

# ARCHIVED REPORT

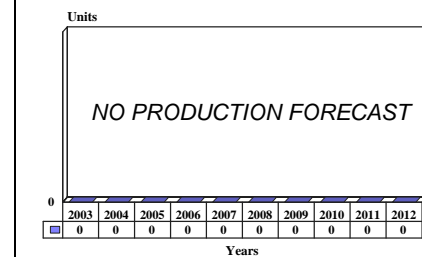
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## AAR-50 (NAVFLIR) - Archived 5/2004

### Outlook

- Production of the NAVFLIR is believed to be complete
- NAVFLIR's replacement, ATFLIR, became operational in 2002
- Barring any new information, this report will be archived in the near future

10 Year Unit Production Forecast  
2003 - 2012



### Orientation

**Description.** Navigation Forward-Looking Infrared (NAVFLIR) system for aircraft; also called the Thermal Imaging Navigation Set (TINS).

**Sponsor**

US Navy  
 Naval Air Systems Command  
 Washington, DC  
 USA

**Contractors**

Raytheon Systems Company  
 141 Spring Street  
 Lexington, Massachusetts (MA) 02173  
 USA  
 Tel: +1 617 862 6600  
 Fax: +1 617 860 2172  
 Web site: [www.raytheon.com](http://www.raytheon.com)

**Status.** In service.

**Total Produced.** An estimated 610 systems were produced through 2002.

**Application.** F/A-18C/D Hornet aircraft and AV-8B Night Attack and Radar/Night Attack Harriers.

**Price Range.** Each system, according to the price of similar systems, is approximately US\$1.1 million.

### Technical Data

Characteristics	<u>Metric</u>	<u>US</u>
Total pod weight	97.07 kg	214 lb
<b>Weapon Replaceable Assemblies</b>		
Adapter	23.15 kg	51 lb
FLIR sensor unit (FSU)	25.42 kg	56 lb

	<u>Metric</u>	<u>US</u>
Pod electronics unit (PEU)	20.88 kg	46 lb
Thermal control unit (TCU)	27.24 kg	60 lb
Pod length/diameter	198.12 cm/25.4 cm	78 in/10 in
FSU	48.26 cm x 25.4 cm	19 x 10 in
PEU	58.42 cm x 25.4 cm	23 x 10 in
TCU	88.58 cm x 25.4 cm	27 x 10 in

**Weapon Replaceable Assemblies** (continued)

Field of view	19.5° H x 19.5° V displayed
Video format	RS-170 (modified), 525 lines
Resolution	320 lines x 755 pixels/line
Interpolation	320 FLIR lines to 460 TV lines
Video polarity	Black-hot/White-hot
Mode control	Avionics Mux Bus, 1553A or B
MTBF	> 410 hours
MTTR (WRA)	17 minutes
Fault isolation to WRA	> 95 percent
Fault isolation to SRA	> 90 percent
Environmental	Active refrigeration or passive heat exchanger modes

**Design Features.** The Hughes AAR-50 Navigation FLIR (NAVFLIR) is designed to provide fighter aircraft with a low-altitude visual navigation capability at night and in adverse weather conditions. The system is a pod-mounted, fixed-field-of-view FLIR consisting of four subsections or field-level weapon replaceable assemblies (WRAs). These field-level WRAs are the FLIR sensor unit (FSU), the pod electronics unit (PEU), the thermal control unit, and the pod adapter. The FLIR sensor and pod electronics units, derived from the Hughes AAQ-16, provide a 60 percent NAVFLIR commonality with the helicopter pod turret system. Installed on McDonnell Douglas F/A-18Cs and Ds, the NAVFLIR pod is mounted on the starboard side of the fuselage in a fixed, forward-staring position. The AAR-50 incorporates materials with high corrosion resistance and is designed for operation in harsh carrier-deck thermal, mechanical, and electro-magnetic interference environments. The pod can be reconfigured for installation on a variety of aircraft.

The FSU converts incoming IR energy into video signals. Its operating features include auto temperature focus control, microprocessor control, electronic bore-sight control, and a built-in test (BIT) capability.

The PEU processes the incoming video signal, converts the enhanced video signal to TV format, and provides a self-diagnostic BIT capability. It also includes dual microprocessor control and programmable signal processing accomplished via the MIL-STD-1553 Mux Bus.

Developed by the FCD Corp as the Model RS-374, the thermal control unit (TCU) provides environmental cooling for the FSU and PEU. Operating in two modes – either refrigeration or direct heat rejection – the TCU incorporates a digital control unit that provides

continuous BIT capability. The refrigeration assembly features a lightweight compressor, a condenser, and a high-performance fan for ground operation of the TCU. In flight, an efficient ram air scoop captures the required air flow over the entire flight profile with minimum drag penalty. TCU operating power is obtained directly from the aircraft power distribution system and consists of 115 Vac, three-phase, 400 Hz and 28 Vdc inputs.

The pod adapter provides the mechanical mounting interface for the other three WRAs and the routing conduit for electronic cables into the aircraft.

**Operational Characteristics.** The AAR-50 utilizes advanced electronic digital processing to provide a high-quality TV-like image projected onto the cockpit head-up display (HUD) during high-speed and low-level flight. The pilot can select either black-hot or white-hot images that correspond more closely with a daylight scene. In the black-hot mode, the hottest objects appear black and the coldest objects appear white – the reverse is true in the white-hot mode. The automatic electronic boresighting capability provided in the NAVFLIR geometrically aligns the scene on the HUD with the outside view. The automatic target detection function assists the flight crew by highlighting or cueing potential targets on the HUD scene. Two of the 11 electronic circuit cards in the NAVFLIR digital signal processor are dedicated to automatic target detection. NAVFLIR can maintain clear horizon definition even during high-g maneuvers. Constant system-level onboard BIT and fault isolation are also provided.

