fixed and verified.

Based on MOT&E data and test observations, DOT&E determined that JHMCS was operationally effective, but not operationally suitable due to significant deficiencies in reliability, maintainability, supportability, and availability of the system and concurs with the recommendation by both Services to delay full-rate production until deficient areas are fixed and verified.


*DOT&E determined that the Joint Helmet Mounted Cueing System was operationally effective, but not operationally suitable and concurs with the recommendation by both Services to delay full-rate production until deficient areas are fixed and verified.*

JHMCS brings a significant increase in combat capability by allowing aviators to look and designate air and ground targets in a matter of seconds and without maneuvering their aircraft.

This capability, however, has four significant limitations: low system reliability, limited night utility, incompatibility in an environment when aviators need laser eye protection, and a Navy funding mismatch between the helmet and the high-off-boresite-angle missile, AIM-9X. Low system reliability continues to seriously jeopardize system operational availability. The current system design needs to be enhanced to provide compatibility with night vision and laser eye protection goggles. This could further expand the system's capability to include operations at night and situations where aviators need laser eye protection. The Navy's funding mismatch between the helmet and AIM-9X procurement will result in the first F/A-18E/F squadrons deploying for several years with only part (JHMCS) of their high-off-boresite combat envelope. The Navy will not realize the full air-to-air combat potential of the F/A-18E/F until it corrects this funding mismatch and conducts adequate follow-on operational test and evaluation of the F/A-18E/F with JHMCS and the AIM-9X missile.

# Joint Primary Aircraft Training System (JPATS)

The Joint Primary Aircraft Training System (JPATS) is a system of primary flight training devices tailored to meet U.S. Air Force and U.S. Navy aircrew requirements. The principal JPATS mission is to train entry-level United States Air Force/United States Navy student pilots in primary flying skills to a level of proficiency at which they can transition into an advanced pilot training track leading to qualification as military pilots, navigators, and naval flight officers. JPATS is designed to replace the U.S. Air Force T-37B and U.S. Navy T-34C aircraft and their associated Ground-Based Training Systems.

The JPATS consists of the T-6A Texan II air vehicles, simulators and associated ground-based training devices, a training integration management system, instructional courseware, and contractor logistics support. The Services will acquire common aircraft and the remaining components will be as common as possible. Logistics support will be tailored to each Service's maintenance concept.

Initial student training began in October 2001 at Moody Air Force Base, Georgia. Both Air Force and Navy students have graduated during the past year. Currently, aircraft are being delivered to Laughlin Air Force Base in Del Rio, Texas, the next entry-level student training base and to the Naval Air Station in Pensacola, Florida, in preparation for navigation flight officer training beginning in Augusts 2003.

## TEST & EVALUATION ACTIVITY

A multi-service system level end-to-end test, with a class of entry-level students, began on June 14, 2002, at Moody Air Force Base, Georgia, and concluded on December 12, 2002. The composition of the class was twelve Air Force and five Navy students who were observed throughout the entire course. This was the first time the aircraft and the ground-based components were evaluated as a complete system.

In addition to student training, resolution to some of the previously identified deficiencies are being addressed. Of the safety related deficiencies, two have been potentially corrected. First, the environmental control system (ECS) has been redesigned and installed on production aircraft and is currently under evaluation. It appears the fix was successful. The second deficiency was the ultra-high frequency (UHF) radio being intermittent in certain aircraft attitudes. An additional antenna will be installed on the aircraft as the fix to the UHF radio discrepancy. Testing was completed; however, the fix has not been installed on aircraft at the operating base and has not been evaluated during student training.

*Joint Primary Aircraft Training System is designed to replace the U.S. Air Force T-37B and U.S. Navy T-34C aircraft and their associated Ground-Based Training Systems.*

## TEST & EVALUATION ASSESSMENT

DOT&E's Test and Evaluation Report to Congress, dated November 2001, concluded that the aircraft was operationally effective, with numerous limitations, deficiencies and workarounds, and not operationally suitable. Problem and safety related areas included the engine, ECS, UHF and VHF radio performance, flight manuals and checklists, the emergency oxygen system, ground egress, the trim systems, the power control lever, the wheel brakes, cockpit storage, and rear view mirrors. Some improvements have been noted in the past year, but most of the previously listed deficiencies are not yet corrected.

The aircraft reliability and maintainability is continuously being monitored as a result of the unsuitable rating in the last evaluation. A 25 aircraft, 2,000 flight-hour demonstration at Laughlin Air Force Base will be conducted to assess operational suitability and examine whether the aircraft is meeting contractual requirements. This will be the first opportunity to see if aircraft can achieve the operational tempo that will be required by the Navy. The operational requirements verification plan to conduct the demonstration is in work.

The ground based training system consists of three major components: Aircrew Training Devices (ATDs), the Computer Based Training System (CBTS), and the training integration management system (TIMS). The ATDs are working well with minor deficiencies. There were minimal impacts to student training, but fixes to identified deficiencies have been slow. The Modification and Update Support System (MUSS) is not fully operational. The CBTS is also rated favorably; however, several areas could use improvement. Some of the courseware requires significant rework while another portion exhibits consistency problems and displays erroneous information.

The TIMS is not operationally effective or suitable in its current configuration. The system is still in development although some components have functionality. The functions that are working include: academics, student status, schedule viewer and the gradebook. Functions that require workarounds include the schedule build (flight level only), training forecast schedule, maintenance, and the flight surgeon inputs. Functions not working include the squadron scheduling and qualifications manager. The operational version is not expected to be ready for evaluation until early 2003. Numerous workarounds and real time changes were required to keep the system running during the end-to end evaluation evaluation. The TIMs will be re-evaluated during Follow-on Test and Evaluation.

# Joint Surveillance Target Attack Radar System (JSTARS) E-8C

The Joint Surveillance Target Attack Radar System (JSTARS) is a surveillance, battle management, and targeting radar system mounted on a Boeing 707 designated the E8-C. The 25-30 year old airframe has been refurbished and equipped with the JSTARS radar system, communications gear, 18 mission workstations, and an air refueling capability. It is a joint Air Force and Army program with the Air Force as the executive service. The system is required to perform surveillance and battle management for air and land component forces and is intended to meet the operational need to locate, classify, and support precision engagement of time-sensitive moving and stationary targets. Four systems combine to perform this mission: the JSTARS radar, E-8C aircraft, Army Common Ground Station (CGS), and data link connection between the two–the Surveillance and Control Data Link (SCDL). The follow-ons to the JSTARS radar, platform and data link are the Multi-Platform Radar Technology Insertion Program (MP-RTIP), Multi-sensor Command and Control Aircraft, and the Multi-Platform Common Data Link respectively. These programs are covered in a separate report.

The JSTARS program office originally planned four E-8C block upgrades. Block 10 provided the Tactical Digital Information Link; Block 20 was the Computer Replacement Program; and Block 30 integrates satellite communications, the Attack Support Upgrade, and Improved Data Modem (IDM). The Block 40 upgrade eventually transitioned to the separate MP-RTIP. Block 30 is now broken into separate efforts to upgrade the engines, avionics, and radar modes. In addition, the E-8C will be performing many of the missions previously assigned to the Airborne Battle Command and Control Center (ABCCC), which are being decommissioned.

### TEST & EVALUATION ACTIVITIES

- Initial JSTARS IDM testing was conducted from January to April 2002. The IDM provides a sensor-to-shooter data link between the E-8C and Apache AH-64D helicopters. There were three phases of testing. Phases 1 and 2 consisted of laboratory and ground testing, respectively. Phase 3 consisted of two flight test sorties conducted during a 101st Airborne Division exercise at Fort Leonard Wood, Missouri. During the exercise, one E-8C provided threat and targeting data to three companies of Apache helicopters that were conducting deep attack operations.

- The US Army conducted an evaluation of the CGS with the 82nd Airborne Division during a rotation to the Joint Readiness Training Center at Fort Polk, Louisiana in September 2002.

- Test and Evaluation of the Block 30 upgrades is being developed and will be published in a new TEMP. This testing will include Developmental Test and Operational Test of the individual upgrades and will culminate in a dedicated Operational Test and Evaluation (OT&E) of the combined upgrades.


*The Joint Surveillance Target Attack Radar System system is required to perform surveillance and battle management for air and land component forces and is intended to meet the operational need to locate, classify, and support precision engagement of time-sensitive moving and stationary targets.*

### TEST & EVALUATION ASSESSMENT

Although a Multi-Service OT&E had been originally intended for the JSTARS system, it was evaluated instead during Operation Joint Endeavor (OJE) in Bosnia. While the assessment in an operational context was valuable, it presented critical limitations to the scope of the evaluation because of the limited nature of the air tasking and static ground situation of OJE. As a result, only a limited capability in support of target attack and battle management was demonstrated. Because of these shortfalls and unresolved issues in Multi-Service Operational Test and Evaluaion, OSD directed an E-8C Follow-on Test and Evaluation (FOT&E).

DOT&E continued to monitor JSTARS during subsequent FOT&Es, operational deployments, and exercises. The system's operational suitability has improved, but it still has not met its requirements. While the radar picture provides information on large-scale movements of ground targets over a corps-sized area and supported commanders feel it gives them a higher level of situational awareness, it is still difficult to find small-scale militarily significant (e.g., company-sized) movements. Also, the Army found the current radar does not have the potential to provide adequate information to support targeting against moving or stationary targets with indirect fire weapons systems such as artillery or Army Tactical Missile System.

Recent IDM testing demonstrated that the required targeting and surveillance messages could be transmitted in a timely and accurate manner between JSTARS E-8C and Apache AH-64D helicopters, sufficient to support target attacks by the Apache. Some operational deficiencies were noted during testing and recommendations were made to resolve these prior to equipment installation. For example, the Apache pilots could not distinguish between moving and stationary targets; those moving were incorrectly seen as stationary.

Because JSTARS was not completely tested during OJE, the future OT&E of the E-8C should be rigorous enough to evaluate the unresolved surveillance, target attack, and battle management issues identified by DOT&E. To be operationally realistic, future testing should include a full range of missions assigned to JSTARS, supporting both Army and Air Force users. The various missions should not be tested one at a time in isolation, but instead should be conducted in concert in order to evaluate workload and capacity issues. This is especially important given that the JSTARS E-8C will pick up the additional responsibility to perform many missions assigned to the Airborne Battlefield Command and Control Center.

# Large Aircraft Infrared Countermeasures (LAIRCM)

The Large Aircraft Infrared Countermeasures (LAIRCM) system enhances individual aircraft survival through improved aircrew situational awareness of the electromagnetic threat environment. The fundamental requirement for the LAIRCM system is to provide protection against man-portable, shoulder-fired and vehicle launched infrared guided missiles. The system will be installed on the C-17, C-130, and KC-135 aircraft. LAIRCM is designed to autonomously detect and declare Infrared (IR) threat missiles then track and jam the missiles to create a miss, resulting in aircrew and aircraft protection.

The system consists of five basic elements: a Control Indicator Unit (CIU), a Missile Warning Subsystem (MWS) which may include either or both ultraviolet (UV) and IR sensors, a Pointer/Tracker Transmitter (P/T) subsystem, a Countermeasures Processor (CP), and a laser jam source subsystem. The CP is the master system controller and the interface among the subsystems. Up to three laser jammers will be installed on each aircraft type. All the subsystems, with the exception of the laser jammer, are non-developmental items (NDI) that have been previously tested as part of the special operations C-130 Directed IR Countermeasures (DIRCM) program. In 2002, the multi-band laser was tested as part of the LAIRCM system at the hardware-in-the-loop (HITL) facility known as the Air Force Electronic Warfare Evaluation Simulator (AFEWES), and at the Aerial Cable Car Facility (ACF) during the operational assessment (OA) that supported the Milestone C, Low-Rate Initial Production (LRIP) decision in August 2002. LAIRCM will undergo initial operational test and evaluation on the C-17 during FY04 to support the full-rate production decision.

In response to the urgent requirement stated in the LAIRCM Operational Requirements Document, Aeronautical Systems Center developed an evolutionary strategy to yield a near-term solution for the protection of large transport type aircraft. The use of proven subsystem solutions, integrated into a LAIRCM system, is the first step in the LAIRCM Evolutionary Acquisition strategy to address the overall requirement. This first step, designated Phase 1, is to identify a near-term LAIRCM solution. The LAIRCM System Program Office, in association with Air Force Research Laboratory, conducted comprehensive market research to evaluate options available from industry as well as from Government programs. Based on the market research, only four subsystems demonstrated the maturity and performance to provide a near-term solution. All or part of the selected subsystems will comprise the LAIRCM system. Four of the subsystems (CIU, P/T, CP, UV MWS) will come directly from the United States Special Operations Command's (SOCOM) DIRCM program, presently in production. The final subsystem will be a Multi-Band Laser Subsystem, which has been developed by Northrop Grumman as part of their Internal Research and Development Program and has undergone considerable laboratory and field testing. The UK has installed the system on nine different aircraft types and there are plans for integration on eight additional aircraft types. The DIRCM systems for the United States Air Force SOCOM aircraft were bought under the UK contract. The SOCOM aircraft are currently undergoing a User Qualification Evaluation Test on three different types of C-130s to ensure effective operation prior to deployment.

*The Large Aircraft Infrared Countermeasures is designed to autonomously detect and declare Infrared threat missiles then track and jam the missiles.*

### TEST & EVALUATION ACTIVITY

The primary thrust of LAIRCM test and evaluation during FY02 was to conduct an OA on the uninstalled system to support the Milestone C LRIP decision. The assessment included extensive utilization of the Development Verification Test (DVT) model to predict the performance of the AAR-54 missile warning subsystem during the HITL tests. These tests addressed jammer effectiveness against actual missile seekers and were used to predict performance in the live missile shots against the entire LAIRCM system at the Aerial Cable Car Facility at the White Sands Missile Range. In addition, the results from the previous operational utility evaluations of four different C-130 DIRCM installations were used as part of the assessment. The DVT model underwent a limited validation to ensure that the predictions of missile declaration were reasonable and could be used in the HITL tests to provide accurate declaration times to the laser tracker. The results of live missile fire tests provided the actual declaration times and correlated well with the model predictions. Over 4,000 jammer effectiveness runs were conducted at the HITL facility and they demonstrated very successful jammer performance against the threats required in the operational requirements document.

Twenty-six live missiles were fired at the LAIRCM system at the ACF. For two of the events, dual missile shots were fired. The system successfully countered all the missile types that were launched, including those fired during the dual-shot events. Two problems with the missile warning sub system were encountered during the ACF tests. Both were software related and satisfactory fixes have been incorporated.

**TEST & EVALUATION ASSESSMENT**

LAIRCM, using the majority of the components of the already fielded DIRCM system, contributed to the success of the LAIRCM Operational Assessment. The previously accomplished C-130 tests, the several successful live fire tests against the DIRCM system, and the extensive qualification and environmental tests that were performed on the DIRCM system all substantially mitigated the usual risks associated with complex systems in development. The DIRCM program had to solve several problems during its infancy, which resulted in a more mature system for LAIRCM. The only developmental component within LAIRCM is the multi-band laser, which to date has performed almost flawlessly during the 4,000 runs in HITL tests and 150 hours of system operating time.

There are two major risk areas remaining that must be evaluated during the remainder of the test program. First and foremost is the performance of the system as actually installed on the C-17 aircraft. Although the system has demonstrated good functional performance during the early operational assessment phase, it has not been subjected to the temperature and vibration environment on a real C-17. Again some of this risk is tempered by the fact that the DIRCM system has been successfully integrated on several US and UK aircraft, but the C-17 environment will be especially stressful. C-17 integration and flight tests will be the primary test activity leading up to Initial Operational Test & Evaluation (IOT&E), scheduled for early FY04.

The second risk is with the multi-band laser. Although it did perform successfully in the OA, it has not yet completed its environmental qualification tests. These tests are currently being performed and the results should be available prior to IOT&E.

The DVT model will continue to be used as an evaluation tool and will require a more substantive validation prior to accreditation for IOT&E. The Program Manager has agreed with a DOT&E plan for further validation through correlation of the model with multi-sensor test results planned in FY03.

# Milstar Satellite System

The Milstar satellite system supports strategic and tactical missions through global communications that are secure, jam resistant, survivable, and have a low probability of intercept.

Milstar provides worldwide coverage for multi-Service ground, airborne, submarine, and shipborne terminal communications connectivity. There are the three Milstar segments: space, terminal, and mission control.

- Space Segment: The full Milstar operational capability will be provided by five geo-synchronous satellites. The first two satellites possess the original strategic communications low data rate (LDR) payload, while subsequent satellites will also possess a tactical medium data rate (MDR) payload. Each LDR/MDR satellite uses a variety of antennas to support the requirements of both tactical and strategic users. Additionally, cross-links between the satellites provide worldwide connectivity without using vulnerable ground relays.
- Terminal Segment: The Milstar terminal segment consists of a family of multi-Service ground, shipborne, submarine, and airborne terminals functionally interoperable and tailored to meet the individual Service requirements. These terminals include the Air Force air and ground command post terminals; the Navy Extremely High Frequency Satellite Program (NESP) ship, shore, and submarine terminals; and the Army's Single-Channel Anti-jam Man- Portable terminal and Secure, Mobile, Anti-jam, Reliable, Tactical Terminal (SMART-T).
- Mission Control Segment: The Milstar mission control segment provides communications resource management and satellite operations support. The primary responsibility of the mission control segment is to maintain the satellite in a state of readiness to support user communication requirements during all levels of conflict.

The first Milstar satellite was launched in 1994 onboard a Titan IV rocket. The second satellite was launched in 1996. Milstar Flight 3, the first LDR/MDR satellite, was launched on April 30, 1999. However, the mission was declared a failure when a problem with the Centaur upper stage placed the satellite in a nonoperational orbit. Milstar Flight 4 was launched on February 27, 2001, and was declared operational on July 23, 2001. Milstar Flight 5 was launched on January 15, 2002, and was declared operational on March 29, 2002. Milstar Flight 6 is scheduled to launch in February 2003. In lieu of an additional Milstar satellite to replace Flight 3, the first flight of the Advanced Extremely High Frequency (AEHF) satellite program (Pathfinder) was to be launched on an accelerated schedule. Restructuring of the AEHF program to reduce technical and funding risk has eliminated the accelerated launch date, but the Pathfinder will be programmed to operate initially as a Milstar II LDR/MDR satellite.

*The Milstar satellite system provides secure, jam resistant, survivable worldwide coverage for multi-Service ground, airborne, submarine and shipborne terminal communications connectivity.*

Air Force Space Command declared Initial Operational Capability (IOC)-1 for Milstar on July 21, 1997. The Milstar LDR system currently supports IOC-1 missions. Multi-service Operational Test and Evaluation (MOT&E) of the LDR/MDR satellites began in late FY01. Delays in development and testing of the resource planning and monitoring software will prevent completion of MOT&E in time to support a December 2003 IOC-2 decision. AF Space Command has not yet determined how they will respond to this breach.

