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RCS: DD-A&T(Q&A)823-510



## **Infrared Search and Track (IRST)**

As of FY 2021 President's Budget

Defense Acquisition Management  
Information Retrieval  
(DAMIR)

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## Table of Contents

Common Acronyms and Abbreviations for MDAP Programs .....	3
Program Information .....	5
Responsible Office .....	5
References .....	6
Mission and Description .....	7
Executive Summary .....	7
Threshold Breaches .....	10
Schedule .....	11
Performance .....	12
Track to Budget .....	13
Cost and Funding .....	13
Charts .....	21
Risks .....	23
Low Rate Initial Production .....	26
Foreign Military Sales .....	27
Nuclear Costs .....	27
Unit Cost .....	28
Cost Variance .....	31
Contracts .....	34
Deliveries and Expenditures .....	39
Operating and Support Cost .....	40

## Common Acronyms and Abbreviations for MDAP Programs

Acq O&M - Acquisition-Related Operations and Maintenance  
ACAT - Acquisition Category  
ADM - Acquisition Decision Memorandum  
APB - Acquisition Program Baseline  
APPN - Appropriation  
APUC - Average Procurement Unit Cost  
\$B - Billions of Dollars  
BA - Budget Authority/Budget Activity  
Blk - Block  
BY - Base Year  
CAPE - Cost Assessment and Program Evaluation  
CARD - Cost Analysis Requirements Description  
CDD - Capability Development Document  
CLIN - Contract Line Item Number  
CPD - Capability Production Document  
CY - Calendar Year  
DAB - Defense Acquisition Board  
DAE - Defense Acquisition Executive  
DAMIR - Defense Acquisition Management Information Retrieval  
DoD - Department of Defense  
DSN - Defense Switched Network  
EMD - Engineering and Manufacturing Development  
EVM - Earned Value Management  
FOC - Full Operational Capability  
FMS - Foreign Military Sales  
FRP - Full Rate Production  
FY - Fiscal Year  
FYDP - Future Years Defense Program  
ICE - Independent Cost Estimate  
IOC - Initial Operational Capability  
Inc - Increment  
JROC - Joint Requirements Oversight Council  
\$K - Thousands of Dollars  
KPP - Key Performance Parameter  
LRIP - Low Rate Initial Production  
\$M - Millions of Dollars  
MDA - Milestone Decision Authority  
MDAP - Major Defense Acquisition Program  
MILCON - Military Construction  
N/A - Not Applicable  
O&M - Operations and Maintenance  
ORD - Operational Requirements Document  
OSD - Office of the Secretary of Defense  
O&S - Operating and Support  
PAUC - Program Acquisition Unit Cost

PB - President's Budget  
PE - Program Element  
PEO - Program Executive Officer  
PM - Program Manager  
POE - Program Office Estimate  
RDT&E - Research, Development, Test, and Evaluation  
SAR - Selected Acquisition Report  
SCP - Service Cost Position  
TBD - To Be Determined  
TY - Then Year  
UCR - Unit Cost Reporting  
U.S. - United States  
USD(AT&L) - Under Secretary of Defense (Acquisition, Technology and Logistics)  
USD(A&S) - Under Secretary of Defense (Acquisition and Sustainment)

## Program Information

**Program Name**

Infrared Search and Track (IRST)

**DoD Component**

Navy

## Responsible Office

CAPT Jason Denney  
Program Executive Officer (PMA-265)  
Bldg 2272, Suite 445, NAVAIRSYSCOMHQ  
47123 Buse Road, Unit IPT  
Patuxent River, MD 20670-1547

**Phone:** 301-757-7669  
**Fax:** 301-757-7520  
**DSN Phone:** 757-7669  
**DSN Fax:** 757-7520  
**Date Assigned:** July 11, 2019

[jason.m.denney@navy.mil](mailto:jason.m.denney@navy.mil)

## References

### **SAR Baseline (Production Estimate)**

Assistant Secretary of the Navy (Research, Development & Acquisition) (ASN(RDA)) Approved Acquisition Program Baseline (APB) dated February 13, 2017

### **Approved APB**

Assistant Secretary of the Navy (Research, Development & Acquisition) (ASN(RDA)) Approved Acquisition Program Baseline (APB) dated December 5, 2018

## Mission and Description

The F/A-18E/F (Block II and later aircraft) Infrared Search and Track (IRST) system is a centerline-mounted store consisting of a passive long-wave infrared sensor and aerodynamic structural assembly integrated onto the front end of an external fuel tank.

The IRST system will provide the F/A-18E/F an alternative fire control solution with the ability to search for, detect, and track targets in a high electronic attack / radar-denied environment. It will also give the F/A-18E/F the ability to guide Beyond Visual Range missiles to engage those targets.

## Executive Summary

### Program Highlights Since Last Report

The F/A-18E/F Infrared Search and Track (IRST) Block II is an Engineering Change Proposal (ECP-6497) to the Block I system that upgrades the sensor's optics, processor and software to increase system performance and achieve full CPD capabilities. The re-programming of Aircraft Procurement, Navy (APN)-5 to RDT&E in the FY 2016 (PB) to support the Block II development pushed the F/A-18E/F IRST over the MDAP threshold, and the program was reclassified as an ACAT IC on November 5, 2015.

The Block I (LRIP II) contract began deliveries in February 2019. To date, 11 of the 12 units have been delivered to support tactics, techniques, and procedures development; aircrew and maintainer training; and extended fleet demonstrations of IRST. Early fleet demonstration is also intended to support refinement of the logistics support model for Block II IRST, which is significant because Block II logistics support is identical to Block I, and expose fleet users to IRST systems prior to IOC. Early exposure of IRST to fleet will generate a base of knowledge and feedback that will inform IRST Block II development. The fleet received their first IRST systems in March 2019, along with all training necessary to maintain and operate the systems. Subsequently, a successful fleet live-fire was executed in April 2019, which was the first of its kind using only IRST systems.

As part of Block II risk reduction, the Block II capital asset successfully flew on The Boeing Company's Test Bed Operations aircraft on September 13, 2019, flew on the VX-23 F/A-18 on October 23, 2019, and again November 11, 2019. In October 2019, Naval Air Warfare Development Center received four Block I IRST systems to support tactics development and Strike Fighter Tactics Instructor training in conjunction with the TOPGUN course. This was designed to allow all TOPGUN course graduates an opportunity to train on IRST before Block II IOC and assist in ensuring fleet employment recommendations are in place prior to Block II IOC. Shipboard suitability testing for IRST occurred in November 2019 to support the first fleet shipboard deployment during the CVW-17 Tailored Ships Training Availability (TSTA) in November and December 2019. Two squadrons in CVW-17 conducted operations throughout TSTA with IRST systems, further refining the logistics support model for IRST hardware.

