Reasons Behind Program Delays

(For Selected Programs with Nunn-McCurdy Breaches)

Background

- In April 2011, DOT&E completed an analysis of the reasons behind program delays for 41 major programs that had experienced significant delays
- DOT&E conducted a follow-on analysis to examine delays in programs that had undergone a Nunn-McCurdy breach (the selected sample includes 27 of the 41 programs since 1997 that had a Nunn-McCurdy breach*)
  - Two of the Nunn-McCurdy breach systems did not experience delays, but are included here for completeness
- This briefing summarizes the latest analysis

* There were 9 programs in the April 2011 analysis that had Nunn-McCurdy breaches: CH-47F, DDG 1000, Excalibur, F-35, LPD-17, MH-60S, NPOESS, RMS, SSN 774

Summary of Program Delays (Nunn-McCurdy subset) Analysis

- As in the April 2011 analysis, we found that program delays are common; the reasons behind the delays are varied:
- Manufacturing
  - » Manufacturing delays, quality control problems, software development delays, or integration problems
- Programmatic
  - » Funding or scheduling problems
- Performance problems in DT or OT
  - » System problems identified during testing that must be addressed
- Problems conducting the test
  - » Test range availability, test instrumentation problems, and test execution problems

Program	Delay	Manufacturing, Software Development, and Integration	Programmatic	Performance Problems in DT	Performance problems in OT	Problems in Conducting Test	Problem Observed Conducting Test
ATIRCM/CMWS	FRP delayed over 5 years	1	1	1	1		
F-22 Raptor	FRP delayed 7 years	1	1	1			
Global Hawk	Operational testing delayed over 2 years	1	1	1			
C-5 Modernization	IOT&E delayed over 2 years	1	1	1	1		
C-130J Hercules	QOT&E 2 delayed 5 years	1	1		1		
C-130 AMP	FRP projected to be delayed 6 years	1	1	1			
E-2D Advanced Hawkeye	IOC delayed over 2 years		1	1			
JASSM	FRP delayed a year	1	1		1		
JPATS	IOT&E delayed a year	1	1	1	1		
FMTV	FRP delayed over a year	1		1	1	1	test unit deployed
FBCB2	Operational testing delayed 2 years	1				1	test unit deployed
Javelin	FRP delayed over a year	1					
WIN-T Inc 2	FRP projected to be delayed over a year		1	1	1		
JTRS GMR	FRP projected to be delayed 3 years	1	1	1			
EFV	IOT&E was delayed 10 years, then program was cancelled	1	1	1	1		
VH-71 Presidental Helo	First Unit Equipped delayed 3 years, then the program was cancelled	1	1				
Apache Block III	FRP delayed 2 years		1				
SADARM	First Unit Equipped delayed 9 years, then program was cancelled	1		1	1		
Comanche	FRP delayed 3 years, then program was cancelled	1	1	1			
Armed Recon Helo	FRP delayed 3 years, then program was cancelled	1	1	1	1		
H-1 Upgrades	FRP delayed over 5 years	1		1	1		
MV-22 Osprey	MS III delayed 5 years	1	1	1	1		
*Longbow Apache**	*No delay*						
*GMLRS Unitary**	*No delay*						
AEHF Satellite	Delays of 3 to 4 years	1		1	1		
WGS	MOT&E delayed 4 years	1					
SBIRS	First geosynchronous launch delayed 3 years	1	1	1			

Conclusions

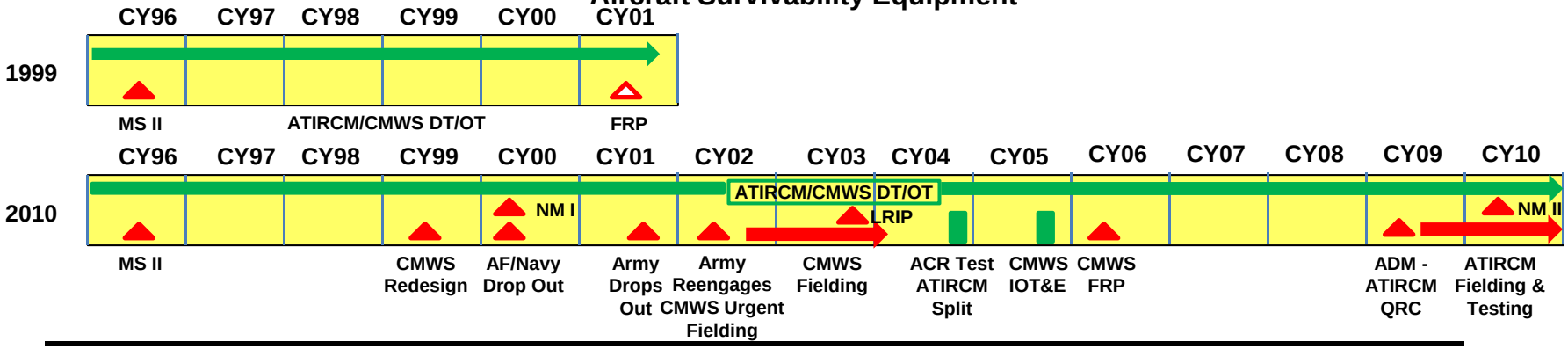
- As with the previously studied population of programs, the Nunn-McCurdy breach programs rarely experienced program delays as a result of problems in conducting tests, but were frequently delayed by the performance problems found during DT and OT
- For programs with Nunn-McCurdy breaches, programmatic and manufacturing problems were also common

Outline for Nunn-McCurdy Analysis

- Air Warfare Examples
- Land Warfare Examples
- Net-Centric Examples

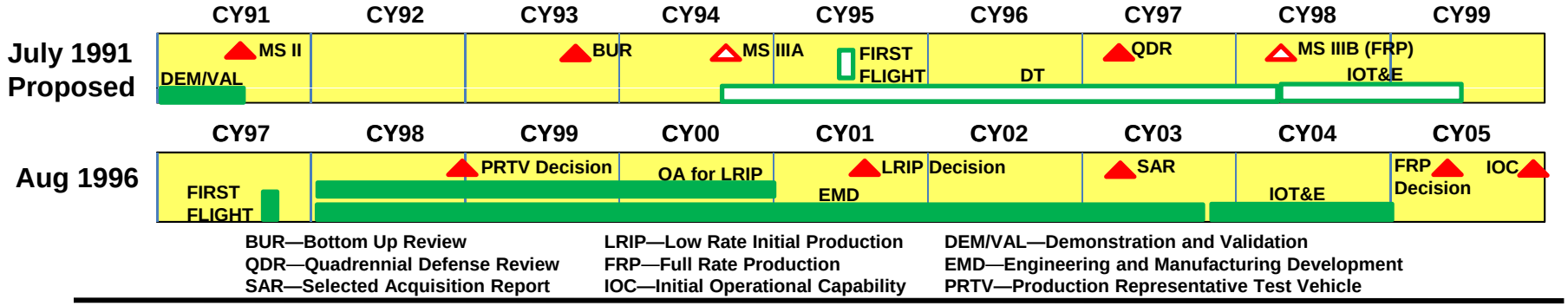
Advanced Threat Infrared Countermeasures/ Common Missile Warning System (ATIRCM/CMWS)

Aircraft Survivability Equipment



- Since its beginning in 1991, the ATIRCM/CMWS program has had two Nunn-McCurdy breaches and multiple program delays because of complex acquisition, programmatic, and technical issues. Testing revealed technical and reliability problems with the system. Full Rate Production has been delayed over 5 years.
- In FY1996-2000, the program was restructured three times because of cost overruns and schedule delays. The contractor had delays in producing operable prototypes to be used for test. Major problems were experienced in the development of the ATIRCM/CMWS digital system model designed to augment developmental and operational testing. Doubts about the capability of CMWS to meet their tactical aircraft requirements caused the Air Force and Navy to drop out of the program in 2000, and the program experienced its first Nunn-McCurdy breach in May 2000 because of cost growth.
- Because of funding shortfalls for some of its major programs such as the Comanche helicopter, the Army withdrew funding in November 2001; however, at that point, the Special Operations Command continued to fund CMWS.
- In 2002 the Army reengaged and began a limited production and urgent fielding in response to wartime urgent needs; an LRIP decision was made in 2003 for ATIRCM/CMWS.
- In preparation for the Aerial Cable Range (ACR) test in 2004 at White Sands, the newly modified ATIRCM failed the pre-test preparations because of water intrusion and the inability to distinguish targets from IR clutter. At that point, ATIRCM and CMWS were effectively split (but not formally split by an Acquisition Decision Memorandum (ADM)) into two separate activities within the program office. This was formally documented in a TEMP update in preparation for the CMWS-only IOT&E which was followed by a CMWS-only FRP in the spring of 2006.
- Since the CMWS FRP, the Army's first priority has been equipping Army helicopters and fixed-wing aircraft with CMWS to support the troops in theater. The second priority has been developing improvements to CMWS due to problems found in OT such as poor performance against certain threats and performance shortfalls in certain environments. The third priority has been ATIRCM.
- ATIRCM languished because of poor performance and reliability problems attributed to an immature design coupled with unrealistic schedules and competing resources.
- Because of an urgent operational need in 2009, an April 2009 ADM authorized ATIRCM as a QRC activity to purchase 83 systems to equip CH-47 Chinooks. ATIRCM DT/OT testing took place in 2009 in order to support the ATIRCM First Unit Equipped (FUE) which occurred in November 2009. No formal ATIRCM IOT&E or FRP decision is planned.
- The Army notified Congress of its second Nunn-McCurdy breach in March 2010. The cost growth and subsequent breach for ATIRCM and CMWS was because of the length of the program, wartime urgent needs, changes in required production quantities, and inconsistencies in cost computations to do with separating out and reconciling the individual CMWS and ATIRCM A- and B-kit costs and quantities.
- In September 2010, an ADM designated CMWS and ATIRCM as subprograms, and new Acquisition Strategies and Acquisition Program Baselines were accepted; meanwhile, the Army has been fielding CMWS since 2002 and ATIRCM since 2009 on its aircraft. The ADM also designated a new-start third subprogram, Common Infrared Countermeasures (CIRCM), as the eventual replacement for ATIRCM.

