

NAVY AREA THEATER BALLISTIC MISSILE DEFENSE (NATBMD)



Navy ACAT ID Program

Total Number of Systems:	1500 missiles
Total Program Cost (TY\$):	\$6710M
Average Unit Cost (TY\$):	\$2.4M
Full-rate production:	3QFY03

Prime Contractor

Raytheon Missile Systems Company
Lockheed Martin Government Electronic
Systems (AEGIS cruiser)

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The Navy Area Theater Ballistic Missile Defense (NATBMD) system is intended to minimize the vulnerability of U.S. forces and protect population areas against the ballistic missile threat. The mission of NATBMD is to protect amphibious assault forces and coastal cities from short-to medium-range ballistic missiles, while maintaining current Standard Missile capabilities against manned aircraft and cruise missiles. The NATBMD system contributes to three of the four *Joint Vision 2010* operational concepts: *full-dimensional protection, precision engagement, and dominant maneuver*. Navy Area supports:

- *Full-dimensional protection* by defeating incoming short and medium range ballistic missiles to assist in controlling the airspace.

- ***Precision engagement*** by contributing to a Theater Ballistic Missile Defense (TBMD) family of systems that can locate TBMD targets, provide command and control, engage targets, and assess level of success.
- ***Dominant maneuver*** by the application of information, engagement, and mobility capabilities to accomplish a lower-tier TBMD defense.

The NATBMD consists of the following:

- Standard Missile-2 Block IVA, which incorporates an infrared seeker, an adjunct forward-looking fuze, and an improved autopilot to the proven Block IV airframe.
- Upgrades to the AEGIS weapon system to enable tracking and engagement of high-speed, low cross-section, theater ballistic missiles.
- Upgraded Link-16 message set that provides interoperability with Navy, other Service theater ballistic missiles defense systems, and Command and Control Systems.

Prior to Milestone III and fleet introduction, the Navy will deploy an interim theater ballistic missile defense capability called LINEBACKER. This system will serve as a User Operational Evaluation System and will possess a limited contingency capability. The LINEBACKER system consists of AEGIS Weapon System software installed on two cruisers and 35 missiles. Prior to Initial Operating Capability, LINEBACKER ships have either a theater ballistic missile defense capability *or* an anti-air warfare capability. The objective NATBMD system will be able to engage all threats simultaneously.

The Navy will use the two LINEBACKER ships for training and testing. They will be deployable in contingency operations. Twenty-five of the 35 LINEBACKER missiles will be used in at sea testing during DT/OT and OPEVAL. They will be replaced with LRIP missiles to maintain a contingency capability.

BACKGROUND INFORMATION

The NATBMD system entered Milestone II/Phase II in March 1997. Program Demonstration and Risk Reduction (PD&RR) activities consisted of the following:

- Extended Tracking and Control (ET&C) experiment. The Navy conducted the ET&C experiment in June 1995 off Kauai, HI, demonstrating the ability of the AEGIS system to track two separate ballistic missile targets from launch through impact. ET&C also demonstrated AEGIS's ability to receive and process cueing data from national sensors in a timely manner.
- Environmental Test Round-1A (ETR-1A). The Navy fired a STANDARD MISSILE round with a prototype infrared seeker on a ballistic trajectory (no target) at White Sands Missile Range (WSMR) on August 2, 1996. ETR-1A collected data to validate wind tunnel testing, demonstrated infrared dome cover removal and dome cooling system performance, and collected seeker infrared flight environmental vibration data.

- Developmental Test Round-1A (DTR-1A). The Navy fired a STANDARD MISSILE round with prototype infrared seeker at a Lance target at WSMR on January 27, 1997. DTR-1A demonstrated end-to-end missile performance and placed warhead fragments on the target. The missile successfully intercepted the Lance.

TEST & EVALUATION ACTIVITY

The NATBMD TEMP was approved in February 1997. The TEMP includes the complete test matrix for LINEBACKER (previously called the User Operational Evaluation System or UOES), DT and OT. EMD phase testing will examine performance against ballistic missiles, aircraft, cruise missiles, multiple targets, and countermeasures/debris environments. Supporting the Milestone III decision in FY03 are four major test phases:

- FY99-FY00: DT/OA consisting of eight missile firings at WSMR (without the AEGIS/SPY-1 Radar).
- FY01: LINEBACKER at sea tests consisting of three missile firings against Lance and HERA threat representative targets at the Pacific Missile Range Facility (PMRF), Kauai, HI.
- FY01-FY02: Iranian Missile Protection Act (IMPACT 98), a congressionally mandated test to determine the capability of lower-tier BMD systems against medium-range ballistic missile threats. The test will consist of a target tracking event for characterization and a single Block IVA firing against a long-range target at Kwajelain Atoll.
- FY02-03: 25 missile at sea DT and OT firings at PMRF.