## TEST & EVALUATION ACTIVITY

- LDR Initial Operational Test and Evaluation (IOT&E) was completed in March 1997.
- The Milstar IOT&E Final Report (August 1998) stated that the Milstar LDR system was effective and suitable with limitations.
  - DOT&E and Air Force Space Command (AFSPC) directed the Air Force Operational Test and Evaluation Command (AFOTEC) to retest six Measures Of Performance (MOPs).
    - Of these, AFOTEC retested three connectivity MOPs during the period of September 1999 to February 2000.
    - AFOTEC also conducted tests from June 2000 to May 2001 to re-evaluate two suitability MOPs.
- MDR operational tests focus on individual and combined Service terminals communicating through an on-orbit satellite.
  - Operational testing with Flights 4 and 5 began with Developmental Test/Operational Test events during the on-orbit test periods and continue with dedicated Operational Test events that began in late FY01.
- The Army's SMART-T underwent Follow-on Test and Evaluation for MDR capability in September 2001, while the Navy tested its MDR-capable NESP terminal in April- May 2002.
- Anti-jamming and low probability of intercept are two critical capabilities of the Milstar system, and both were tested with an on-orbit satellite in FY01.
  - MDR uplink anti-jam capabilities were developmentally tested via a demonstration of the nulling antenna during the Milstar system test of Flight 4.
- Most of the test activity this year involved developmental testing of the mission planning element, MDR interoperability, and Flight 5.
  - The Automated Communications Management System (ACMS) continued a series of developmental events to eventually support a fielding decision.
  - The Joint Interoperability Test Command (JITC) tested interoperability between MDR-capable terminals and issued certification letters in October 2002.
  - The emphasis of the Flight 5 system test was on verifying the establishment of the Milstar "ring" constellation, the performance of multi-satellite MDR communications, inter-satellite timing resolution, and evolving ACMS capabilities.

## TEST & EVALUATION ASSESSMENT

The Milstar Space Segment continues to perform well, as currently fielded with LDR capability. As there has been limited dedicated operational testing with the on-orbit LDR/MDR satellite, no assessments can be made regarding operational effectiveness and suitability. However, review of the developmental test program for the space segment has not revealed any areas of operational concern.

The loss of Flight 3 (the first LDR/MDR satellite) degrades operational utility. Worldwide coverage from 65° South to 65° North latitude will not be available for the Milstar MDR terminals until the launch of the first AEHF (Pathfinder) satellite in FY08. The lack of a fourth medium data rate satellite will limit the ability to provide two-satellite coverage to some contingency operations and therefore limit the throughput of protected communications. Another impact of the loss of Flight 3 is that approximately 25 degrees of longitude will have no MDR coverage (based on current plan for satellite placement).

The Milstar Terminal Segment has met mixed results. The Navy's LDR terminals have been successfully fielded for 5 years. The Air Force airborne terminal has demonstrated the required reliability and maintainability. However, the Army ground terminals have demonstrated reliability and maintainability shortfalls. Further discussion of the Navy NESP and Army SMART-T terminals are provided in separate sections of this annual report.

The Mission Control Segment for LDR operations has been performing its mission successfully since the launch of the first Milstar satellite in 1994. During LDR IOT&E, the mobile constellation control station's endurance ability was not tested. DOT&E directed a full test of the endurance requirement during follow-on testing. AFOTEC is working toward conducting the endurance retest in FY03 and has identified their requirements to United States Strategic Command to plan an appropriate test event.

Additionally, delays in development of ACMS are of concern. Because of the existing shortfalls of ACMS, the Army and Navy have fielded their terminals with interim planning software (the Milstar Communications Planning Tool – integrated (MCPT-i)), as their primary planning tool. Under this scenario, MCPT-i should be tested to verify it meets all the requirements of the Mission Planning Element, and interoperability between ACMS and MCPT-i should be tested.

Finally, in the realm of interoperability, there is currently no concept of operations (CONOPS) for the Joint Task Force (JTF) mission. Test of the JTF mission is critical to evaluate interoperability of the Milstar system and terminals in an operational context. Some interoperability demonstrations have been conducted during developmental testing, including the JITC MDR interoperability test. However, until the CONOPS is specified, it is not known if the limited base band used in these tests is operationally representative. DOT&E recommends a CONOPS be developed as soon as possible. In the absence of a CONOPS, AFOTEC has worked with Atlantic Fleet Command and Air Force Special Operations Command to devise the most operationally realistic test possible. They will participate in a communications exercise in January 2003 to conduct this test.

# Minuteman III Guidance and Propulsion Replacement Programs

The Minuteman III Intercontinental Ballistic Missile (ICBM) consists of three solid propellant stages (including rocket motors, inter-stage hardware, and ordnance), the liquid Propulsion System Rocket Engine, and the guidance set that can deliver up to three re-entry vehicles. Five hundred Minuteman III ICBMs are currently deployed in hardened launch facilities at three operational bases.

The Guidance Replacement Program (GRP) and PRP are a set of hardware and software modifications designed to extend the service life of the Minuteman III while preserving its current capabilities. This program is needed to prevent a projected decline in reliability due to aging electronic components and unavailable replacement parts. GRP replaces the guidance computer, signal converters, and power distribution components while retaining the current Minuteman III inertial measurement unit. GRP is required to preserve current accuracy and reliability while enhancing supportability.

The Propulsion Replacement Program (PRP) will extend the life of the Minuteman III operational force by replacing the solid propellant propulsion subsystems. Due to observed failure modes (age-related degrades) and the rocket motors' approaching service life, the solid stages now in the force were projected to begin to deteriorate in 2002. PRP will remanufacture the solid rocket motors, inter-stage hardware, and ordnance using new materials and processes that were qualified to replace unavailable or environmentally prohibited materials. In addition to hardware, PRP modifies two Minuteman III software elements: the Minuteman Operational Targeting Program and the Flight Program Constants Tape. These software modifications require use of the GRP-modified guidance system.

DOT&E conducted an independent assessment of the GRP program from 1996 through 1999, culminating in submission of a report to Congress in December 1999 in fulfillment of the provisions of Title 10, U.S. Code, Section 2399. DOT&E determined that the GRP upgrades were operationally effective and suitable, although there had been insufficient numbers of flight tests (two) to confirm the accuracy and reliability assessments. The Air Force proceeded to full-rate production of the modified guidance systems in December 1999.

After two GRP flight tests and two PRP flight tests, the accuracy evaluation was still subject to considerable uncertainty. DOT&E required three additional flight tests to give the evaluation higher confidence in the demonstrated performance results. DOT&E agreed to accept data from already scheduled Minuteman III Force Development Evaluation (FDE) program flight tests as long as the missiles were configured with the GRP modified guidance system. These flights were conducted in FY01. DOT&E completed its independent assessment of the PRP program, culminating in submission of a report to Congress in September 2001 in fulfillment of the provisions of Title 10, U.S. Code, Section 2399. The Air Force approved full-rate production in September 2001.

*The Guidance Replacement Program and the Propulsion Replacement Program are a set of hardware and software modifications designed to extend the service life of the Minuteman III while preserving its current capabilities.*

### TEST & EVALUATION ACTIVITY

All programmed operational test activities have been completed for GRP and PRP. Both programs are currently in full-rate production.

## TEST & EVALUATION ASSESSMENT

DOT&E found both GRP and PRP to be operationally effective and suitable even though accuracy performance, which is primarily attributed to the guidance system modified by GRP, fell slightly short of the operational requirement. DOT&E determined that the shortfall in accuracy is offset by the overall improvement in weapon system reliability, which makes the Minuteman III weapon system more operationally effective than Minuteman III with the current guidance and propulsion systems.

After seven flight tests with the modified guidance system, the Air Force found that accuracy results were not in agreement with expectations. Accordingly, the Air Force conducted a supplemental accuracy investigation under the guidance of a Senior Review Team (SRT). The SRT assessment identified two primary sources of bias error in the guidance system software. One source was erroneous implementation of computational precision. In some navigation calculations, truncation was implemented where round-off was intended. In some guidance calculations, better approximations were needed to maintain adequate precision.

The other primary error source was a small, undesired residual velocity bias introduced into the calculations that govern the attitude of the re-entry vehicles at deployment. The factors leading to the bias have a complex dependence on the azimuth and trajectory. For test-flight missions from Vandenberg Air Force Base to Kwajalein, the errors reinforce one another. In other trajectories, the errors might increase dispersion but not contribute significantly to the weapon delivery error. Operational trajectories would still have been less than optimum if this situation had not been discovered, so it is fortunate that the westerly test trajectory highlighted the problem. Since the government may not want to rely on chance discovery in the future, it is worth noting that most anomalies can be detected if sample size is adequate. The SRT recommended expanding the rate of Minuteman III FDE flights from three to five per year, for at least five years.

The Air Force initiated corrective actions though an Accuracy Upgrade Program (AUP). The first flight of the Minuteman III with the corrections incorporated into the NS-50 guidance set occurred on June 7, 2002. Initial impressions of the results were very positive. The downrange biases observed previous to the AUP modifications appeared to have been corrected. DOT&E will continue to monitor this situation.

# MQ-1 Predator Unmanned Aerial Vehicle (UAV) System

The Predator medium altitude endurance unmanned aerial vehicle (UAV) system is a theater asset intended to provide a cued and non-cued reconnaissance, surveillance, targeting acquisition, and limited strike capability. Its long dwell capability is intended to provide the theater commander with continuous imagery coverage of any area of interest. Additionally, beginning in 2002, all MQ-1 Predator air vehicles will be equipped with two Hellfire missiles and a multi-spectral targeting sensor including a laser designator. Originally designated RQ-1, multi-role systems capable of reconnaissance, surveillance, and limited strike are designated MQ-1.

The Predator system contains both air and ground segments. The air segment consists of four full composite air vehicles powered by turbo-charged Rotax 914 engines. The air vehicle can simultaneously carry Electro-Optic, Infrared (EO/IR) and Synthetic Aperture Radar (SAR) sensor payloads. Four EO/IR payloads and three SAR payloads will be provided for each of four air vehicle systems. The air vehicle can also carry one Hellfire missile under each wing; however, the SAR payload cannot be operated when the air vehicle is configured to carry and fire Hellfire missiles.

The system will be required to operate in less than ideal weather conditions, and a glycol weeping-wing de-icing system was developed to provide the capability to transit through moderate icing conditions. Two sets of weeping wings will be provided for each system with four air vehicles. The weeping wings are not internally configured for weapons carriage.

The ground segment consists of a shelter containing the Ground Control Station (GCS) and a Predator Primary Satellite Link for satellite communications between the air vehicle and the ground station. Data link systems between the air vehicle and the ground system include C-band line-of-sight (LOS), and Ku-band satellite for operations beyond LOS. Dissemination of imagery, both video and still image files, beyond the GCS is the responsibility of the supported commander. A typical deployment detachment consists of one Predator system and 55 personnel. United States Air Force 11th, 15th, and 17th Reconnaissance Squadrons at Indian Springs Air Force Auxiliary Field, Nevada, currently operate Predator systems. The Air Force had already procured its original planned force structure of 12 Predator systems when Initial Operational Test and Evaluation (IOT&E) took place in October 2000. Predator system number six was the first system retrofitted with all baseline capabilities and was used for initial operational testing. In response to the war on terrorism, funding for additional Predator assets and improvements was provided. The Predator fleet will be expanded by three squadrons beginning in FY04. Additional MQ-1 systems are being procured along with the development of a follow-on system, the MQ-9, also known as Predator B.

*MQ-1 Predator: Originally designated RQ-1, multi-role systems capable of reconnaissance, surveillance, and limited strike are designated MQ-1.*

## TEST & EVALUATION ACTIVITY

During operations in Kosovo in 1999, a few Predators were equipped with a laser designator for designating targets for laser-guided weapons released by fighters. The following year, the Air Force began to test Predators armed with Hellfire missiles, and the basic capability had been demonstrated prior to September 11, 2001. Armed and unarmed Predators have been used extensively in operations in Afghanistan.

Detachment 4 of the 53rd Test and Evaluation Group continues to support Predator block upgrades. FY02 testing included the ability to transfer control of the air vehicle from one GCS to another, a demonstration of moving target indicator on the SAR, and an upgraded GCS software version.

Another capability developed during wartime operations is the Rover system that allows Predator EO/IR imagery to be received as streaming video onboard the AC-130 gunship. Voice communication between the gunship's tactical controller and the UAV operator viewing the same picture should improve Predator's ability to talk the gunship onto a target.

The Defense Threat Reduction Agency is conducting experiments using a Predator air vehicle with the chemical combat assessment system. The experiments involve removing the Predator's SAR and installing the Predator Infrared Airborne Narrowband Hyperspectral Combat Assessor, which acts as a remote sensor. Additionally, mini-UAVs might be attached to the Predators wings. The mini-UAVs, called Flight Inserted Detection Expendables for Reconnaissance contain a Spectrometric Point Ionizing Detector Expendable/Recoverable point sensor, and a sample collector. The Predator could be used to release the mini-UAV once it reaches the contaminated site.

### TEST & EVALUATION ASSESSMENT

Formal testing this year has been limited by test article availability due to Operation Enduring Freedom. Testing that has been conducted consisted primarily of demonstrations of new capabilities proposed by the Air Force Battlelab. DOT&E is working with the Air Force Test and Evaluation Center and the 53rd TEG-Detachment 4 to plan tests for upgrades to the deficiencies reported on during IOT&E. Test plans for the MQ-1, armed Predator are also being developed.

# MQ-9 Predator B Unmanned Aerial Vehicle System

MQ-9, commonly referred to as Predator B, is a follow-on to Predator, RQ-1/MQ-1. The system is intended to fly higher, faster, provide more power, and carry larger payloads than the original Predator system. Two prototypes flown to date are not capable of carrying the size payload the Air Force is seeking. The third air vehicle to be delivered will have an increased gross take-off weight (10,000 pounds versus 7,250 pounds) and increased payload capacity (750 pounds internal and 1,500 pounds on each wing). The weapons and sensors carried by the air vehicle have yet to be finalized.

An Interim Requirements Document (IRD) was approved by Air Combat Command (ACC) on May 14, 2002. Specific thresholds are not established, but weapons, sensor, navigation, datalinks, and payload capabilities are planned to increase during spiral development. For instance, Hellfire, used on the MQ-1, will likely be the initial weapon and future spirals will incorporate new technologies such as the Small Diameter Bomb and the Low Cost Autonomous Attack Systems (LOCAAS) as they are available. The MQ-9 will use the same ground station as the MQ-1. After deciding MQ-9 would not be a Pathfinder, the Air Force elected to revisit MQ-9 requirements. The Air Force is currently working to produce a new IRD to be approved by the Air Force Requirements Oversight Council (AFROC).

The concept of operations for MQ-9 was approved by ACC on May 2, 2002. As its MQ designation implies, the MQ-9 will have multiple missions. The plan is to use MQ-9 in armed reconnaissance ("hunter-killer") roles as well as reconnaissance, surveillance, and target acquisition (RSTA). Hunter-killer missions require the system to find, identify, and kill targets. The combination of persistent Intelligence, Surveillance, and Reconnaissance (ISR) capability and the ability to engage with onboard weapons or coordinate off-board fires is intended to increase the probability of detecting and successfully negating time sensitive targets. Attack capability will be increased during spiral development as new weapons are integrated, allowing greater emphasis on the armed reconnaissance mission over traditional RSTA. In addition to Hunter-Killer and RSTA missions, the requirements and concept of operations highlight the ability of the unmanned system to penetrate, discriminate, and negate pre-planned high-value, high-risk targets.

Two prototype aircraft have been delivered and a third is on contract. Acquisition of three more aircraft are on hold until operational requirements are defined. The first two aircraft have only a 7,250-pound gross take off weight and do not have the payload capacity or the wing hard points for the anticipated armed reconnaissance mission; however, these two aircraft will be equipped with EO/IR sensors and a synthetic aperture radar. The two prototype aircraft are powered by a Honeywell/McCauley (TPE 331-10T) turbo-prop engine that can use JP-4, -5, -8 or Jet-A fuel. Congressional language directed that the Air Force procure two turbo-prop and one jet-powered Predator-B aircraft; however, there is concern that the jet-powered version may not have adequate endurance.

Three new Predator squadrons are envisioned (for a total of six squadrons including the current 11th, 15th, and 17th Reconnaissance Squadrons), but the mix of MQ-1 and MQ-9

*The MQ-9 combination of persistence and the ability to engage with onboard weapons or coordinate off-board fires is intended to improve joint forces' capability to engage time-sensitive-targets.*

aircraft within the squadrons has not been decided.  Basing locations are currently being studied.

The MQ-9 program plans to employ spiral development to achieve a system capable of effectively employing hunter-killer tactics.  MQ-9 has not yet transitioned to a formal acquisition program, and as a result, has no approved acquisition program baseline that establishes the program schedule for delivering this spiral capability or supporting decision points. However, the Air Force intends to have the first Predator B strike package available for deployment within 36 months.

### TEST & EVALUATION ACTIVITY

The first two prototype Predator B vehicles have flown over 100 hours at altitudes up to 50,000 feet during contractor testing intended to assess basic flying qualities.  Planning for government testing has just begun.  The Air Force is incorporating lessons learned from the first two prototype aircraft into the third aircraft.  The Air Force plans to demonstrate a limited Hellfire Missile employment capability with the third aircraft in the Fall of 2003.

### TEST & EVALUATION ASSESSMENT

No data is available to DOT&E on flight-testing to date.  Work is necessary to formalize and synchronize requirements, concept of operations, acquisition and fielding strategy, and test and evaluation strategy for the system.  Designing an adequate test program will be impossible without first establishing the acquisition program and the production decisions that operational testing is intended to support.

# Multi-Sensor Command and Control Aircraft (MC2A) Multi-Platform Radar Technology Insertion Program (MP-RTIP), Multi-Platform Common Data Link (MP-CDL)

The Multi-sensor Command and Control Aircraft (MC2A) is intended to meet the Air Force's need to integrate Command and Control, Intelligence, Surveillance, and Reconnaissance (ISR), and Information Warfare functions on a single platform – the Boeing 767-400ER. Integration of these functions is to improve the effectiveness of military operations through information superiority by supporting rapid decision analysis, increased battlespace awareness, and shortened decision cycles. The Spiral 1 MC2A capability will include the Multi-Platform Radar Technology Insertion Program (MP-RTIP) sensor and Battle Management Command, Control, Communications, Computer and Intelligence ($BMC^4I$) suite enabled by an open-system architecture. The sensor will support a Ground Moving Target Indicator capability and cruise missile defense support. The MP-CDL will provide the data link to other airborne and ground platforms prosecuting the ground war. Other capabilities may include interfaces to Space-Based Radar, reception of data from, and control of Unmanned Aerial Vehicles (UAV), and combat operations functions. Spiral 1 will include both hardware and software growth provisions to permit incorporation of additional sensor configurations, as well as other BMC4I functionality for future Spirals.