The Block II test hardware is scheduled to deliver in the second quarter of FY 2020. Developmental testing will commence upon hardware arrival.

There are no significant software-related issues with this program at this time.

History of Significant Developments Since Program Initiation	
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History of Significant Developments Since Program Initiation	
Date	Significant Development Description
1st Quarter FY 2008	The F/A-18E/F IRST program was designated as an ACAT III new start. In the Summer of 2008, early prototyping of the IRST system was underway. With the use of independent research and development funding, The Boeing Company used the F-14D baseline IRST with improved hardware to demonstrate passive ranging proof of concept. An ADM was issued by PEO for Tactical Aircraft Programs, approving the IRST system entry into the Technical Development (TD) phase. As a result of the ADM, System Requirements Reviews 1 and 2 were conducted. A funding reduction resulted in the baseline changing from planned delivery of the CDD-required 92 to 68 units.
3rd Quarter FY 2010	The IRST program completed the System Functional Review in May.
1st Quarter FY 2011	The PDR was held in November. The system PDR reflected a major change driven by a funding reduction for Program Objective Memorandum, which rendered the planned program unexecutable. The IRST program management implemented a phased, evolutionary approach to delivery of the required IRST capability and the program was reclassified as an ACAT II program.  The IRST CDD was updated to capture an evolutionary acquisition approach and approved in April 2011. In June 2011, the IRST program completed a successful Milestone B and entered the (EMD) phase. The resultant EMD contract was awarded to Boeing.
1st Quarter FY 2012	The IRST Block I initial product baseline was established at the Critical Design Review (CDR).
3rd Quarter FY 2013	The IRST program conducted a Delta CDR in April and Test Readiness Review in July.
1st Quarter FY 2014	IRST Block I entered the Production and Deployment phase after a successful (MS) C event.
2nd Quarter FY 2015	As a result of the successful MS C event, the IRST Block I LRIP I contract for six systems was awarded in January. In March, ASN(RDA) released the ADM authorizing the entry into the Production and Deployment phase and the procurement of LRIP Lot I units.
1st Quarter FY 2016	In November 2015, USD (AT&L) approved the IRST APB, delegated the MDA for the IRST program to the Navy, and designated the program as a ACAT IC due to the reprogramming of APN-5 funds to RDT&E for Block II development. The IRST program completed a successful Navy Gate 6 / In Progress Review.
4th Quarter FY 2016	As a follow-up, an LRIP Lot II decision meeting was held in August. As a result of this meeting, an ADM was issued in September 2016 authorizing the procurement of 12 additional Block I LRIP systems and concurrence to begin development efforts on the Block II efforts. In December 2016, the IRST program completed the Functional Configuration Audit baseline and awarded the IRST Block I LRIP II contract for 12 systems.
2nd Quarter FY 2017	An updated APB was approved in February 2017 to reflect the acceleration of the IRST (IOC) by two years. The IRST Block II Phase 1 contract action for six Block II engineering change proposal test assets was awarded in May.
3rd Quarter FY 2018	IRST Sensor Sub-Systems (Infrared Receiver and Processor) delta CDR was conducted in May 2018 with the Government Technical Review Board assessing that the design maturity sufficient to justify an accelerated procurement. The IRST Block II Phase 2 development contract to support CDR, non-recurring engineering, and hardware development was awarded in August.
1st Quarter FY 2019	The Block I Infrared Optimized Configuration contract for 16 hardware kits awarded in

	October. Parallel activities were conducted to mature the Block II initial product baseline with a successful CDR conducted in November.
1st Quarter FY 2019	On December 4, 2018, the MS C Decision Review for the IRST program was held to assess program readiness to continue the Block II Production and Deployment phase. All criterion were successfully met, and the program received MS C approval and authorization to procure Block II LRIP units. The IRST Block II LRIP III contract action for six units was awarded in December.

## Threshold Breaches

### APB Breaches

<b>Schedule</b>		<input type="checkbox"/>
<b>Performance</b>		<input type="checkbox"/>
<b>Cost</b>	RDT&E	<input type="checkbox"/>
	Procurement	<input type="checkbox"/>
	MILCON	<input type="checkbox"/>
	Acq O&M	<input type="checkbox"/>
<b>O&amp;S Cost</b>		<input type="checkbox"/>
<b>Unit Cost</b>	PAUC	<input type="checkbox"/>
	APUC	<input type="checkbox"/>

### Nunn-McCurdy Breaches

#### Current UCR Baseline

PAUC	None
APUC	None

#### Original UCR Baseline

PAUC	None
APUC	None

### Schedule



Schedule Events				
Events	SAR Baseline Production Estimate	Current APB Production Objective/Threshold	Current Estimate	Current Estimate
Block I Milestone B Review	Jun 2011	Jun 2011	Dec 2011	Jun 2011
Block I Milestone C Review	Mar 2015	Mar 2015	Mar 2015	Mar 2015
Block II Pre-Development IPR	Jul 2017	Oct 2017	Oct 2017	Oct 2017
Block II Milestone C Review	Jun 2018	Dec 2018	Dec 2018	Dec 2018
Initial Operational Test & Evaluation (Start)	Aug 2020	Aug 2020	Feb 2021	Aug 2020
Full Rate Production Decision Review (FRPDR)	Jul 2021	Jul 2021	Jan 2022	Jul 2021
Initial Operational Capability	Sep 2021	Sep 2021	Mar 2022	Sep 2021

**Change Explanations**

None

**Acronyms and Abbreviations**

IPR - In Progress Review

## Performance

Performance Characteristics				
SAR Baseline Production Estimate	Current APB Production Objective/Threshold		Demonstrated Performance	Current Estimate
<b>Operational Availability</b>				
>/0.95	>/0.95	>/0.8	TBD	>/0.95

Classified Performance information is provided in the classified annex to this submission.