F-22 RAPTOR

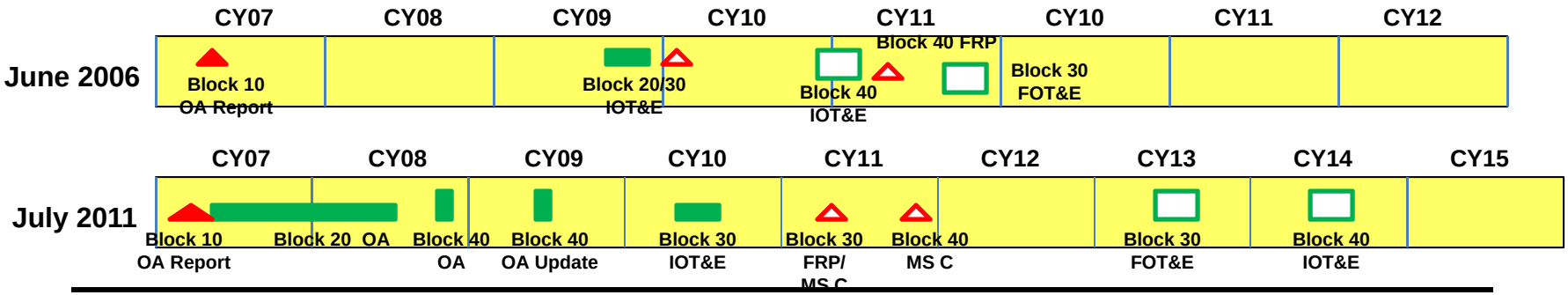


BUR—Bottom Up Review
QDR—Quadrennial Defense Review
SAR—Selected Acquisition Report
LRIP—Low Rate Initial Production
FRP—Full Rate Production
IOC—Initial Operational Capability
DEM/VAL—Demonstration and Validation
EMD—Engineering and Manufacturing Development
PRTV—Production Representative Test Vehicle

- **Program Delays:**
  - The program experienced schedule delays totaling 84 months from 1991 to 2005
  - Cause:
    - Early manufacturing problems with composite materials, LO materials, subassembly integration, and aircraft mounted nozzle sidewalls
    - A series of funding restructures (FY93-FY96) led to three re-phases of the program. The re-phases reduced the number of EMD aircraft from 11 to 9 and the number of engines from 33 to 27. The EMD schedule slipped 26 months and the production program slipped 32 months.
    - Development testing discovered structures problems with the vertical tails; avionics operational flight program (OFP) stability; integrated maintenance information system (IMIS) stability
  - Impact:
    - First Flight delay 2.5 years
    - Low Rate Initial Production delay 6 years
    - IOT&E delay 6 years
    - Full Rate Production delay 7 years
    - Extended development testing to accomplish test point burn down from discovery of additional problems
- **Significant Events to Program Restructure:**
  - Original plan was to procure 750 aircraft. Due to cost growth and production delays, planned production quantities decreased over time, causing program restructure and production delays:
    - July 1991, MS II decision caused a restructure to procure 648 aircraft
    - October 1993, Bottom Up Review caused a restructure to procure 442 aircraft
    - May 1997, Quadrennial Defense Review caused a restructure to procure 339 aircraft
    - April 2003, Selected Acquisition Report; 271 aircraft to be procured
    - 2006 Multi-Year Procurement Congressional Decision; 187 aircraft to be procured (Final Inventory)

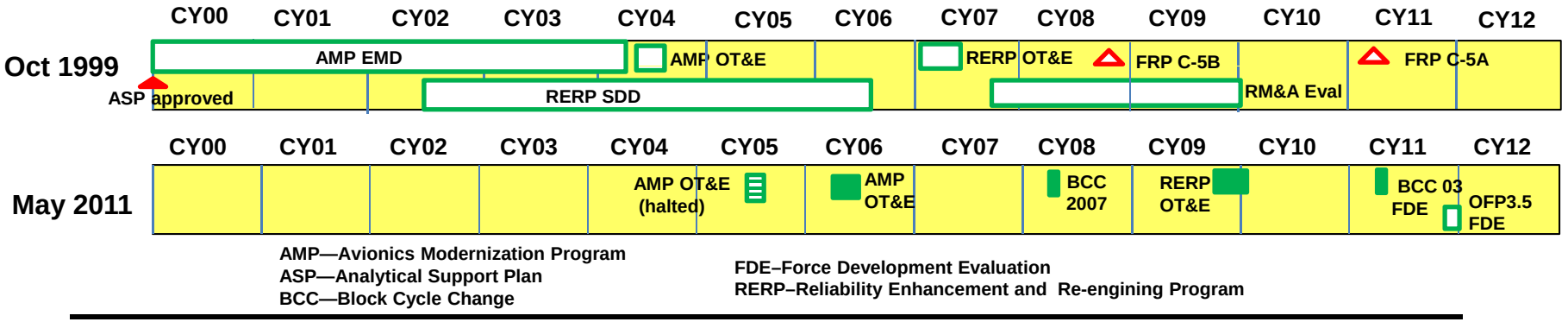
Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Global Hawk (RQ-4A/4B)



- **Operational testing delayed over two years**
- **The Global Hawk ACTD program took place in 1998 to 2000.**
- **Two Nunn-McCurdy breaches since 2001 MS B have resulted in significant changes to program:**
  - **2002 decision to create both an RQ-4A and RQ-4B aircraft under one program**
  - **2005 decision introduced Blocks: [10 (RQ-4A with EISS), 20 (RQ-4B with EISS), 30 (RQ-4B with EISS and ASIP) and 40 (RQ-4B with MP-RTIP)]**
  - **2006 Nunn-McCurdy Recertification (Baseline calendar top line above) introduced Lot acquisition strategy and directed completion of a Block 10 OA Report**
  - **2011 Nunn-McCurdy Recertification (New calendar bottom line above) created four new subprograms with separate milestones and requirement and test documentation requirements: Baseline (Block 10/20, nothing further required), Block 30 (proceed to a combined MS C/FRP), Block 40 (proceed to MS C), and Ground Station Re-Architecture and Communications System Re-Architecture (GSRA/CSRA, to be initiated at a MS B decision, Date TBD)**
- **Numerous issues occurring during DT resulted in delays to start of OT:**
  - **Global Hawk Block 30 prioritization lower than other taskings to Combined Test Force at Edwards**
  - **Extremely aggressive, high-risk schedule allowed no time to fix deficiencies found in DT; almost every performance problem, resource conflict, or sortie delay resulted in a slip to OT**
  - **Click bonds had quality control issues in manufacturing**
  - **Problems in Block 30 have a domino effect on Block 40 due to common resources and low priority of Block 40**
  - **Fielding Block 10 systems for operational missions took precedence over the development and test of Block 20, 30, and 40 aircraft systems. Additional manpower and funding were not provided for Block 20, 30, and 40.**

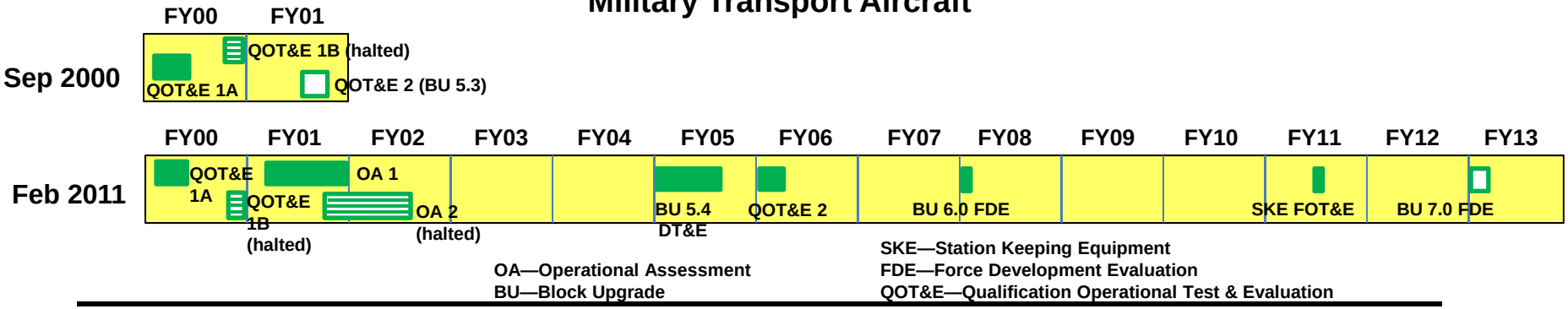
C-5 Modernization (AMP and RERP) Super Galaxy



- **Contractor testing, USAF DT&E/QT&E, OT&E, and FDE, have been ongoing over 11 years, with IOT&Es delayed over two years**
  - **Avionics Modernization Program (AMP) was and is the baseline configuration for Reliability Enhancement and Re-engining Program (RERP) upgrades**
  - **Major design deficiency (computer memory & throughput) identified at AMP CDR; resolution still pending; hardware and software architectures limit design and modification flexibility**
  - **Programs restructured multiple times; Nunn-McCurdy breach formalized in early 2008**
- **AMP OT&E started and stopped in 2005; AMP OT&E restarted in 2006 following a crash that precipitated a design change; AMP effective with limitations & not suitable**
  - **Software development and integration shortfalls – flight management system failures/instabilities; autopilot disconnects; displays**
  - **Deficiencies in reliability, maintainability, built-in test, information assurance, tech orders, and training**
- **14 AMP requirements deferred to RERP; 9 not resolved (7 pending in RERP OFP 3.5); AMP has had two Block Cycle Changes (BCC 2007 & BCC 03); BCC 04 in development; RERP entered OT&E with 7 major deficiencies or deferred capabilities (OFP 3.5 and 3.5.2 in development)**
  - **Known deficiencies before RERP OT&E: auto-throttles, built-in test, CNS/ATM, environmental control system, information assurance, survivability enhancements, training systems & devices, and thrust reversers**