The MC2A evolved from the Block 40 upgrade to the Joint Surveillance Target Attack Radar System (JSTARS) E-8C (a B-707), designated the Radar Technology Insertion Program (RTIP). Soon after, RTIP was restructured as MP-RTIP and the program office was directed to develop a scalable sensor for multiple platforms. An Analysis of Alternatives was conducted to determine whether to install the sensor on a B-707 or on a newer aircraft. Using this analysis, the Air Force decided a B-767-400ER best suited their needs for capability and growth. After the aircraft was chosen, the Air Force further decided to evolve the MP-RTIP into Spiral 1 of the MC2A.

The MP-RTIP program is still charged with developing a scalable sensor. The largest sensor being developed is for MC2A. A smaller sensor is also being developed for the Global Hawk UAV. Additionally, the there are provisions to develop a sensor for the NATO Advanced Ground Surveillance Program.

The Multi-Platform Common Data Link (MP-CDL) was initially planned to replace the JSTARS Surveillance and Control Data Link, which transmitted data to/from the E-8C and its ground station, the Common Ground Station. The Air Force attempted to restructure the MP-CDL program into the backbone for a Network Centric Warfare capability to support Network Centric Collaborative Targeting (NCCT). Because of difficulties determining the requirements, the Air Force has restructured the program as a technology development and experimentation program. The MP-CDL program will produce a few systems with which to explore concepts and capabilities. If those capabilities meet an operational need, the Air Force may decide to produce them for employment on combat systems.


*The Spiral 1 Multi-Sensor Command and Control Aircraft capability will include the Multi-Platform Radar Technology Insertion Program sensor and Battle Management Command, Control, Communications, Computer and Intelligence suite enabled by an open-system architecture with the MP-CDL as the datalink.*

## TEST & EVALUATION ACTIVITIES

- The MP-RTIP program participated in three operator in the loop (OITL) modeling and simulation events during 2002.

- The MC2A program is modifying the test strategy developed by the MP-RTIP program to support the broader mission and requirements of MC2A Spiral 1.
- Because of problems determining its requirements, the MP-CDL program is restructuring the program as a technology development and experimentation program.

### TEST & EVALUATION ASSESSMENT

MP-RTIP participation in OITL events has been used to explore how MP-RTIP can contribute to the conduct of the air war. Information gained from the OITL events will help scope the MC2A Spiral 2 and to ensure that Spiral 1 provides adequate provisions for follow-on spirals.

Testing MC2A Spiral 1 will present significant challenges that must be addressed early. The MC2A will provide simultaneous air, ground, and sea C2ISR support and targeting information to all the services. It will require a high degree of joint interoperability for both ground combat and air defense. Demonstrating the ability to support the joint prosecution of the air and ground wars simultaneously will require carefully planned field tests augmented by modeling and simulation, and will demand an unprecedented level of joint cooperation.

The MP-CDL is being designed to connect many joint C4ISR platforms. Therefore, coordination with each of these platforms will be crucial during development. Thus far, the MP-CDL program has not produced an Operational Requirements Document, in part because of current CDL user’s concerns that the MP-CDL’s broadcast mode has potential to cause significant electromagnetic interference. The current acquisition strategy was conceived as a means to continue test and experimentation to support the MP-RTIP data link and NCCT requirements, while allowing the CDL community time to resolve the potential problems. However, the Air Force has indicated a need to field MP-CDL terminals produced under this strategy if MP-CDL meets the Air Force’s requirements. Therefore, continued oversight of MP-CDL by the multi-service CDL community and DOT&E will be required to ensure that the system meets joint requirements.

Finally, the risk associated with the interdependency of these two Acquisition Category 1D programs (MC2A and MP-RTIP) must not be underestimated. MC2A Spiral 1 is dependent on MP-RTIP to deliver its primary sensor. MP-RTIP is dependent on MC2A to provide a test platform for the sensor. Planned delivery of the two will have to be closely coordinated to ensure neither has to wait for the delivery of the other. Due to the scope and the long lead-times required for both programs, neither will be able to tolerate delays of this type without experiencing significantly increased costs.

# National Airspace System (NAS)

The National Airspace System (NAS) program will replace three types of Air Traffic Control and Landing System (ATCALS) equipment used to support the radar approach control mission. NAS includes voice switches, approach control and control tower automation, and airport surveillance radars. When fully fielded, the Department of Defense (DoD) NAS program upgrade will include the following four programs:

Voice Communications Switching System (VCSS) is the communications component of the NAS modernization program. VCSS is being procured to replace existing analog voice systems approaching the end of their economic and technical life cycle. VCSS is designed to provide highly reliable, state-of-the-art air-to-ground, ground-to-ground, and intercom communications for controllers of military and civil air traffic.

DoD Advanced Automation System (DAAS) receives and processes primary and secondary radar data, flight plan information, weather, airport environmental data, and administrative information (such as Notices to Airmen).

Digital Airport Surveillance Radar (DASR) consists of integrated primary and secondary radar subsystems to provide accurate target data to the local air traffic control facilities. The DASR should have improved target detection and accuracy, clutter rejection, aircraft identification accuracy, altitude data, and weather capability.

Military Airspace Management System (MAMS) will schedule, track, and document utilization of special use airspace in a non-real-time manner, as well as interoperate with the Federal Aviation Administration (FAA). Scheduling agencies will access the MAMS central web site using desktop computers with Internet access.

The ATCALS equipment to be replaced has limited interoperability and excessive cost growth for operations and support. The FAA has undertaken a massive upgrade of the nation's air traffic control system infrastructure by replacing analog systems with state-of-the-art digital technology. Most DoD systems are currently analog and will not easily or economically interface with the new generation FAA equipment. Without the added capability, DoD will be unable to continue providing efficient and reliable service to all air traffic system users, military or civilian.

Furthermore, DoD NAS cost and operational effectiveness analyses indicate that DoD will experience excessive operations and support costs if the DoD air traffic control equipment is not replaced.

The FAA is the lead organization for VCSS and DAAS testing; with the Air Force serving as DoD lead for DASR testing and sole test agency for MAMS. DoD is working with the FAA through an interagency agreement for all VCSS, DAAS, and DASR test activities.

VCSS DoD Multi-service Operational Test and Evaluation (MOT&E) occurred throughout 1999. The VCSS was found operationally effective; however, it was rated not operationally suitable because of interrelated issues concerning parts reliability, maintainability, depot-level support, spare parts provisioning, and technical documentation. DOT&E reviewed corrective actions taken after MOT&E and found them adequate to rectify the suitability shortcomings. The full-rate production decision was executed in November 1999.

*The National Airspace System program replaces three types of Air Traffic Control and Landing System equipment used to support the radar approach control mission.*

MAMS was taken out of development to sustainment on October 1, 2000. Since then, three software versions have been released – one major release, and two minor releases.

DAAS and DASR underwent combined Developmental Test/Operational Test from October 1999 to January 2000 at Eglin Air Force Base. Deficiencies were documented, some of which needed to be resolved before the start of the MOT&E, and others that needed to be resolved before full system fielding. Regression testing began in April 2000 at Eglin Air Force Base; and in June 2000, all deficiencies critical to the MOT&E were either verified as fixed or were downgraded in severity.

DAAS and DASR began parallel MOT&E at Eglin Air Force Base in June 2000 in support of the NAS Milestone III decision. As a result of DAAS and DASR deficiencies (15 Category 1 deficiencies; six DAAS and nine DASR) documented during the MOT&E, the Air Force Operational Test and Evaluation Center (AFOTEC) agreed to stop the MOT&E in October 2000 to allow the Air Force and Raytheon to make changes in the software that drives the digital radar and automation systems.

MOT&E resumed in March 2001 at Eglin Air Force Base and continued through mid-April 2001. AFOTEC released its interim summary report in June 2001. While the DAAS was found operationally effective and operationally suitable, the DASR was found not operationally effective and potentially operationally suitable. Nine Category 1 deficiencies were associated with the DASR. Major areas of concern included the lack of management of false targets, probability of detection, susceptibility of interference, and the performance of the weather channel.

Based on AFOTEC's conclusions in the interim summary report, the NAS Program Office requested that AFOTEC release its final report on the DAAS. AFOTEC complied with the request and published a final MOT&E report on the DAAS in May 2002 with the understanding that during subsequent DASR MOT&E (MOT&E 2) the DAAS would be examined from a NAS system-of-systems perspective.

### TEST & EVALUATION ACTIVITY

- DOT&E approved the test concept for MOT&E 2 which called for resolving Operational Requirements Document (ORD) parameters during Developmental Test/Operational Test preceding MOT&E 2.
- Developmental Test/Operational Test data were collected largely from flight tests run in the summer of 2002:
- Some ORD parameters were not adequately resolved during the scheduled DT/OT period and logistics supportability issues were outstanding.
- MOT&E 2 began late in July 2002 with assurance from the NAS program office that corrective actions were in place to complete the Developmental Test/Operational Test data collection and to resolve open issues with logistics supportability.
- Adequate data are being collected to determine the operational effectiveness and operational suitability of the DASR.
- MOT&E 2 ended on September 6, 2002.

### TEST & EVALUATION ASSESSMENT

DOT&E shares concerns with AFOTEC over the immaturity of the DASR configurations that have been presented for Operational Test. After each test period, critical deficiencies were identified and the program office implemented plans to fix, regression test, and re-test operationally. During each test event, similar or additional deficiencies were documented.

DOT&E expressed concern with not completing the Developmental Test/Operational Test flight tests, data collection, and analysis before entering MOT&E 2. DOT&E felt the risk in not adequately characterizing the performance of the DASR prior to starting MOT&E 2 was more than minimal. At the end of MOT&E 2, there were still five Category 1 deficiencies and 185 Category 2 deficiencies identified and unresolved against the DAAS and DASR systems. DOT&E will publish one Beyond Low-Rate Initial Production report on the NAS after all system-level testing is complete. The NAS program office had planned for a Milestone III decision in January 2003; the Air Force is currently reviewing MOT&E 2 results to determine if a production decision is warranted.

The DASR system under test at Eglin does not contain several Engineering Change Proposals (ECPs) that are planned but not yet government approved for the DASR systems to be fielded in DoD. DOT&E reviewed test data from the FAA ECP-equipped DASR test site at Stockton, California, in an effort to determine if the ECPs would affect system performance and therefore call into question MOT&E test results obtained from Eglin. The results did not clearly indicate that the ECPs would have any operational effect on DASR performance.

Additionally, the DAAS system under test at Eglin will not be what is ultimately fielded at the majority of DoD sites. An updated DAAS system, called FS-2, with presentation symbology more similar to current FAA systems will eventually be fielded in DoD.

In light of the potential changes to DAAS and DASR between MOT&E testing and ultimate fielding, DOT&E recommends Follow-on Operational Testing be conducted on both updated systems prior to full-scale DoD fielding.

# National Polar-Orbiting Operational Environmental Satellite System (NPOESS)

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) is a Tri-Agency program jointly administered by the Department of Defense, the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA). The program is managed by an NPOESS Executive Committee through an Integrated Program Office (IPO) and is being acquired under U.S. Air Force acquisition authority. NPOESS will provide a national remote sensing capability to acquire and disseminate global and regional environmental data for a period of at least ten years.

NPOESS contains the following segments:

- A space segment comprised of the satellites, payload components, and ground support equipment, and operated in a sun-synchronous, near-polar orbit at a nominal 833 km altitude.
- A command, control, and communications segment, providing for spacecraft control and state-of-health monitoring and supporting the delivery of data to designated centralized facilities and field terminals.
- An Interface Data Processor Segment (IDPS) comprised of data processing functions for centralized facilities.
- A Field Terminals Segment (FTS) comprised of software that receives direct real time mission data from the Space Segment and generates weather products for field terminal users.
- Launch Support, which is comprised of the resources to accomplish launch operations and to place the satellite in the correct orbit.

NPOESS Milestone I occurred in FY97. The Program Definition/Risk Reduction (PDRR) phase was structured around system architecture studies, sensor and algorithm development, and other risk reduction efforts prior to the award of the Shared System Performance Responsibility (SSPR) contract. During PDRR, multiple contracts were awarded for each higher risk sensor and/or suite of sensors, and for system studies. The final SSPR contractor was selected and the program entered into the Acquisition and Operations Phase after a Key Decision Point (KDP)-C decision in August 2002.

A key risk reduction activity is the NPOESS Preparatory Project (NPP), which is a joint Integrated Program Office/NASA space flight of selected critical imaging and sounding sensor systems. This flight, scheduled for FY06, will provide NPOESS with a risk reduction demonstration and NASA with selected sensor data to provide continuity with the current environmental and weather satellites.

#### TEST & EVALUATION ACTIVITY

The test strategy utilizes Modeling and Simulation (M&S) and combined Developmental Test/Operational Test for early insight into the system's potential operational performance, followed by dedicated Multi-service Operational Test and Evaluation (MOT&E).

*The National Polar-Orbiting Operational Environmental Satellite System will provide a national remote sensing capability to acquire and disseminate global and regional environmental data for a period of at least ten years.*

During dedicated MOT&E, operational testers will conduct tests on production-representative hardware and software, supplemented as required with data from validated and accredited M&S.

The test concept includes two Operational Assessments (OAs). OA1 occurred in FY02 in support of KDP-C and will be updated prior to Critical Design Review (CDR) in FY05. OA2 will occur in FY06 in support of the NPP risk reduction effort. The MOT&E will be conducted once two satellites, the C3S/IDPS, and a sufficient number of field terminals are fielded, nominally in the FY11 timeframe.

The IPO has developed a Memorandum of Agreement (MOA) with the Services on the issue of Field Terminal interoperability and funding. Under this MOA, the IPO will provide two direct data links to Field Terminal users, one for High Rate Data (HRD) in X-band at 20 Megabits per second (Mbps), and one for Low-Rate Data (LRD) in L-band at 3.5 Mbps for more austere users. The IPO plans to demonstrate prototype NPOESS HRD and LRD terminals as a guide to users in modifying or replacing their existing terminals, and will fund and distribute non-proprietary HRD and LRD versions of Field Terminal software over the life of the system. Under this MOA, individual agencies will fund, procure, and manage their own Field Terminals to satisfy their user needs.

The concept of a tri-Agency Combined Test Force was refined to correspond with the current acquisition strategy and to better define the Air Force Operational Test and Evaluation Command's (AFOTEC's) role in each of the Test and Evaluation (T&E) activities within the overall NPOESS operational test concept. Although AFOTEC will be the lead agency for all Operational Test and Evaluation events, it will combine efforts with other Service Operational Test Agencies, NOAA, and NASA during MOT&E to make the most efficient use of expertise and resources.

NPOESS is making satisfactory progress toward operational effectiveness and suitability, but there are issues with field terminal acquisition and Environmental Data Record quality that must be resolved prior to CDR in FY04. Furthermore, there is schedule risk with the planned FY06 NPP flight that must be reassessed at CDR.

Agreement has been reached regarding user field terminal testing with NPOESS satellites both in the factory and on-orbit. Lack of synchronization between the NPOESS program and the Services' field terminal acquisition programs, however, could put this test concept at risk. Unavailability of user field terminals could impact two key test events. The first is a combined Developmental Test/Operational Test event that would verify interoperability by connecting at least one of each type of field terminal directly to the satellite in the factory. The second test event is MOT&E, the primary system-wide operational test. DOT&E is working with the users to ensure that the IPO's proposals address all user requirements and that an integrated acquisition and test strategy is developed to evaluate end-to-end interoperability.

Algorithm performance has been identified as a leading risk to EDR quality. The IPO and their contractors have identified a risk mitigation strategy that includes Technical Interchange Meetings, code testing using the Integrated Weather Products Testbed, phased algorithm verifications, and other techniques. This is an adequate strategy, and DOT&E will continue to work with the IPO to track progress on this important issue. EDR quality is also affected by sensor performance and data quality control. Sensor performance is at risk for three key sensors that represent major advances over legacy sensors, and each faces a tight development schedule and technical challenges. Quality control of the data processing string in the IDPS should be planned to ensure that erroneous data is properly filtered and that operators are alerted whenever error conditions arise.

NPP is the primary risk reduction flight for NPOESS. It will carry three key NPOESS sensors and generate 93 percent of the NPOESS data volume. The first NPOESS satellite need date is in FY08, but the largest schedule driver is the NPP mission, with a planned launch in May 2006. This results in schedule risk for the delivery of the three sensors and the IDPS in time for the launch of NPP. This could potentially result in either a delay of the NPP launch, flying NPP without the full complement of sensors, or flying NPP without fully capable sensors or data processing capabilities. Any of these scenarios would adversely impact NPOESS by reducing the degree of risk mitigation offered by NPP.

T&E and risk reduction activities in FY02 included an update of the Test and Evaluation Master Plan, an Operational Assessment (OA) in support of KDP-C, further definition of roles and responsibilities for a Combined Test Force and for field terminal development, and ground demonstrations conducted by the two PDRR contractors.

### TEST & EVALUATION ASSESSMENT

OA1 was conducted by AFOTEC in support of KDP-C. This OA occurred at an early stage in the program's development when there was no hardware and software to test, and the prime contractor and final system design had not yet been determined. As a result, the OA was primarily a paper study, supplemented by M&S. AFOTEC determined that NPOESS is making satisfactory progress, with qualifications, toward operational effectiveness. AFOTEC also determined that the program is making satisfactory progress towards supporting MOT&E. Suitability was not observed because no hardware was available to test.

NPOESS is an extremely complex system, composed of different elements, which are supplied by a multitude of vendors. The successful operation of the system depends critically on rigorous system engineering. It is particularly important that the efforts of different contractors and of different groups belonging to the same contractor are coordinated and consistent.

# NAVSTAR Global Positioning System (GPS)

The NAVSTAR Global Positioning System (GPS) is an Air Force-managed Joint Service program that provides highly accurate, real-time, all weather, passive, common-reference grid position and time information to military and civilian users worldwide. It consists of three segments: space, control, and user equipment (UE). The space segment consists of a 24-satellite constellation in semi-synchronous orbits. The original Block I satellites were replaced with Block II/IIA satellites. Currently, Block II/IIA satellites are being replaced with Block IIR as the II/IIA satellites degrade on-orbit.

The control segment consists of a master control station, four ground antennas, a pre-launch capability station, and five geographically dispersed monitoring stations. The control segment monitors satellite downlink signals and uploads corrections to diminish errors broadcast to users. The user segment consists of numerous types of GPS receivers that use satellite downlink signals to determine position, velocity, and precise time. These receivers are hosted on a multitude of platforms.