The LINEBACKER system, deployed onboard USS LAKE ERIE (CG-70) and USS PORT ROYAL (CG-73), has demonstrated the ability to detect, track, cue other sensors and TBMD systems and simulate engagements against TBMD targets. LINEBACKER was evaluated extensively during the Navy Theater Wide Test Target Vehicle (TTV-1) firing in 1QFY99, Navy Fleet exercises in 3QFY99, and the Theater Missile Defense Critical Measurements Program event 3A (TCMP-3A) in 4QFY99. The primary Navy Area objective for TCMP 3A was to collect AEGIS LINEBACKER radar data to be used for engagement assessment studies in support of IMPACT 98.

The Navy and DOT&E are currently assessing the target types and scope of testing to be used in LINEBACKER at sea testing. Options include the Short-Range Air Launched Target (SRALT), the Lance, and the land launched HERA; all options have inherent limitations. The various test and target working groups are working to mitigate as many limitations as possible. These tests will collect data to support an assessment for the Theater Commanders of LINEBACKER's warfighting capability against recognized threat systems.

The NATBMD program has made significant progress in Y2K certification. The Navy has certified that the STANDARD MISSILE-2 Block IVA missile, the Vertical Launcher System, and AEGIS Baseline 5 Phase III computer program are Y2K compliant. The AEGIS LINEBACKER program is built off the Baseline 5, Phase III program. The Baseline 6, Phase III program has Y2K compliance in its contract and will be tested in developmental and operational testing after the year 2000.

The NATBMD LFT&E strategy for static warhead arena tests, dynamic warhead sled tests, direct hit sled tests, flight tests and other ancillary tests and simulation analyses was approved by DOT&E in August 1996. DOT&E approved the test plan for the STANDARD MISSILE-2 Block IVA warhead arena tests in November 1997. Phase I arena testing concluded in April 1998 with the following test and results:

- Arena Test-1 (AT-1). The Navy detonated a STANDARD MISSILE -2 Block IVA test warhead against a unitary high-explosive theater ballistic missile (TBM) payload at the Energetic Materials Research & Testing Center, New Mexico Tech., Socorro, NM, on November 19, 1997. The target was destroyed.
- Arena Test-5A (AT-5A). The Navy detonated a STANDARD MISSILE -2 Block IVA test warhead against a high-explosive TBM payload on December 18, 1997. A mission kill was demonstrated.
- Arena Test-4A (AT-4A). The Navy detonated a STANDARD MISSILE -2 Block IVA test warhead against various types of threat TBM warhead payloads (targets) on March 17, 1998. A mission kill was demonstrated.
- Arena Test-2 (AT-2). The Navy detonated a STANDARD MISSILE -2 Block IVA test warhead against a short-range nuclear target surrogate and eight targets that were surrogates of anti-ship missile airframes on April 16, 1998. The warhead achieved a mission kill of the TBM payload and mission kills/recognizable kills of the anti-ship cruise missile targets.

DOT&E approved the test plan for dynamic warhead sled testing in July 1998. Warhead sled testing was conducted at the Holloman AFB High-Speed Test Track in Alamogordo, NM from July 1998-January 1999. A dynamic warhead sled test report was published in June 1999. The sled tests series included:

- Warhead Sled Test-1A (WST-1A). On July 7, 1998, the Navy fired a STANDARD MISSILE -2 Block IVA test warhead, flying at approximately 5000 ft/sec, against four TBM-payload targets, (including unitary high-explosive, unitary chemical warhead and chemical submunition warheads). All targets were extensively defeated.
- Warhead Sled Test-1B (WST-1B). On August 6, 1998, the Navy fired a STANDARD MISSILE -2 Block IVA test warhead, flying at approximately 5000 ft/sec, against four targets that included one TBM bulk chemical replica (with chemical simulant) and three anti-ship missile targets. All targets were destroyed.
- Warhead Sled Test-4A (WST-4A). On September 16, 1998, the Navy fired a STANDARD MISSILE -2 Block IVA test warhead, flying at approximately 5000 ft/sec, against a unitary high explosive warhead. The target was defeated.
- Warhead Sled Test-5A (WST-5A). On December 3, 1998, the Navy fired a STANDARD MISSILE-2 Block IVA test warhead, flying at approximately 5000 ft/sec, against a nuclear warhead target. The target was defeated.