### Requirements Reference

F/A-18E/F Infrared Search and Track CDD, Change 2, dated October 20, 2014

### Change Explanations

None

## Track to Budget

### RDT&E

Appn	BA	PE		
Navy	1319	07	0204136N	
			<b>Project</b>	<b>Name</b>
	1662		F/A18 Improvement	(Shared) (Sunk)
	2069		F/A18 Infrared Search and Track (IRST)	(Sunk)
Navy	1319	04	0604014N	
			<b>Project</b>	<b>Name</b>
	2069		F/A-18 Infrared Search and Track (IRST)	

### Procurement

Appn	BA	PE		
Navy	1506	05	0204136N	
			<b>Line Item</b>	<b>Name</b>
	0515		Infrared Search and Track (IRST)	
	0525		F-18 Series	(Shared)
Navy	1506	05	0204161N	
			<b>Line Item</b>	<b>Name</b>
	0605		Spares and Repair Parts	

## Cost and Funding

### Cost Summary

Total Acquisition Cost							
Appropriation	BY 2008 \$M			BY 2008 \$M	TY \$M		
	SAR Baseline Production Estimate	Current APB Production Objective/Threshold		Current Estimate	SAR Baseline Production Estimate	Current APB Production Objective	Current Estimate
RDT&E	764.0	799.7	879.7	800.2	878.6	926.4	933.3
Procurement	1150.6	1192.4	1311.6	1134.0	1468.5	1511.8	1447.7
Flyaway	--	--	--	733.2	--	--	929.9
Recurring	--	--	--	701.6	--	--	888.7
Non Recurring	--	--	--	31.6	--	--	41.2
Support	--	--	--	400.8	--	--	517.8
Other Support	--	--	--	234.2	--	--	307.8
Initial Spares	--	--	--	166.6	--	--	210.0
MILCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acq O&M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1914.6	1992.1	N/A	1934.2	2347.1	2438.2	2381.0

#### Current APB Cost Estimate Reference

Program Office Cost Estimate dated December 04, 2018

#### Cost Notes

No cost estimate has been completed for the program in the previous year.

Total Quantity			
Quantity	SAR Baseline Production Estimate	Current APB Production	Current Estimate
RDT&E	9	3	3
Procurement	170	170	170
Total	179	173	173

## Cost and Funding

### Funding Summary

Appropriation Summary									
FY 2021 President's Budget / December 2019 SAR (TY\$ M)									
Appropriation	Prior	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	To Complete	Total
RDT&E	655.1	112.4	84.2	35.1	25.9	9.9	10.7	0.0	933.3
Procurement	407.4	67.6	216.2	244.4	210.3	215.6	34.1	52.1	1447.7
MILCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acq O&M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PB 2021 Total	1062.5	180.0	300.4	279.5	236.2	225.5	44.8	52.1	2381.0
PB 2020 Total	1085.4	219.8	280.5	282.0	242.1	230.6	66.7	31.0	2438.1
Delta	-22.9	-39.8	19.9	-2.5	-5.9	-5.1	-21.9	21.1	-57.1

Quantity Summary										
FY 2021 President's Budget / December 2019 SAR (TY\$ M)										
Quantity	Undistributed	Prior	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	To Complete	Total
Development	3	0	0	0	0	0	0	0	0	3
Production	0	24	4	25	40	40	29	0	8	170
PB 2021 Total	3	24	4	25	40	40	29	0	8	173
PB 2020 Total	3	24	12	25	40	40	29	0	0	173
Delta	0	0	-8	0	0	0	0	0	8	0

## Cost and Funding

### Annual Funding By Appropriation

Annual Funding							
1319   RDT&E   Research, Development, Test, and Evaluation, Navy							
Fiscal Year	Quantity	TY \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2007	--	--	--	--	--	--	3.5
2008	--	--	--	--	--	--	4.8
2009	--	--	--	--	--	--	16.8
2010	--	--	--	--	--	--	24.6
2011	--	--	--	--	--	--	58.0
2012	--	--	--	--	--	--	40.2
2013	--	--	--	--	--	--	93.1
2014	--	--	--	--	--	--	59.7
2015	--	--	--	--	--	--	45.0
2016	--	--	--	--	--	--	42.7
2017	--	--	--	--	--	--	94.1
2018	--	--	--	--	--	--	68.1
2019	--	--	--	--	--	--	104.5
2020	--	--	--	--	--	--	112.4
2021	--	--	--	--	--	--	84.2
2022	--	--	--	--	--	--	35.1
2023	--	--	--	--	--	--	25.9
2024	--	--	--	--	--	--	9.9
2025	--	--	--	--	--	--	10.7
Subtotal	3	--	--	--	--	--	933.3

Annual Funding							
1319   RDT&E   Research, Development, Test, and Evaluation, Navy							
Fiscal Year	Quantity	BY 2008 \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2007	--	--	--	--	--	--	3.5
2008	--	--	--	--	--	--	4.7
2009	--	--	--	--	--	--	16.4
2010	--	--	--	--	--	--	23.7
2011	--	--	--	--	--	--	54.5
2012	--	--	--	--	--	--	37.2
2013	--	--	--	--	--	--	85.2
2014	--	--	--	--	--	--	53.9
2015	--	--	--	--	--	--	40.1
2016	--	--	--	--	--	--	37.4
2017	--	--	--	--	--	--	80.9
2018	--	--	--	--	--	--	57.2
2019	--	--	--	--	--	--	86.1
2020	--	--	--	--	--	--	90.7
2021	--	--	--	--	--	--	66.6
2022	--	--	--	--	--	--	27.2
2023	--	--	--	--	--	--	19.7
2024	--	--	--	--	--	--	7.4
2025	--	--	--	--	--	--	7.8
Subtotal	3	--	--	--	--	--	800.2

Annual Funding								
1506   Procurement   Aircraft Procurement, Navy								
Fiscal Year	Quantity	TY \$M						
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program	
2015	6	59.5	--	--	59.5	29.6	89.1	
2016	12	78.3	--	--	78.3	36.9	115.2	
2017	--	--	--	--	--	2.5	2.5	
2018	--	132.3	--	--	132.3	2.5	134.8	
2019	6	57.0	--	--	57.0	8.8	65.8	
2020	4	30.9	--	3.2	34.1	33.5	67.6	
2021	25	86.3	--	23.3	109.6	106.6	216.2	
2022	40	149.5	--	--	149.5	94.9	244.4	
2023	40	144.5	--	4.0	148.5	61.8	210.3	
2024	29	114.4	--	6.7	121.1	94.5	215.6	
2025	--	6.1	--	4.0	10.1	24.0	34.1	
2026	8	29.9	--	--	29.9	10.1	40.0	
2027	--	--	--	--	--	10.0	10.0	
2028	--	--	--	--	--	0.7	0.7	
2029	--	--	--	--	--	0.7	0.7	
2030	--	--	--	--	--	0.7	0.7	
Subtotal	170	888.7	--	41.2	929.9	517.8	1447.7	

Annual Funding 1506   Procurement   Aircraft Procurement, Navy								
Fiscal Year	Quantity	BY 2008 \$M						
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program	
2015	6	52.4	--	--	52.4	26.0	78.4	
2016	12	67.5	--	--	67.5	31.8	99.3	
2017	--	--	--	--	--	2.1	2.1	
2018	--	109.8	--	--	109.8	2.1	111.9	
2019	6	46.4	--	--	46.4	7.2	53.6	
2020	4	24.7	--	2.6	27.3	26.6	53.9	
2021	25	67.5	--	18.2	85.7	83.4	169.1	
2022	40	114.7	--	--	114.7	72.7	187.4	
2023	40	108.7	--	3.0	111.7	46.4	158.1	
2024	29	84.3	--	4.9	89.2	69.7	158.9	
2025	--	4.4	--	2.9	7.3	17.3	24.6	
2026	8	21.2	--	--	21.2	7.1	28.3	
2027	--	--	--	--	--	6.9	6.9	
2028	--	--	--	--	--	0.5	0.5	
2029	--	--	--	--	--	0.5	0.5	
2030	--	--	--	--	--	0.5	0.5	
Subtotal	170	701.6	--	31.6	733.2	400.8	1134.0	