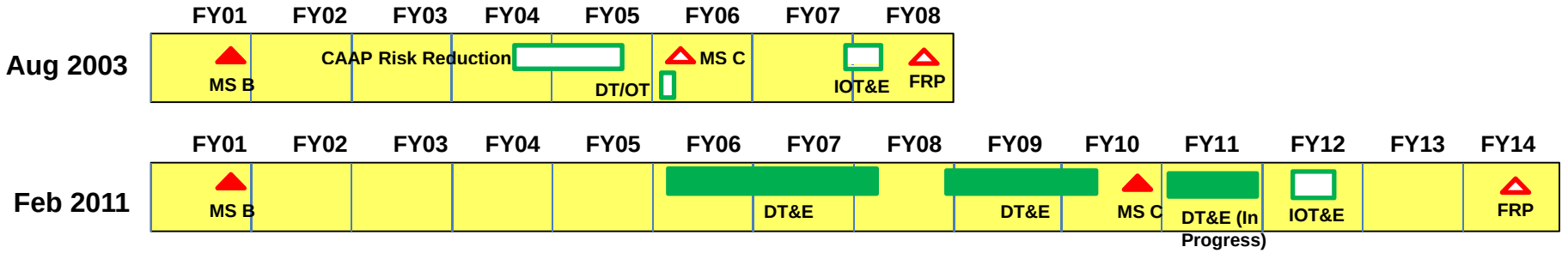
C-130J Super Hercules

Military Transport Aircraft



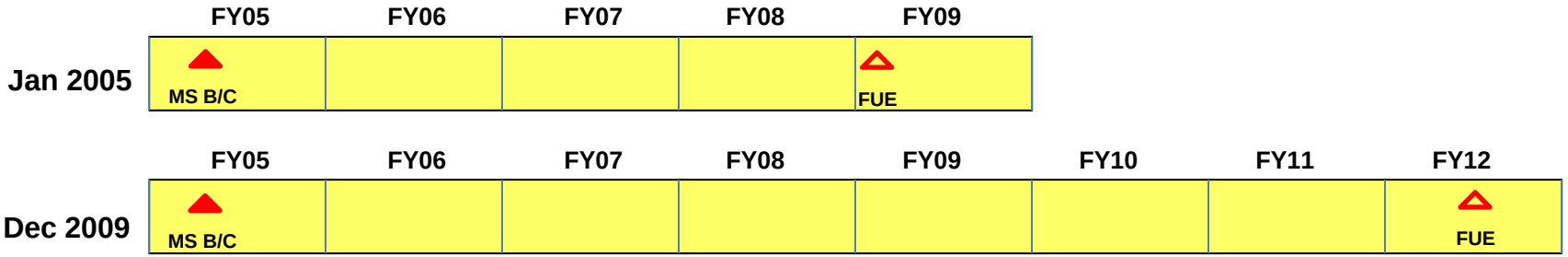
- **Contractor testing, USAF Qualification Test & Evaluation (QT&E), OA, FDE, QOT&E, and FOT&E have been ongoing over 15 years, with QOT&E delayed 5 years, on an aircraft that began delivery without an Operational Requirements Document and was accepted for years without meeting contractual system specifications**
  - **Initial acquisition as commercial (even though no C-130J certified or in production with 70% new design compared to legacy C-130) through FAR Part 12 contract inhibited government oversight**
  - **Multiple variants for multiple customers concurrently developed with varying priorities and shifting resources within contractor**
- **Phase 1 QOT&E through Operational Flight Program (OFP) 5.2 was terminated early in September 2000 with AFOTEC assessing the C-130J not effective, not suitable**
  - **Software development and integration shortfalls, lack of funding for logistics/training support**
  - **Deficiencies in communication/navigation software, airdrop, formation flight, reliability, tech orders**
- **Deficiencies in required capabilities repeatedly deferred to subsequent block upgrades (BU) with limited capability releases after each test**
  - **Assault landings, airdrop, formation flight/station keeping equipment (SKE), integrated diagnostics, defensive systems have all been deferred capabilities corrected through upgrades**
  - **SKE FOT&E tested a software correction to deficiencies identified in 2004; effectiveness & suitability still not clear (hardware failures offset software improvement)**
  - **BU 7.0 FDE has slipped three times to at least one year delay due to software integration problems**

C-130 Avionics Modernization Program (AMP)



- **Full Rate Production projected to be delayed six years**
- **Program began with intent to modernize up to 485 aircraft comprised of 14 Mission Design Series under 5 commands and 6 program offices**
  - **Common Avionics Architecture for Penetration (CAAP) for 71 AFSOC aircraft was intended to be a rapid acquisition, but determined that CAAP first required AMP as a baseline**
  - **Funding changes immediately after MS B prioritized rapid development of limited AFSOC system upgrades at the expense of 2-year delay in AMP program**
- **Selection AMP contractor led to programmatic delays**
  - **Establishing baseline technical data for widely varied aircraft was grossly underestimated; ad hoc modifications by commands created far more than 14 de facto configurations requiring unplanned changes to program specifications while the contractor had to reverse-engineer a different contractor's aircraft**
  - **DOD IG & GAO investigation into contract bias delayed program, then directed partial re-compete for installation of FRP kits (which delayed MS C again in 2008)**
- **Special Operations configurations (CAAP) were eliminated from the AMP program after Nunn-McCurdy restructuring in 2007**
  - **Restructure required new Acquisition Program Baseline – programmatic delay**
- **DT revealed excessive crew workload during critical phases of flight, deferment of necessary capabilities, immaturity of integrated diagnostics and mission planning that have delayed IOT&E since 2009**

VH-71 Presidential Helicopter



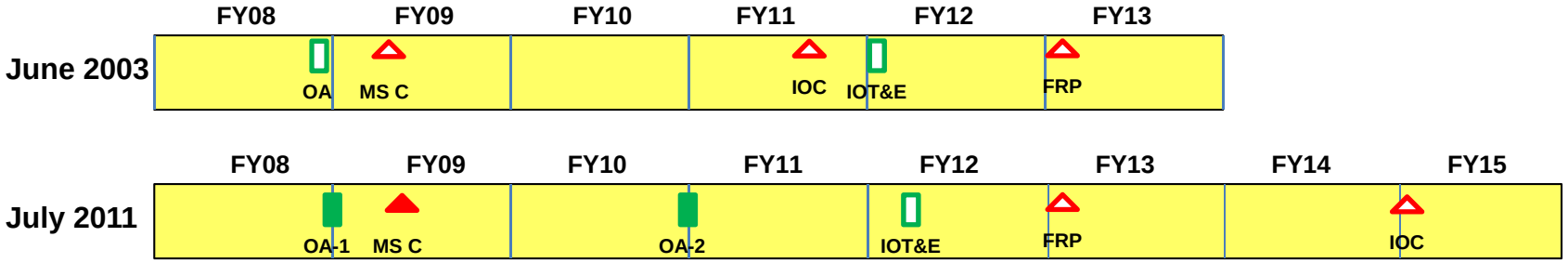
- First Unit Equipped (FUE) delayed three years, then program was cancelled
- Compressed schedule dictated by the White House
- Source selection process was shorter than desired and contributed to confusion about specifications
- Program was at risk from the start
  - Unexecutable schedule
  - Inaccurate cost estimates
  - Increment I aircraft were heavy and required redesign to meet performance requirements
  - Integration of communications equipment was much more challenging than expected

- Nunn-McCurdy breach in Jan 2009
- White House cancelled the program in 2010

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

E-2D Advanced Hawkeye

Carrier-based Airborne Early Warning and Command and Control System

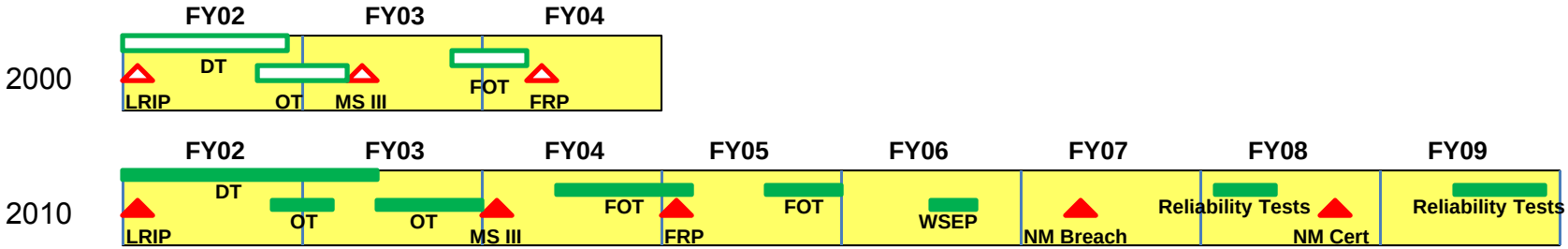


- **OA-1 and MS C slipped one month due to DT test delays**
  - Due to overheating, radar testing was only at half max power, delaying the execution of some test points
- **Prior to starting OA-1, the Navy added OA-2 to support the buy of LRIP Lots 3 and 4**
- **In FY 08, IOC changed to 1QFY15 in two stages. The change did not affect test schedule**
- **First IOC moved to 3QFY13, because of IOC definition change (no impact on deployment)**
  - Previous E-2 IOT&Es were performed by fleet squadrons preparing for deployment. IOC had to be declared prior to giving the aircraft to the squadron, therefore IOC was prior to IOT&E.
  - In FY08, E-2 received a permanent test squadron. Thus IOC was changed to occur when aircraft are given to the first deployed fleet E-2D AHE squadron, which is after IOT&E.
- **Second IOC slipped to 1QFY15 because Congress cut AHE budget (delayed deployment)**
  - Congress removed an aircraft from AHE's LRIP
  - Delayed until there would be enough aircraft to train and deploy the first E-2D AHE squadron
  - Removal of an aircraft resulted in a N-M breach
- **In FY11, IOT&E slipped one quarter**
  - New Cooperative Engagement Capability (CEC) equipment is supplied to the E-2D AHE by the CEC program office
  - Delivery and integration of the CEC has been delayed
  - Integration is not complete and more delays are possible