An operational assessment of the first Block IIR satellite was conducted in late 1997. Although the IIR satellite met all navigation and timing requirements, a significant problem was found with the improved cross-link capabilities. The cross-link system sensed spurious radio frequency interference that inhibited completion of system tasks. An interim fix for the problem has been incorporated on the second and third IIR satellites, and a more robust resolution to the problem is being applied to the remaining Block IIR/IIR-M satellite family.

Currently, there are six Block IIR satellites on-orbit. The GPS IIR satellites provide the same functionality as earlier satellites, with added capabilities in two-way ranging and requiring less human interfacing for on-orbit operations. There are 14 additional Block IIR launches planned, with as many as 10 of those being the modernized or Block IIR-M version. The first Block IIR-M satellite launch is planned for late FY04. The IIR-M capabilities add developmental military use only M-code on the L1 and L2 signals and a civil code on the L2 signal. Block IIF satellites are also under development, with the first IIF satellite launch planned for August 2005. The Block IIF satellites are functionally equivalent to the IIR/IIR-M satellites and pave the way towards operational M-code after Initial Operational Test and Evaluation (IOT&E) in 2009. Block IIF will also add a new separate signal for civilian use, designated L5.

Active user equipment programs include continuing Miniaturized Airborne GPS Receiver 2000 platform installations in FY03 and beyond; Defense Advanced GPS Receiver deliveries beginning in FY03; and M-code receiver deliveries beginning in FY09. All receivers produced after FY02 are to have the Selective Availability Anti- Spoofing module capability installed.

*The NAVSTAR Global Positioning System is an Air Force-managed Joint Service program that provides highly accurate, real-time, all-weather, passive, common-reference grid position and time information to military and civilian users worldwide.*

### TEST & EVALUATION ACTIVITY

FY02 activity included continued test planning meetings and revision and approval of the GPS Modernization Test and Evaluation Master Plan (TEMP) during the final quarter.

Future testing includes implementing the Block IIR-M (FY05) and IIF (FY07) test programs, and the evolution of the new control system, the Architecture Evolution Plan.

The next round of IOT&E will occur when 24 operational Block IIR-M and Block IIF satellites are on-orbit and control segment software Version 6 is declared operational.

IOT&E will be a system-wide test of the space and control segments and legacy and modernized (M-code capable) user equipment scheduled to take place in FY09.

### TEST & EVALUATION ASSESSMENT

As reported last year, ground testing and on-orbit tests continue to indicate that the proposed solution to the Block IIR cross-link problem is being resolved satisfactorily. The six successfully launched Block IIR satellites are performing their navigation and timing mission without any reported problem and are expected to meet all navigation and timing requirements for the IIR system. However, it is still too early to report a final determination of the effectiveness and suitability of the entire series of IIR satellites.

Delays in developing and testing the GPS Operational Control Segment are DOT&E's chief concerns. Control software segment development continues to be a moderate to high-risk area with an ambitious schedule. In the space segment arena, the M-code signal is not fully defined, and this uncertainty is beginning to impact development and test schedules. Resources should be brought to bear to ensure timely design and development of both control segment software and M-code signal generation on satellites. In addition, development of M-code capable user equipment lags behind the development of the space and control segments, and this may induce delays in testing the Block IIR-M and IIF systems, along with the attendant M-code and civil signal capabilities.

The planned test approach provided in the new version of the GPS TEMP (being updated with change pages) is straightforward and well thought out. Extensive joint developmental/operational testing is planned to ensure early and adequate insight into the new capabilities planned for inclusion into the GPS mission (i.e., associated control segment software and M-code functionality, second and third civil signals, and signal protection for U.S. and allied forces).

The TEMP and associated test planning documents are being revised to accommodate the introduction of variable satellite signal power settings and increases in signal strength. The greatest effect of these changes may be to user equipment and antenna electronics. Thus, changes in the planned operational assessments and IOT&E are required to adequately test these new capabilities.

DOT&E continues to advocate the testing of new and legacy GPS receivers as early in the program as possible. These receivers must be integrated into representative platforms (i.e., ships, aircraft, and land vehicles) and tested in operational environments. DOT&E is monitoring very closely the developmental and operational testing of the so-called Interface Control Document-compliant, Block IIA, IIR, IIR-M, and IIF compatible GPS cards that form the basis of the next generation of GPS user equipment. Full testing will not occur until M-code capable receiver cards are available (FY09 timeframe). Before that time, backward compatibility will be tested using legacy receivers and initial M-code performance will be tested using prototype receivers.

Early operational evaluation/testing of UE integrated into operational platforms, including testing on an inverted range and/or anechoic chamber, must take place in the FY03-05 timeframe to ensure backward compatibility with existing legacy user equipment. As modernized prototypes and receiver cards become available, anechoic chambers may also be used to discover shortfalls that might exist in the design of modernized user equipment.

# RQ-4A Global Hawk Unmanned Aerial Vehicle (UAV)

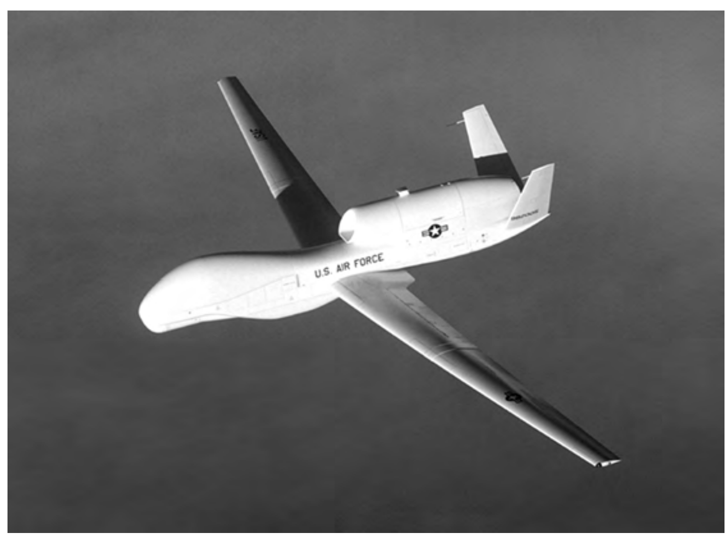
The Global Hawk Unmanned Aerial Vehicle (UAV) system is a theater commander's asset designed to satisfy surveillance and reconnaissance shortfalls. The Global Hawk air vehicle is to provide high-resolution Synthetic Aperture Radar (SAR) and Electro-Optical/Infrared (EO/IR) imagery at long range with long loiter times over target areas. A Signals Intelligence (SIGINT) capability is also being developed. Potential missions for the Global Hawk cover the spectrum of intelligence collection capabilities to support joint combatant forces in worldwide peace, crisis, and wartime operations.

The Global Hawk UAV system is comprised of an air vehicle component with air vehicles, sensor payloads, avionics, and data links; a ground segment with a launch and recovery element (LRE); a mission control element (MCE) with embedded ground communications equipment; a support element; and trained personnel.

The Global Hawk air vehicle is optimized for high-altitude, long range, and endurance; it is to be capable of providing 28 hours endurance while carrying 3,000 pounds of payload and operating above 60,000 feet mean sea level. The integrated sensor suite contains SAR, EO, and IR sensors. Each of the sensors provides wide area search imagery and a high-resolution spot mode. The radar also has a ground moving target indicator mode. A limited initial SIGINT capability will be incorporated prior to the Initial Operational Test and Evaluation (IOT&E) in FY06 while a more capable system in development will be integrated in production aircraft in the years that follow. Global Hawk is intended to operate autonomously using a satellite data link (either Ku or UHF) for sending sensor data from the aircraft to the MCE. The common data link can also be used for direct down link of imagery when the UAV is operating within line-of-sight of users with compatible ground stations.

The ground segment consists of the MCE for mission planning, command and control, and image processing and dissemination; the LRE for controlling launch and recovery; and associated ground support equipment. By having separable elements in the ground segment, the MCE and the LRE can operate in geographically separate locations, and the MCE can be deployed with the supported command's primary exploitation site. Both ground segments are contained in military shelters with external antennas for line of sight and satellite communications with the air vehicles.

The Global Hawk program began as part of the High Altitude Endurance Advanced Concept Technology Demonstration (ACTD) in 1995 under Defense Advanced Research Projects Agency management. At the conclusion of the ACTD, United States Joint Forces Command declared the Global Hawk had military utility and submitted a military utility assessment in September 2000 to support the transition from an ACTD to an acquisition program. Early operational assessments produced by the Air Force Operational Test and Evaluation Command and DOT&E found the system potentially effective and potentially suitable.




*Potential missions for the Global Hawk cover the spectrum of intelligence collections capabilities to support joint forces in peace, crisis, and wartime operations.*

The Milestone II decision in March 2001 approved entry into engineering and manufacturing development as well as low-rate initial production (LRIP) of six air vehicles, two MCEs, and two LREs. Prior to that decision, DOT&E approved the Test and Evaluation Master Plan (TEMP), asking for an update within 120 days of the contract award. Since March 2001, the program has been accelerated and re-baselined. At a meeting of the Defense Acquisition Board (DAB) in March 2002, the Air Force presented an accelerated program that produces a multi-INT (EO/IR/SAR/SIGINT) system through a spiral development program consisting of at least 4 spirals. The Defense Acquisition Executive approved spiral 1 and 2 development as well as the production of 17 LRIP air vehicles, 4 ground segments, and advanced procurement for the FY06 Full-Rate Production buy. In response to OSD direction, an updated Operational Requirements Document (ORD) to reflect the new program was approved by the Joint Requirements Oversight Council on October 29, 2002.

The DAB met in December 2002 and approved development of spirals 3 and 4, which include integration of the full SIGINT capability and the Multiplatform Radar Technology Insertion Program payload, and an increase of LRIP from 17 to 19 air vehicles. The DAB also approved program changes proposed by the Air Force to improve affordability, including the dedication of 12 of the 51 total aircraft to carry only the MP-RTIP sensor.

The Air Force has identified Global Hawk as a "Pathfinder Program" for an acquisition streamlining effort intended to field key capabilities to the warfighter as quickly as possible using spiral development. This effort intends to improve both the requirements generation process and the combined Development Test/Operational Testing process. The proposed TEMP ties specific ORD requirements to the test phases where they will be tested.

## TEST & EVALUATION ACTIVITY

Three Global Hawk air vehicles and ground elements were deployed in October 2001 to support operations in Afghanistan. One air vehicle crashed December 30, 2001, because of an assembly defect, while a second one crashed July 10, 2002, due to suspected engine failure. Of the five Global Hawk air vehicles built during the ACTD, two are available. A sixth aircraft, procured as one of two at the end of the ACTD but prior to the LRIP, made its first flight April 22, 2002.

There has been limited formal test and evaluation activity this year. Following the April-May 2001 deployment to Australia, flight-testing conducted at Edwards Air Force Base included brake tests, cross-wind limitation testing, and the first replace on station (ROS) testing. Since October 2001, flight testing at Edwards has been limited to supporting operations in Afghanistan through activities such as check flights of new software builds. Functional check flights of air vehicle 6 and calibration of a new sensor suite that was delivered in February 2002 were also performed. Electromagnetic Interference and Compatibility (EMI/EMC) ground testing was conducted at Edwards Air Force Base in June 2002 to baseline the aircraft for SIGINT development and integration. Testing was slowed by necessary down-time following the two air vehicle crashes. The Air Force Operational Test and Evaluation Command has collected data on deployed operations and produced a classified report on Global Hawk performance during participation in Operation Enduring Freedom (OEF).

A TEMP is in coordination to address changes in operational requirements and acquisition strategy. A detailed test plan is expected to cover the period leading up to IOT&E in FY06. Air vehicle 7, which will be the primary aircraft for development and operational testing during Developmental Test/Operational Testing, is expected to begin productive flight test at Edwards in January 2003.

## TEST & EVALUATION ASSESSMENT

The ACTD ended with a number of areas where improvement was needed or performance was not known. The DOT&E Early Operational Assessment (EOA) noted mission planning, imagery dissemination, scene accountability, system re-tasking, and communication bandwidth burden as areas where improvement would be necessary for an operationally effective system. Average National Imagery Interpretation Rating Scale rating of SAR imagery was also found to be below specifications. The EOA found that reliability and spare parts availability must be improved as well as a logistics infrastructure and maintenance concept would be necessary for an operationally suitable system.

There were many areas where data were lacking at the end of the ACTD. In particular, neither the EO/IR nor the radar's ground moving target indicator mode was examined in depth. EO/IR development has been further hampered by the loss of the only four EO/IR sensors in air vehicle mishaps.

Since the ACTD, the only periods where data were collected under operational conditions was during an Australian demonstration in April 2001 and during support for OEF. The data from Australia is limited by the use of non-representative tactics and experimental software. (The Australian Defence Force funded the development of experimental maritime modes for the radar.) Details of support for OEF to the extent they are known are classified and are not included here.

Problems similar to the ACTD experience were seen in Australia, including lengthy mission planning, lack of user friendly re-tasking capability, and lower than expected reliability (largely driven by frequent sensor "crashes" and problems with imagery processing and storage software in the ground station). Lack of spare parts, training, and technical data were again noted as programmatic voids. A joint Australian/U.S. report also noted lower than expected imagery quality from the EO/IR sensor based on preliminary analysis by Australian image analysts.

The Air Force Operational Test and Evaluation Command's OEF report is classified. The report, however, notes contributions of the system through making a large volume of imagery available to the theater intelligence architecture and provides anecdotal evidence of Global Hawk positively affecting decisions. Two air vehicles were lost during the deployment and suitability issues similar to those seen in previous testing were noted.

The report on the first developmental ROS testing, accelerated because of OEF, found the ability of the system to conduct ROS marginal, noting unsatisfactory voice communications and controls and displays. EMI testing provided a baseline EMI profile. Performance was found satisfactory although some mitigation may be required depending on operational requirements.

The applicability of this data to production systems is limited, however. By the time the first IOT&E is expected to occur in FY06, much of the system will have changed. The system will have an entirely new EO/IR sensor and the radar will have completely new software, along with increased power and associated changes in hardware. Modifications are also planned to increase endurance, including re-winging the aircraft. A SIGINT package is being added and, to accommodate the increased weight of the payload, structural changes are also being made. Many of these changes, however, will not occur until after the operational assessment, limiting DOT&E's ability to draw conclusions on these new capabilities in support of the In-Process Review following the FY04 Operational Assessment.

Demands on development and test resources are extreme in the Global Hawk program. The program has lost three air vehicles and cannibalization has left another unflyable. The first four EO/IR sensors delivered have also been lost. The situation is exacerbated by participation in demonstrations. Not only do the demonstrations demand assets such as air vehicles, they also require the development of unique capabilities to support those efforts. In addition to the 2001 Australian deployment, a congressionally-directed United States Southern Command demonstration planned for February 2003 and a German demonstration planned for April 2003 require the development of capabilities such as maritime radar modes, an air-to-air moving target indicator, and a European Aeronautic Defence and Space electronic intelligence sensor. In addition to pulling test assets, these demonstrations put the system in non-representative configurations and limit applicability of any ancillary data collected.

Spiral development creates a dynamic operational test and evaluation environment. DOT&E is working with the program office to ensure that the program complies with "fly-before-buy" philosophy and practices.

# Sensor Fuzed Weapon (SFW)

The CBU-97 Sensor Fuzed Weapon (SFW) is a 1,000 pound class, unpowered, air-delivered, wide-area smart munition intended to provide multiple kills per pass against armored and support vehicles. The system is certified on the A-10, B-1, B-2, B-52, F-15, and F-16 and is designed to be compatible with various United States Navy/United States Marine Corps and NATO aircraft. The weapon is capable of delivery in adverse weather conditions, day or night, at various altitudes and airspeeds. SFW consists of a SUU-66/B Tactical Munitions Dispenser (TMD), which houses ten BLU-108 submunitions. Each submunition contains four projectiles, an orientation and stabilization system, a radar altimeter, and a rocket motor. After spin-up and release from the submunitions, the projectiles scan the area under their flight path with a two-color passive infrared sensor. The Preplanned Product Improvement (P$^3$I) projectile also incorporates an active laser range finder. Upon detecting a valid target, an electronic pulse detonates an explosive charge driving an explosively formed penetrator into the target.

The SFW can be delivered at low or high altitudes and at low through supersonic speeds. High altitude deliveries are more precise when the SFW is configured with the Wind Corrected Munitions Dispenser (WCMD) tail kit. WCMD is an inertial guidance tail kit that replaces the existing tail section of current tactical munitions dispensers to improve delivery accuracy when released from medium to high altitude. Retrofit of SFW with WCMD tail kits began in April 2001, designated the CBU-105.

In 1996, the Air Force instituted an SFW P$^3$I program, which implements three major improvements: performance against countermeasures; performance against softer targets without degrading current target-set performance; and increased area coverage. The sensor is upgraded to enhance its performance against cooler targets and improve weapon aimpoint accuracy, as well. The SFW P$^3$I submunition is designated BLU-108B/B and the all-up-round is designated the CBU-105B/B with the WCMD tail kit.

Producibility Enhancement Program (PEP) hardware upgrades were also initiated for SFW to reduce costs and improve the ability to be produced through design improvements. PEP-1 involved electronic and mechanical changes to the projectile. FOT&E of PEP-1 concluded in 1998 and test results indicate PEP-1 changes did not degrade the performance of SFW.

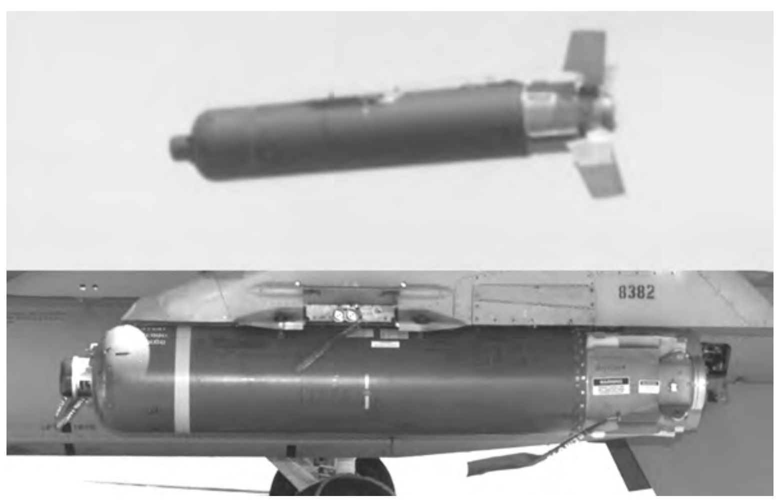
The LFT&E strategy for SFW P$^3$I includes collection of sensor data against a representative target set, repeat of shot lines from the original (1990) SFW LFT&E test to compare SFW P3I against baseline results, and two additional shots to further evaluate performance.