Cost Quantity Information		
1506   Procurement   Aircraft Procurement, Navy		
Fiscal Year	Quantity	End Item Recurring Flyaway (Aligned With Quantity) BY 2008 \$M
2015	6	91.9
2016	12	146.4
2017	--	--
2018	--	--
2019	6	46.4
2020	4	24.7
2021	25	67.5
2022	40	114.7
2023	40	108.7
2024	29	80.1
2025	--	--
2026	8	21.2
2027	--	--
2028	--	--
2029	--	--
2030	--	--
Subtotal	170	701.6

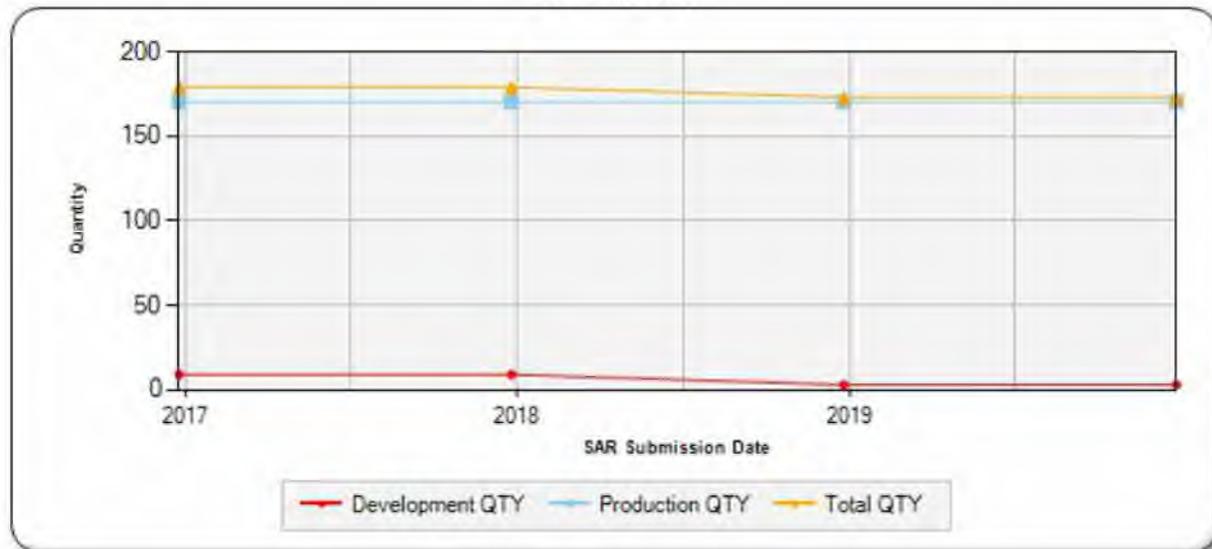
Charts

IRST first began SAR reporting in December 2016

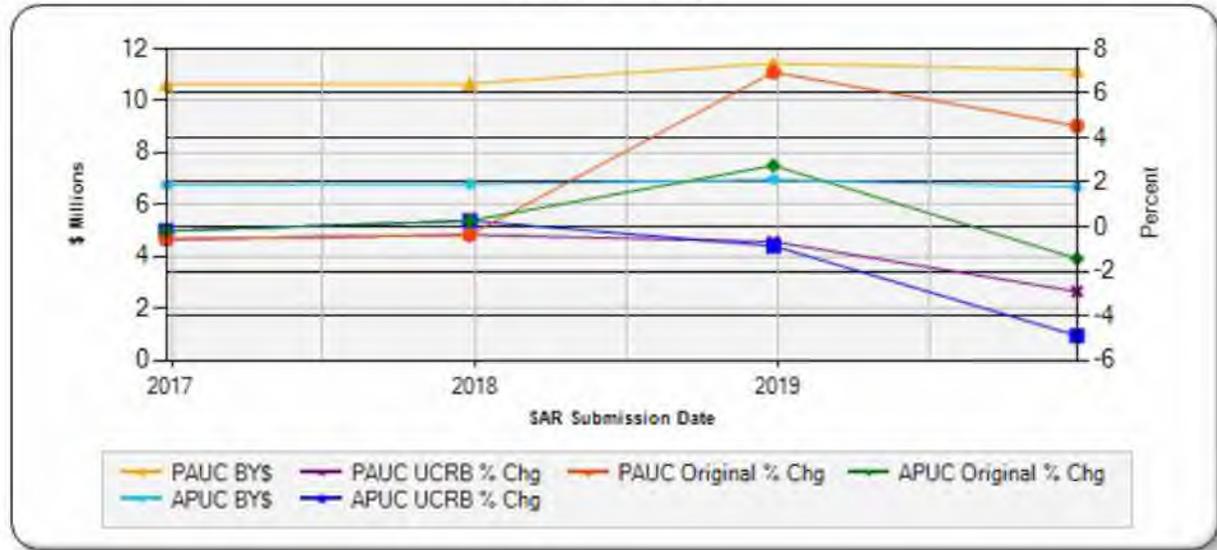
Program Acquisition Cost - IRST  
Base Year 2008 \$M