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

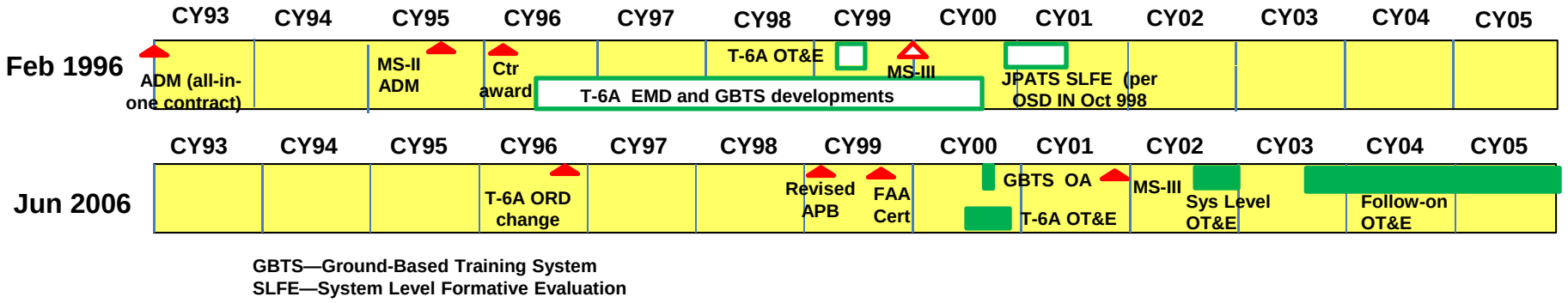
Joint Air-to-Surface Standoff Missile (JASSM)

Cruise Missile for Stand-off Attack



- Full Rate Production delayed by one year and FOT&E delayed two years, with continuing reliability issues
- There were design issues with the flight control actuator and fuel control mechanism, but the major delays were caused by reliability issues (workmanship and quality control)
- Although the DT testing was extended, inadequate DT led to most of the discoveries occurring in OT;
  - With less than half the original operational testing complete, testing uncovered issues with arming/detonation, flight control jamming, departures from controlled flight, problems with the special coating, and circuitry shorts
  - Due to these issues, the Air Force issued a “stop test” order, delaying the completion of OT
  - Corrective actions caused program delays and the shunting of some corrections to FOT&E (denoted FOT in the schedule charts)
  - More discoveries occurred in FOT&E, the correcting of which caused a second “stop test” order and further program delays
- The DOT&E BLRIP report found the missile operationally effective, but not operationally suitable
- Correcting the reliability issues increased the cost per missile, led to delays in schedule, and along with the pursuit of un-programmed missile variants, ultimately caused a Nunn-McCurdy breach
- The reliability problems were/are so great that a Reliability Acceptance Program was instituted, which carries to present day; samples from production lots are tested to determine if the program continues to improve according to the reliability growth curve mandated by OSD
- The extended range version of the missile (JASSM-ER) was formally approved post-Nunn McCurdy, and is about to start IOT&E

T-6A Joint Primary Aircraft Training System (JPATS) Texan II



GBTS—Ground-Based Training System
SLFE—System Level Formative Evaluation

- IOT&E delayed over a year, with additional problems needing to be addressed in FOT&E
- JPATS was a Pilot Program for Streamlined Acquisition (T-6A aircraft; the Ground-Based Training System with multiple simulators, computerized courseware, and a computerized management system; plus Contractor Logistics Support)
  - T-6A, a derivative of the Pilatus PC-9, with major differences, was called Commercial-Off-the-Shelf (COTS)
  - FAA certification of T-6A repeatedly delayed development
  - Program restructured multiple times; Nunn-McCurdy breach in September 2007
- Revised Acquisition Program Baseline in February 1999; MS-III and FAA cert slipped
- More developmental and production delays (1999-2000) plus August 2000 crash where 2 experienced pilots ejected near Randolph AFB, TX (RAFB); MS-III slipped again
  - Engine seizures (lack of oil pressure); insufficient cockpit cooling air; flight controls; durability; tire life
  - OT&E without students at RAFB: T-6A operationally effective but not safe for student training
  - January 2001 new USAF Acquisition Strategy
- January-May 2001 OT&E reduced to OA (incomplete courseware, interfaces, TIMS)
- November 2001 BLRIP: testing inadequate and T-6A not operationally suitable
- August 2003 BLRIP Addendum: 5 Category I deficiencies and over 200 Category II deficiencies; Mission Capable Rate and Mission Effectiveness Rate not met
- August 2003 – March 2006 FOT&E not suitable

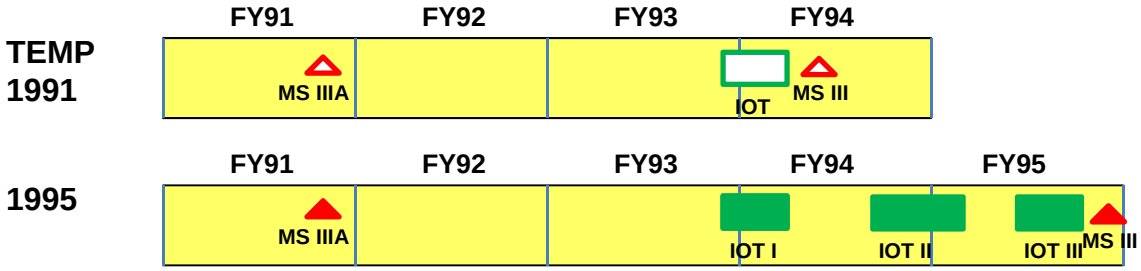
Proposed Event | Completed Event | Proposed Decision Point | Completed Decision Point

Outline for Nunn-McCurdy Analysis

- Air Warfare Examples
- Land Warfare Examples
- Net-Centric Examples

Family of Medium Tactical Vehicles (FMTV)

Light Medium (2.5-ton capability) and Medium (5-ton capacity) tactical trucks

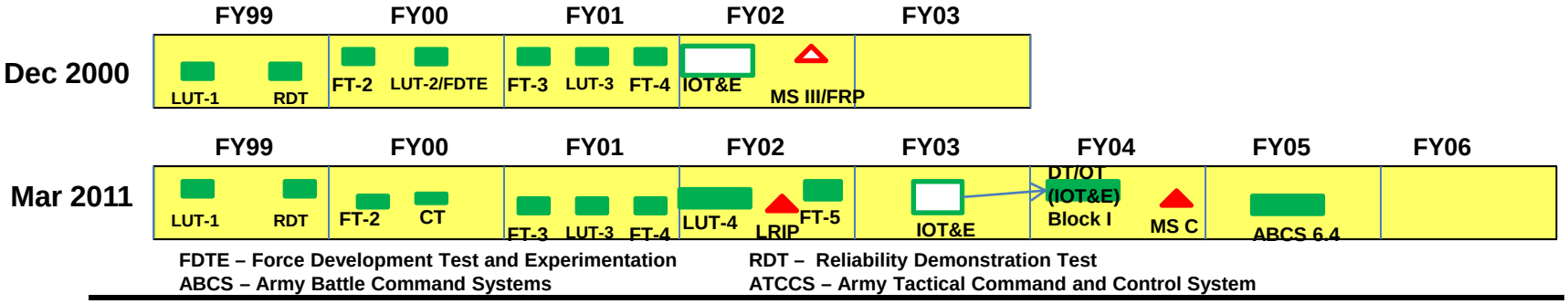


- **FY 94 FRP (MS III) was delayed 19 months for the reasons listed below**
- **The original IOT started several months after the beginning of developmental testing**
  - **Reliability issues found first in IOT, later in DT**
  - **This IOT ended with a demonstrated operational reliability well below the requirement**
  - **Primary cause was lack of production quality control**
- **After a period during which fixes were applied, another IOT, now called IOT II, was conducted**
  - **This test ended, before completion, when the test unit was deployed to Haiti**
  - **Initial indications were that demonstrated operational reliability was still below the requirement**
- **After another period during which fixes were applied, a final IOT, called IOT III, was conducted**
  - **At this point the demonstrated operational reliability met or exceeded the requirement**

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Force XXI Battle Command, Brigade and Below (FBCB2)

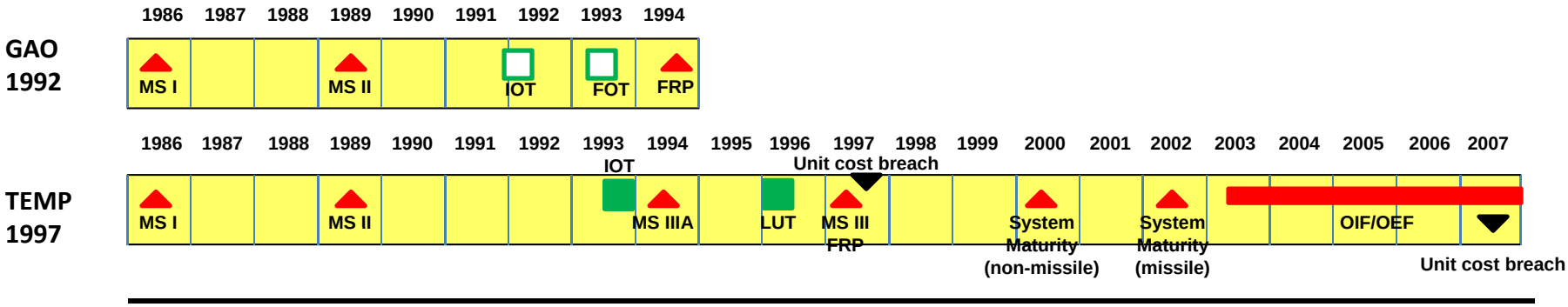
Track friendly and hostile forces on the battlefield