The Air Force approved production of the SFW P$^3$I in January 2001. WCMD Milestone III was approved in February 2001. No further acquisition milestones are planned for SFW.

**TEST & EVALUATION ACTIVITY**

SFW P$^3$I Developmental Test/Operational Test flight test weapon deliveries are complete.

All tests contributing to LFT&E of the SFW P$^3$I concluded in FY01. DOT&E provided Congress with an LFT&E report on system lethality in March 2002.




*Analysis of recently concluded Wind Corrected Munitions Dispenser, Sensor Fuzed Weapon Preplanned Product Improvement tests also indicate that the P$^3$I-variant meets requirements. DOT&E awaits the Air Force final report. This report should also provide documentation currently lacking in the field with respect to SFW P$^3$I performance in operationally relevant conditions.*

## TEST & EVALUATION ASSESSMENT

Previous operational tests of the WCMD validate additional SFW employment capability from medium and high altitudes. Analysis of recently concluded WCMD, SFW $P^3I$ tests also indicate that the $P^3I$-variant meets requirements. DOT&E awaits the overdue Air Force final report, which should resolve disagreements that exist with data previously published by various Air Force test agencies. This report should also provide documentation currently lacking in the field with respect to SFW $P^3I$ performance in operationally relevant conditions.

LFT&E of SFW $P^3I$ was supported by captive flight testing of the sensor system over moving and stationary threat targets, as well as modeling and simulation of lethality against threat targets not represented in testing. However, LFT&E of SFW $P^3I$ did not include tactical drops of the munition against moving formations of threat vehicles. Future tests of munitions that rely on sensor-fuzed warheads will require either realistic end-to-end testing or a robust validation of the analytical techniques used to link individual elements of the engagement sequence. Test and analytical results describing detailed system technical performance and system lethality against the expected targets are classified, and are included in the final LFT&E report. LFT&E testing was adequate to support an evaluation of terminal lethality against the range of expected targets.

# Space-Based Infrared System (SBIRS)

The Spaced-Based Infrared System (SBIRS) replaces the current Defense Support Program (DSP). SBIRS improves support to theater CINCs, U.S. deployed forces, and allies, by providing better data quality and timeliness in four mission areas: Missile Warning, Missile Defense, Technical Intelligence, and Battlespace Characterization.

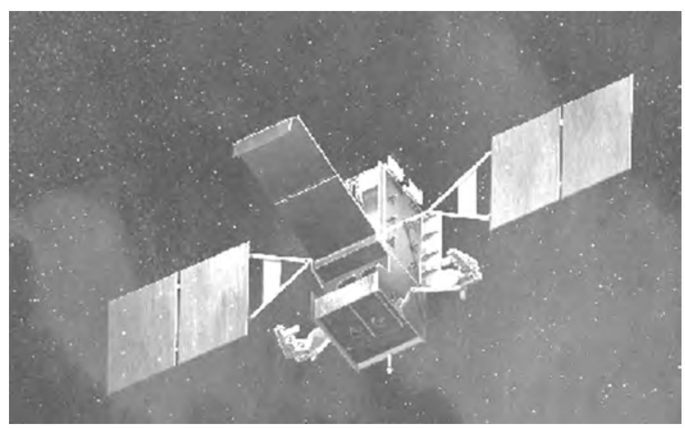
The SBIRS is being acquired in three increments:

- Increment 1: which attained Initial Operational Capability in FY02, consolidated DSP and Attack and Launch Early Reporting to Theater ground stations into a single CONUS Mission Control Station (MCS). Increment 1 operates with DSP satellite data.
- Increment 2: upgrades Increment 1 software and hardware to operate SBIRS High satellites. SBIRS High includes four satellites in Geosynchronous (GEO) orbit, with the first launch expected in FY07, and two hosted payloads in Highly Elliptical Orbit (HEO), first available in FY03. A fifth GEO satellite will be procured as a replenishment/ spare. SBIRS High satellites will primarily improve current DSP operational capabilities.
- Increment 3: will operate SBIRS Low satellites, which will provide a mid-course tracking and discrimination capability for effective ballistic-missile defense. SBIRS Low has been transferred to the Missile Defense Agency, is currently a research and development initiative, and is not further addressed in this report.

The SBIRS Increments 1 and 2 entered the Engineering Manufacturing Development phase following a Milestone II Defense Acquisition Board review in October 1996. During FY02 the Air Force made substantive programmatic changes to SBIRS Increment 2 due to a Nunn-McCurdy breach. As a result, the Air Force delayed launch of the first GEO satellites from FY04 to FY06, and rescheduled incremental deliveries of the ground segment to better align with the delayed satellite schedule.

### TEST & EVALUATION ACTIVITY

- SBIRS ground segment test activity during FY02 included an Operational Utility Evaluation (OUE) of the Interim Mission Control Station Backup-1 (IMCSB-1) co-located with the Lockheed-Martin Contractor Development Facility in Boulder, Colorado. The 54-day IMCSB-1 OUE was completed on October 29, 2002. The final test report was signed by the Air Force Operational Test And Evaluation Center (AFOTEC)/CC on December 16, 2002.
  - The IMCSB-1 provides an interim Increment 1 backup capability to the existing MCS facility until the MCSB is complete.
    - The IMCSB-1 operates with DSP, and will be upgraded to Increment 2 capabilities in preparation for operation with HEO and GEO satellites.
    - The IMCSB is operationally separate (physical security, communications, etc.), but physically located with the Contractor Development Facility; when activated as a backup operations crews from the MCS will man the IMCSB and conduct SBIRS operations.
  - SBIRS space segment test activity during FY02 included HEO proto-qualification testing and HEO-1 assembly and functional testing.



*The Space-Based Infrared System replaces the current Defense Support Program and provides data to theater commanders, U.S. deployed forces, and allies in four mission areas: Missile Warning, Missile Defense, Technical Intelligence, and Battlespace Characterization.*

- The contractor also presented Baseline Updates of the SBIRS High spacecraft and SBIRS system; GEO subsystem tests will begin in FY03.

## TEST & EVALUATION ASSESSMENT

Based on results released in the IMCSB-1 final test report, the IMCSB was rated as effective and suitable and performed as well or better than the MCS during Initial Operational Test and Evaluation. The Suitable rating is an improvement over the Increment 1 Initial Operational Test and Evaluation rating primarily due to the IMCSB meeting all of its dependability requirements. Overall, the IMCSB is capable of strategic and theater missile warning, command and control of the DSP constellation, and system activation in the event of a loss of operational capability of the primary MCS.

The latest SBIRS re-baseline provided some schedule relief to the high concurrency between the Increment 2 ground and space segments. However, the schedules remain tight, with little recovery time available for problem correction.

For Test and Evaluation, we are concerned with the delivery schedule for system-level models and simulations (M&S) for Operational Test and Evaluation (OT&E). The tool required for OT&E of the multi-satellite certification (FY09) and GEO-capable multi-mission mobile processors (FY09) is the Simulation Over Recorded Data (SORD) M&S tool that began development in FY03. However, there is insufficient time between final GEO deployment and OT&E to accommodate scenario development and the necessary level of verification, validation, and accreditation. Furthermore, the solar flyer configuration for GEO satellites complicates the clutter rejection function, impacts GEO coverage capability, and complicates any M&S validation activities.

# Unmanned Combat Aerial Vehicle - Air Force (UCAV-AF)

The unmanned combat air vehicle (UCAV) is an autonomous, stealthy, unmanned strike aircraft. The aircraft will carry advanced sensors for target acquisition, electronic support measures, and air-to-ground weapons. A weapon has not yet been selected, but candidates include Joint Direct Attack Munition and the small diameter bomb. Incorporation of electronic attack capabilities is planned for future spirals. Air vehicles are monitored and re-tasked from a ground station connected via Line-of-sight (LOS) and Beyond-line-of-sight (BLOS) data links. The operations concept has been designed to offer reduced operations and support costs compared to manned attack aircraft. The concept includes storing UCAVs in containers for up to 10 years prior to use and extensive use of simulation during training. The system is also being designed to allow one operator to control up to four air vehicles.

The initial role chosen for UCAV is suppression of enemy air defenses (SEAD). The mission role is seen as evolving from a preemptive to a reactive SEAD mission. Preemptive SEAD involves attacking known, generally fixed, air defenses at the beginning of the campaign for air superiority. Reactive SEAD is a more dynamic mission and involves protecting friendly aircraft.

The Defense Advanced Research Programs Agency (DARPA) is currently the developing agency for UCAV. The program will be transferred to the Air Force in FY03. The system is being developed using a spiral development approach, concurrently developing, producing, testing, and fielding systems in blocks. The current prototype air vehicles, X-45A, will migrate from Block 1 to Block 4. The next series of prototypes, X-45B will be Block 5. The first operational capability will reside in the Block 20, A-45 systems. The Air Force is planning to request an Authority to Proceed (ATP) decision to begin development and procurement of the Block 10 systems. Congressional Language calls for 30 operational UCAV systems by 2010; accordingly, the Air Force is planning to deliver 14 Block 10 UCAVs between 2006 through 2008 and 16 Block 20 UCAVs between 2009 through 2010. The Block 20 is envisioned as the production representative system. A total of 132 production air vehicles are currently planned.

A number of improvements are planned in order to produce an operational system from the existing X-45A aircraft. DARPA and Boeing have agreed to a contract extension that will deliver the X-45B, a second demonstration vehicle that is larger, more capable, and incorporates low observable technology. However, payloads will not be incorporated until the A-45 aircraft are developed.

The Air Force has identified the UCAV as a "Pathfinder Program" for an acquisition streamlining effort intended to field key capabilities to the warfighter as quickly as possible using spiral development. This effort intends to improve both the requirements generation process and the combined Developmental Test/Operational Test process. A collaborative requirement working group and integrated verification team has been established to support the Pathfinder efforts. Although the contractor has a well-developed demonstration program, the evaluation concept for the first 30 operational air vehicles is still not defined.

*The Air Force intends to develop Unmanned Combat Aerial Vehicle using a spiral development approach, concurrently developing, producing, testing, and fielding systems.*

### TEST & EVALUATION ACTIVITY

To date, test activity has been conducted at NASA Dryden Space Center under a joint DARPA, Air Force, Boeing system demonstration program. The X-45A's first flight occurred on May 22, 2002, and lasted 14 minutes. Testing prior to the first flight included ground and taxi tests. Preliminary operational test planning has also begun inside the Air Force in anticipation of the transition to an Air Force-led formal acquisition program in FY03.

### TEST & EVALUATION ASSESSMENT

The Air Force UCAV represents a significant leap in the roles, missions, and capabilities of Unmanned Aerial Vehicles (UAVs). UCAV will be required to survive and be effectively employed in an environment unprecedented for UAVs. Other firsts are plans for in-flight refueling of a UAV, and air vehicle-to-operator ratios of up to four-to-one. Integration with strike packages, low observability maintenance, long-term storage, and extensive use of simulation in training are other operational aspects of system performance that will require thorough testing. End-to-end, mission level evaluations of the system's capability will be required to measure performance before buying and fielding.

# Wideband Gapfiller Satellite (WGS)

The Wideband Gapfiller Satellite (WGS) communications system will provide communications to the U.S. warfighters, Allies, and Coalition Partners during all levels of conflict short of nuclear war. It is the next generation wideband component in the Department of Defense's future Military Satellite Communications (MILSATCOM) architecture.

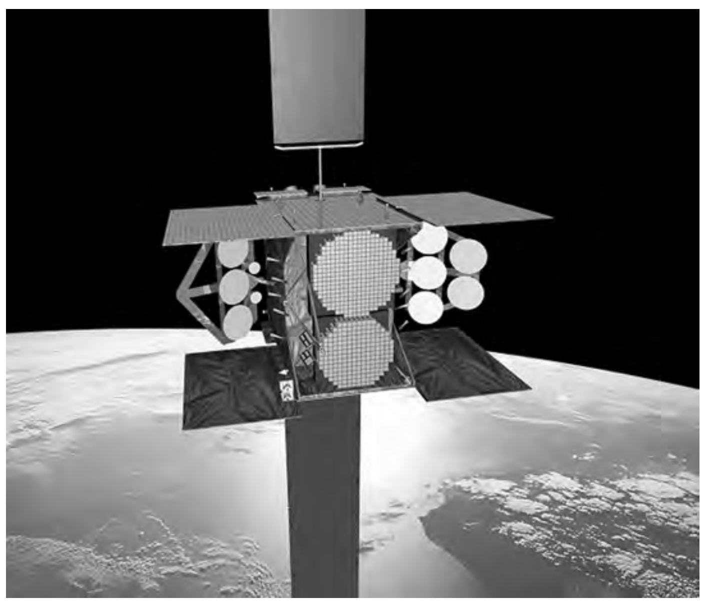
WGS will satisfy military communications needs by providing communications in both the X-band and military Ka-band frequencies. It will combine capabilities onto a single satellite for tactical X-band communications, augment the Global Broadcast Service (GBS) Phase II system, and provide new two-way Ka-band services. This new service is being introduced to alleviate the spectrum saturation of X-band, and should greatly increase both the available single-user data rate and total satellite capacity over today's Defense Satellite Communications System (DSCS) III satellites.

The satellite segment is being acquired by the Air Force under the Federal Acquisition Regulation Part 12 rules for commercial item acquisition. Because of its commercial nature, this program has no lead-in development phase, but will proceed directly from award to launch in one combined Engineering Manufacturing Development/Production phase. The first launch is now projected for 3QFY04. The final two launches are projected for 1QFY05 and 4QFY05. The Army is acquiring the ground control segment and the MILSATCOM Joint Program Office is integrating the WGS and GBS space and ground segments.

The 2001 Defense Appropriations Act signed on August 9, 2000, limited funding to two satellites. Subsequently, the Office of the Secretary of Defense signed a Program Decision Memorandum on August 22, 2000, supplementing WGS funding by $272.9 million to ensure funding of the complete constellation of three satellites.

## TEST & EVALUATION ACTIVITY

- Test and evaluation planning continued in FY02 for the WGS system
- A Milestone II/III Test and Evaluation Master Plan (TEMP) was approved by DOT&E on October 26, 2000, and a TEMP update is in the signature coordination cycle. The Acquisition Decision Memorandum requires that the TEMP be updated within 90 days after the Critical Design Review (CDR).
- Air Force Operational Test and Evaluation Center (AFOTEC) completed an early operational assessment (EOA) of the WGS system September 2000 in support of a combined Milestone II/III decision.
- AFOTEC will perform an Operational Assessment based primarily on the CDR data package
- Government Developmental Test and Operational Test members will start observing contractor developmental testing and intersegment testing in FY03.



*The Wideband Gapfiller Satellite will satisfy military communications needs by providing communications in both the X-band and military Ka-band frequencies.*

## TEST & EVALUATION ASSESSMENT

DOT&E received the WGS EOA outbrief on November 7, 2001, with the following issues highlighted:

- The complexity of cross-banding between the X-band and Ka-band onboard the satellite and the concurrent development of the Gapfiller Satellite Configuration Control Element (GSCCE) with the automation upgrades of the Satellite Operations Center and DSCS Operations Center (DSCSOC) networks pose a risk to successful WGS development and implementation.
- Interoperability and compatibility requirements compound the complexity of developing the control software for WGS. The GSCCE used to control WGS payloads must be interoperable with the DSCSOC network. An ongoing Army software development program is upgrading the DSCSOC network to a new ODOCS system. This is separate from the concurrent WGS program to produce the GSCCE. If the GSCCE and the ODOCS are not interoperable the DSCSOC operators will not be able to successfully establish communication networks with operational users.
- WGS and the GBS must be interoperable and compatible. GBS is fielding its support infrastructure to structure broadcasts and control the payloads on the Ultra High Frequency Follow-On satellites. WGS payloads (at X and Ka-band) are proposed to be controlled by modified DSCSOCs, currently only capable of controlling X-band payloads. Interoperability between these two systems must be synergistic and not compete to ensure high-speed access for broadcast users.

The test results and analysis presented at the CDR indicate that the design is progressing with no major problems. In addition to the risk areas identified during the EOA, the CDR identified two additional areas of interest.

- WGS is projected to provide a total throughput between 1,227 Mbps (threshold) and 3,600 Mbps (objective) using the same bandwidths presently allocated to DSCS and GBS. The added capacity comes through frequency reuse – use of the same frequency over geographically separated beams. This requires evolution of a Concept of Operations (CONOPS) to ensure that beam allocations for concentrated troop positions do not cause overlap of beams on the same frequency. It also requires that the WGS and DSCS satellites be separated sufficiently in their orbits so that the least capable X-Band antenna can discriminate between the two satellites.
- The WGS satellites are being integrated for launch on both the Delta and Atlas Evolved Expandable Launch Vehicle (EELVs). The first launch will be on Delta and the second on Atlas. Boeing added extra solar panels to their original design, which added weight and changed the class of EELV that will be required. The availability of the launch vehicle and an aggressive integration schedule, less than the normal 24 months, are sources of schedule risk.

# Live Fire Test and Evaluation

# Live Fire Test and Evaluation

# Live Fire Overview

The Live Fire Test and Evaluation (LFT&E) Program was enacted into law, Title X Section 2366, by Congress in FY86. The Federal Acquisition Streamlining Act of FY95 moved the program to the Office of the Director, Operational Test and Evaluation (DOT&E). The LFT&E program has, since its inception, required realistic survivability and lethality testing on platforms and weapons to assure that major systems perform as expected and that our combat forces are protected. The law has proven to be both enduring and flexible, permitting test realism to be balanced against cost and practicality.

Survivability and lethality testing conducted under the auspices of the LFT&E program generate information that directly supports the DOT&E mission of evaluating the effectiveness, suitability, and survivability of major defense acquisition programs. Under LFT&E, realistic lethality data is generated that, when combined with operational test and evaluation results, supports an assessment of operational effectiveness. Also under LFT&E, realistic platform (aircraft, ship, armored vehicle, *etc*.) vulnerability data, damage assessment and reparability information, and crew casualty information is generated and analyzed. This analysis, in conjunction with susceptibility data and operational test and evaluation results, support an evaluation of operational survivability.

LFT&E encompasses testing and evaluation over the course of a program, beginning with component-level testing during the initial design stage. Testing and evaluation continues as the system matures from assemblies to sub-systems, and finally to a full-up, system-level configuration. At the full-up, system-level, the weapon system is fully equipped for combat and with all sub-systems operational and powered. Early identification of deficiencies through LFT&E allows time to impact design trades and make design changes before production configurations are finalized thereby reducing costs.

### INVESTMENT INITIATIVES

In support of its statutory requirements for system vulnerability and lethality testing and evaluation, the LFT&E office provides funding for initiatives that encompass similar and related efforts. These related efforts include increasing the coordination and integration of the testing and training communities, the testing and evaluation of fielded weapons and platforms, the production of munitions effectiveness manuals for the combatant commanders, and advancing technologies and methodologies to increase aircraft survivability.

