Airborne Laser

Program Status

Tenth Annual Directed Energy Symposium

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ABL Description

- ABL is the air-based component of the ballistic missile defense system’s boost phase defense segment

- Highly modified 747-400 aircraft will acquire, track, and kill ballistic missiles in their boost phase

- ABL’s mission is to protect U.S., deployed forces, U.S. Allies, friends and areas of vital interest from BM attack

- ABL is a pathfinder for directed energy programs of the future
ABL Mission Objectives

Primary Mission:
• Kill ballistic missiles during boost phase

Secondary Missions:
• Early launch warning
• Launch / aim point prediction
• Target cue to missile defense assets

ABL provides a global, highly flexible, multi-mission capability to attack ballistic missiles during boost phase
ABL Weapon System Elements

- **Beam Control/Fire Control System** (Lockheed Martin)
  - Turret beam transfer optics
  - Target tracking
  - Atmospheric compensation
  - Fire control sequencing

- **Laser** (Northrop Grumman)
  - (Ground checked Dec 05, ECD 3Q CY08)
  - Laser modules
  - Beam optics
  - Fluid supplies

- **Aircraft 747-400F** (Boeing)
  - Major structural modifications
  - Flight deck modifications

- **Battle Management** (Boeing)
  - Engagement management
  - Mission consoles / flight displays
  - Surveillance & active ranger
  - Communications

- **Air Vehicle Integration & Test** (Boeing)
  - Ground infrastructure
  - Test plan/conduct

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ABL Capability Demonstrations

Target Track/Atmospheric Compensation
- First Flight - 2004
- Passive Track – 2005
- Active Fire Control - ground 2006
- Active Fire Control - flight - 2007

Modified Aircraft
- Return to Flight - 2004
- Airworthiness - 2005
- Final Modifications - 2006
- Return to Flight - 2006

Battle Management
- First Flight - 2004
- Passive Surveillance - 2005
- Active Engagement - 2007

Megawatt Class High Energy Laser
- First Light - 2004
- Lethal Power/Full Duration Lase - 2005
  - Laser Refurbish - 2007
  - Re-Install on A/C - 2007-2008

High Power System Integration (Ground/Flight test) - 2008-2009

ABL’s revolutionary capability is becoming a reality
ABL Accomplishments
(Knowledge Point #1, completed 18 Dec 06)

Low Power Systems Integration–Active Ground Test

- Beacon Illuminator Laser (BILL) and Track Illuminator Laser (TILL) delivered to Wichita
- Integrated BILL/TILL and support systems--several hundred firings
- Ground integration complete
- Integration with Range Simulator Enclosure (RSE) completed
- Predictive Avoidance certification complete
  - 1st open air lasing with TILL 15 Mar
- Multi-Beam Illuminator Bench refurbishment and functional tests complete
- Tests with Big Crow started--Handover of automated plume from Battle Management C4I (BMC4I) to Beam Control/Fire Control (BC/FC)
ABL Accomplishments
(Knowledge Point #2, completed 13 Jul 07)

First In-Flight Atmospheric Compensation with TILL tracking and BILL beacon

✓ Test Target aircraft (Big Crow) readied for testing
  ✓ Ground testing completed
  ✓ Flight testing at North Oscura Peak and Western Test Range completed
✓ Airborne Laser aircraft returned to Edwards AFB and currently undergoing flight testing
  ✓ Flight testing began on 7 Nov 2006
  ✓ Successfully completed first open air lase with TILL, BILL and SHEL
  ✓ Demonstrated ability to actively track a target
  ✓ Demonstrated Atmospheric Compensation using BILL beacon
  ✓ Demonstrated software capable to implement engagement scenarios

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ABL Accomplishments (Knowledge Point #2)

Painted missile against dark background

Cooperative Beacons

Plume Emulator

3 Cameras in Wing-tip

SHEL on target

TILL on target

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ABL Accomplishments
(Knowledge Point #3, completed 28 Sep 06)

Laser Optics Subsystem Test

- Mid and Aft Optical Benches (AOB/MOB) removed from Fuselage and installed in cleanroom
- AOB, MOB enclosures refurbished, cleared for flight
- Electronics, Beam Transfer Assembly, Pallet refurbished, cleared for flight
- Substantiate Optical Diagnostic Subsystem (ODS) HardWire Abort System (HWAS), Environmental, control system, and alignment Adequate to Support HPSI

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ABL Accomplishments
(Knowledge Point #4, completed 23 Aug 07)

Low Power Systems Integration–Active (LPSI-A) Flight Tests

- Completed LPSI-A flight test sufficient to enter into High Power Systems Integration (HPSI)
- Substantiated weapon system beam pointing
- Substantiated weapon system tracking performance
- Substantiated weapon system wavefront control performance
- Substantiated pre-engagement weapon system calibration
- Demonstrated software capability to transition to level 6 operation and implement engagement scenarios
- Demonstrated handover of vertically dynamic target from Battle Management C4I (BMC4I) to Beam Control/Fire Control (BCFC)

Verified ABL can acquire, track, and perform atmospheric compensation in mission-representative environment
ABL Knowledge Point #5

Aircraft & Support Systems Ready for High Power Systems Integration (HPSI) – Commitment date 31 Dec 07

- Laser installation drawings complete
- Chemical support systems and functional tests complete
- Chemical response plans for hangar operations in place
- Laser components refurbished and ready for installation

Verifies support for High Energy Laser installation and testing is completed prior to Chemical Operations
ABL Program Plan
“T-1” ABL Development Path

Low Power Testing (Aircraft, BCFC, BMC4l):
DEMOnstrate the beam control (pointing and tracking) system works

- Flight Turret
- Beam Control Benches
- Ground Test on Aircraft
- A/C Readiness for Flight
- Passive Flight Testing
- Active Systems Ground Testing
- Active Flight Testing

High Power Testing (Laser)
DEMOnstrate the high-energy laser works

- Optics and Diagnostics
- Build-Up Laser Hardware
- Laser First Light on the Ground
- Laser Long Run / Performance Test
- Laser Disassembly and Refurbishment
- Laser Installation on Aircraft

Weapon System Integration
DEMOnstrate the integrated weapon system works

- Weapon System Ground Test
- A/C Readiness for Flight
- Weapon System Flight Test
- Lethal Demonstration

As of Aug 07
August 2009

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ABL Summary

• ABL is a revolutionary warfighting system
  - Primary Mission - Provides critical boost-phase capability to the BMDS
  - Secondary Mission - Early launch warning, launch and impact point prediction, midcourse and terminal defense cueing
  - Pathfinder for future DE weapons

• Major accomplishments continue

• ABL program is well on the way to a lethal system demonstration—Shooting down a ballistic missile in flight