- **Operational testing delayed two years**
- **Early in FY00, as a result of immature software, the Field Test-2 was repeatedly slipped and eventually conducted without meeting entrance criteria. The LUT-2 was downgraded to a Customer Test. Needed enhancements include: robust network management capability, interoperability with ATCCS, and rapid re-establishment of network when communications is lost or task organization change.**
- **Blue Force Tracking (BFT) capability was added to the FBCB2 in early CY03 with the pending imminent deployment of the 4th Infantry Division to Operation Iraqi Freedom (OIF). BFT system uses an L-band satellite radio rather than the terrestrial EPLRS network of FBCB2.**
- **IOT&E in 2003 was cancelled/delayed because test unit was deployed in support of OIF. A distributed DT/OT was conducted in February 2004 with linkages among Ft Huachuca, Ft Hood, and Ft Bragg. It included both BFT and terrestrial FBCB2 systems.**
- **DOT&E BLRIP report issued in 2004 based on DT/OT Block I, field assessments from OIF, and LUT in 2001**
  - **Follow-on testing to demonstrate corrections to shortcomings – principal among these is the reliability. The Mean Time Between Essential Function Failures (MTBEFF) was estimated to be 346 hours against a requirement of 700 hours.**
  - **Interoperability of the FBCB2/BFT version and the FBCB2 terrestrial (EPLRS) has not yet been demonstrated. In addition, FBCB2/BFT are identified as main legacy components required to be interoperable with the Future Combat Systems Modular Brigade Combat Teams.**

Javelin Anti-Tank Missile

Advanced Anti-Tank Weapon System – Medium

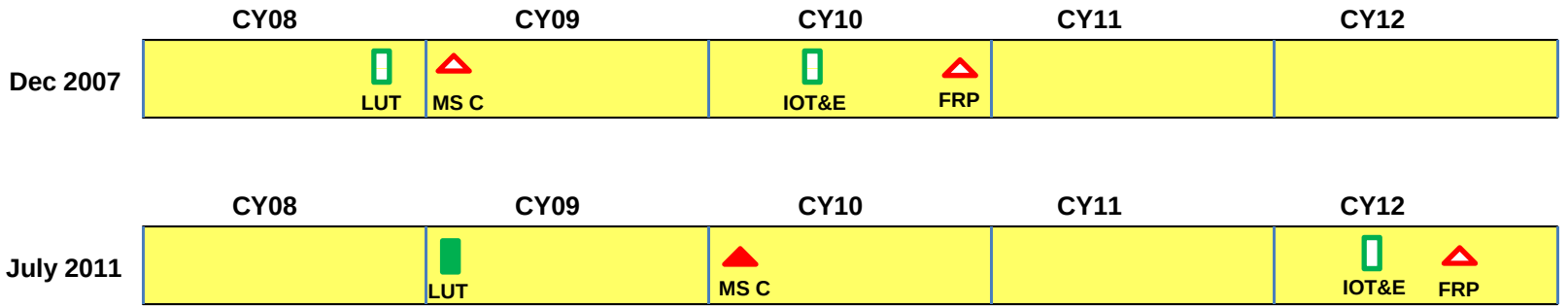


- **Full Rate Production delayed three years**
  - In the early 1990s, manufacturing problems in producing effective focal plane array components for the missile seeker caused an 18-month slippage
- **Javelin experienced Nunn McCurdy breaches for unit cost increases of greater than 50 percent**
  - Javelin system consists of two components
    - » Command Launch Unit, non-disposable, ≈$150,000 each
    - » Missile in expendable launch tube, ≈$86,000 each
  - Javelin unit cost is a combination of procurement dollars divided by number of missiles
    - » Note the CLU costs, but not numbers, are included
    - » Purchase rate was 1 CLU per 5 missiles but in 2007 was changed to 1 per 2.5
- **With the decrease in major combat operations, the Command Launch Unit, an excellent surveillance device, is being used, damaged, and replaced while no missiles are being fired**
- **Javelin breaches were "forgiven" – permitted to revise their original baseline estimate to the current baseline estimate**
  - **Breaches in FY 1997 and FY 2007**

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Warfighter Information Networking – Tactical Increment 2

On-the-move, high-speed, high-capacity communications

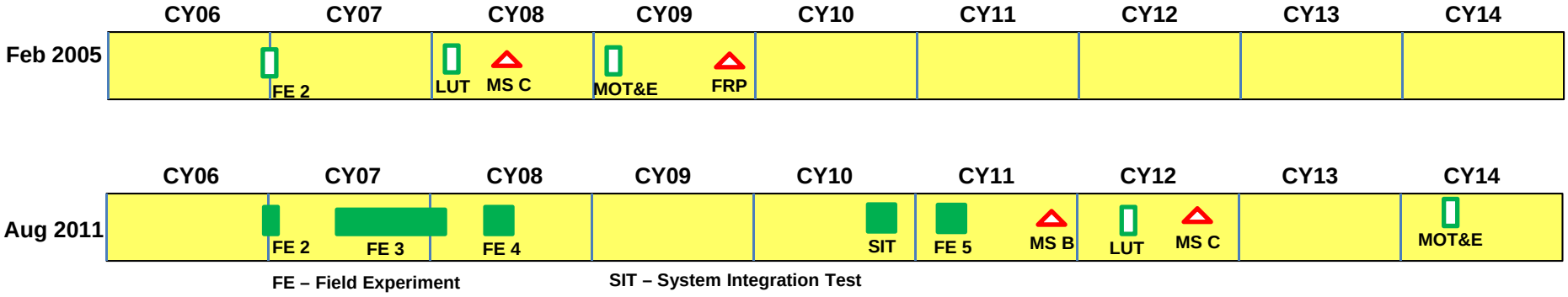


- **Full Rate Production projected to be delayed over a year**
- **The LUT was delayed due to unit availability**
- **WIN-T Increment 2 performed poorly at the LUT, with effectiveness and suitability shortcomings that required subsequent developmental tests and delayed MS C**
  - Effectiveness: No successful line-of-sight messages via Highband Networking Waveform beyond 3.5 kilometers; support of full spectrum operations not tested; tactical operations centers were stationary
  - Suitability: None of the on-the-move configuration items met reliability requirements – Tactical Communications Node demonstrated 176 hours (900 required); Point of Presence demonstrated 87 hours (900 required); Soldier Network Extension demonstrated 49 hours (300 required)
- **The IOT&E was additionally delayed to combine testing at the Network Integration Events**

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

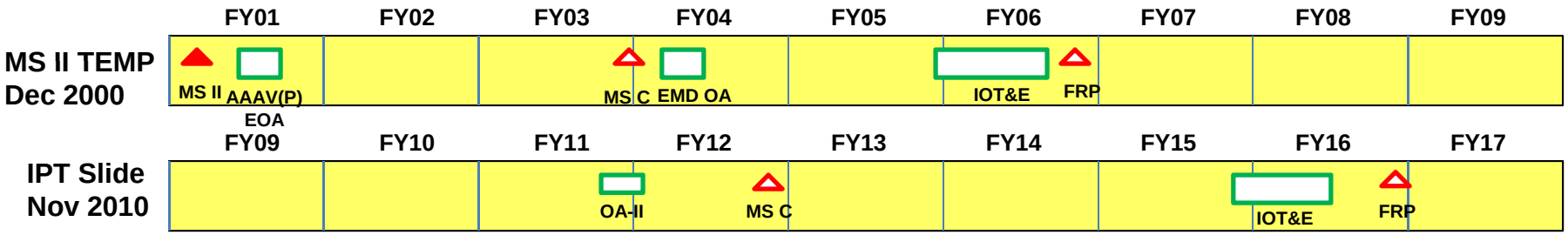
Joint Tactical Radio Ground Mobile Radio

Wide and Narrowband connectivity on the move



- **Full Rate Production projected to be delayed three years**
- **The LUT was consecutively delayed due to poor performance in developmental testing: Field Experiment 3 (2007), Field Experiment 4 (2008), System Integration Tests Part 1 and 2 (2010), Field Experiment 5 (2011)**
- **The Ground Mobile Radio continues to have multiple deficiencies:**
  - **Mean Time Between Essential Function Failure has been on the order of 10 hours in developmental testing (1200 hours required).**
  - **The scaling performance of the wideband networking waveform (WNW) continues to be disappointing with no physical network ever scaling over 35 nodes (requirement is 100 nodes)**
  - **Range performance of the radio has been disappointing, typically 6-7 kilometers for WNW on a single hop (about 15-20 kilometers needed for brigade operations)**
  - **The complexity of the system is such that integration into combat vehicles (Bradleys, Abrams and Strykers) is currently impossible**
- **The 2011 Nunn-McCurdy breach has resulted in a program re-evaluation and move of the LUT to the Army NIE 12.2 in April-May 2012, with a MOT&E planned for 2QFY14.**

Expeditionary Fighting Vehicle (EFV)