### LIVE FIRE TESTING AND TRAINING

The FY97 Defense Appropriation included congressional funding to investigate alternative uses of simulation and training technology in support of Live Fire Testing and Evaluation (LFT&E). This initiative came to be known as the Live Fire Testing and Training (LFT&T) program.

The LFT&T Program fosters the exchange of technology initiatives and uses between the live fire and test communities. The underlying LFT&T Program objectives are to enhance cost-effective testing and training and improve warfighting readiness. The program has funded twenty-five projects totaling approximately $28 million since its inception. Several projects have transitioned to operational use and are already providing benefits to the warfighter.

The LFT&T Program funded a total of nine projects in FY02. A summary of the FY02 projects follows:

- **Weapons Aimpoint Analysis and Training Tool:**
  Small arms weapons and their associated fire control systems are becoming increasingly more complex to enable engagement of targets that were previously considered protected or difficult to attack. The objective of this project is to develop an infrared live fire tracking and data collection system that will allow testing and training communities to measure, in real time, a gunner's aimpoint during target engagements and determine the true sources of error. New capabilities will include a method to validate ballistic models for

complex fire control systems, real-time gunner/weapon aimpoint position data, a method to separate gunner errors from weapon system errors, and enhanced weapon aimpoint and tracking feedback.

- **Man Portable Air Defense Systems Test and Training Results:** MANPADS shoulder fired missiles are a significant threat and of great importance to national and world security. The objectives of this project are to facilitate the collection and presentation of MANPADS test results to facilitate its use as training materials and in updating Joint Munitions Effectiveness Manuals and databases.

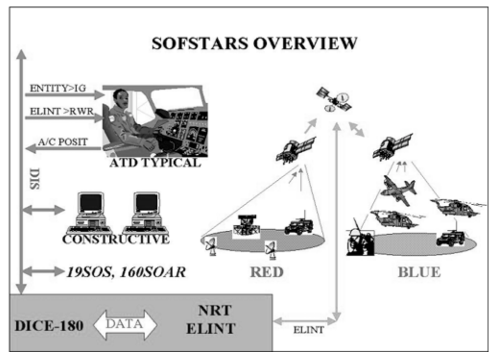
- **Moving Weapons Platform Simulator:** Operating a stabilized, platform mounted weapon is complicated and costly depending on platform and logistics costs, range availability, data collection time, and ammunition costs. These factors increase testing and training costs. The objectives of this project are to develop a system that allows weapons concepts to be evaluated earlier in the design process, reduce the live fire range time requirements, serve as an individual weapons operator training system, and serve as the baseline system for defining pilot/driver/weapons operator team training system requirements.

- **Virtual Target Gunnery System:** Using simulation technologies, targets used on live firing ranges can be greatly advanced beyond the technologies still in use from the 60's and 70's (*e.g.*, silhouettes, stationary or attached to a mechanical device/vehicle). This project will demonstrate an enhanced live fire target technology by presenting intelligent, simulated targets to trainees learning to use the Mark 38 25-mm machine gun. These simulated targets will be presented in a real world setting, with the targets integrated in real time into the gunner's real-world view.

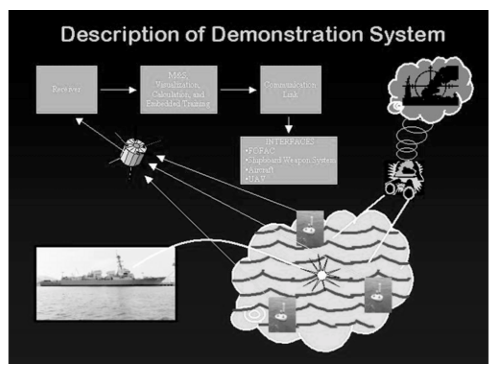
- **Dismounted Infantryman Testbed:** Current simulation testbeds, focused at the individual/weapon level, do not provide the capability to examine the complex interrelationships and synergism of a fighting team employing multiple weapons. The objective of this project is to provide a validated multi-user training device that allows the testing and training communities to analyze, and subsequently optimize, the lethality and survivability of a fighting team. Specific objectives include: planning and conducting exercises on simulated test ranges to examine the interrelationships between man, team and multiple weapon systems employment, and developing performance metrics and analysis methodologies to support both the testing and training communities.

- **Live Fire Advanced Concepts:** Cost effective means to provide small unit training, development of tactics, techniques, and procedures, and testing of new weapons and warfighting concepts are needed. This project will create a simulated environment that allows soldiers to maneuver throughout the battlefield, using a head-mounted display to view the terrain and friendly and opposing forces. It is weapon system independent, and can easily accommodate the addition of new weapons.

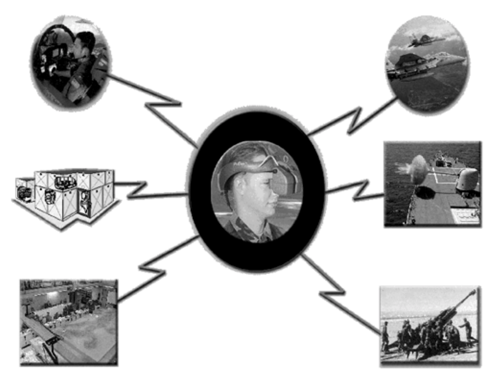
- **Special Operations Forces (SOF) Signals Training and Rehearsal System:** Special Operations Forces aircrew training devices do not provide for a realistic, simulated, combat environment because they do not include near-real-time intelligence information as would be encountered in the real world. The objective of this effort is to develop a system that will integrate live, virtual, and constructive simulations and national intelligence capabilities into SOF aircrew training devices.




- **Enhanced Overwater Scoring System:** The Navy had a need to perform end-to-end weapons testing and training without range space limitations, either in location or size. This project demonstrated a virtual, relocatable "range" for training, as well as for the test and evaluation of extended range weapon systems. This system allows land-based, sea-based, air-launched or dropped weapons to be fired at an impact area offshore over open water. The Navy has adopted this system for their live fire training activities.




- **Multi-Purpose Terminal Control and Supporting Arms Trainer:** Each of the services implements calls-for-fire in different ways, while joint operations require service members to interact with other service members with predictable results. This project will apply the latest display technologies, synthetic terrain viewers, and scenario development techniques to the development of a prototype multi-purpose terminal control and supporting arms trainer (MultiSAT). The MultiSAT will provide a joint standardized system for instruction in the employment and techniques of Naval surface fire, tactical air, and field artillery support in expeditionary operations.



## JOINT LIVE FIRE PROGRAM

The Joint Live Fire (JLF) Program was initiated by the Office of the Secretary of Defense (OSD) in March of 1984 to establish a formal process to test and evaluate fielded U.S. systems against realistic threats. This process continues today taking into account changes in operational scenarios, changes in threat munitions and targets, and the testing of legacy systems. This process provides a means to gather additional data not collected by acquisition programs. It allows survivability and lethality assessments of fielded systems or for specific component upgrade programs where LFT&E does not encompass the overall system. DOT&E/LFT provides funding and technical and financial oversight.

The JLF program consists of three groups: Aircraft Systems (JLF/AS), Armor/Anti-Armor (JLF/A/AA), and Sea Systems (JLF/SS). JLF/AS focuses on the vulnerability of U.S. fixed-wing and rotary aircraft to realistic threats and on the lethality of fielded U.S. weapons/munitions against foreign aircraft. The JLF/A/AA focuses on the vulnerability of fielded U.S. ground systems (tanks, trucks, armored personnel carriers) to realistic threats and on the lethality of fielded U.S. weapons/munitions against realistic targets. The JLF/SS focuses on the vulnerability of fielded surface combatants, including attack gunboats, and on the lethality of fielded U.S. weapons/munitions against realistic targets.

In FY02, the JLF/AS program addressed the vulnerability of the CH-47 Chinook, C-130 Hercules, H-60 Blackhawk, and the lethality of the U.S. 20mm projectile PGU-28/B against selected foreign targets. In addition, FY02 efforts included continued development of Man-Portable Air Defense Systems test capability to increase the amount of information gained from each shot.

- **CH-47D Testing and Analysis:** The CH-47D Chinook helicopter JLF program includes tests and analyses to determine the vulnerability of the rotor blade and the rotor power train to expected threat projectiles. The Army Research Laboratory and the Boeing Company jointly completed integrated ballistic and structural tests. Test planning and damage prediction analyses were also completed for the final rotor blade test series (dynamic, loaded rotors on a CH-47D ground-test helicopter) to occur in FY03. Test equipment/target material buildup and pre-shot predictions were completed in preparation for the first phase of rotor power train (transmission) gunfire tests scheduled early in FY03.

- **Transport Aircraft Vulnerability Testing and Analysis:** A dynamic, free-flight test of a MANPADS missile against a C-130 aircraft with a running engine was conducted to determine the vulnerability of a pylon-mounted, turbo-fan engine and associated secondary effects to the platform from this threat. All damage modes were documented and used in furthering the state of the art in modeling and simulation. This test also provided an opportunity for Air Force C-130 Battle Damage Repair technicians and engineers to gain practical experience on a C-130 with realistic MANPADS damage. Additionally, JLF is conducting an analysis to determine the types of damage that will result in a C-130 mission abort and the vulnerable area of the aircraft for those types of damage. In upgraded C-130 configurations, some functions performed by the crew in older models have been automated and the crew size reduced.

- **PGU-28/B Lethality Testing:** The U.S. 20mm PGU-28/B SAPHEI (semi armor-piercing high explosive incendiary) projectile was developed in the mid 1980s, replacing the U.S. M-56A3 HEI projectile in the air-to-ground role due to its armor penetrating capability. Two separate, but complimentary, test programs were conducted to better understand the lethality of the PGU-28/B against a MIG-29 Fulcrum and a MIL-24 Hind. Information was collected and analyzed to characterize the lethality of this munition against these targets and to provide information to the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME). Data provided to the JTCG/ME assisted in characterizing the effectiveness of the PGU-28/B against several threat systems and for updating the Joint Munition Effectiveness manuals.

- **H-60 Testing:** The H-60 helicopter program includes tests and analyses to determine the ballistic vulnerability of the tail rotor subsystem. This effort complements the ongoing Joint Army/Navy H-60 Helicopter LFT&E program, since the tail rotor subsystem is common to the Army's UH-60M and the Navy's MH-60S and MH-60R aircraft. Battle Damage Assessment and Repair (BDAR) efforts will be coordinated with the Army Aviation Logistics School at Fort Eustis, Virginia.

In FY02, the JLF/A/AA program continued to evaluate, through ballistic testing, the lethality of selected U.S. munitions against a foreign main battle tank and against the Scud-B system. JLF/A/AA also investigated the fire and explosion suppression capabilities of fuel tank filler technologies.


- **Munitions Lethality:** Lethality testing was continued against a classified foreign main battle tank target. These tests were started in FY01 and will conclude in FY03. The objectives of these tests are to assess the lethality of current and developmental U.S. munitions against a currently fielded, foreign main battle tank, to acquire empirical data to calibrate current vulnerability methodologies, to update existing JLF and LFT&E databases, to supplement live-fire lethality tests and evaluations for the tested munitions, and to provide empirical data to assist field commanders in training on how to engage and defeat the tested threat target. The results will be incorporated in the JTCG/ME munitions effectiveness manuals.

- **Munitions Lethality: SCUD-B Target:** Lethality testing of several U.S. munitions against the Scud-B target continued. These lethality data will be used by the JTCG/ME to update joint munitions effectiveness manuals. Additionally, planning was completed for the conduct of testing against a chemical warhead surrogate to determine the potential for destroying chemical warheads and the potential hazard posed by release of warhead contents.

- **JLF Fuel Tank Filler Tests:** Fuel cells in ground and air vehicles contribute to a significant portion of the system's vulnerable area. Threat munitions impacting and penetrating or perforating these cells can lead to fuel fire explosions and/or sustained fuel fires which could possibly lead to the catastrophic destruction of the targeted system. Fuel cell inerting technologies have been developed which effectively suppress explosions in impacted fuel cells. A series of tests were conducted to determine the ullage suppression performance of selected fuel tank filler technologies.

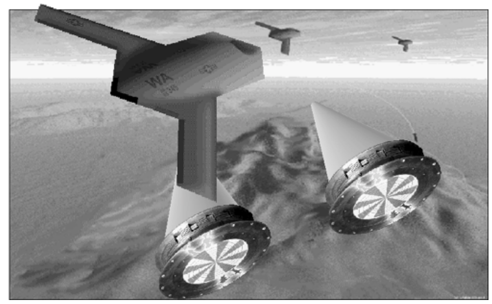
In FY02, the JLF/SS program conducted a series of lethality tests against an aluminum hulled Mk3 Patrol Boat for the purpose of demonstrating HELLFIRE Missile lethality against small boat threats. Two tests were conducted by dynamically firing a shaped charge variant of the HELLFIRE on a sled-track. A third shot was a static detonation of the blast and fragment variation of the missile. Data and damage assessment collected and analyzed will be used by the JTCG/ME to address a systems effectiveness requirement.

### JOINT TECHNICAL COORDINATING GROUP ON AIRCRAFT SURVIVABILITY

The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) was chartered in 1971 by the Joint Logistics Commanders to provide a mechanism to ensure inter-service exchange of aircraft survivability technologies, modeling and simulation (M&S) methodologies, and design tools necessary to field more survivable and combat effective aircraft. The JTCG/AS was re-chartered in 1991 under the Joint Aeronautical Commanders Group and has since focused on establishing survivability as a design discipline, developing vulnerability and susceptibility reduction technologies, providing standard models to assess aircraft survivability, and supporting survivability education.

In FY02, the JTCG/AS worked closely with members of the acquisition community and DOT&E to identify critical issues regarding aircraft survivability. In response, the JTCG/AS funded almost 50 projects worth approximately $8.4 million to enhance aircraft survivability in areas such as fire and explosion protection, reduction of susceptibility and vulnerability to MANPADS, advanced threat identification and exploitation, advanced electronic warfare technology, and aircraft survivability model development and upgrades. Several examples of these projects are shown below.

- **Weapons Bay Ablative "Proof of Concept":** This project was developed to reduce the vulnerability of combat aircraft from a ballistically impacted munition and to obtain critical protection data on a full-scale weapons bay. This project has increasing importance for advanced low-signature aircraft that carry weapons internally. The JTCG/AS is working closely with Lockheed Martin and government engineers to use this data in the design of the F-35 aircraft.



- **Very Wideband Accurate Direction Finding (DF):** This project will enable improved aircrew situational awareness and thus improved platform survivability. It provides airborne antenna apertures that allow 360-degree reception, ambiguity resolution, and accurate location of threat signals, which do not currently exist in most combat aircraft today. This project is intended to both enhance capabilities and miniaturize electronic warning and threat identification systems for transition to future platforms such as UAVs.

- **Survivable Engine Control Algorithm Demonstration (SECAD):** This project along with the Engine Damage Detection program will reduce aircraft propulsion system vulnerability to engine damage in combat (ballistic impact) and peacetime (foreign object damage, bird ingestion) by preserving thrust and engine operating stability. During combat, this capability could allow the aircrew additional engine operating time to safely egress from hostile areas or return safely to allied bases. The SECAD program designed an algorithm capable of detecting and classifying engine damage by using only existing engine sensors as input parameters. The algorithms use the existing aircraft FADEC (Fully Automated Digital Engine Control) to detect damage and then adjust engine operating schedules allowing the engine to continue operating at less than optimum levels. The development is currently being conducted in coordination with the F-18 program office and General Electric. The SECAD improvements have been incorporated into the F/A-18E/F developmental roadmap.

- Under survivability model initiatives, several projects provide configuration management and user support for a core set of models as newer models are being developed by the services and industry. The JTCG/AS funds projects to track baseline codes, updates to those codes, user forums to exchange information and lessons learned about these models and their applications. Additionally, the JTCG/AS sponsors the Joint Accreditation Support Activity (JASA), which documents the credibility of these survivability models.

- The Integrated Survivability Assessment (ISA) project will develop a process, integrating the proper roles of modeling and simulation with test and evaluation, to evaluate the overall integrated operational survivability of an aircraft system. This process combines engineering level data, Live Fire test data, and mission level M&S data with operational test results to determine the platform operational survivability.

## JOINT TECHNICAL COORDINATING GROUP FOR MUNITIONS EFFECTIVENESS

The Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) was chartered by the Joint Logistics Commanders (JLC) over 30 years ago to serve as DoD's focal point for authenticated non-nuclear munitions effectiveness information. The JTCG/ME, under the auspices of the JLC's, authenticates data/methodology for use in training, systems acquisition, weaponeering, procurement, and combat modeling. Joint Munitions Effectiveness Manuals (JMEMs) are used by the Armed Forces of the United States, NATO, and other allies to plan operational missions, support training and tactics development, and support force-level analyses. The JTCG/ME also develops and standardizes methodologies for the evaluation of munitions effectiveness and maintains databases for target vulnerability, munitions lethality and weapon system accuracy.

JTCG/ME

In FY02, the JTCG/ME executed the following work program:

- Enhanced the operational tools and data on the following JMEM CD-ROMs: JMEM Air-to-Surface Weaponeering System (JAWS) v2.2. Attack (in support of Operation Enduring Freedom), v2.2.1, and v2.2.2; Joint Anti-Air Combat Effectiveness – Air Defense (J-ACE: AD) v2.0; Joint Anti-Air Combat Effectiveness - Air Superiority (J-ACE: AS) v2.1; Joint Anti-Air Combat Effectiveness - Ship Anti-Air Warfare (J-ACE: AAW); JMEM/Surface-to-Surface Weaponeering Effectiveness System (JWES) v2.0, v2.1 and Target Manual v2.3 on JAWS.

- Increased support to the warfighter, by distributing products and product updates via the classified Internet with the JTCG/ME Products and Information Access System (JPIAS).

- In response to high priority requirements, continued population of existing databases to incorporate weapons effectiveness and target vulnerability data.

- Continued execution and technical coordination efforts to address target vulnerability data generation.

- Continued the development of standardized models and methodology for Air-to-Surface, Surface-to-Surface and Anti-Air effectiveness calculations.

- Conducted Configuration Management/VV&A efforts on specific JTCG/ME models.

- Together with the JTCG/AS, released Advanced Joint Effectiveness Model (AJEM) v2.0, conducted AJEM Production Analysis Support and released Component Vulnerability Analysis Archive v5.0.

- In coordination with J-8, developed Chairman, Joint Chiefs of Staff Instruction to codify the command requirements data call and prioritization in support of FY03 program build.

- Initiated intelligence collection/production requirements process in collaboration with the Defense Intelligence Agency and Service intelligence centers.

- Continued to implement National Disclosure Policy and classification review of JMEM CD-ROMs to address requirements for coalition operations.