- Warhead Sled Test-6A (WST-6A). On December 8, 1998, the Navy fired a STANDARD MISSILE-2 Block IVA test warhead, flying at approximately 5000 ft/sec, against a nuclear warhead target. The target was damaged.
- Warhead Sled Test-7A (WST-7A). On January 3, 1999, the Navy fired a STANDARD MISSILE 2 Block IVA test warhead, flying at representative velocities, against a high-explosive submunition warhead target. The target was defeated.

Warhead sled testing will be followed by a direct hit sled testing series, fragment projector testing, and the second phases of warhead sled testing and arena testing in late 1999. Based on current lethality data and predictions for the first phase of body-on-body lethality tests, we believe that the second phase of sled tests may be unnecessary. Appropriate adjustments to the lethality test plan will be dependent upon the outcome of the phase one body-on-body lethality sled testing.

TEST & EVALUATION ASSESSMENT

The Navy, AEGIS, and STANDARD MISSILE contractors have a long history of evolutionary development of the AEGIS and the Standard Missile system. However, the Navy has yet to demonstrate an integrated system capable of acquiring, tracking, and intercepting theater ballistic missiles. The PD&RR phase demonstrated that the AEGIS SPY-1 radar could track a theater ballistic missile and, in a separate test, the STANDARD MISSILE demonstrated that it could engage and intercept a Lance target using guidance data from White Sands Missile Range tracking instrumentation.

The program has strongly embraced an event driven program. Utilizing lessons learned from the Welch Panel on Ballistic Missile Defense, two additional risk reduction flights have been added to the White Sands Missile Range flight test schedule. These additional tests will address the first two risks listed below. In addition, high fidelity hardware-in-the-loop simulations have been incorporated into the program for a more thorough understanding of the seeker performance capability. Engineering and Manufacturing Development technical risks include:

- Forward Looking Fuze (FLF): The Navy must verify slaving the RF tracker to the Infrared (IR) seeker, real-time processing data fusion, and burst time accuracy. FLF mitigating actions include a series of experiments including miss-distance measurements against artillery shell firings and an additional WSMR target flyby to evaluate IR/Seeker dome performance.
- IR dome Cooling System Redesign: During the PD&RR flight, the IR seeker experienced high noise that was probably caused by contamination of the seeker dome by the dome cooling system. Modifications have been made to the dome cooling system design and will be flight tested early during the WSMR DT/OA.
- AEGIS Weapon System Computer Program Complexity: The AEGIS system may have difficulties maintaining both ballistic missile and anti-air warfare missions given the high radar loading levels required for multiple, high-speed, low cross-section theater ballistic missile targets.
- Linear Search Track Processor Development: The test and integration schedule for the Linear Search Track Processor is aggressive. The Linear Search Track Processor is an

adjunct processor that enhances the resolution of the AEGIS radar at long range. This processor is required for resolving closely spaced objects such as separating reentry vehicles.

Ballistic Missile target verification, validation, and accreditation is a concern. Of the several target options proposed by the Ballistic Missile Defense Organization (BMDO) for Navy at sea testing, all have various limitations in terms of signatures, flight dynamics, trajectory, and/or navigational accuracy. Achieving fidelity to the threat across these regimes, as well as being able to precisely place the target into the defended area is critical to the evaluation and assessment of effectiveness. The T&E community is working with the Navy and the BMDO to resolve target issues.

CONCLUSIONS, RECOMMENDATIONS, LESSONS LEARNED

Notwithstanding the aforementioned risk areas, the program is technically solid. There are several remaining technical and test issues that could challenge the development schedule.

- The missile and radar development programs must both proceed without significant difficulties to maintain a tight schedule.
- The current target surrogate set could lead to significant test limitations in target signature and footprint.
- A failure at the IMPACT 98 test could require additional test resources prior to Milestone III to examine system capability against advanced threats.