Quantity - IRST



Unit Cost - IRST  
Base Year 2008 \$M



## Risks

### Significant Schedule and Technical Risks

Significant Schedule and Technical Risks	
<b>Milestone B (April 2011)</b>	
1.	Technical: Performance risk was assessed as moderate. Initial Infrared Search and Track (IRST) technical risk assessments by the prime contractor revealed only low and medium risks. The technology behind the legacy F-14D IRST system is well documented over its history. Hardware improvements being incorporated from other platforms are, likewise, known sub-systems. The primary source of technological risks came from software development and aircraft integration. Of the medium category risks, the only hardware-related item was the centerline pod environment. Other medium risks were integration and software issues such as Multi-Source Integration, data processing throughput, Inertial Measurement Unit integration, new technology compatibility, and false alarm rate. Therefore, future risk reduction activities were centered on these areas as both the prime contractor and sub-contractor offer considerable experience on the F/A-18 and other aircraft.
2.	Schedule: Schedule risk of the EMD phase was assessed as moderate. Preliminary trade studies, modeling and simulation, more than ten demonstration flights with a representative prototype sensor flying on F/A-18E/F aircraft, and the extensive use of non-developmental item design and hardware all work to minimize risk. The program could only afford a limited number of flight test assets, with spare weapon replaceable assemblies being supplied on an as-needed basis by borrowed laboratory assets. Test assets were aggressively managed throughout the program to mitigate the schedule risk caused by this asset limitation.
3.	Cost: Cost risk for the EMD phase was assessed as moderate. The Naval Air Systems Command Cost Department provided an ICE that supported Milestone B. The IRST system has been developed as an evolutionary Block I/II program due to funding limitations. The Block I IRST system had been developed using the current funding at that time to support a FY 2016 IOC. However, a Program Objective Memorandum (POM) 13 submittal to request additional funding was required for IRST to be executable. The Block II IRST system is an engineering change proposal to the IRST program and required a POM14 submittal.
<b>Milestone C (October 2014)</b>	
1.	Programmatic: The IRST program's overall risk was assessed as moderate. The main program risks concern software development, structural qualification of the system, and compressed flight test schedule. Mitigation plans have been developed for all risks, and these mitigation plans have all been accurately tracked and programmed into the program budget. A Risk Reduction Demonstration was performed with an AN/AAS-42 IRST system mounted in an F/A-18E/F modified external fuel tank on the centerline weapons station of Air Test and Evaluation Squadron (VX-31) and Air Test and Evaluation Squadron (VX-23) F/A-18E/F aircraft. The Chief of Naval Research concurred with this assessment in June 2011.
<b>Current Estimate (December 2019)</b>	
1.	Schedule: Impact of Flight Test Execution of IOC (hardware availability, time to test and tune with Software Configuration Set H16). Mitigation plan includes working compressed schedule to balance asset availability. Use of Block 1, Capital Asset, and Prototype hardware are part of the mitigation, but remain a challenge. This risk is forecast for closure in August 2021.
2.	Technical: Impact of Sensor Alignment Boresight Estimated Routine on Weapon Quality Track Key Performance Parameter. Mitigation plan includes lab testing, flying test bed operations and early development hardware flights. This risk is on track and only two steps remain. This risk should close in May of 2020.
3.	Technical: IRST Block II - Impact of Processor Stability on System Performance. – Mitigation includes lab testing, flying test bed operations and early development hardware flights. This risk is on track and only two

	steps remain. This risk should close in May of 2020.
4.	Technical: Impact of Built-In Test (BIT) false alarms on reliability. Mitigation includes flying test bed operations and prototype flights. Expecting closure in July 2020.

## Risks

### Risk and Sensitivity Analysis

Risks and Sensitivity Analysis	
<b>Current Baseline Estimate (December 2018)</b>	
1.	F/A-18E/F IRST Cost risk is assessed as moderate. During the Block II Development Phase, there will be cost risks associated with the Infrared Receiver due to four major new components being developed (elevation drive update, new optics, Digital Focal Plane-Array, and Fiber Optic Gyros). Flight test risk is also anticipated with reference to flight test experience during Block I. There is a moderate-level risk that the current dome coating will wear faster than was originally planned, requiring more dome replacements. Maintenance costs incurred for dome replacement will contribute to a higher life-cycle costs. The Block II configuration will incorporate a Boron Phosphide-coated dome that will reduce the rate of erosion on the dome, thereby reducing the number of dome replacements over the life of the system.
<b>Original Baseline Estimate (February 2017)</b>	
1.	Cost risk for the EMD Phase is assessed as moderate. The IRST system is being developed as an evolutionary Block I / II program due to funding limitations. The Block I IRST system has been developed to support IOC. Due to budget constraints, Block II is not currently funded. The program currently carries one moderate-level cost risk relating to dome reliability. There is a risk that the current dome coating will wear faster than was originally planned, requiring more dome replacements. Maintenance costs incurred for dome replacement will contribute to higher life-cycle costs.
<b>Revised Original Estimate (N/A)</b>	
None	
<b>Current Procurement Cost (December 2019)</b>	
1.	The current Procurement Cost is the same as the Current Baseline Estimate.

## Low Rate Initial Production

Item	Initial LRIP Decision	Current Total LRIP
<b>Approval Date</b>	12/2/2014	12/4/2018
<b>Approved Quantity</b>	6	43
<b>Reference</b>	Milestone C ADM	Block II LRIP III Milestone C ADM
<b>Start Year</b>	2015	2018
<b>End Year</b>	2017	2021

The Current Total LRIP Quantity is more than 10% of the total production quantity in order to field the Resource Sponsor's required number of IRST systems prior to CY 2024.

## Foreign Military Sales

Country	Date of Sale	Quantity	Total Cost \$M	Description
Australia	1/30/2020	12	130.8	FMS Case, AT-P-GQF, Amendment 2, provides for the procurement of 12 IRST systems and support.

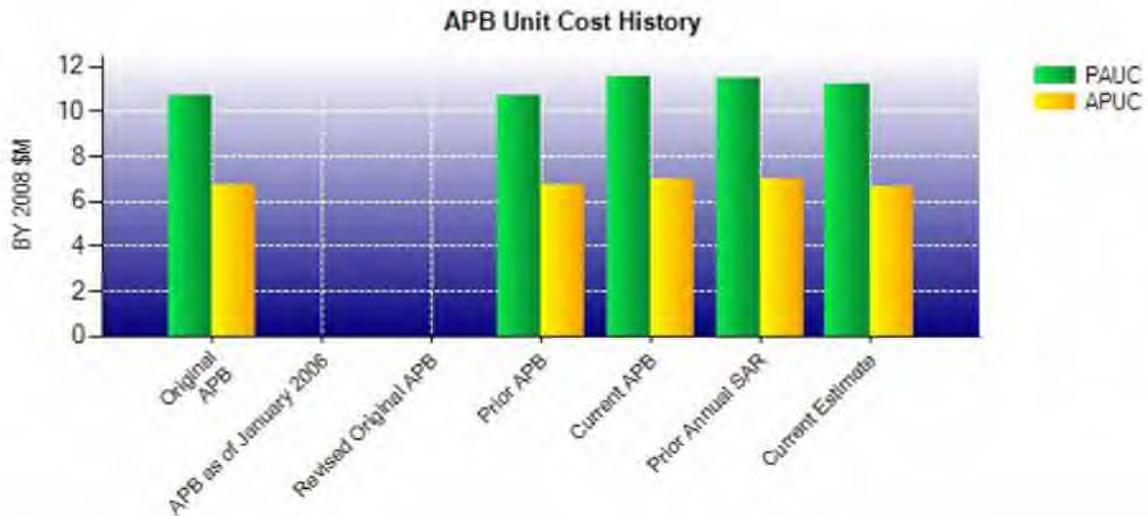
### Notes

## Nuclear Costs

None

**Unit Cost**

Current UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2008 \$M	BY 2008 \$M	% Change
	Current UCR Baseline (Dec 2018 APB)	Current Estimate (Dec 2019 SAR)	
<b>Program Acquisition Unit Cost</b>			
Cost	1992.1	1934.2	
Quantity	173	173	
Unit Cost	11.515	11.180	-2.91
<b>Average Procurement Unit Cost</b>			
Cost	1192.4	1134.0	
Quantity	170	170	
Unit Cost	7.014	6.671	-4.89
Original UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2008 \$M	BY 2008 \$M	% Change
	Original UCR Baseline (Feb 2017 APB)	Current Estimate (Dec 2019 SAR)	
<b>Program Acquisition Unit Cost</b>			
Cost	1914.6	1934.2	
Quantity	179	173	
Unit Cost	10.696	11.180	+4.53
<b>Average Procurement Unit Cost</b>			
Cost	1150.6	1134.0	
Quantity	170	170	
Unit Cost	6.768	6.671	-1.43