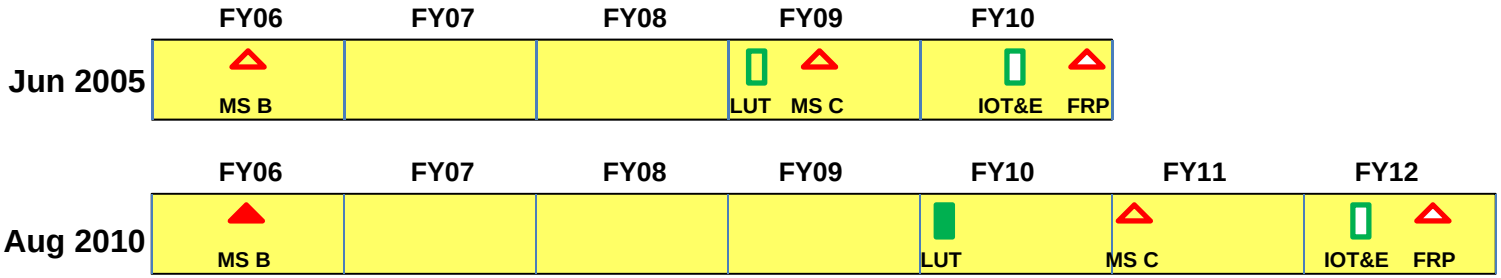


- **IOT&E and FRP had been delayed by approx ten years before program was cancelled**
- **EFV program was rebaselined in 2002, adding an additional year to the program schedule, and then rebaselined again in 2003, adding another year to the program schedule**
  - Initial EMD schedule of approximately three years did not allow sufficient time to test, evaluate the results, fix the problem, and retest to make certain that problems are fixed before moving forward
- **Because of demonstrated problems with hydraulics, hydrodynamic appendages, and key electronic systems, the program was rebaselined again in 2005, this time adding an additional two years to the two years added during the previous rebaselinings**
- **In June 2007, the EFV program was restructured as a result of Nunn-McCurdy-level cost overruns and operational effectiveness and suitability problems identified during the 2006 EFV Operational Assessment (OA)**
  - Performance and reliability shortfalls required a significant vehicle redesign; the EMD phase had to be redone (additional $1B+ and nearly 5-year delay)
    - » Based on missions conducted during the 2006 OA, the Mean Time Between Operational Mission Failures (MTBOMF) estimate was 4.5 hours, which was significantly below the 15 hours predicted by the program office's reliability growth model and the 43.5-hour requirement (Key Performance Parameter)
  - As part of the program's Nunn-McCurdy certification process, the Department of the Navy developed a restructuring plan to allow time to construct a second generation of EMD-phase prototypes and to conduct a second OA.
  - Restructuring (and additional post-restructuring delays caused by delays in delivering new prototype vehicles) resulted in the program's Milestone C being delayed from Jan 2007 to Dec 2011
  - Funding decisions further postponed Milestone C (from Dec 2011 to Sept 2012) and the Full Rate Production decision until late FY16
- **Program was cancelled in Jan 2011 by SecDef for affordability reasons**

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

AH-64D Apache Block III

Modernized AH-64D attack helicopter with Level II-IV UAS control, improved performance, and enhanced survivability

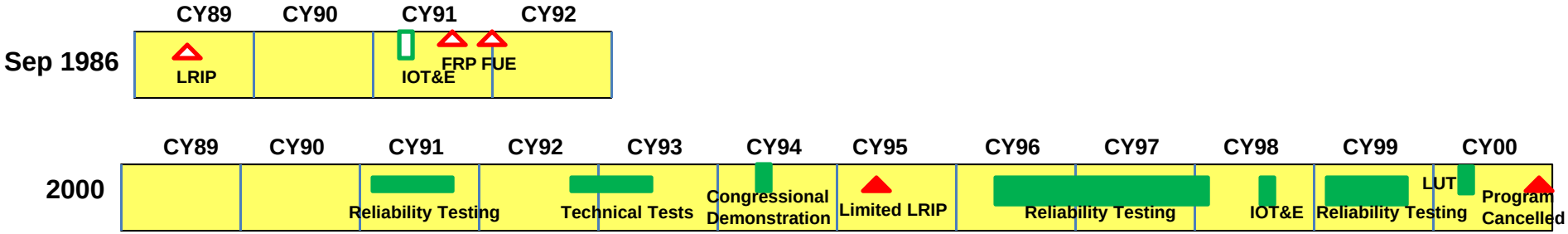


- **MS C and FRP projected to be delayed two years**
- **2009 Nunn-McCurdy breach from increase in fleet requirements**
  - **Just before Milestone C, OSD directed creation of new aviation brigade adding 56 additional Apache Block III aircraft to the production quantity**
  - **Milestone B program envisioned rebuilding 634 existing Apache aircraft**
  - **All 56 new aircraft must be built new using all new high-dollar components (engines, drives, sensors)**
  - **IOT&E and FRP delayed to accommodate new funding profile**

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Sense and Destroy Armor (SADARM)

Smart, anti-tank sub-munition

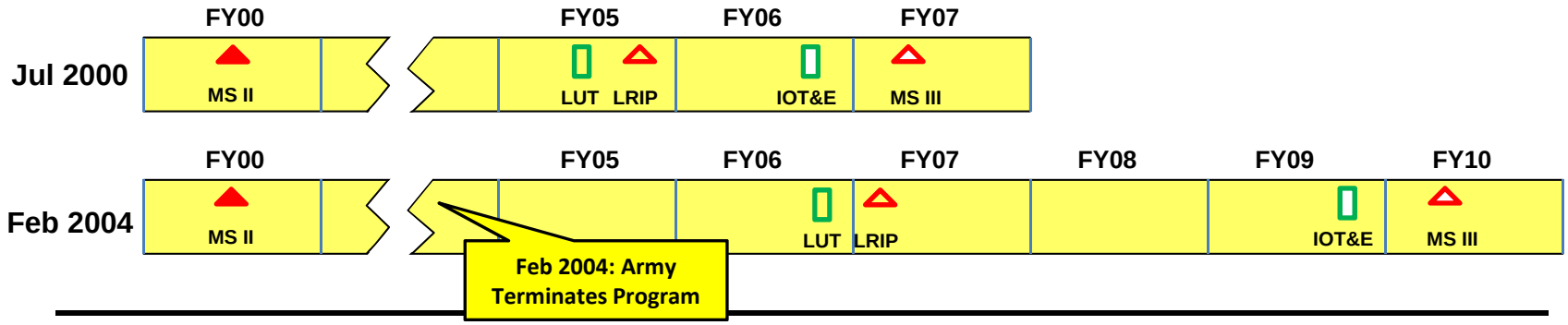


- **First Unit Equipped (FUE) delayed 9 years, then program was cancelled**
- **SADARM had many delays over its long history due to technical problems**
  - November 1993 GAO report counted 6 schedule changes from 1986 to 1993
  - Congress cancelled the program in FY01 budget.
- **Production and design problems discovered in DT caused initial delays**
  - 1991 testing had 16% reliability (80% required). Testing in 1993 was suspended due to poor performance (9 of 42 hits) and duds (7 of 42 duds).
  - Congress gave program very limited money in FY94 budget
  - A one-time limited Congressional demonstration allowed program to enter limited LRIP
  - Cut in funding and program restructure caused additional delays
- **Poor IOT&E performance further delayed program**
  - Reliability testing prior to IOT&E showed reliability at operational ranges near 40%
  - DOT&E evaluated the system as not effective (achieved 86% of kill requirement) and not suitable (40% reliability vs 80% required)
  - IOT&E showed problems with winds and countermeasures
  - Program made additional design and production changes in preparation for LUT, also proposed product improvement (PI) SADARM with new design.
- **LUT in 2000 showed improved performance**
  - Reliability 72% vs 80% requirement
  - Exceeded kill requirement by 40%
  - Still no fix for wind and countermeasure problems
  - Was very inefficient (24 rounds required for modest kill requirement) making the munition expensive

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

RAH-66 Comanche

Twin-engine, two-pilot, stealthy armed reconnaissance/attack helicopter

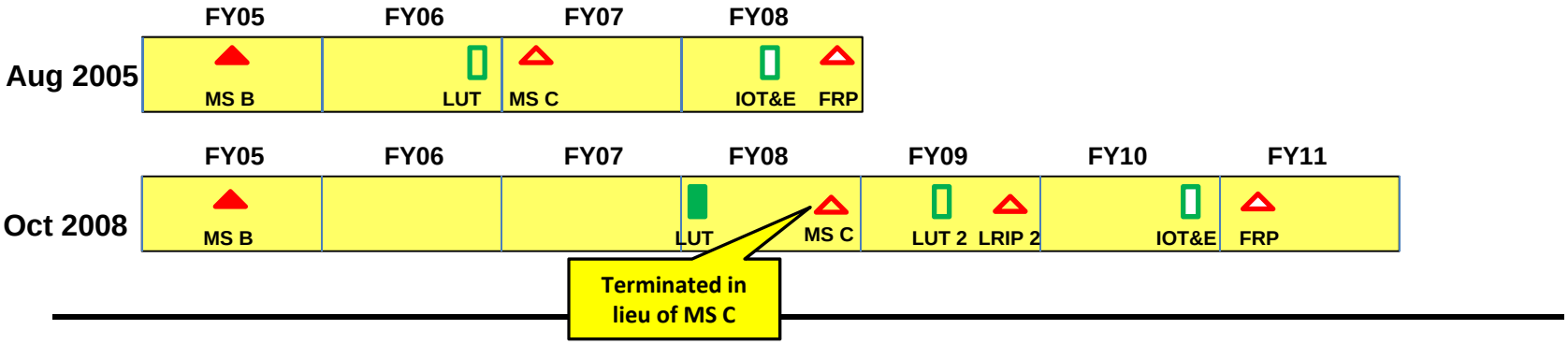


- **FRP delayed three years, then program was cancelled**
- **Technical challenges existing at MS II, and others discovered soon after, led to 6th program restructure in 2002**
  - **Additional time needed to develop fly-by-wire and mission equipment software**
  - **Projected weapon accuracy would not meet specifications; weapons integration behind schedule**
  - **Competing requirements to increase antenna performance while reducing radar cross section**
  - **Current and projected aircraft weight exceeded goals; flight performance requirements at risk**
- **Restructured program proposed evolutionary capabilities in 3 blocks**
  - **Program unable to meet all requirements by FY10; Block III capability projected for FY13**
  - **Production quantity reduced from 1205 to 646**
  - **Fielding postponed by three years**
- **In February 2004, the Army terminated the Comanche program**
  - **Funds retained within Army Aviation**