# Test Resources and Ranges

# Test Resources and Ranges

# Resource Challenges for Transforming the T&E Infrastructure

This report concentrates on the transformation of the test and evaluation (T&E) infrastructure which includes people, processes, and facilities. Over the past year some progress was made concerning test resource problems but challenges remain. This report addresses specific initiatives to meet future T&E resource requirements.

The 2001 Quadrennial Defense Review (QDR) states that the transformation of the U.S. military will result from exploiting new operational concepts and capabilities, using existing and emerging technologies, and applying new organizational structures. Transformation of our warfighting systems must be accompanied by transforming the T&E processes and the T&E infrastructure into modern, efficient, joint test capabilities. Transformation of this infrastructure will be a continuing challenge in the years ahead. Sufficient infrastructure funding to enable adequate demonstration and evaluation of weapon system effectiveness, suitability, and survivability before fielding is vital.

The T&E infrastructure must be capable of accommodating a dynamic environment where evolutionary acquisition initially delivers equipment whose design does not satisfy all requirements. Part of the expectation is that the use of these immature systems will define deficiencies and refine requirements for further development. Evolutionary acquisition means that both development and testing will be a continuous process.

New technologies will have significant effects on the evolution of the T&E infrastructure. Examples include embedded instrumentation, nanoelectronics, robotics, directed energy, and hypersonics. New joint warfighting concepts seeking to leverage such technologies will also shape the future infrastructure. New test capabilities and methodologies are needed to adequately evaluate systems-of-systems and families-of-systems. Evaluating larger footprint weapons and sensors will require access to air, land, and sea battle-spaces encompassing both testing and training ranges. Interoperability and commonality between ranges (across Services and between testing and training ranges) are necessary to efficiently use DoD resources and increase the tempo of testing. Currently, modernization plans for test ranges focus on satisfying near-term test requirements and do not adequately map into the future. A long-term, comprehensive, DoD modernization plan that identifies and invests in future needs is essential for transforming T&E capabilities.

## PERSONNEL CHALLENGES

Having sufficient personnel with the proper skills to conduct developmental and operational testing is an essential element of adequate T&E resources. Past trends have resulted in the personnel status described below. Future needs demand that these trends be reversed.

### Acute Personnel Shortages Exist

During the last ten years, persistent efforts reduced T&E infrastructure expenditures. Eliminating personnel associated with testing was a primary means of reducing expenditures. However, this practice resulted in fewer work shifts available at the remaining test sites, which reduced the tempo of testing. Figure 1 depicts the decline in personnel at the Major Range and Test Facility Base (MRTFB) in terms of work years from 1992 to 2002.

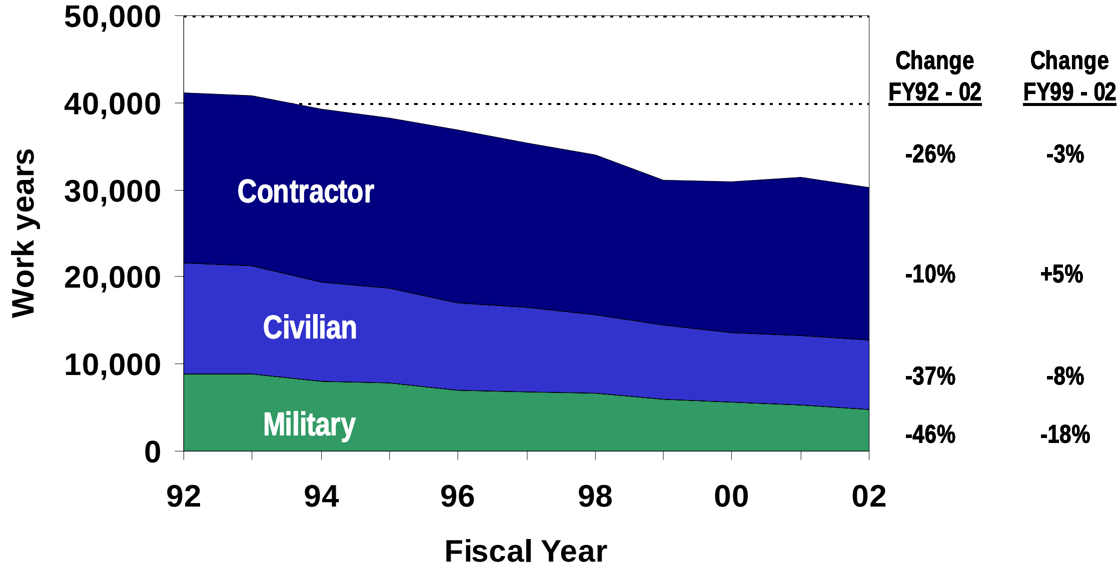



*Figure 1. Reductions in MRTFB work years (FY92-FY02)*

Having fewer personnel at the test sites not only limits the flexibility of facility managers, but also decreases the capacity of test facilities to meet the needs of test sponsors. Additional test personnel are required to improve test designs and to increase the tempo of testing to support continuous development and the rapid movement and analysis of data. More personnel are also needed to support surge testing. Some of the more pressing personnel needs include:

- *Technologically competent personnel to conduct research and development on future T&E capabilities*—The T&E infrastructure should lead weapon systems acquisition in both sophistication and technology. A capability-based T&E infrastructure is analogous to capability-based acquisition.
- *A force of competent engineers to ensure an adequate reliability component for every test event*—Operational testing often reveals suitability deficiencies in reliability, availability and maintainability. Reliability testing is done to learn where investments could significantly improve reliability.
- *More software professionals capable of evaluating software architectures and designs early in the development process*—The testing infrastructure was designed around hardware, but software is now the critical component of modern weapon systems. Hardware/software integration is increasingly critical to system performance. Test ranges are critically short of software professionals.
- *Military personnel to provide direct user input*—There is an urgent need to bring military personnel, such as the Army's Soldier-Operator-Maintainer-Tester-Evaluators, back into the infrastructure so that systems undergoing developmental test can have the benefit of direct soldier input. There is increased emphasis on providing earlier feedback to the development process, however, user participation is diminished. Military users and operators must be restored to developmental testing in order to enhance the effectiveness of test programs.
- *Additional technical expertise in particular areas*—Shortages exist in flight safety systems, chemical and biological research, and mathematical and statistical analysis experts.

The F-22 program is one example of the effect personnel shortages can have on weapon programs. Slippages in F-22 flight-testing are partly attributable to shortages of key in-house test support personnel. To mitigate this problem, the Air Force has accepted a Lockheed proposal to add additional funding to the F-22 contract so that Lockheed can augment the government-contractor test team with additional contractor technical personnel.

Another example is the B-1B Block E upgrade program, which had difficulty scheduling releases of live weapons at the national ranges- partly because of the shortage of Explosive Ordnance Disposal resources and personnel.

Also, the Navy's VX-9 operational test unit does not have enough flyable F/A-18s to accomplish all the testing that it is tasked to perform. This resulted in deferring Joint Air-to-Surface Standoff Missile (JASSM) carrier operability testing. The Navy reported that F/A-18E/F test aircraft were so over-tasked that they would not be able to test JASSM on the F/A-18E/F until 4QFY03 or later. The Navy attributes the inability to keep the jets flying to shortages in people (ground crews) and parts.

**MRTFB Workforce Demographics**
Another result of the MRTFB personnel draw down is a dramatic shift in the demographics of civilian government employees in the science and engineering (S&E) workforce. Figure 2 depicts the distribution of civilian government employees at the MRTFB who are in S&E positions as compared to the national S&E workforce. Only 3 percent of the MRTFB civilian S&E workforce is under 30 years of age as compared to 18 percent of the nation's S&E workforce. Over 39 percent of the MRTFB S&E workforce is over 50 years of age and rapidly approaching retirement eligibility. Due to hiring restrictions in recent years there are few junior MRTFB personnel to ensure a strong, technically qualified workforce for future T&E leadership. DoD needs to address the consequences of the aging workforce.

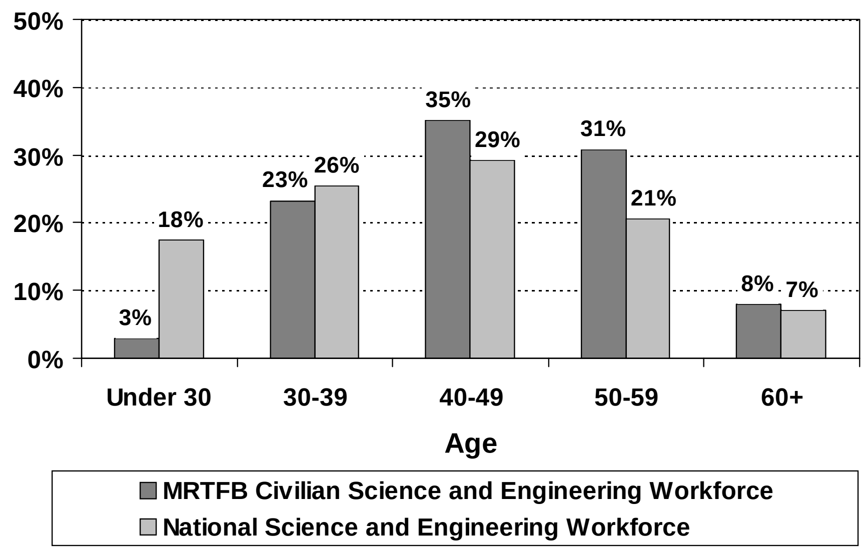



*Figure 2. MRTFB civilian science and engineering employee distribution by age*

**Operational Test Agency (OTA) Personnel**
Operational Test Agency (OTA) workload is increasing because:

- The T&E process is more complex as a result of the introduction of advanced technologies.
- System testing occurs in more complex operational environments.
- Evolutionary acquisition emphasizes earlier involvement of operational testers and evaluators in system development and increases the number of test events to be planned, conducted, and evaluated.

Early and continuous involvement by the OTAs is an effective means for obtaining operational insight about a system under development when design flexibility still exists. Early involvement also permits the OTAs to build a knowledge base to enhance the operational test program.

After a steady decline from FY93 to FY00, the OTA workforce rose slightly in FY01 due to an increase in civilian government personnel. Nevertheless, the total OTA workforce in FY02 is smaller than in FY93 despite an increased workload. Although stabilization of the government workforce is a positive sign, there remains a significant imbalance between OTA resources and their respective workloads.

Another concern is the proportionately smaller military presence within the OTA workforce. This represents a potential loss of operational expertise. Concurrently, dependence on contractor support is increasing. Table 1 shows the changes in the OTA workforce composition during the past 12 years.

*Table 1. OTA workforce composition*

| | FY 1990 | | FY 2002 | |
|---|---|---|---|---|
| | Number | % of Workforce | Number | % of Workforce |
| Military Personnel | 2,112 | 48 | 1,305 | 36 |
| Government-Civilian Personnel | 1,236 | 28 | 1,150 | 31 |
| Contractor Personnel | 1,048 | 24 | 1,222 | 33 |
| Total | 4,396 | 100 | 3,677 | 100 |

As with the MRTFB S&E workforce, the OTA's are confronted with an aging civilian workforce. The average age of government civilians within the OTA workforce in the GS-7 to GS-15 pay grade range is 51 years. Only 13 percent of the OTA civilians are under 40 years of age. As the workforce ages, government service needs to become more attractive to potential younger recruits entering a highly competitive environment.

**Personnel Actions are Required**
An increase in T&E personnel is needed to accommodate the transformation of the U.S. military.

Specific personnel actions to address outstanding issues include:

- Recruiting recently educated technical personnel.
- Increasing the number of soldiers, sailors, airmen, and Marines involved in developmental and operational testing.
- Addressing shortfalls in reliability, software, and test engineers; chemical and biological researchers; and statistical analysts.
- Increasing the statistical expertise of the T&E workforce so advanced statistical methods may be more widely applied.
- Increasing OTA staffing (with a focus on operational experience) to more adequately address joint issues, interoperability, early involvement, and testing of non-major systems.

The timeline for reconstituting the testing workforce should address near-, mid-, and long-term remediation. Hiring momentum should address the retirement challenge and guarantee a successful transfer of existing knowledge and experience to the next generation.

## MANAGEMENT PROCESSES

Transformation in the acquisition environment will require the Department's T&E infrastructure to change its management processes in order to be more responsive. Such changes should focus on long-range investment planning, funding policy, mitigation of encroachment, and a more useful employment of modeling and simulation.

**Funding Policy**

One factor that influences the adequacy of testing is the customer charge policies on the different ranges. DoD policy calls for customers to pay for the direct costs associated with testing, while the range or center parent organization pays for sustaining the test facility availability. This uniform charge policy was implemented to promote decisions on where and when to test that reflected program technical requirements.

Preliminary results from a recent DoD-IG study state, "… uniform funding does not occur because the manner, method, and amount of funding received by each range vary significantly, both within and across Services. Some ranges receive higher percentages of institutional funding as well as funding from congressional add-ons, Central Test and Evaluation Investment Program (CTEIP) funds, and funds from other agencies. Some funds for 13 ranges are withheld or the ranges receive funds based on other than a need-based methodology." The preliminary results state "As a result," of this and other factors, "the Office of the Secretary of Defense and the Secretaries of the Military Departments do not have comparable data needed to make informed decisions on the funding levels needed to reduce the backlog of the test assets and infrastructures. In addition, program managers may also be lacking the relevant information necessary to make informed test decisions for their programs."

Figure 3 depicts trends in MRTFB funding sources since FY92. In the period shown, the portion of MRTFB funding borne by test customers increased from 44 percent to over 57 percent. This shift resulted from the failure of institutional funding for the MRTFB to compete successfully with other demands in the Service programming and budgeting processes. This shift in costs to the customers may be a contributing cause to a reduction in developmental testing.

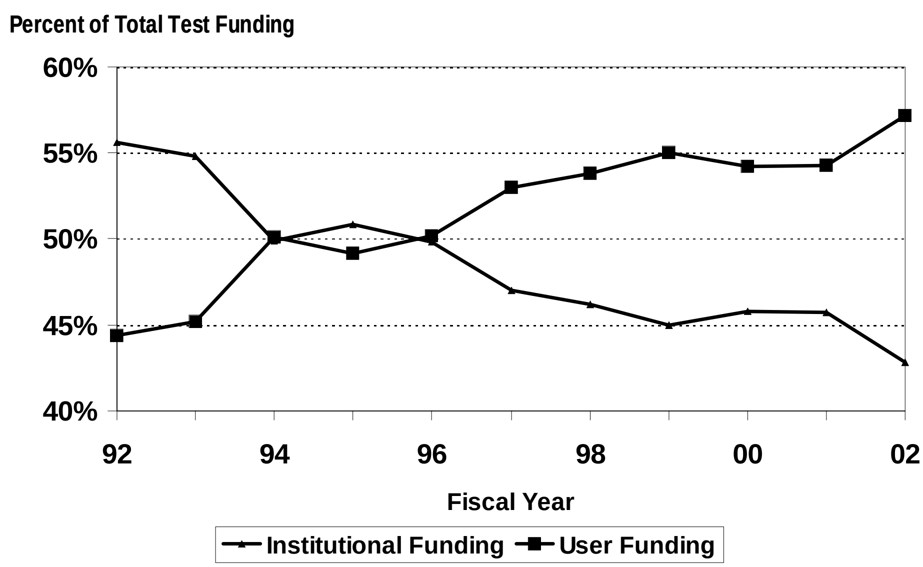



*Figure 3. MRTFB funding trends*

**T&E Infrastructure Modernization**
Early in 2002, the Secretary of Defense directed an examination of requirements to modernize the Department's test infrastructure. This report is the foundation for developing a DoD strategic plan for improving the test infrastructure so that it is capable of supporting affordable, adequate testing while leveraging investments in joint training ranges.

**Range Encroachment**
Encroachment refers to the cumulative result of outside influences that inhibit normal military training and testing. It includes urban sprawl near military areas, loss of frequency spectrum, restrictions on using air, land, and sea space, and endangered species migrating to ranges. A steady increase in such encroachment has serious consequences and threatens the use of testing and training ranges.

*Legislative Proposal Addressing Encroachment*
To mitigate encroachment, the Department submitted a legislative proposal entitled the Readiness and Range Preservation Initiative (RRPI). DOT&E strongly endorses measures such as the RRPI to sustain access to ranges capable of supporting adequate testing. This legislative package included the following provisions:

- *Endangered Species Act*—Confirms that there is no need to designate critical habitat on military installations for which an Integrated Natural Resources Management Plan (INRMP) is completed.
- *Marine Mammal Protection Act*—Codifies the National Research Council's recommendation that the current definition of "harassment" of marine mammals, which includes "annoyance" or "potential to disturb," be refocused on biologically significant effects.
- *Migratory Bird Treaty Act (MBTA)*—Reverses a March 2002 decision of a U.S. District Court applying the MBTA to training activities at the Farallon de Medinilla range in the Western Pacific. The provision would require the Services to take practical steps to prevent injuries to birds in the course of training.
- *Clean Air Act*—Provides more flexibility by ensuring that emissions from military training and testing are consistent with state implementation plans under the Clean Air Act.
- *Resource Conservation and Recovery Act (RECRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA*)—Confirms that military munitions are subject to the Environmental Protection Agency's Military Munitions Rule while on range and that cleanup of operating ranges is not required so long as the material stays on the range.
- *Cooperative Buffer Zone Acquisition Authority*—Provides DoD with additional authority to work with conservation groups to address urban encroachment of its installations. Purchase of land around existing installations would be managed to protect habitat for sensitive species and to prevent development incompatible with the installation.
- *Conveyance of Surplus Property for Conservation Purposes*—Provides legislative authority to transfer surplus property without charge to state governments, local governments, or private organizations for conservation purposes.

The legislative proposals served to open a needed debate on the effects of encroachment on military readiness. DOT&E will continue to support reasonable measures to address the effects of encroachment on adequate testing of systems prior to fielding. DOT&E is committed to the proposition that adequate testing is an essential element of equipping military units to ensure operational readiness.

*Reduction In Available Radio Frequency Spectrum Could Limit Testing*
Another constraint on testing is the limitation imposed by the available frequency spectrum. The testing of modern military systems relies heavily on the use of the radio frequency (RF) spectrum. Recent studies show that the DoD transformation initiatives and the next generation of technology being incorporated into weapon designs will require greater spectrum for operation and higher telemetry data rates. The expansion of consumer telecommunication services resulted in pressure from the private sector to reallocate RF spectrum from government to non-government use. This reallocation of available telemetry spectrum, coupled with increased data requirements, threatens the adequacy of

spectrum to support future testing. DOT&E is supporting efforts to defend against spectrum reallocation and to avoid adverse effects on U.S. test ranges and programs that could result from the loss of existing telemetry spectrum.