APB Unit Cost History					
Item	Date	BY 2008 \$M		TY \$M	
		PAUC	APUC	PAUC	APUC
Original APB	Feb 2017	10.696	6.768	13.112	8.638
APB as of January 2006	N/A	N/A	N/A	N/A	N/A
Revised Original APB	N/A	N/A	N/A	N/A	N/A
Prior APB	Feb 2017	10.696	6.768	13.112	8.638
Current APB	Dec 2018	11.515	7.014	14.094	8.893
Prior Annual SAR	Dec 2018	11.438	6.954	14.093	8.893
Current Estimate	Dec 2019	11.180	6.671	13.763	8.516

**SAR Unit Cost History**

Current SAR Baseline to Current Estimate (TY \$M)									
PAUC Production Estimate	Changes								PAUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
13.112	0.041	0.321	0.028	0.816	-0.087	0.000	-0.468	0.651	13.763

Current SAR Baseline to Current Estimate (TY \$M)									
Initial APUC Production Estimate	Changes								APUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
8.638	0.027	0.000	0.029	0.771	-0.474	0.000	-0.476	-0.123	8.516

<b>SAR Baseline History</b>				
<b>Item</b>	<b>SAR Planning Estimate</b>	<b>SAR Development Estimate</b>	<b>SAR Production Estimate</b>	<b>Current Estimate</b>
Milestone A	N/A	N/A	N/A	N/A
Milestone B	N/A	N/A	Jun 2011	Jun 2011
Milestone C	N/A	N/A	Mar 2015	Mar 2015
IOC	N/A	N/A	Sep 2021	Sep 2021
Total Cost (TY \$M)	N/A	N/A	2347.1	2381.0
Total Quantity	N/A	N/A	179	173
PAUC	N/A	N/A	13.112	13.763

**Cost Variance**

Summary TY \$M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Production Estimate)	878.6	1468.5	--	2347.1
Previous Changes				
Economic	+1.1	+7.8	--	+8.9
Quantity	-23.3	--	--	-23.3
Schedule	--	--	--	--
Engineering	--	+131.1	--	+131.1
Estimating	+69.9	+23.7	--	+93.6
Other	--	--	--	--
Support	--	-119.3	--	-119.3
Subtotal	+47.7	+43.3	--	+91.0
Current Changes				
Economic	+1.4	-3.2	--	-1.8
Quantity	--	--	--	--
Schedule	--	+4.9	--	+4.9
Engineering	+10.1	--	--	+10.1
Estimating	-4.5	-104.2	--	-108.7
Other	--	--	--	--
Support	--	+38.4	--	+38.4
Subtotal	+7.0	-64.1	--	-57.1
Total Changes	+54.7	-20.8	--	+33.9
Current Estimate	933.3	1447.7	--	2381.0

Summary BY 2008 \$M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Production Estimate)	764.0	1150.6	--	1914.6
Previous Changes				
Economic	--	--	--	--
Quantity	-19.0	--	--	-19.0
Schedule	--	--	--	--
Engineering	--	+108.5	--	+108.5
Estimating	+51.7	+17.3	--	+69.0
Other	--	--	--	--
Support	--	-94.3	--	-94.3
Subtotal	+32.7	+31.5	--	+64.2
Current Changes				
Economic	--	--	--	--
Quantity	--	--	--	--
Schedule	--	--	--	--
Engineering	+7.4	--	--	+7.4
Estimating	-3.9	-78.7	--	-82.6
Other	--	--	--	--
Support	--	+30.6	--	+30.6
Subtotal	+3.5	-48.1	--	-44.6
Total Changes	+36.2	-16.6	--	+19.6
Current Estimate	800.2	1134.0	--	1934.2

Previous Estimate: December 2018

RDT&E	\$M	
Current Change Explanations	Base Year	Then Year
Revised escalation indices. (Economic)	N/A	+1.4
Adjustment for current and prior escalation (Estimating) (Estimating)	+1.0	+1.5
Revised estimate to reflect service-wide funding adjustments. (Estimating) (Estimating)	-3.2	-3.9
Revised estimate due to Congressional Mark in FY 2020. (Estimating) (Estimating)	-0.9	-1.1
Additional funding for Incorporated Capability Enhancement Requirement.(Engineering) (Engineering)	+7.4	+10.1
Adjustment for current and prior escalation. (Estimating)	-0.8	-1.0
<b>RDT&amp;E Subtotal</b>	<b>+3.5</b>	<b>+7.0</b>

Procurement	\$M	
Current Change Explanations	Base Year	Then Year
Revised escalation indices. (Economic)	N/A	-3.2
Stretch-out of procurement buy profile from FY2020 to FY2026 due to Congressional Mark in FY2020 for production early to need. (Schedule) (Schedule)	0.0	+4.9
Revised estimate to reflect service-wide funding adjustments. (Estimating) (Estimating)	-96.5	-126.3
Adjustment for current and prior escalation.(Estimating) (Estimating)	-1.9	-2.6
Revised estimate due to Congressional Mark in FY2020 \$33.7M for production early-to-need.(Estimating) (Estimating)	+19.1	+24.1
Adjustment for current and prior escalation. (Estimating)	+0.6	+0.6
Adjustment for current and prior escalation. (Support)	+0.1	+0.3
Decrease in Other Support to update for actuals. FY2020 \$5.5M Congressional Mark for support early-to-need.(Support) (Support)	-12.9	-19.3
Increase in Initial Spares was to reflect service-wide funding adjustments.(Support) (Support)	+43.4	+57.4
<b>Procurement Subtotal</b>	<b>-48.1</b>	<b>-64.1</b>

## Contracts

### Contract Identification

**Appropriation:** Procurement  
**Contract Name:** IRST Block I LRIP II  
**Contractor:** The Boeing Company  
**Contractor Location:** 6200 James S. McDonnell Blvd  
 St. Louis, MO 63134  
**Contract Number:** N00019-17-C-0026/3  
**Contract Type:** Fixed Price Incentive(Firm Target) (FPIF)  
**Award Date:** December 15, 2016  
**Definitization Date:** December 15, 2016

Contract Price								
Initial Contract Price (\$M)			Current Contract Price (\$M)			Estimated Price At Completion (\$M)		
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager	
82.1	84.2	12	82.1	84.2	12	75.1	82.1	

Contract Variance			
Item	Cost Variance		Schedule Variance
Cumulative Variances To Date (12/19/2019)	+0.9		-0.9
Previous Cumulative Variances	+9.8		-3.1
Net Change	-8.9		+2.2

### Cost and Schedule Variance Explanations

The unfavorable net change in the cost variance is due to additional supplier staffing for quality checks, accounting methodology changes for when EV performance can be earned on material, and the incentive fee calculation by the Prime on the subcontractor has subcontractor work is nearly complete.

