

Technology Programs

Executive Summary

- The MDA made progress this past year on its four major technology programs.
- The Airborne Laser (ABL) completed the Low Power System Integration (LPSI) flight test series in August, which was one of the 2007 knowledge points, and is on track to complete its second 2007 knowledge point. Integration of the High Energy Laser modules began in September. The MDA moved the first lethal demonstration against a threat-representative ballistic missile to August 2009 from December 2008.
- In FY07, the MDA moved the launch of two Space Tracking and Surveillance System (STSS) satellites from December 2007 to April 2008 due to delays in the flight readiness certification.
- In FY07, the MDA restructured the Kinetic Energy Interceptor (KEI) concept from a boost phase missile defense system (including a launcher, missile, and fire control unit) to a high-speed developmental booster. In FY07, the program completed two first-stage static fire tests and a series of wind tunnel tests.
- The Multiple Kill Vehicle (MKV) program is refining system concepts in preparation for the System Requirements Review scheduled in FY08. In FY07, MKV completed a static hot fire test of the carrier vehicle divert and attitude control system.

Systems

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

- A modified Boeing 747-400F commercial aircraft
- A megawatt-class chemical oxygen-iodine laser
- A laser turret on the aircraft nose and 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



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

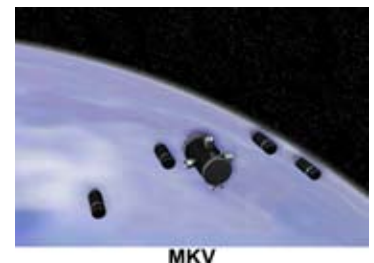
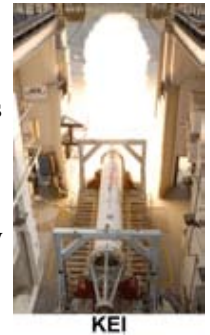
- Two flight test satellites in low-earth orbit
- The Missile Defense Space Experimentation Center, Colorado Springs, Colorado (the primary control center)



- 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
 - High divert velocity kill vehicle that can identify the threat re-entry vehicle in the presence of a bright plume during boost phase and among countermeasures during midcourse phase
 - KEI fire-control/communications (KFC/C) ground suite and a KEI Interceptor Communications System
- Multiple Kill Vehicle (MKV) plans for many small kinetic kill vehicles to be carried aboard a Carrier Vehicle. Key features of the Carrier Vehicle include:

- Kill vehicle restraints and dispense mechanisms
- Communications with kill vehicles and endgame management
- Command and control of the kill vehicles, especially assignment of targets and prevention of fratricide
- Infrared and visible sensors



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, submunitions, 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

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

BALLISTIC MISSILE DEFENSE SYSTEMS

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

Knowledge Point Progress

For the technology programs, the MDA uses knowledge points to measure development progress by focusing on the set of critical activities that define each program's risk. This approach allows the MDA to make informed decisions on advancement of a development activity.

ABL

- Knowledge Point #2 (held over from 2006): First in-flight atmospheric compensation with the Tracking Illuminator Laser and an illuminator laser beacon on a diagnostics-equipped aircraft. The MDA completed this knowledge point in July 2007.
- Knowledge Point #4: Completion of the Low Power System Integration-Active flight test series. The MDA completed this knowledge point in August 2007.
- Knowledge Point #5: Aircraft and support systems ready for High Power System Integration. The MDA expects to complete this knowledge point on time in December 2007.
- Transition Knowledge Point: The MDA moved the first lethality demonstration against a threat-representative ballistic missile to August 2009 from December 2008.

STSS

- Knowledge Point #1: Ground Acceptance Test. In FY07, the MDA delayed the flight readiness certification, which is the demonstration of the ground segment's readiness to control the satellites, to December 2007.
- Knowledge Point #2: Environmental testing of Space Vehicle (SV) 1 has been completed. SV-2 is undergoing satellite integration and environmental testing, which commenced in mid-August 2007. It has not yet been determined whether the SVs will be launched in a dual or single configuration.
- Transition Knowledge Point: After the launch of the two STSS satellites (planned for April 2008), 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 (completed April 2006 – not relevant to current booster-only development)
- Knowledge Point #2: Demonstrate High Acceleration Booster (In FY07, the program made progress toward a booster demonstration with the completion of two first-stage static fire tests.)

MKV

- There are no knowledge points scheduled for MKV in the near term. MKV is refining concepts in preparation for the System Requirements Review in FY08. The MKV program completed a static hot fire test of the carrier vehicle divert and attitude control system in August 2007.
- MKV Knowledge Point # 1: Demonstrate Volume Kill Capability (2QFY11). The MDA will conduct component hover testing (4QFY08), seeker captive carry testing (1QFY10), engagement management demonstrations in real-time digital simulation with hardware in-the-loop testing (3QFY10), and lethality enhancement testing (2QFY11) leading up to Knowledge Point #1.
- MKV Knowledge Point # 2: Determine Affordability of Volume Kill Capability (2QFY13). The MDA will establish production cost commitments (1QFY10); verify and validate production cost commitments (2QFY13); and achieve engineering manufacturing readiness level 2 on the production line (2QFY13) leading up to Knowledge Point #2.
- MKV Knowledge Point # 3: Demonstrate MKV Integrated System Capability from Mid-Course Interceptor (3QFY15). The MDA will conduct hardware-in-the-loop ground testing with a flight configured payload (2QFY12) and integrated, intercept flight testing (3QFY15) leading up to Knowledge Point #3.
- The Director's MKV Knowledge Point #2, being executed by STSS for MKV, was partially accomplished through the Launch of the Near Field Infrared Experiment 2a (FIRE 2a) mission. This knowledge point, in support of the Plume-to-Hardbody Handover effort for Terrestrial and Space basing, included the launch of the NFIRE satellite, successful tracking of the target, and acquisition of substantial infrared tracking data of the stages 1 & 2 of the target missile. NFIRE 2b is to launch in FY08 to acquire near field infrared data.

Recommendations

- Status of Previous Recommendations. The one FY06 DOT&E recommendation for the technology programs pertained to KEI. The recommendation is no longer applicable because of the program restructure.
- FY07 Recommendations. None.