

# Infrared Search and Track (IRST)

## Executive Summary

- The Assistant Secretary of the Navy (Research, Development, and Acquisition) issued a Milestone C Acquisition Decision Memorandum on March 24, 2015, approving entrance into the Product and Deployment phase and Lot 1 of Block I low-rate initial production (LRIP). The memorandum directed the program to complete a second operational assessment (OA 2) and to develop mitigation plans to address the significant risks to effectiveness (identified in OA 1, conducted in FY14) prior to approving Lot 2 LRIP.
- Developmental testing progressed during FY15, expanding the flight envelope in which the sensor can be employed through aeromechanical testing, characterizing sensor performance (including testing algorithm enhancement intended to address problems identified in OA 1), and testing integration with the F/A-18 weapons system.
- The problems identified in OA 1, discussed in detail in DOT&E's December 2014 classified OA 1 report, identified areas of concern. Mission-level operational testing is needed to demonstrate that the Infrared Search and Tracking (IRST) system will provide the F/A-18 an effective combat capability. VX-9 Conducted OA 2 in November 2015. OA 2 will help determine whether improvement seen in developmental testing will translate to the operational environment. OA 2 will help inform the decision to enter IOT&E and will support the Lot 2 LRIP decision.
- The Navy intends for the readiness review for IOT&E to occur in March 2016.

## System

- The IRST system consists of a passive long-wave infrared receiver (IRR), a processor, inertial measurement unit (IMU), and environmental control unit (ECU). The IRR, processor, IMU, and ECU are housed within the Sensor Assembly Structure (SAS). The SAS attaches to the front of the Fuel Tank Assembly that is mounted to the aircraft on the BRU-32 bomb rack. The Navy designed the IRST to be flown on the F/A-18E/F and it will be built into a modified centerline fuel tank.



- The Navy is developing and fielding the system in two blocks: Block I will reach Initial Operational Capability in FY18 and use components from the F-15K/SG IRR that derive from the F-14 IRST system. Block II is planned to begin after the Block I Full-Rate Production Decision Review and will include an improved IRR and updated processors.
- The Navy intends to produce a total of 170 IRST systems. There will be 60 Block I systems, which will eventually be updated to the Block II configuration; the Navy will build an additional 110 Block II systems.

## Mission

Commanders will use IRST in a radar-denied environment to locate and destroy enemy forces. The IRST system is intended to allow the F/A-18E/F to operate and survive against existing and emerging air threats by enhancing situational awareness and providing the ability to acquire and engage targets beyond visual range.

## Major Contractors

- The Boeing Company – St Louis, Missouri
- Lockheed Martin – Orlando, Florida

## Activity

- The Assistant Secretary of the Navy (Research, Development, and Acquisition) held a Milestone C Decision Review on December 2, 2014, and issued a Milestone C Acquisition Decision Memorandum on March 24, 2015, approving entrance into the Product and Deployment phase. The memorandum approved Lot 1 (6 systems) of Block I LRIP, but directed the program to complete a second OA (OA 2) and develop mitigation plans to address the significant risks to

effectiveness identified in OA 1 (conducted in FY14) prior to a decision to award Lot 2 (12 systems) of LRIP.

- The program entered Integrated Test phase IT-C1 in December 2014 following the December Milestone C review. The objectives of this test phase are to clear the flight envelope in which the system can be employed, characterize sensor performance (including testing algorithm enhancements intended to address problems identified in OA 1), and test

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integration of IRST with the F/A-18 weapons system. The Naval Air Systems Command (NAVAIR) IT-C1 report, in conjunction with the Commander, Operational Test and Evaluation Force OA 2 report, will support the program's decision review on whether to enter IOT&E.