The favorable net change in the schedule variance is due to performance being claimed on past due deliveries. The positive change is also due to Lockheed Martin's (LM) change in EV methodology as they converge to (SAP) (Systems, Applications, and Products in Data Processing) which is a resource planning software. This allowed LM to take performance when the materials were received versus waiting for them to be issued to the floor.

**Contract Identification**

**Appropriation:** RDT&E  
**Contract Name:** Block II Phase 1  
**Contractor:** The Boeing Company  
**Contractor Location:** 6200 James S McDonnell Boulevard  
 St. Louis, MO 63134  
**Contract Number:** N00019-17-C-0024/4  
**Contract Type:** Cost Plus Incentive Fee (CPIF)  
**Award Date:** May 25, 2017  
**Definitization Date:** August 22, 2017

Contract Price								
Initial Contract Price (\$M)			Current Contract Price (\$M)			Estimated Price At Completion (\$M)		
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager	
80.0	N/A	6	84.9	N/A	6	83.6	84.9	

**Target Price Change Explanation**

The difference between the Initial Contract Price Target and the Current Contract Price Target is due to a contract modification to incorporate IRST Block II Phase 1 Sensor Critical Design Review support that increased the value by \$4.9M in June 2018.

Contract Variance			
Item	Cost Variance		Schedule Variance
Cumulative Variances To Date (12/15/2019)	-1.5		-2.2
Previous Cumulative Variances	-1.3		-5.7
Net Change	-0.2		+3.5

**Cost and Schedule Variance Explanations**

The unfavorable net change in the cost variance is due to the receiver team using more experienced engineers to complete tasks towards the end of the year and procurement seeing a decline in performance due to an accounting correction from October 2019.

The favorable net change in the schedule variance is due to performance being claimed on past due deliveries, primarily in regards to the Telescope. The positive change is also due to Lockheed Martin's (LM) change in EV methodology as they converge to SAP (Systems, Applications, and Products in Data Processing) which is a resource planning software. This allowed LM to take performance when the materials were received versus waiting for them to be issued to the floor.

**Notes**

This contract is more than 90% complete; therefore, this is the final report for this contract.

**Contract Identification**

**Appropriation:** RDT&E  
**Contract Name:** IRST Block II Phase 2  
**Contractor:** The Boeing Company  
**Contractor Location:** 6200 James S McDonnell Boulevard  
 St. Louis, MO 63134  
**Contract Number:** N00019-18-C-0022/5  
**Contract Type:** Cost Plus Incentive Fee (CPIF)  
**Award Date:** August 17, 2018  
**Definitization Date:** August 17, 2018

Contract Price								
Initial Contract Price (\$M)			Current Contract Price (\$M)			Estimated Price At Completion (\$M)		
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager	
152.5	N/A	0	164.6	N/A	3	164.2	164.9	

**Target Price Change Explanation**

The difference between the Initial Contract Price Target and the Current Contract Price Target is due to a contract modification to procure one IRST Block II engineering development model and two IRST Block I upgrades to infrared optimized configuration that increased the value by \$12.1M in November 2018.

Contract Variance			
Item	Cost Variance		Schedule Variance
Cumulative Variances To Date (12/19/2019)	-3.4		-5.3
Previous Cumulative Variances	-0.2		-0.3
Net Change	-3.2		-5.0

**Cost and Schedule Variance Explanations**

The unfavorable net change in the cost variance is due to tasks requiring more time and oversight due to complexity of design, inefficiencies as the result of the experience level of the engineers, and rework efforts. It was also affected by the incentive fee calculation by the Prime for the subcontractor.

The unfavorable net change in the schedule variance is due to missed milestone dates as a result of manpower shortages, poor performance, and late deliveries.

**Notes**

The contract quantity represents three weapon replaceable assemblies - one engineering development model and two infrared optimized configuration units.

**Contract Identification**

**Appropriation:** Procurement  
**Contract Name:** Infrared Optimized Configuration (IROC)  
**Contractor:** The Boeing Company  
**Contractor Location:** 6200 James S McDonnell Boulevard  
 St. Louis, MO 63134  
**Contract Number:** N00019-19-F-2410/6  
**Contract Type:** Fixed Price Incentive(Firm Target) (FPIF)  
**Award Date:** October 25, 2018  
**Definitization Date:**

Contract Price							
Initial Contract Price (\$M)			Current Contract Price (\$M)			Estimated Price At Completion (\$M)	
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager
155.0	N/A	16	131.6	N/A	16	131.6	131.6

**Target Price Change Explanation**

The difference between the Initial Contract Price Target and the Current Contract Price Target is due to a reduction from the initial price estimate. Upon receipt of the proposal, the PM established a new contract price target.

**Cost and Schedule Variance Explanations**

Cost and Schedule Variance reporting is not required on this (FPIF) contract.

**General Contract Variance Explanation**

Cost and schedule variances are not reported for this contract, because earned value management reporting has not yet commenced due to this contract not being definitized.

**Contract Identification**

**Appropriation:** Procurement  
**Contract Name:** IRST Block II LRIP III  
**Contractor:** The Boeing Company  
**Contractor Location:** 6200 James S McDonnell Boulevard  
 St. Louis, MO 63134  
**Contract Number:** N00019-19-C-0019/7  
**Contract Type:** Fixed Price Incentive(Firm Target) (FPIF)  
**Award Date:** December 28, 2018  
**Definitization Date:**

Contract Price								
Initial Contract Price (\$M)			Current Contract Price (\$M)			Estimated Price At Completion (\$M)		
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager	
55.0	N/A	6	55.0	N/A	6		55.0	

**Cost and Schedule Variance Explanations**

Cost and Schedule Variance reporting is not required on this (FPIF) contract.

**General Contract Variance Explanation**

Cost and schedule variances are not reported for this contract, because earned value management reporting has not yet commenced due to the contract not being definitized.

