

## Standard Missile-6 (SM-6)

### Executive Summary

- Standard Missile-6 (SM-6) Block I (BLK I) has attained Initial Operational Capability; Full Operational Capability is expected in FY18.
- In FY17, the Navy conducted FOT&E to demonstrate a correction to the classified performance deficiency initially reported in DOT&E's classified "Standard Missile-6 (SM-6) Beyond Low-Rate Initial Production Report" issued in May 2015. These Verification of Corrected Deficiency (VCD) events demonstrated that the intended correction mitigated the effects of the deficiency but did not eliminate it. The testing identified two concerns that contributed to the deficiency not being completely eliminated:
  - A classified concern with the missile Target Detection Device
  - A classified concern with the missile active seeker
- In FY17, as part of FOT&E, the Navy conducted SM-6 BLK I modeling and simulation (M&S) to demonstrate interoperability with the Aegis Baseline 9 combat system.
- The Navy commenced operational testing of SM-6 BLK IA, a pre-planned product improvement of the SM-6 BLK I missile, in September 2017. The SM-6 BLK IA testing consists of seven SM-6 BLK IA firings against subsonic and supersonic aerial targets and M&S runs for the record. The Navy intends to complete operational testing in FY18.
- The Navy conducted two SM-6 Dual 1 salvo firings against Ballistic Missile Defense (BMD) targets.

### System

- SM-6 BLK I and BLK IA are the latest evolution of the Standard Missile family of fleet air defense missiles.
- The Navy employs the SM-6 from Aegis-equipped cruisers and destroyers (i.e., *Ticonderoga*-class cruisers and *Arleigh Burke*-class destroyers).
- The SM-6 seeker and terminal guidance electronics derive from technology developed in the Advanced Medium-Range Air-to-Air Missile program.
- SM-6 retains the legacy Standard Missile semi-active radar homing capability.
- SM-6 receives midcourse flight control from the Aegis Weapon System (AWS) via ship's radar; terminal flight control is autonomous via the missile's active seeker or supported by the AWS via the ship's illuminator.
- The Navy intends the SM-6 BLK IA upgrade to provide improved performance against advanced threats.
- SM-6 Dual I capability is being added to provide Sea-Based Terminal BMD capability against short-range ballistic missiles.



- The Navy upgraded the SM-6 to add an anti-surface target capability but it has not yet operationally tested the capability.

### Mission

- The Joint Force Commander/Strike Group Commander will employ naval units equipped with the SM-6:
  - For air defense against fixed-/rotary-winged targets and anti-ship missiles operating at altitudes ranging from very high to sea-skimming
  - As part of the Navy Integrated Fire Control – Counter Air From the Sea (NIFC-CA FTS) operational concept to provide extended range over-the-horizon capability against at-sea and overland threats
  - As part of the NIFC – Collateral (NCC) operational concept to provide extended-range capability against surface targets
- The Joint Force Commander/Strike Group Commander will use SM-6 Dual I to provide Sea-Based Terminal capability against short- and medium-range ballistic missiles in their terminal phase of flight, anti-ship cruise missiles, and all types of aircraft.