The AAR-50 is a central component of the night attack versions of the F/A-18C/Ds being delivered to US Navy and Marine Corps fighter squadrons. In addition to NAVFLIR, these aircraft are equipped with the Loral AAS-38A Nite Hawk targeting FLIR.

Pilots/backseaters wear image-intensifying night vision goggles (GEC Avionics' Cat's Eyes) when operating this configuration. Cockpit lighting is compatible with the NVGs.

## Variants/Upgrades

None identified.

## Program Review

In the mid-1980s, competitors for the AAR-50 program included General Electric, Texas Instruments, Martin Marietta, and Hughes Aircraft. In July 1986, McDonnell Douglas (now a subsidiary of Boeing), the F/A-18 prime contractor, awarded Hughes Aircraft a 30-month full-scale development contract valued at US\$3.8 million for the AAR-50 pod. The contract included the delivery of five prototypes. Delivery of the prototypes started in May 1988; production deliveries began in 1989. The announced US Navy procurement strategy was to equip roughly two-thirds of the F/A-18C/D aircraft being delivered to the Navy and Marine Corps with the NAVFLIR (which was then known as TINS, or Thermal Imaging Navigation Set).

In February 1990, an award valued at US\$5.8 million was publicized for various quantities of 13 line items of interim support spares for the F/A-18 night attack system. This was followed by a US\$8.1 million order to provide eight line items of AAR-50 spares for the F/A-18.

Production of the NAVFLIR continued through the 1990s. The only risk to the program stemmed from a 1994 US Navy consideration. This consideration was to curtail the final outyear buys of the C/D versions of the aircraft to FY96 instead of FY98, in order to safeguard F/A-18E/F procurement in light of impending budget cuts. Such a reduction was not made. In fact, the US Congress provided for an additional 12 F/A-18C/Ds

with FY97 funding, bringing airframe production out to 1999.

The NAVFLIR was also mounted on the AV-8 Harrier aircraft starting in 1988. Approximately 110 Night Attack and Radar/Night Attack (also known as the Harrier II and Harrier II Plus) versions of the AV-8 Harrier were equipped with the NAVFLIR system for the US Marines. Other customers of these NAVFLIR-equipped Harriers are Spain (21) and Italy (13).

In the later half of the 1990s, a remanufacture program was started to extend the life to the AV-8B Harrier to 2022. In this effort, 72 existing Day Attack Harriers were to be rebuilt to the Radar/Night Attack specifications. This program was completed by the end of 2001. Spain also upgraded some of its Day Attack models to Radar/Night Attack specifications.

In FY92, the Navy launched advanced development of the F/A-18E/F Super Hornet. The avionics of these aircraft will share 90 percent commonality with the F/A-18C/D. However, the targeting/navigation system on the F/A-18E/F Super Hornet aircraft is being replaced by the ATFLIR system, which is produced by Raytheon with BAE Systems reportedly providing the navigational technology. The first squadron of ATFLIR-equipped F/A-18 E/F aircraft became operationally capable in mid-2002. This appears to have brought an end to significant NAVFLIR production.

## Funding

Funding for the AAR-50 NAVFLIR is not specifically identified in current budget documents.

## Recent Contracts

No contracts identified since the following:

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Boeing	665.5	Jul 1998 – Contract from US Navy for the procurement of 44 NAVFLIR equipped AV-8B remanufactured aircraft, integrated logistics support, sustaining build engineering, contractor engineering and technical services, publications management contractor support, modification kits, spare and repair parts, program sustaining support, and associated technical, administrative and financial data.

## Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Jul	1986	Full-scale AAR-50 development contract
May	1988	First prototypes delivered to US Navy
Sep	1989	First four production AV-8B Night Attack Harriers delivered
Fall	1989	First production-unit deliveries for F/A-18C/D aircraft
	1997	Hughes acquired by Raytheon, becomes Raytheon Systems Company
July	1998	US Navy begins to remanufacture AV-8B Day Attack models to Radar/Night Attack specifications
May	2000	Boeing contract to upgrade two Spanish Harriers to the Harrier II Plus configuration
May	2002	Initial Operational Capability of ATFLIR equipped F/A-18E/F aircraft completed

## Worldwide Distribution

AAR-50 NAVFLIR deliveries have been to **US Navy/Marine Corps** and to the **Italian** and **Spanish** navies.

## Forecast Rationale

After a successful production run that lasted through the 1990s, it appears that the life cycle of the AAR-50 NAVFLIR system has come to an end. NAVFLIR was considered a significant improvement over previous systems, but it did have resolution and magnification deficiencies that needed to be addressed. In the search for a more advanced system offering better resolution and magnification, the Advanced Targeting Forward-Looking Infrared (ATFLIR) was developed. The ATFLIR system, developed for the new F/A-18E/F Super Hornet, entered low-rate initial production and

became operational in 2002. The US Navy also intends to use the ATFLIR system as a retrofit item on F/A-18C/D aircraft. Apart from providing better resolution and magnification, the ATFLIR system also replaces the AAS-38 Nite Hawk targeting pod, thus freeing up valuable weapon stations on a fighter aircraft. With advanced systems like ATFLIR entering service, new production of the NAVFLIR system is unlikely. Minimal production may occur in support of maintenance activities.

## Ten-Year Outlook

### ESTIMATED CALENDAR YEAR PRODUCTION

<u>Designation</u>	<u>Application</u>	Thru 02	<u>High Confidence Level</u>			<u>Good Confidence Level</u>			<u>Speculative</u>			Total 03-12	
			03	04	05	06	07	08	09	10	11		12
AAR-50 NAVFLIR	Prior Prod'n:	610	0	0	0	0	0	0	0	0	0	0	0