**Notes**

The undefinitized contract was awarded with a not-to-exceed value of \$55M.

## Deliveries and Expenditures

Deliveries				
Delivered to Date	Planned to Date	Actual to Date	Total Quantity	Percent Delivered
Development	3	3	3	100.00%
Production	17	17	170	10.00%
Total Program Quantity Delivered	20	20	173	11.56%

Expended and Appropriated (TY \$M)			
Total Acquisition Cost	2381.0	Years Appropriated	14
Expended to Date	690.3	Percent Years Appropriated	58.33%
Percent Expended	28.99%	Appropriated to Date	1242.5
Total Funding Years	24	Percent Appropriated	52.18%

The above data is current as of February 10, 2020.

## Operating and Support Cost

### Cost Estimate Details

<b>Date of Estimate:</b>	December 31, 2019
<b>Source of Estimate:</b>	POE
<b>Quantity to Sustain:</b>	170
<b>Unit of Measure:</b>	System
<b>Service Life per Unit:</b>	17.60 Years
<b>Fiscal Years in Service:</b>	FY 2021 - FY 2041

Total O&S Costs reflects the programmatic, cost data, and technical updates provided by the program since Milestone C in December of 2018.

CAPE O&S Cost Estimating Structure (CES) element 3.0 Maintenance and element 4.6 Sustaining Support/Data and Tech Pub costs are variable and based on system flight hours. For CAPE O&S CES element 4.1 Sustaining Support/System Specific Training and associated personnel costs are estimated based on the annual requirement for those elements. CAPE O&S element 4.2 Sustaining Support/Support Equipment Replacement and Repair is estimated as a total requirement and then applied on an annual basis. CAPE O&S CES element 5.1 Continuing System Improvements/Hardware Modifications is based on the total number of operating and pipeline pods while CES element 5.2 Continuing System Improvements/Software Maintenance is based on current Software Lines of Code (SLOC) count and accounts for SLOC count growth in outyears.

IRST is set to operate in TACAIR F/A-18E/F squadrons and the service life of the IRST system is limited only by the existence of those squadrons. The estimate uses Naval Synchronization Toolset data version 19-01 to model F/A-18 E/F aircraft and TACAIR squadron availability.

Total System Procurement: 170  
 Total System Years: 2,992  
 Service Life Per Unit: 17.6 (Calculated by dividing Total System Years by Total System Procurement)  
 Average Flight Hours per Fleet System per month: 38.4  
 Total Life Cycle Flight Hours: 682,805

### Sustainment Strategy

The IRST Sustainment Strategy is based on the following assumptions:

The IRST system will be operated by F/A-18E/F aircraft assigned to land and carrier based squadrons. The current plan is for six IRST assets per squadron to be fielded to 24 operating F/A-18E/F squadrons. These squadrons are to be located at Naval Air Station (NAS) Oceana, NAS Lemoore and Marine Corps Air Station Iwakuni; and will deploy aboard aircraft carriers based on the most current operational schedule.

The IRST program is an evolutionary acquisition program with Block I and Block II systems. Procurement involves the acquisition of 18 Block I systems, followed by 152 Block II systems and retrofits of the 18 Block I systems to the Block II configuration. The 18 Block I LRIP systems will be used to initially to support IRST tactics development, aircrew familiarization, test and evaluation, maintainer training, software configuration set testing, and a "speed-to-the-fleet" technical demonstration initiative. Block I systems are not intended to be permanently fielded to fleet squadrons. The program will reach Initial Operating Capability (IOC) upon delivery of the first six Block II IRST systems in late FY 2021.

The IRST system logistics concept will leverage off logistics support processes currently in place for the F/A-18E/F aircraft. No specialized logistics processes should be required to support the IRST system.

IRST hardware support will be a joint effort between Boeing, Lockheed Martin Missiles and Fire Control, General Electric Aerospace, MDSI, Lakehurst, In-Service Support Center (ISSC) Jacksonville, ISSC North Island, Naval Supply Systems Command, and Naval Air Systems Command. The planned IRST support concept is a three-level (Organizational to Intermediate to Depot) maintenance concept. A Level of Repair Analysis was conducted that resulted in a recommendation for a three level support infrastructure (Organizational, Intermediate and Depot) for all Weapons Replaceable Assemblies except the Inertial Measurement Unit and Processor. The Original Equipment Manufacturer will provide interim support until I-Level and Depot maintenance capabilities are stood up, which will occur no later than IOC + 4 years.

#### Antecedent Information

No Antecedent.

Annual O&S Costs BY2008 \$M			
Cost Element	IRST	N/A (Antecedent)	
	Average Annual Cost Per System	N/A	
Unit-Level Manpower	0.000	--	
Unit Operations	0.000	--	
Maintenance	0.200	--	
Sustaining Support	0.027	--	
Continuing System Improvements	0.099	--	
Indirect Support	0.000	--	
Other	--	--	
<b>Total</b>	<b>0.326</b>	<b>--</b>	

Item	Total O&S Cost \$M			
	IRST			N/A (Antecedent)
	Current Production APB Objective/Threshold	Current Estimate		
<b>Base Year</b>	1354.6	1490.1	977.3	N/A
<b>Then Year</b>	1953.0	N/A	1461.9	N/A

Disposal cost is not included in the O&S Cost of the current APB objective and threshold for this program, nor is it included in the Current Estimate listed above.

#### Equation to Translate Annual Cost to Total Cost

The average annual cost per system for IRST is calculated by dividing the Total O&S Cost of \$977.3M CY2008 by 2,992 total IRST system years, resulting in \$0.327M CY2008 per system per year.

O&S Cost Variance		
Category	BY 2008 \$M	Change Explanations
Prior SAR Total O&S Estimates - Dec 2018 SAR	1358.9	

Programmatic/Planning Factors	-140.1	Naval Synchronization Toolset 19-01 data reflects fewer F/A-18E/F TACAIR Squadrons and flight hours, resulting in fewer IRST system years and flight hours.
Cost Estimating Methodology	0.0	No change from December 2018 SAR
Cost Data Update	-44.0	Updated cost data resulting in lowered unit prices and input estimates.
Labor Rate	0.0	No change from December 2018 SAR.
Energy Rate	0.0	No change from December 2018 SAR.
Technical Input	-197.5	Projected increased reliability per CDRL and updated technical inputs for O-Level support equipment procurement costs and phasing.
Other	0.0	No change from December 2018 SAR.
<b>Total Changes</b>	<b>-381.6</b>	
<b>Current Estimate</b>	<b>977.3</b>	

### Disposal Estimate Details

<b>Date of Estimate:</b>	December 31, 2019
<b>Source of Estimate:</b>	POE
<b>Disposal/Demilitarization Total Cost (BY 2008 \$M):</b>	4.4

The TY\$ value is \$8.4M.