

## Technology Programs

### Executive Summary

- The MDA made progress this past year on its four major technology programs.
- The Airborne Laser (ABL) lethal demonstration against a threat-representative ballistic missile is scheduled for late FY09. On September 7, 2008, the MDA successfully fired the high-energy chemical laser onboard the ABL aircraft for the first time during ground testing at Edwards Air Force Base, California.
- The launch of two Space Tracking and Surveillance System (STSS) satellites has been delayed due to recent technical problems with Space Vehicle 2. A fix is anticipated, but due to logistical constraints in scheduling, the launch date has been delayed to 2009.
- The Kinetic Energy Interceptor (KEI) made progress in developing and testing the Stage 1 and 2 rocket motors in FY08, completing two static fire tests, two burst tests, and initiating avionics qualification testing. A number of motor case components were redesigned as a result of issues discovered during earlier testing.
- The Multiple Kill Vehicle (MKV) program re-organized its Acquisition Strategy and is progressing towards a System Requirements Review in 3QFY09. In FY08, MKV completed an end-to-end simulation in an open architecture modeling framework and demonstrated key engagement management algorithms.

### Systems

Airborne Laser (ABL) is a prototype missile defense weapon system consisting of:

- A modified Boeing 747-400F commercial aircraft
- An infrared surveillance system
- A megawatt-class chemical oxygen-iodine laser
- A laser turret on the aircraft nose
- Two illuminator lasers on a bench in the fuselage
- Optical benches with highly sensitive cameras, sensors, and mirrors
- Hardware and software for battle management, command, control, communications, computers, and intelligence
- Ground support equipment for storing, mixing, transporting, and loading laser chemicals



ABL



STSS

Space Tracking and Surveillance System (STSS) is a research and development system that will consist of:

- Two flight test satellites in low-earth orbit
- The Missile Defense Space Experimentation Center, Colorado Springs, Colorado (the primary control center)
- The Low Satellite Operations Center, Redondo Beach, California (the backup control center)

Kinetic Energy Interceptor (KEI) is planned as a land-based, air-transportable battery with the following components:

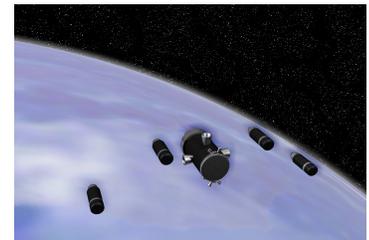
- Transportable erector launcher
- High acceleration and high burnout-velocity booster rocket
- KEI fire-control/communications (KFC/C) ground suite and a KEI Interceptor Communications System



KEI

Multiple Kill Vehicle (MKV) plans for many kinetic kill vehicles to be carried aboard a single payload. Key features include:

- Liquid Axial Propulsion
- Divert and Attitude Control Propulsion
- Infrared Sensors
- Communications with kill vehicles and endgame management
- Command and control of the kill vehicles, especially assignment of targets and prevention of fratricide



MKV

### Missions

Airborne Laser (ABL) – Combatant commanders will use the ABL to destroy threat ballistic missiles in the boost phase before they have an opportunity to deploy re-entry vehicles, sub-munitions, or countermeasures. Commanders will use ABL to:

- Autonomously acquire and track threat ballistic missiles using its passive infrared sensors
- Establish precise track on the missile nose and an aim point on the propellant tank using its illuminator lasers
- Destroy the missile by placing laser thermal energy on the tank or motor case to weaken the casing, allowing internal pressure to rupture the tank
- Generate and pass target cues to the BMDS and theater assets

Space Tracking and Surveillance System (STSS) – U.S. Strategic Command will use the STSS, a space-based sensor element of the Ballistic Missile Defense System (BMDS) to:

- Acquire, track, assess, and report ballistic missile and intercept events from lift-off to re-entry

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- Provide a space node to support data fusion, over-the-horizon radar/sensor cueing, interceptor handover, and fire control

Kinetic Energy Interceptor (KEI) – U.S. Strategic Command will use the KEI as a primary intercept missile in the BMDS to:

- Intercept threats in boost, ascent, and midcourse phases of flight
- Intercept medium-, intermediate-, and long-range ballistic missiles
- Independently exercise command, control, battle management, and communications at the battery level, access sensor data, and communicate with the kill vehicle
- Boost alternate kill vehicles toward the interception point

Multiple Kill Vehicle (MKV) – The U.S. Strategic Command will use the MKV as the primary kill mechanism for the interceptors deployed in the BMDS to:

- Intercept long-range ballistic missiles and countermeasures in the midcourse phase of flight

- Mitigate the target discrimination problem by destroying all major objects in the field of view using many small kill vehicles

## Prime Contractors

- Airborne Laser: Boeing
- Kinetic Energy Interceptor: Northrop Grumman
- Multiple Kill Vehicle: Lockheed Martin
- Space Tracking and Surveillance: Lockheed Martin

## Knowledge Point Progress

For the technology and other programs, the MDA uses knowledge points to measure development progress by focusing on the set of critical activities that define each program's risk. The MDA defines a technology Knowledge Point as a technology development event that provides critical information for a key technology decision. This approach allows the MDA to make informed decisions on advancement of a development activity.