### Major Contractor

Raytheon Missile Systems – Tucson, Arizona

# FY17 NAVY PROGRAMS

## Activity

- In FY17, the Navy conducted multiple test phases for SM-6. The Navy conducted the FOT&E and BMD tests in accordance with DOT&E-approved test plans.
- SM-6 BLK I has attained Initial Operational Capability, and Full Operational Capability is expected in FY18.
- SM-6 BLK I FOT&E
  - Two SM-6 BLK I FOT&E VCD events in April 2017 successfully intercepted a target employing countermeasures.
  - One SM-6 BLK I FOT&E VCD event in April 2017 failed to intercept a target employing countermeasures.
  - At the conclusion of SM-6 BLK I FOT&E live flight testing, DOT&E satisfactorily resolved the Launch Availability Key Performance Parameter.
- SM-6 BLK I M&S FOT&E
  - The Navy commenced SM-6 BLK I M&S FOT&E in September 2017. The Navy intends to demonstrate SM-6 BLK I compatibility with the Aegis Baseline 9 combat system during the FOT&E.
  - The Navy intends to complete testing in early FY18.
- SM-6 BLK I Developmental Testing
  - One SM-6 BLK I Developmental Test Software Alignment event in April 2017 demonstrated that the missile successfully acquired, tracked, and intercepted a high altitude, high closing velocity target.
  - One SM-6 BLK I Developmental Test Software Alignment event in April 2017 intended to demonstrate the missile's ability to intercept a high altitude, high closing velocity target. The test failed because the missile failed to launch.
- NIFC-CA FTS SM-6 Tests
  - The Navy attempted to execute SM-6 BLK I NIFC-CA FTS event AS-04 in March 2017, but a target failure precluded the event. AS-04 is rescheduled for FY18.
  - The Navy successfully executed SM-6 BLK I NIFC-CA FTS event LFT-05 in May 2017. The SM-6 BLK I successfully intercepted a target. The Navy's first attempt of LFT-05, in December 2016, was unsuccessful.
- SM-6 BLK I BMD Testing
  - During FTM-27 Event 1, in December 2016, an Aegis Baseline 9.C1 destroyer (which hosts the Aegis BMD 5.0 Capability Upgrade) engaged a complex medium-range ballistic missile target with a salvo of two SM-6 Dual I missiles. FTM-27 Event 1 was the first demonstration of Aegis BMD Sea-Based Terminal capability against complex ballistic missile targets.
  - During FTM-27 Event 2, in August 2017, an Aegis Baseline 9.C1 destroyer engaged a complex medium-range ballistic missile target with a salvo of two SM-6 Dual I missiles. The test, which was a follow-on from FTM-27 Event 1, further demonstrated aspects of the Baseline 9.C1 Sea-Based Terminal engagement capability.
- SM-6 BLK IA Developmental Testing
  - The Navy conducted developmental testing of pre-planned product improvements to the SM-6 BLK I missile (i.e., SM-6 BLK IA). The Navy successfully executed SM-6 BLK IA Guided Test Vehicle (GTV) event 3b (GTV-3b) in June 2017 after two prior failures (GTV-3 in August 2016 and GTV-3a in November 2016).
    - The Navy conducted a failure review board of the failed GTV-3a event before proceeding with the GTV-3b event.
- SM-6 BLK IA Operational Testing
  - The Navy commenced operational testing of the SM-6 BLK IA and successfully conducted two flight tests in September 2017.
  - Operational testing continues in FY18 to complete planned live flight-testing and M&S runs for the record.
- DOT&E will publish an FOT&E report in FY18 that addresses all SM-6 BLK I live fire tests and M&S tests. This report will focus on SM-6 BLK I performance when employed from Aegis Baseline 9 ships.
- DOT&E will publish an SM-6 BLK IA report once testing is complete in FY18.

## Assessment

- As reported in DOT&E's memorandum, "Post Initial Operational Test and Evaluation Observations and Assessment of Standard Missile-6 Block I Suitability," dated December 2016, DOT&E considers the previously reported uplink/downlink antenna shroud reliability deficiency resolved.
- The Navy developed specific software improvements to SM-6 BLK I to mitigate the classified performance deficiency discovered during IOT&E and in DOT&E's classified IOT&E report. VCD FOT&E events conducted by the Navy demonstrated that the software improvements work as intended and lessen the severity of the deficiency, but the improvements did not resolve the deficiency in all instances. The testing identified two concerns that contributed to the deficiency not being fully resolved.
  - Testing revealed a classified concern with the missile's Target Detection Device.
  - Testing revealed a classified concern with the missile's active seeker.
- NIFC-CA FTS event LFT-5 further demonstrates the NIFC-CA FTS capability, but – as with previous NIFC-CA FTS tests – the Navy did not conduct the test under operationally realistic conditions. Moreover, the Navy's test scenarios are not sufficiently challenging to demonstrate the NIFC-CA FTS requirements defined in the Navy's September 2012 NIFC-CA FTS Testing Capability Definition Letter. Nevertheless, the Navy has deployed the NIFC-CA FTS capability as a tactical option in fleet air defense. DOT&E reported on NIFC-CA FTS in the classified "Aegis Weapon System Baseline 9A Early Fielding Report" issued in July 2015, and will continue to report on NIFC-CA FTS in future Aegis Weapon System assessments.
- During SM-6 BLK IA event GTV-3a, the SM-6 BLK IA experienced an inflight failure that prevented the target from intercepting its intended target. The failure delayed the start of SM-6 BLK IA operational testing.

# FY17 NAVY PROGRAMS

- The Launch Availability Key Performance Parameter was unresolved in SM-6 BLK I IOT&E. During SM-6 BLK I FOT&E, the Navy fired, without failure, seven missiles that met the required storage requirements. While these results were not sufficient to state that BLK I meets its required Launch Availability with high statistical confidence, the results were sufficient to indicate no significant problem exists with storage reliability.

## Recommendations

- Status of Previous Recommendations.
  - The Navy is addressing the previous recommendations from FY14 to 1) complete corrective actions of the classified performance deficiency discovered during IOT&E and 2) develop a flight test program to test those corrective actions.
- FY17 Recommendation.
  1. The Navy should continue investigating the classified performance deficiency discovered during IOT&E, perform corrective actions, and verify corrective actions with flight tests. This includes correcting the two new problems encountered during FY17 SM-6 BLK I VCD tests.
- The Navy has not addressed the FY15 recommendation to provide DOT&E an operational test concept and operational test plan for NIFC-CA FTS Increment 2; DOT&E rescinded this recommendation as the Navy integrated NIFC-CA FTS as a tactical option in fleet air defense. DOT&E removed the NIFC-CA FTS program from T&E oversight and it will be tested as a normal tactic in future Aegis/SM-6 testing.

# FY17 NAVY PROGRAMS