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

Armed Reconnaissance Helicopter

Replacement for OH-58D helicopter for armed reconnaissance helicopter missions

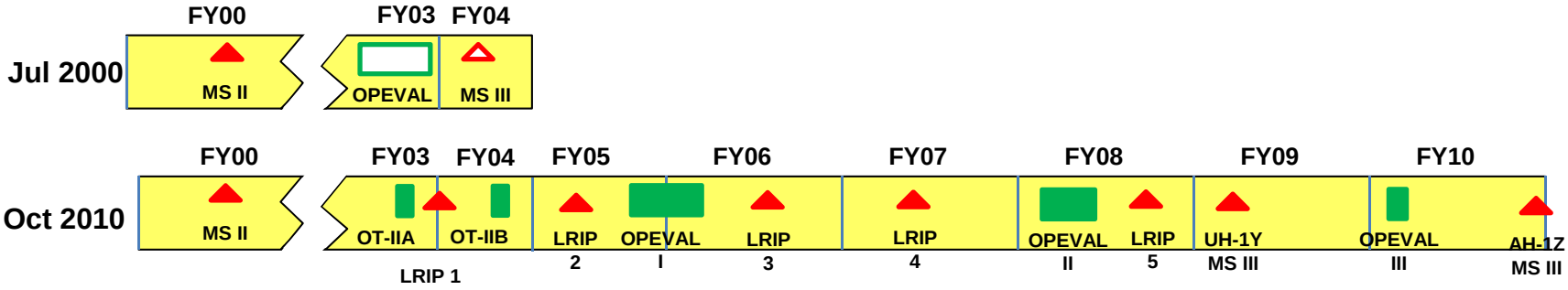


- **FRP delayed three years, then program was cancelled**
- **Contractor design was not as mature as briefed at Milestone B**
  - While largely based on a commercial design, the ARH needed new designs for the engine, landing gear, sensor, tail cone, exhaust faring, and other structural components
  - Contractor was unable to produce test data on flight components that they asserted were qualified for flight. This necessitated additional unplanned testing to qualify the components.
- **Milestone B development timeline was unrealistic**
  - Contractor underestimated the integration challenges
  - Engine upgrade and integration of sensor package, laser, cockpit software, and armament did not go well
  - Milestone C delayed to address most pressing development and integration challenges
- **Immature integration of cockpit controls and sensor was evident at Nov 07 LUT**
  - Sensor tracking and target location performance was not acceptable; one mission failed for inability to locate and track targets – a fundamental reconnaissance task
  - Crew workload and frustration was unacceptably high
  - Weapons, survivability equipment, and secure communications equipment were not yet integrated
- **DAE terminated program in lieu of Milestone C**
  - Cited Nunn-McCurdy cost breach
  - Initiated AoA for OH-58D replacement

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

H-1 Upgrades

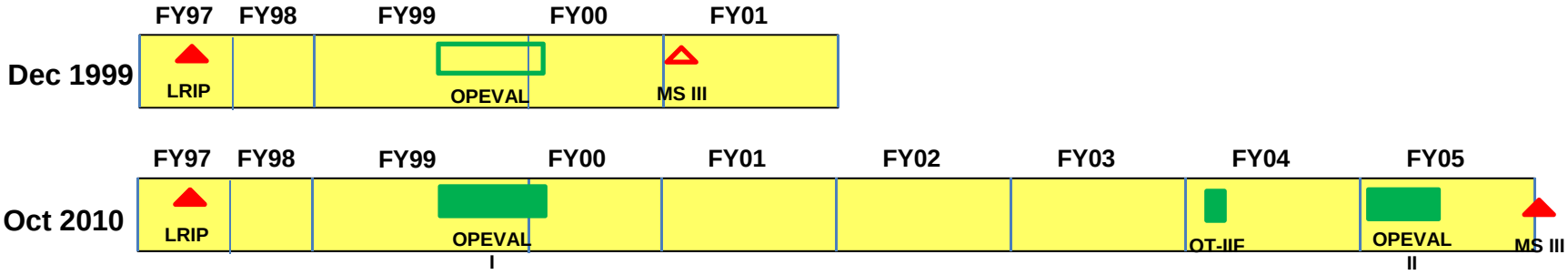
Upgrades USMC Cobra and Huey helicopters with digital cockpits, common power train, and common tail section



- **Full Rate Production of UH-1Y delayed over five years and of AH-1Z over seven years**
- **Technical difficulties in DT and early OT postponed start of OPEVAL I**
  - **Pressure and heat spikes in hydraulic system**
  - **Delamination of composite main rotor yoke and cuff; designed for 10,000-hour life; achieves 1,500 hours**
  - **Redesign of engine exhaust required to prevent overheating tail section**
  - **Integration and reliability deficiencies with AH-1Z targeting sensor**
- **OPEVAL I – Effectiveness and suitability shortfalls with both aircraft**
  - **Assault support mission success was 36% (17 of 48)**
    - » **Poor performance of targeting sensor**
    - » **Rocket and Hellfire missile delivery was not effective.**
    - » **Helmet performance and restrictions limited operations in the expected low-light operational conditions.**
  - **Suitability issues include reliability, human factors and interoperability**
    - » **AH-1Z MFHBA requirement > 24.0 hours; demonstrated 17.3 hours (many problems with targeting sensor)**
    - » **UH-1Y MFHBA requirement > 33.1 hours; demonstrated 26.1 hours**
- **OPEVAL II – UH-1Y effective and suitable; AH-1Z withdrawn from test**
  - **AH-1Z targeting sensor performance and reliability so poor that missions could not be conducted**
- **OPEVAL III – AH-1Z effective and suitable**
  - **Aircraft equipped with new production targeting sensors**

MV-22 Osprey

Tilt-rotor aircraft capable of airplane flight and vertical take-off and landing

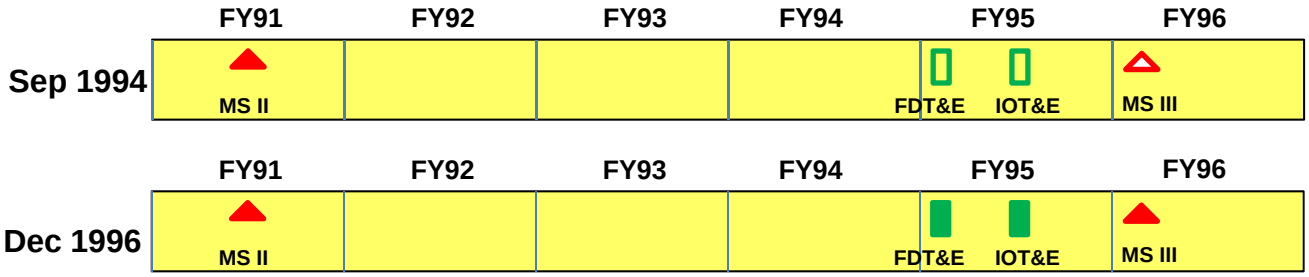


- **Full Rate Production delayed five years**
- **Technical and funding challenges throughout DT that began in 1982**
  - **SECDEF attempted to cancel the program in 1989-1990**
  - **Full Scale Development Aircraft were overweight – did not meet performance requirements**
  - **Development of fly-by-wire software – unstable in hover near the ground and over ships**
  - **Two crashes during development**
  - **Poor reliability in DT**
- **OPEVAL I – Effective, but not suitable because of safety and reliability issues**
  - **Missions successfully completed, but fatal crash during test**
    - » **Effect of vortex ring state on aircraft performance not well tested or understood**
  - **Failed to meet all reliability, availability, and maintainability requirements**
  - **Another fatal crash before MS III decision**
    - » **Poorly designed wiring and hydraulics in engine nacelles**
    - » **Emergency procedures not fully tested or understood**
- **Program restructured in 2000**
  - **Major redesign of engine nacelles**
  - **Extensive testing at high rates of descent to understand aircraft response to vortex ring state**
- **Return to OPEVAL with MV-22 Block A aircraft in 2005**
  - **MV-22 effective and suitable**

Proposed Test Event **Completed Test Event** **Proposed Decision Point** **Completed Decision Point**

AH-64D Longbow Apache

Modernized AH-64A attack helicopter with radar targeting sensor and radar-guided Hellfire Missile