(CTEIP) initiatives may increase spectrum efficiency. However, the use of higher frequency bands to supplement current capabilities must be explored. An agenda item for the 2006 World Radiocommunication Conference is expansion of the telemetry spectrum by adding frequency allocations in the 3-30 GHz range.

**Process Actions are Required**

Specific process actions involving T&E resources include the following:

- Developing a comprehensive DoD strategic T&E modernization and investment plan.
- Supporting legislative proposals to mitigate encroachment.
- Decreasing the cost of testing to programs by increasing the institutional funding of the ranges.
- Increasing the amount of testing during development, including reliability testing, software testing, component-level testing, and operational concepts testing.
- Promoting continuous testing of all items in the inventory (but especially for systems that are evolutionary) so that faults are found in testing before they are found in combat.
- Encouraging the use of embedded test instrumentation in conjunction with embedded training.
- Conducting operational tests in the context of joint operations and with joint participation.

## FACILITIES

The primary challenge to the T&E infrastructure is ensuring that T&E capabilities keep pace with the transformation of warfighting technologies and operational concepts. The transformation of warfighting capabilities will stress the T&E infrastructure. In some instances, without increased investments in new T&E methods and technologies, a significant risk exists that T&E capabilities may not be adequate to test future systems. The outlines of the transformed force are sufficiently clear to require priority attention to the definition and investment in T&E capabilities necessary to support this force.

**Developmental Testing Occurs at the MRTFB**

Most developmental testing within the Department is conducted at the MRTFB locations shown in Figure 4. These sites, operated by 30,000 military, civilian government, and contractor personnel, range from wind tunnels and electronics integration test facilities to the Department's largest open-air, land, and sea test ranges. The function of the test infrastructure has remained relatively unchanged since the MRTFB's founding in 1974: "The MRTFB is a national asset that shall be sized, operated, and maintained primarily for DoD T&E support missions."[1]

[1]DoD Directive 3200.11, "Major Range and Test Facility Base (MRTFB)," May 1, 2002.

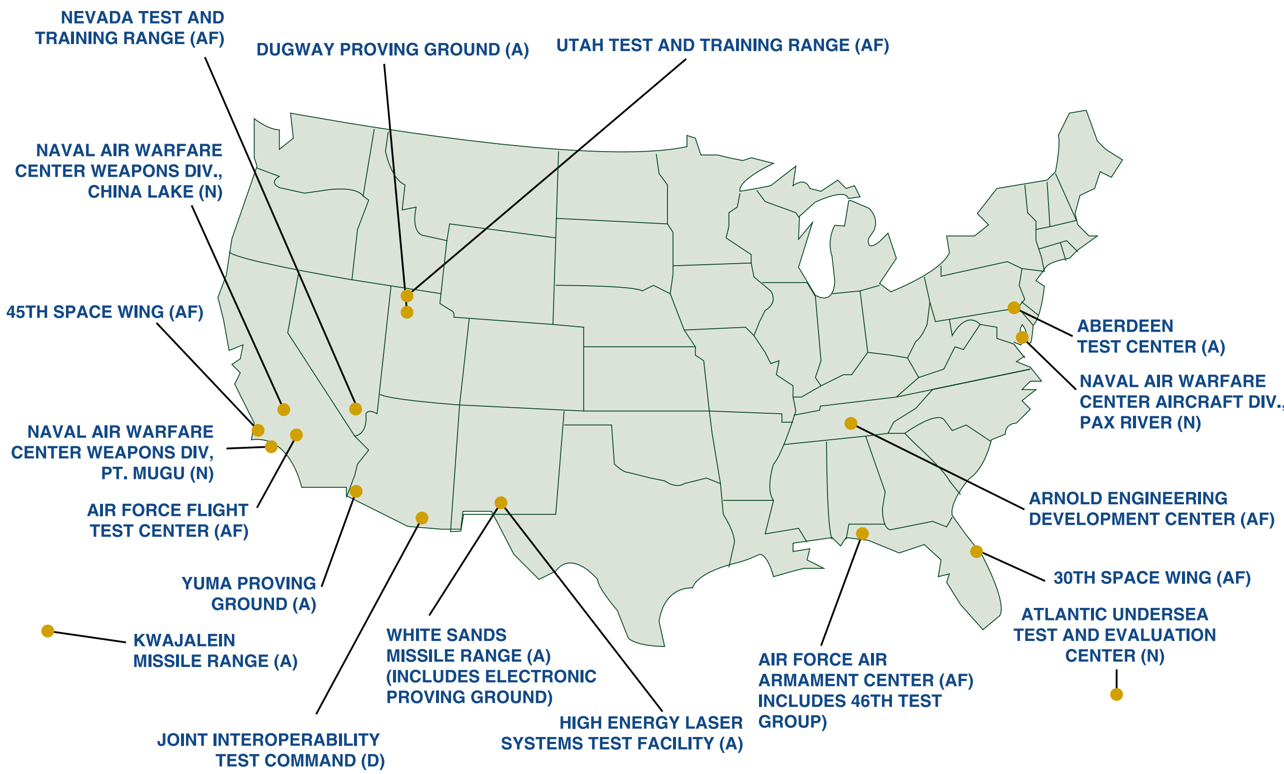



*Figure 4. The Major Range and Test Facility Base*

**T&E Investment Programs are Improving and Extending Current Capabilities**
Sustaining current capabilities and improving the test technology are the focus of existing T&E investment programs. The Service and Defense Agency investment and modernization (I&M) programs along with the OSD CTEIP program upgrade existing capabilities, but have inadequate resources to develop the new capabilities required by emerging weapons technologies.

*Service and Defense Agency I&M Programs Modernize Existing Capabilities*
I&M programs fund the modernization of existing test facilities and the acquisition of new capabilities to meet testing needs. Each Military Service pursues an I&M strategy that often focuses on test assets that are Service-unique with little multi-Service utility. Service I&M funding has been relatively constant in recent years.

In FY02, the Army I&M program completed the major portion of the Ronald Reagan Ballistic Missile Defense Test Site project to provide for remote operation of instrumentation and to modernize radars on different parts of the Kwajalein Atoll. This project will reduce on-island staffing and inter-island transportation and should improve data management and mission response times. Progress on other Army I&M projects included completing the frequency surveillance system and continuing the upgrade of the test support network at White Sands Missile Range. Projects completed at Aberdeen Test Center addressed full spectrum imaging, advanced data acquisition and analysis, and joint fire survivability test instrumentation.

In FY02, the Navy's I&M program completed the hydrophone replacement program at the Atlantic Undersea T&E Center, Bahamas; remote telemetry for the Naval Air Warfare Center Weapons Division; and the multi-spectral avionics testing capability at the Naval Air Warfare Center Aircraft Division. This latter investment provides the capability to test modern aircraft (e.g., F-22, F-18E/F, and Joint Strike Fighter) across the frequency spectrum¾Radio Frequency (RF), Ultra Violet (UV), Infrared (IR), and Electrical-Optical (EO).

The Air Force's I&M investments completed in FY02 included flight simulation modernization, an interactive T&E network, and C4I modeling and simulation. Future investments will include advanced range telemetry, advanced Global Positioning System (GPS) range sensors, the Air Force Electronic Warfare Evaluation System (AFEWES) upgrade, an air warfare mission simulator development, a weapons integration and compatibility support project, an armaments/munitions digital modeling and simulation capability, a scene characterization and recognition system for advanced munitions, a real-time display and an analysis system for test data, and improved turbine engine structural integrity process.

The Missile Defense Agency (MDA) uses MRTFB facilities and is funding upgrades at the Pacific Missile Range Facility, at the Ronald Reagan Ballistic Missile Defense Test Site, Wake Island, and at the White Sands Missile Range. MDA also is developing a test infrastructure for a wide range of airborne sensor programs, including the High Altitude Observatory Aircraft and the Wide-body Airborne Sensor Platform.

*CTEIP Provides Improved Capabilities for All Services*

CTEIP is an OSD-managed program established to develop T&E capabilities normally considered beyond a single Service's area of responsibility. Its objectives include applying state-of-the-art technology to correct deficiencies in T&E capabilities and improve the efficiency of the test process; improving interoperability and interconnectivity among test facilities and ranges; developing, validating, and integrating modeling and simulation with open-air testing; and developing mobile test instrumentation as an alternative to fixed facilities.

New test capabilities being developed by CTEIP include:

- *Enhanced Range Applications Program (EnRAP)*—The EnRAP responds to test and training requirements for a spectrum-efficient, flexible data link designed to support a wide variety of applications, including time-space-position information, data transfer, and target control.
- *Third-Generation Range Space Wireless Networks*—This CTEIP project addresses near-term shortfalls in spectrum efficient test capabilities and mitigates spectrum encroachment through development of technologies to operate at higher frequencies that will support more realistic operational testing of future weapons, sensors, and platforms.
- *Foundation Initiative 2010 (FI 2010)*—FI 2010 is developing and validating a common architecture and a core set of tools to permit inter-range communication and networking capabilities that will connect test ranges, test centers, and key high-performance computing capabilities. Millennium Challenge 02 demonstrated the value of FI 2010 to testers, trainers, and experimenters.
- *Theater Air and Missile Defense (TAMD) Interoperability Assessment Capability (TIAC)*—The TIAC project provided the Joint Interoperability Test Command (JITC) with the capability to test TAMD interoperability from multiple interfaces across the Joint Data Network and Joint Planning Network during the Roving Sands exercise in June 2001.
- *Virtual Flight Test (VFT)*—The VFT methodology is expected to bridge the gap between hardware-in-the-loop testing, which is based on static wind tunnel testing, and open-air flight-testing. The airframe, including the autopilot, inertial sensors, and control actuators, can be suspended in the wind tunnel by a device that will allow free rotation of the VFT hardware in response to moments produced by steady and unsteady aerodynamic interaction with the airframe and control devices.

*The Test and Evaluation/Science and Technology (T&E/S&T) Program Will Advance New Test Technologies*

During FY02, DOT&E launched the Test and Evaluation/Science and Technology (T&E/S&T) program to develop or adapt critical technologies for test applications. Such technologies will transition to test capability investment programs to support DoD transformation initiatives and weapon system acquisition schedules, and will address deficiencies in critical multi-Service T&E infrastructure modernization.

This year, T&E/S&T projects were initiated in three critical areas: high bandwidth communications and spectrum efficiency, multi-spectral systems test, and hypersonic systems test. A backlog of other test technology needs will be addressed as funding becomes available, including miniaturized instrumentation; directed energy, chemical/biological, and information systems testing; and modeling and simulation tools.

**T&E Infrastructure is Supporting Joint Experimentation**

For over a year, DOT&E worked with U.S. Joint Forces Command (USJFCOM) to provide assistance in the conduct of the Millennium Challenge 2002 (MC02) and to define the role of the T&E ranges in this joint experiment. MC02 was the largest live field experiment ever staged by DoD and was conducted in a distributed fashion on training and test ranges located in the southwestern United States. One of the MC02 goals was to define requirements for future linking of test and training ranges to support testing, training, and experimentation.

The MC02 experiment successfully demonstrated that testing and training ranges throughout the country could be linked for joint training and experimentation. It also included integration of live and simulated actions to facilitate situational awareness at the operational level. T&E range assets and T&E-developed tools such as TENA were indispensable to the success of MC02.

**Aging Test Infrastructure Must be Renewed**

The T&E infrastructure is in need of recapitalization. This applies to the capital infrastructure (buildings, roads, runways, and major facilities such as wind tunnels) as well as the technical infrastructure (radars, instrumentation, targets, and test equipment used to support testing). The current recapitalization rate is significantly below that of comparable private industrial facilities and does not provide effective T&E capabilities. This results in delays, waivers of test requirements, and test limitations discussed throughout this report. To reestablish an adequate technical test infrastructure, additional resources for test ranges and facilities must be found.

**T&E Capabilities Must Change to Keep Pace With Transformation**

DoD T&E capabilities must lead, not lag, transformation. Adequate test capabilities must be in place, ready to test transformational systems throughout their development cycles. Additionally, greater flexibility in T&E processes and capabilities must be adopted if they are to adequately support the shorter acquisition cycles planned for developing transformational systems. Evolutionary acquisition will require more frequent—nearly continuous—testing. T&E capabilities must be in place to satisfy an increased tempo of testing.

Operational considerations also influence T&E transformation. For example, it is clear that future operations will be conducted jointly. A joint, seamless command, control, communications, computers, intelligence, surveillance, and reconnaissance ($C^4ISR$) network will form the backbone of such operations. Weapon systems will operate over significantly greater ranges with greater precision. The ability to effectively operate in littoral regions and urban areas will be essential and the military reliance on space assets will continue to increase.

**Infrastructure Transforming Actions Are Required**

DoD T&E infrastructure must provide realistic testing environments, realistic threats, and a well understood “ground truth” that is provided by the proper instrumentation. The testing must be supported by rapid, effective analysis of the test results and must provide prompt feedback to the system developers and warfighters.

Existing T&E capabilities will not be adequate to support the development of the transformed force. It is necessary to implement an investment strategy which fills the “gaps and seams” of the current T&E capability and addresses the following issues:

*Joint, Network-Centric Test Environments*

DoD test ranges evolved over the years into three sets of Service-centric test capabilities. Now, DoD needs new processes and capabilities that facilitate testing in a joint environment. A network-centric environment is needed that can support joint testing for joint operations by joint forces. A comprehensive “wrap-around” environment should have immediate application to interoperability and system-of-systems testing at every range. Every range could support testing for joint operations. Specific needs include:

- *Interoperable testing and training ranges*—The barriers between Service-centric test ranges and between test and training ranges must be removed. Millennium Challenge 02 revealed the potential inherent in linking ranges to accomplish joint objectives.
- *Common joint test instrumentation*—Currently a wide variety of different and incompatible T&E range instrumentation impedes the ability to achieve joint, interoperable ranges.
- *Improved systems interoperability testing*—Upgraded distributed test beds, and increased emphasis on testing of system-of-systems $C^4$ISR capabilities is needed.

*Larger Test Areas*

Current T&E ranges are inadequate to test the greater reach of the weapon systems under development. DoD must obtain means to test systems with larger operational footprints. In addition to a network of joint, interoperable testing and training ranges, linking live, virtual, and constructive simulations and mobile, common instrumentation will enhance testing larger footprint systems or system-of-systems. The testing community needs to form an alliance with the training community to permit launching from training ranges into the test ranges. The alternative is to extend land ranges into ocean target areas or expand the existing ranges. Similarly, the maneuver areas to test new joint operational concepts will require expanded range space.

*Operational Environments*

The array of likely operational environments is not adequately replicated in the DoD test infrastructure. The needs include:

- *Adequate unmanned aerial vehicle (UAV) test capabilities*.
- *Improved test facilities for urban warfare.*
- *Improved testing in natural environments*.

*New Test Ranges*

In some operational areas, new test capabilities or new test ranges are needed. Areas that need to be addressed include:

- *An improved shallow water (littoral) test capability.*
- *Space Range*—There is a recognized need for a T&E capability to adequately test space systems in orbit.
- *Replacement of Atlantic Fleet Weapons Training Facility (AFWTF)*—An adequate replacement for the operational testing capability provided by AFWTF is required.

*New Test Range Capabilities*

DoD needs to improve existing facilities and ranges in order to provide the capability to test the high-performance systems now being developed. Specific areas include:

- *Testing in wind tunnels.*
- *Missile Defense*—Building the facilities to test elements of the missile defense agency demonstrates an unprecedented need for cross-Service T&E resource integration.

*Operations Against a Robust, Adaptive, Asymmetric Threat.*

The capabilities to test in a realistic threat environment must also improve. The needs include:

- *Systematic approach to threat analysis and representation throughout the systems development and acquisition process*—"Red Teams" should be established with the dedicated task to probe system weaknesses that are under development and provide feedback to system developers and force developers.
- *More realistic threat representations for all warfare areas*.

*New Weapons Technologies*
DoD must upgrade current T&E capabilities and provide new capabilities to meet the challenges of testing emerging transformational technologies. The needs include:

- *Capability to test hypersonic systems throughout their flight regimes.*
- *Improved capabilities for testing directed energy weapons*.
- *Test capabilities that address robotics and unmanned vehicles*.

*Investment in Advanced Test Technologies and Instrumentation*
To meet the challenges of testing the transformed force, we must invest in the test technologies necessary to provide the data to adequately characterize system performance. Test technologies of particular importance include:

- *Test data management, processing, and analysis*—Current systems are inadequate to meet the significant increases in volume, sources, and variety of data that will be generated in future testing.
- *Real Time Casualty Assessment (RTCA) instrumentation*—There is no family of joint, interoperable RTCA instrumentation that can handle the full range of combat interactions, e.g., direct and indirect fires, air-to-ground engagements, and ground-to-air engagements.
- *Embedded instrumentation*—Test (and training) instrumentation should be designed into combat systems from the beginning.
- *Multi-spectral test capabilities*.

*Additional and Improved Targets*
The current inventory of targets does not adequately replicate emerging threats. Adequate operational testing of new weapon systems requires targets possessing significantly greater threat fidelity. Examples include:

- *Anti-ship cruise missile targets*.
- *Full-scale aerial targets*
- *Subscale aerial targets.*
- *Sea borne targets*—Sea borne targets are needed to represent coastal patrol craft and asymmetric terrorist watercraft.
- *Diesel-electric submarines*—DoD needs realistic diesel-electric submarine targets.

*Chemical/Biological Testing*
New test chambers are needed as is a review of test methodologies for the chemical/biological testing to ensure we are doing everything necessary to analyze the data we collect. One such review by the National Academy of Sciences is already beginning.

**SUMMARY**

Thoroughly examining T&E policies, processes, and capabilities must be done in order for DoD to meet the challenges of transforming the U.S. military. The policy must be keep what works, discard what does not, and remain flexible in adapting to new requirements. There must be a corporate approach to policies, processes, and investment priorities in order to accomplish this.

DoD is transforming to meet the dynamic operational requirements of the war on terrorism, as well as future high-technology conflict. This transformation is not only limited to new hardware and technological innovation, but it also involves transforming capabilities through operational innovation. The future T&E infrastructure should comprise a comprehensive suite of joint, interoperable capabilities that provide a spectrum of full and realistic opportunities to test new technologies, improved platforms, and innovative tactics and training methods. We face a strong challenge to recruit and retain personnel, to define and implement innovative T&E processes, to maintain and recapitalize an adequate T&E infrastructure, and to transform the capabilities to meet the demands of the future.

Index

# Index

# INDEX OF PROGRAMS

Click on a title to go to that page.

# INDEX OF PROGRAMS

Click on a title to go to that page.

# INDEX OF PROGRAMS

Click on a title to go to that page.

# INDEX OF PROGRAMS

Click on a title to go to that page.

DOT&E Activity
and Oversight

DoD Programs

Army Programs

Navy Programs

Air Force Programs

Live Fire Test
and Evaluation

Test Resources
and Ranges

Index

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