

## Standard Missile-6 (SM-6)

### Executive Summary

- The Navy completed the Phase 2 modeling and simulation in support of IOT&E in July 2012. Phase 2 was an extensive modeling and simulation effort that examined Standard Missile-6 (SM-6) battlespace with the legacy Aegis Weapon System but not the Navy Integrated Fire Control-Counter Air (NIFC-CA) or Aegis Baseline 9 capability.
- The Navy will not demonstrate achievement of all of the SM-6 Capability Production Document performance requirements until the fielding of the NIFC-CA From the Sea capability in FY14/15. The Navy plans to demonstrate NIFC-CA From the Sea SM-6 capability during FOT&E as documented in the SM-6 Test and Evaluation Master Plan.
- In IOT&E Phase 1 flight tests, SM-6 demonstrated significant new capabilities against maneuvering targets, low-altitude targets, and targets with electronic countermeasures, successfully completing 7 of 12 intercept attempts. Within the constraints of the legacy Aegis combat system, SM-6 also demonstrated the longest downrange engagement range for a Standard Missile to date. IOT&E Phase 2 modeling and simulation confirmed SM-6 performance demonstrated in flight test.
- To demonstrate corrective actions to suitability anomalies discovered during IOT&E, the Navy conducted a series of high-temperature wind tunnel and flight tests. The results of that testing demonstrated the corrective actions were effective; however, the unexpected discovery of insulation inter-layer delamination on three of five wind tunnel test articles questions the finality of the Navy's corrective actions. Additional testing is ongoing.
- An unresolved performance anomaly from flight-testing affects SM-6 effectiveness. The Phase 2 modeling and simulation testing confirmed this. The Navy is working to develop corrective actions for this performance deficiency; however, testing of these actions has not been scheduled.

### System

- SM-6 is the latest evolution of the Standard Missile family of fleet air defense missiles that incorporates components from two existing Raytheon product lines: the SM-2 Block IV and the Advanced Medium-Range Air-to-Air Missile (AMRAAM).
- SM-6 is employed from cruisers and destroyers equipped with Aegis combat systems.



- The SM-6 seeker and terminal guidance electronics derive from technology developed in the AMRAAM program. SM-6 retains the legacy Standard Missile semi-active radar homing capability.
- SM-6 receives midcourse flight control from the Aegis combat system via ship's radar; terminal flight control is autonomous via the missile's active seeker or supported by the Aegis combat system via the ship's illuminator.

### Mission

- The Joint Force Commander/Strike Group Commander will use SM-6 for fleet air defense against fixed-/rotary-winged targets and anti-ship missiles operating at altitudes ranging from very high to sea-skimming.
- The Joint Force Commander will use SM-6 as part of the NIFC-CA concept to provide extended-range, over-the-horizon capability against at-sea and overland threats.

### Major Contractor

Raytheon Missile Systems – Tucson, Arizona

### Activity

- The Navy completed Phase 2 of the IOT&E in July 2012 in accordance with the DOT&E-approved operational test plan. Phase 2 was an extensive modeling and simulation effort that

examined legacy Aegis Weapon System SM-6 battlespace but not the NIFC-CA or Aegis Baseline 9 capability.

# NAVY PROGRAMS

- The Navy conducted high-temperature wind tunnel tests to verify correction of the uplink/downlink antenna reliability deficiency. The Navy plans to continue this verification with the conduct of follow-on flight testing in FY13. The Navy conducted one SM-6 flight test in support of the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS) integration testing. Data from this flight combined with the FY13 flight tests will provide some but not all of the data needed to verify the uplink/downlink antenna deficiencies have been corrected.

## Assessment

- The Navy will not demonstrate all of the SM-6 Capability Production Document performance requirements until the fielding of the NIFC-CA From the Sea capability in FY14/15.
  - In Phase 1 IOT&E, SM-6 demonstrated significant new capabilities against maneuvering targets, low-altitude targets, and targets with electronic countermeasures, successfully completing 7 of 12 intercept attempts. The current capabilities of the legacy Aegis SPY-1 B/D and associated combat system are unable to demonstrate the full operational capability of the SM-6. Within those constraints, SM-6 demonstrated the longest downrange engagement range for a Standard Missile to-date. Phase 2 modeling and simulation confirmed SM-6 performance demonstrated in flight test with the legacy Aegis combat system.
  - As an excursion during the Phase 2 modeling and simulation activity, the Navy conducted a number of trials using third party sensors similar to the NIFC-CA capability. The trials indicated that the SM-6 battlespace will be significantly expanded once these capabilities are fielded.
  - A performance deficiency discovered during IOT&E remains unresolved. The Phase 2 modeling and simulation trials confirmed this. The Navy is exploring corrective actions; however, implementation and testing of these corrective actions are not scheduled.
- The high-temperature wind tunnel tests of the uplink/downlink antenna reliability deficiency examined the antenna sealant material fixes and the insulation bonding manufacturing process improvements. The trials recorded no anomalies against these fixes; however, the unexpected discovery of insulation inter-layer delamination on three of five wind tunnel test articles questions the finality of the Navy's corrective actions. Coupled with the data collected on the JLENS integration flight test, the data are insufficient to assess corrective action efficacy on the overall uplink/downlink antenna reliability deficiency. DOT&E will continue to collect data on upcoming SM-6 FOT&E flight tests and will re-assess effectiveness and suitability when sufficient data are available.
  - Based upon combined data from the IOT&E and developmental/operational flight tests, the SM-6 does not meet the flight reliability criteria established by USD(AT&L) for full-rate production. DOT&E will continue to collect reliability data during upcoming SM-6 FOT&E firings and will re-assess suitability at the conclusion of these tests.
  - First seen in developmental testing, the Mk 54 Safe-Arm Device anomaly carried forward into IOT&E with additional occurrences. The Phase 2 modeling and simulation trials confirmed that the sensitivity of missile lethality is dependant on the fuze mode, target, and engagement conditions.

## Recommendations

- Status of Previous Recommendations. The Navy is addressing the previous recommendations.
- FY12 Recommendation.
  1. Until reliability deficiencies are resolved, the Navy should consider issuing tactics that employ multiple missiles for certain targets.