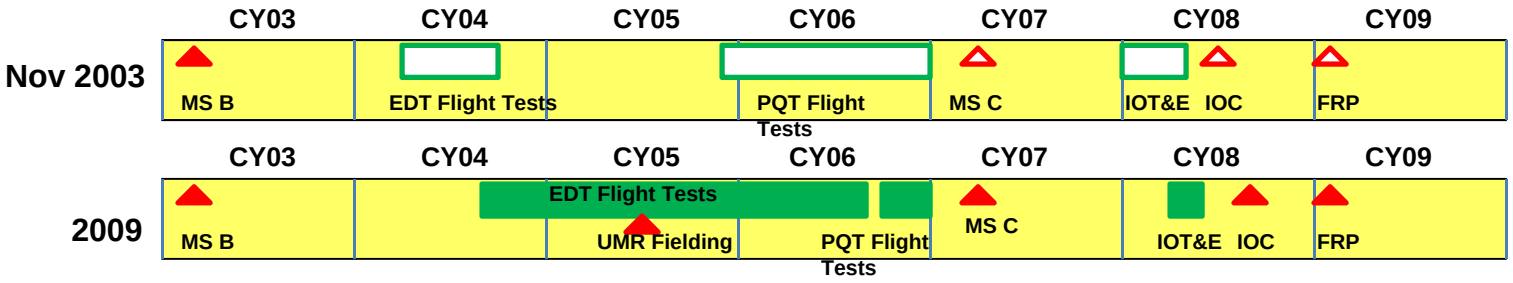


- **1993 Nunn-McCurdy breach from increase in fleet requirements**
  - **Before 1993, program plan was to modernize 227 AH-64A aircraft into AH-64D aircraft, each equipped with Fire Control Radar (radar targeting sensor)**
  - **In 1993, the Army decided to modernize the entire AH-64A fleet (758 aircraft) into AH-64D aircraft**
    - **Only 227 aircraft equipped with the Fire Control Radar and refurbished with GPS, avionics upgrades, digital communications equipment, and launch capability for radar-guided Hellfire missile**
    - **All other aircraft refurbished with GPS, avionics upgrades, digital communications equipment, and launch capability for radar-guided Hellfire missile**
- **No change to program development schedule**
- **No delay in test schedule**

Proposed Test Event | Completed Test Event | Proposed Decision Point | Completed Decision Point

Guided Multiple Launch Rocket System (GMLRS) Unitary

Precision, unitary warhead rocket



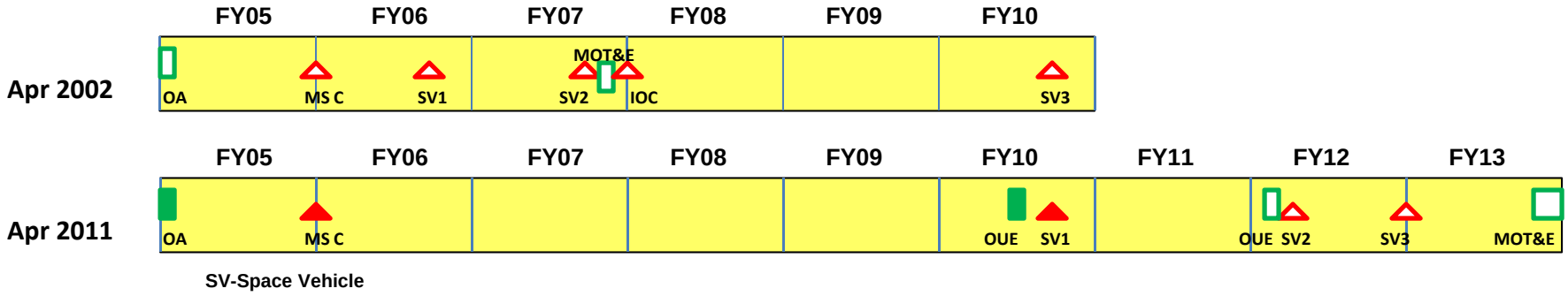
- **Urgent Material Release (UMR) and technical problems did not result in significant schedule delays since MS B**
- **Interim rocket version fielded in June 2005 as UMR**
  - **Not explicitly in MS B plan, but program office built in schedule time to test an interim rocket in CY05 if needed.**
  - **UMR rocket only had point detonating and delay fuze. It did not include proximity fuze or insensitive munition (IM) rocket motor.**
- **After testing, Army decided not to field Insensitive Munition (IM) rocket motor**
  - **Army attempted to improve rocket motor's IM capability. Because of technical challenge, program office added schedule time and kept option to use current rocket motor through UMR program.**
  - **Testing showed limited IM improvements and early PQT events had 3 failed failed launches attributed to new IM design.**
- **2007 Nunn-McCurdy breach due primarily to change in test quantities**
  - **Change in Army force structure (1100 to 600 launchers) reduced buy from 140k to 43.5k rockets**
  - **Increased proportion of GMLRS Unitary rockets over GMLRS DPICM rockets. Changes in GMLRS DPICM affect GMLRS Unitary, because they have same funding line.**
  - **$250 M RDT&E effort for IM motor and self-destruct DPICM fuze contributed to cost increase for items that were ultimately not fielded**

Outline for Nunn-McCurdy Analysis

- Air Warfare Examples
- Land Warfare Examples
- Net-Centric Examples

Advanced Extremely High Frequency (AEHF) Satellite

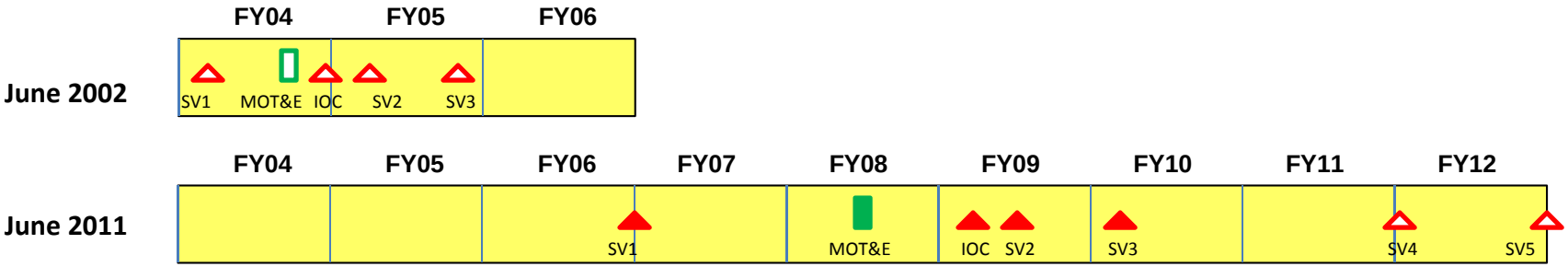
Provides secure and protected satellite communication to tactical and strategic forces



- **Satellite launch delayed by 4 years due to series of technical problems**
  - **Development of a dedicated crypto chip**
  - **Immaturity of ground control software**
  - **Manufacturing problems with reaction wheel assemblies, the scalable power regulator unit, the on-board computers , the demodulator, and the cross-link lock assemblies**
  - **2010 failure of the apogee engine during orbit-raising of Space Vehicle One (SV1)**
- **September 2008 Nunn-McCurdy breach was due to unit cost (not schedule).**
- **FY10 Operational Utility Evaluation (OUE) of backward compatible mission control software revealed concerns with information assurance, reliability, availability, and maintainability of ground control systems.**

Wideband Global SATCOM (WGS)

Provides high data rate satellite communication to tactical and strategic forces

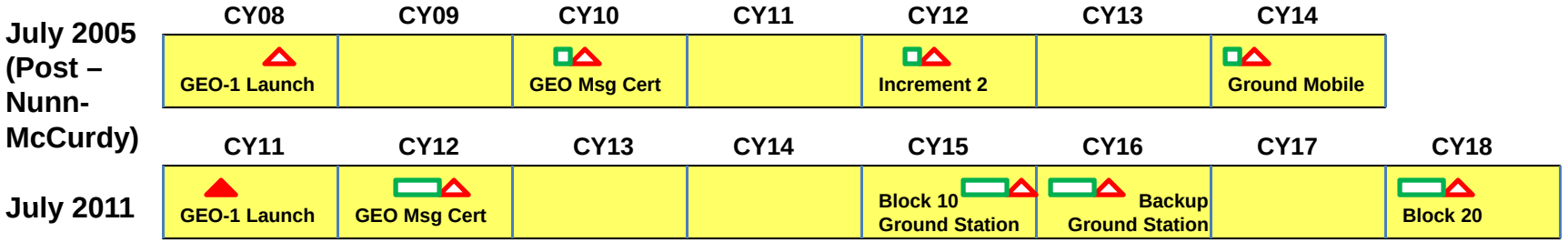


- **MOT&E delayed four years**
- **March 2010 Nunn-McCurdy breach due to unit cost (not schedule). However, there were several technical problems that contributed to schedule delays.**
  - Unit cost increases were due to below-cost fixed-price of initial block of three satellites, subsequent to decision to expand the constellation, and breaks in production
- **MOT&E demonstrated the space segment was effective but identified concerns with information assurance of the ground control segment and an inability of the Consolidated Network Planning Software (CNPS) to properly disseminate mission planning information to the network of Wideband Satellite Operations Centers.**
- **Significant delays occurred in the first block of satellites due to manufacturing and quality control issues**
  - 2003 - Problems with phased-array antenna
  - 2005 - Performance problems in the payload channelizer oscillator and incorrectly-installed rivet-nuts on SV1
  - 2006 - Faulty solder joints and microwave power amplifier anomalies

Proposed Test Event | **Completed Test Event** | **Proposed Decision Point** | **Completed Decision Point**

Space-Based Infrared System (SBIRS)

Constellation for missile warning, missile defense, battlespace awareness, and technical intelligence.



- **First SBIRS satellite in geosynchronous (GEO) orbit delayed three years from 2005 baseline.**
  - Additional delays in the ten years from the 1996 requirements definition to the 2005 re-baselining were primarily caused by unrealistic requirements, immature technology, and a contract structure (Total System Performance Responsibility) that limited government insight into system development.
- **SBIRS will deliver a constellation including infrared payloads in geosynchronous and highly-elliptical orbits along with associated ground processing capabilities to replace legacy Defense Support Program assets.**
- **The lack of a consolidated acquisition strategy document for the remainder of the program makes it difficult to assess the top-level schedule.**
  - The current delivery, called Effectivity-5, consists of the first geosynchronous satellite and ground facilities.
  - The next delivery, Block 10, will consolidate and replace the current ground architecture.
  - The strategy for deliveries beyond Block 10, including ground mobile assets, remains vague.
- **For the past several years, most delays have been caused by problems preparing for the first launch into geosynchronous orbit.**
  - Development of the satellite flight software was delayed repeatedly due to reliability issues.
  - The discovery of non-space-qualified parts required the contractor to replace some satellite components.