

STANDARD Missile 6 (SM-6)

Executive Summary

- The STANDARD Missile 6 (SM-6) program is in low-rate initial production.
- The SM-6 OT&E commenced in May 2010, but was suspended to investigate two failures. During five attempted missions, initial analysis indicates one mission was successful, one was not completed due to a target failure, one was a missile software-to-ship integration failure, and two were missile fuze software failures. Two postponed missions, as well as re-attempts for the failed missions, remain to be executed prior to IOT&E.
- The Navy completed failure analysis and determined the corrective action needed to address the failures. Re-testing to verify the corrective actions is planned for January 2011.
- The failures and resulting delays have exhausted the margins that existed in the SM-6 schedule.

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. SM-6 retains the legacy STANDARD Missile semi-active radar homing capability.
- SM-6 receives midcourse flight control from the Aegis combat system; terminal flight control is autonomous via the missile's active seeker or supported by the ship's radar.



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 Naval Integrated Fire Control – Counter Air (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

- In FY10, the Navy completed land-based developmental testing at White Sands Missile Range, New Mexico. The final mission, Guidance Test Vehicle-3 was an SM-6 engaging a BQM-74E target with electronic countermeasures. Guidance Test Vehicle-1 and Guidance Test Vehicle-2 were successfully flown in FY08; the Advanced Area Defense Interceptor mission was successfully flown in FY09. Guidance Test Vehicle-3 was successfully flown on January 11, 2010, meeting its test objectives after target countermeasure equipment failures prevented the first firing attempt on December 2, 2009.
- DOT&E approved the developmental/operational test plan in April 2010.
- In May 2010, the Navy began at-sea Developmental Testing/Operational Testing (DT/OT) and live fire testing at the Pacific

Missile Range Facility, Kauai, Hawaii. Subsequent failures during DT/OT led to suspension of the test series. During five attempted missions, one mission was successful, one was not completed due to a target failure, one was a missile software-to-ship integration failure, and two were missile fuze failures. Two missions remain to be executed. Details of each test in the order they were executed is as follows:

- DT-5/OT-3. SM-6 successfully engaged a QUH-1 helicopter target at low altitude.
- DT-3. On the first attempt for this mission, the target presentation, a BQM-74E target with electronic countermeasures, was unsuccessful. This target failure was unrelated to the December 2009 target failure. This mission is being rescheduled.

NAVY PROGRAMS

- Alternate-1. During the mission, the SM-6 failed to guide to the BQM-74E target.
 - DT-3 (second attempt). SM-6 engaged and directly impacted an electronic countermeasures equipped BQM-74E target; however, the missile fuze failed to function properly.
 - DT-1/OT-1. SM-6 engaged a supersonic, high altitude AQM-37 target. Although the SM-6 successfully guided to the target, the missile fuze again failed to function properly. Remaining flight testing was suspended following this mission. As an additional test objective, the DT-1/OT-1 mission successfully demonstrated the compatibility of SM-6 and SM-2 (three SM-2s and one SM-6 fired from two ships) in a mass raid environment.
 - Upon suspension of flight testing, two failure review boards were formed to determine the cause of the failures and to identify corrective actions. These boards have completed their investigations. The Alternate-1 mission failure was attributed to errors in missile software-to-ship integration, which have been corrected via changes to SM-6 software. The DT-1/OT-1 and DT-3 missile fuze failures were caused by a fuze software design error that has been corrected in a subsequent fuze software build. This fuze software build will be installed in the remaining SM-6 flight test rounds and tested in the January 2011 DT/OT test period and the July 2011 IOT&E.
 - The two postponed developmental/operational test missions and the re-fly of the failed missions are planned for January 2011.
 - IOT&E is planned for July 2011 at the Pacific Missile Range Facility, Kauai, Hawaii.
- 4QFY11 will not be met if further deficiencies are uncovered during the remaining test program. Additional discoveries are possible given the number of significant areas still requiring further testing and evaluation (i.e. electronic countermeasures; long-range engagements; warhead lethality; and testing against a threat-representative set of anti-ship cruise missiles, unmanned air vehicles, and full-scale aircraft).
- The lack of a reliability growth program makes rigorous estimation of missile reliability difficult. SM-6 has functioned successfully in five of eight completed intercept attempts to date. The developmental/operational test failures were previously unknown failure modes. SM-6 reliability will be assessed upon completion of IOT&E.
 - The Navy does not have a clear test strategy for SM-6 in the NIFC-CA role. Testing of the SM-6/NIFC-CA capability will not occur until after the SM-6 full-rate production decision. Also required for the NIFC-CA capability is the Aegis Advanced Capability Build-12 and E-2D program; neither will be delivered until after 2012.
 - Testing of SM-6 against one specific, fielded anti-ship cruise missile threat will not occur until after the full-rate production decision because the Navy will not complete development of the threat surrogate in time to support the SM-6 IOT&E.

Recommendations

- Status of FY09 Recommendations. The Navy successfully addressed the FY09 recommendations.
- FY10 Recommendations.
 1. The Navy should develop a test strategy for the SM-6 in the NIFC-CA role to determine funding and resource needs.
 2. To address the existing gap in the fleet's ability to defend itself against fielded anti-ship cruise missiles, the Navy should accelerate testing against the full anti-ship cruise missile threat set.

Assessment

- The suspension of developmental/operational testing exhausted the schedule margins that existed in the SM-6 schedule. The planned full-rate production decision in