- Based on the results of aeromechanical testing conducted by VX-23 at Patuxent River, Maryland, NAVAIR issued a flight clearance in May 2015 that allowed flight test with the full envelope of flight conditions when the fuel tank is empty. NAVAIR issued another flight clearance in July permitting flight with fuel in the tank, but under restricted conditions. Carrier qualification testing is expected to be completed in December 2015, which will be followed by further aeromechanical testing required to clear the full flight envelope, including fuel carriage.
- VX-31 at China Lake, California, conducted performance flight testing, providing data needed to verify specification compliance and to certify the system's readiness to transition to IOT&E. VX-31 has tested eight new releases of IRST software since OA 1. These releases include algorithm improvements intended to correct problems seen in OA 1. Expansion of the available flight envelope has permitted testing in more dynamic conditions and allowed participation by VX-31 in a large force exercise at Nellis AFB, Nevada, in June 2015.
- VX-31 conducted integration of the IRST system with the weapon system, including the ability to fuse IRST sensor information with other sensors (such as radar) into Multi-Sensor Integration (MSI) tracks on which weapons can be employed. A progression of simulated AIM-120 shots using captive carry missiles have been performed with more captive carry missions expected prior to a live AIM-120 shot against a QF-4 drone in 3QFY16 or 4QFY16.
- VX-9 conducted OA 2 in November 2015. The OA will include four simulated combat trials that will provide data to evaluate the ability of the system to support detection, tracking, and missile employment in a dynamic, operationally representative environment. OA 2 should help inform the decision to enter IOT&E as well as the Lot 2 LRIP decision.
- In July 2015, the Navy requested USD(AT&L) designate IRST as an Acquisition Category I (ACAT I) program (from ACAT II) because the program has exceeded the research and development dollar threshold due to the research development test and evaluation funding provided in the FY16 presidential budget to Congress for Block II development. The Navy also requested delegation of decision authority to the Navy (i.e., designation as an ACAT IC). Designation to ACAT IC is expected in November 2015.
- A Lot 2 LRIP decision is expected in December 2015 and the IOT&E readiness review is currently planned for March 2016.

### Assessment

- The system tested in OA 1 could not detect and track targets well enough to support weapons employment in an environment that reflects realistic fighter employment and tactics.

- The Key Performance Parameter (KPP) and the derived contract specification for detection and tracking describe only a narrow subset of the operational environments where the Navy will employ IRST. Meeting the KPP (with a narrow reading of the KPP requirement) does not ensure a useful combat capability.
- The program has made an effort to develop a more robust tracking capability to provide capability outside the KPP conditions. This effort includes the introduction of a new tracking algorithm and the release and the testing of eight new IRST software versions since OA 1.
- While improvement has been seen in developmental testing, the nature of the problems with detection and tracking identified in OA 1 are such that mission-level operational testing is needed to demonstrate that these problems will not prevent IRST from providing the F/A-18 an effective combat capability. Until satisfactory performance has been demonstrated in an operationally-representative environment that includes jamming and dynamic maneuvering, the risk of an unsuccessful IOT&E is high.
- The Navy's decision to add a second OA that includes realistic mission scenarios prior to IOT&E will significantly reduce the risk of an unsuccessful IOT&E by providing test data in a dynamic maneuvering and jamming environment prior to the decision to enter IOT&E.
- The program has decided to use a mechanical boresight procedure instead of using the line-of-sight estimation algorithm known as servo-transfer alignment as originally planned. The Navy is assessing the impact on IRST logistics. The system's logistics will be affected by how long the boresight will hold and the support equipment that will be required. The contractor has reported that ground vibration testing shows the boresight should hold longer than three times the mean time between repairs. The program is tracking angular accuracy during flight test to look for any degradation. The maintenance task analysis for the intermediate-level (I-level) (aboard ship) and depot-level (D-level) to determine the maintenance tasks for each level is currently in process. However, based on the types of maintenance that will likely require realignment, I-level (aboard ship) and depot-level support equipment for alignment will may be needed for the I and/or D-levels.

### Recommendations

- Status of Previous Recommendations. The Navy should continue to address the two FY14 recommendations:
  1. Explicitly state detection and tracking requirements for the range of operational conditions in which the Navy expects to employ the system. N98, which has responsibility for naval aviation warfighting requirements, is currently authoring a requirements clarification memorandum regarding the KPP scenario.
  2. Improve detection and tracking performance prior to entry into IOT&E. Improvements will be tested in OA 2 in November 2015.
- FY15 Recommendations. None.