

Infrared Search and Track (IRST)

Executive Summary

- On November 5, 2015, the USD(AT&L) designated the Infrared Search and Track (IRST) program as an Acquisition Category (ACAT) I program and delegated milestone decision authority to the Navy.
- The Commander, Operational Test and Evaluation Force (COTF) conducted Operational Assessment 2 (OA 2) in November 2015. OA 2 included simulated air combat against a challenging, operationally realistic threat surrogate. The system continues to have difficulty with detection and tracking in an environment that reflects realistic fighter employment and tactics. DOT&E reported OA 2 results in a January 27, 2016, classified memorandum.
- Assistant Secretary of the Navy (ASN) for Research, Development, and Acquisition (RDA) held an IRST program review on January 27, 2016, and in a September 8, 2016, Acquisition Decision Memorandum (ADM), ASN (RDA) approved a restructured program that foregoes full-rate production of Block I sensors and proceeds directly to development of the Block II system. The Block I system will not be fielded and IOT&E did not begin in 2016 as planned.
- The Navy plans to hold the Block II Preliminary Design Review in May 2017 and begin IOT&E in 2020.

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 developed Block I using components from the F-15K/SG IRR, which is based on the F-14 IRST design. Block I will be used to support testing and tactics



development. Block II is being acquired through an Engineering Change Proposal contract as an engineering change to Block I. Block II will include improvements to the IRR and updated processors.

- The Navy intends to produce a total of 170 IRST systems. The 18 Block I low-rate initial production (LRIP) systems will be retrofitted to the Block II configuration and an additional 152 Block II systems will be acquired.

Mission

Commanders will use F/A-18E/F aircraft equipped with the 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 USD(AT&L) designated IRST as an ACAT IC program on November 5, 2015.
- COTF conducted OA 2 in November 2015. VX-9, with support from VX-31, conducted realistic engagements over the China Lake Range Complex and Point Mugu Sea Range. DOT&E reported results in a January 27, 2016, classified memorandum.
- ASN (RDA) held an IRST program review on January 27, 2016, to consider LRIP-2 and receive a program status update.
- Following the ASN (RDA) review, the Navy developed a new program plan, which foregoes full-rate production of Block I

after the acquisition of the 18 LRIP units and proceeds directly to the development of the Block II system, which is expected to enter IOT&E in 2020. Under the new plan, the Block I LRIP units will not be fielded, but will be used for testing and tactics development until they can be retrofitted to the Block II configuration.

- In a September 8, 2016, ADM, ASN (RDA) approved Block I LRIP-2 (12 units) and entry into the Block II development phase.

FY16 NAVY PROGRAMS

- Based on the results of aeromechanical testing, Naval Air Systems Command (NAVAIR) issued a flight clearance in July that allowed flight test with the full envelope of flight conditions when the fuel tank is empty and excludes a small set of conditions when the tank has over 500 pounds of fuel (and an even narrower set of conditions with more than 1,500 pounds of fuel). The new flight clearance also clears the fuel tank for shore-based catapults and arrestments (with less than 230 pounds of fuel). Since the July flight clearance was issued, Boeing has released their carrier suitability report, which recommends IRST for unrestricted carrier operations. The Program Office provided the results to NAVAIR engineering, which are reviewing them, and will release an updated flight clearance if appropriate.
- The program has increased the scope of Integrated Test Phase IT-C1 to include testing IRST on aircraft software System Configuration Set (SCS) H14 and will extend the test phase through summer 2017. The objectives of this test phase are to characterize sensor performance (including testing algorithm enhancements intended to improve performance) and test integration of IRST with the F/A-18 weapons system. Testing also includes a progression of simulated AIM-120 shots on IRST tracks using captive carry missiles. The culminating live weapons shots planned for Block I were canceled.

Assessment

- 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. Much of developmental testing, however, was focused on verifying this contract specification.
- OA 2 included realistic operational conditions. The system tested in OA 2, while much improved from OA 1, could not reliably detect and track targets well enough to support weapons employment in an environment that reflects realistic fighter employment and tactics.
- Demonstrated reliability is below what was expected at this point in the flight test program. As of the time of DOT&E's OA 2 report, the cumulative Mean Time Between Operational Mission Failure (MTBOMF) was 4.1 hours; the reliability after incorporating known fixes was 19.5 hours. The MTBOMF requirement is 40 hours and the system was expected to have a projected reliability of 38 hours when entering IOT&E.
- Most of the failures are built-in test (BIT) false alarms that require a system reset and are therefore scored as an OMF.
- The Block II system has significant commonality with the Block I system. Block I will continue to fly between now and the start of Block II IOT&E. If the program keeps in place its reliability growth program, identifying and correcting failure modes, the reliability of components that Block II has in common with Block I should improve.
- The Block I system reliability growth plan was overoptimistic in its assessment of initial reliability. A new reliability growth plan is needed for Block II and care should be taken to

- determine a realistic initial reliability and growth rate. While reliability has grown with Block I and projected reliability at the time of OA 2 was 19.5 hours, new hardware and software might initially reduce Block II reliability. Achieving the desired reliability could require a design effort focused on the reliability of the BIT system in order to meet the 40-hour threshold requirement. The program should also consider reviewing the rationale for the current reliability threshold.
- The logistical impact of requiring a mechanical boresight procedure for Block II should be considered for the Block II sensor design.
- The new flight clearance is a significant improvement over the flight clearance used in OA 2. Given the rate at which fuel is consumed from the centerline fuel tank, these restrictions are effective for only a short period at the beginning of the mission profile and should not have an operational impact.
- Many of the Block I system's difficulties with detection and tracking seen in OA 1 and OA 2 did not require flight testing to uncover them, but could have been discovered earlier via analysis and modeling and simulation. The Navy expects that the Block II configuration (which includes sensor and aircraft hardware and software), will provide improved capability. This assumption should be tested as early as possible, prior to major decisions, via analysis and modeling and simulation if flight test data are not available. The program has a wealth of data and lessons learned that could be used to support such an effort.

Recommendations

- Status of Previous Recommendations. The Navy should continue to address the two FY15 recommendations:
 1. Explicitly state detection and tracking requirements for the range of operational conditions in which the Navy expects to employ the system. The requirements document has not been updated. Testing, however, has included operationally realistic conditions and COTF and DOT&E have evaluated the system against the stated mission need.
 2. Improve detection and tracking performance prior to entry into IOT&E. The Navy has elected not to proceed beyond LRIP with Block I and will wait until the Block II sensor and SCS H16 aircraft software are available prior to entering IOT&E.
- FY16 Recommendations. The Navy should:
 1. Use modeling and simulation and analysis (including analysis of Block I data) to test the detection and tracking capability of the Block II system as early as possible, well prior to flight test. Document this strategy in the updated Test and Evaluation Master Plan.
 2. Future developmental testing should include more testing beyond specification compliance to ensure readiness to conduct operationally representative missions in operational testing and in combat.
 3. Correct issues seen in the Block I in-flight transfer alignment system or include the necessary logistical support for mechanical boresight in the Block II design.