### ABL

- Knowledge Point #5: Aircraft and Support Systems Ready for High Power System Integration. The MDA completed this knowledge point on time in December 2007.
- Knowledge Point #6: Conduct First Light into the Laser Calorimeter. The MDA completed this knowledge point on September 7, 2008, ahead of the originally planned date in 1QFY09.
- Knowledge Point #7: Conduct First Light through the Beam Control/Fire Control Subsystem. The MDA expects to complete this during 1QFY09.
- Director Knowledge Point: Demonstrate the capability of the ABL to successfully negate a threat representative SRBM Foreign Military Asset (FMA) during boost phase.

### STSS

- Knowledge Point #1: Ground Acceptance Test. In FY08, the MDA completed this knowledge point by conducting the ground tests necessary for flight readiness certification.
- Knowledge Point #2: Space Vehicle Integration. Although environmental testing of both Space Vehicles was completed in November 2007, recent technical problems with Space Vehicle 2 have further delayed the launch.
- Knowledge Point #3: Confirm Constellation Performance Affordability. The MDA had planned to complete this knowledge point by 4QFY08, but the completion date has slipped to FY09.

- Director Knowledge Point: After the launch of the two STSS satellites (launch date to be determined), the MDA will conduct four major flight tests to characterize sensor performance. The flight tests will serve as a risk reduction for the eventual fielding of an operational constellation of satellites.

### KEI

- Knowledge Point #1: Demonstrate Overhead Non-imaging Infrared Accuracy for Boost Phase Fire Control. The MDA completed this knowledge point in April 2006; however, it is not relevant to current booster-only development, but may be useful if KEI fire control activities are reactivated in the future.
- Knowledge Point #2: Demonstrate High Acceleration Booster. KEI testing in FY08 supported progress towards Knowledge Point #2. This knowledge point is currently scheduled for completion after a booster verification flight test in FY09.
  - A Stage 2 static fire test was conducted in October 2007. A number of Stage 2 redesigns then delayed further booster testing until September 2008 when a second static fire test was successfully conducted.
  - The Stage 2 case redesign was demonstrated in a successful burst test in April 2008. A successful Stage 1 burst test followed in July 2008.
  - Qualification testing of booster avionics and structures began in FY08.

### MKV

- In FY08, MKV demonstrated the first MKV end-to-end simulation operating in an open architecture modeling framework (December 2007), demonstrated key engagement management algorithms (May 2008).
- MKV Knowledge Point #1a: Kill Vehicle Selection for SM-3 Block IIA with Japan. The MDA conducted system and

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- payload trade studies and a joint system concept review to complete the knowledge point.
- MKV Knowledge Point #1b: Define Commonality Characteristics for All Kill Vehicles (2QFY09). The MDA will define component commonality goals and architectures (4QFY08); define common component interface standards (2QFY09); and define common SM-3 Block IIA/B payload environments and interfaces (2QFY09).
  - MKV Knowledge Point #1c: Demonstrate Commonality Characteristics for All Kill Vehicles (3QFY10). The MDA will assess optimal levels of commonality in a prototype seeker ground demonstration (1QFY10) and in prototype Divert and Attitude Control System (DACS) ground tests (3QFY10). The MDA will demonstrate commonality requirements, interfaces, specifications, and hardware selection for both the SM-3 Block IIA and Block IIB (3QFY10).
  - MKV Knowledge Point #2: Demonstrate Multiple Kill Capability (2QFY11). The MDA will conduct component hover testing (1QFY09), seeker captive carry testing (1QFY10), engagement management demonstrations in real-time digital simulation with hardware-in-the-loop testing (2QFY11), and lethality enhancement testing (2QFY11).
  - MKV Knowledge Point #3a: Confirm Affordability of Unitary and Multiple Kill Capability (2QFY10). The MDA will establish production cost commitments (1QFY10) and confirm budget constraints by comparison with contractor cost data reports (1QFY10).
  - MKV Knowledge Point #3b: Validate Affordability of Unitary and Multiple Kill Capability (2QFY13). The MDA will verify and validate production cost commitments (2QFY13) and achieve engineering manufacturing readiness level 2 on the production line (2QFY13).
  - MKV Knowledge Point #4a: SM-3 Block IIA Unitary Kill Vehicle Readiness for Flight Testing (1QFY12). The MDA will:
    - Demonstrate a prototype of the SM-3 Block IIA unitary kill vehicle DACS (TBD)
    - Perform ground test verification of SM-3 Block IIA unitary kill vehicle seeker performance (4QFY11)
    - Conduct a static fire test of a flight configured SM-3 Block IIA unitary kill vehicle DACS (1QFY12)
    - Perform a ground test demonstration of a flight configured SM-3 Block IIA unitary kill vehicle (1QFY12)
  - MKV Knowledge Point #4b: Demonstrate Multiple Kill Vehicle Integrated System Capability from Midcourse Interceptor (3QFY15). The MDA will conduct ground testing of flight-configured payloads (2QFY12) and conduct integrated system intercept flight testing (3QFY15).

## Recommendations

- Status of Previous Recommendations. There were no previous recommendations.
- FY08 Recommendations. None.

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