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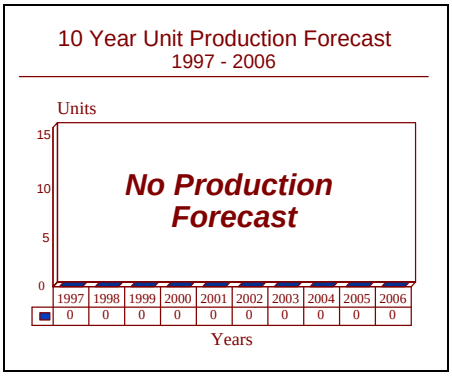
SAR-8/IRST - Archived 2/98

Outlook

- SAR-8 EMD canceled
- New generation IRST has attracted a variety of contenders
- Lockheed Martin wins big Navy IRST contract in 1996
- Large and receptive US/foreign IRST market likely



Orientation

Description. The SAR-8 infrared search and target designation system is a passive, electro-optical shipborne surveillance system.

Sponsors

US Navy
Naval Sea Systems Command (NAVSEA)
Washington, DC
USA
(SAR-8)

US Navy
Naval Surface Warfare Center (NASURWARCEN)
Dahlgren, Virginia (VA)
USA
(IRST)

Canadian Commercial Corp
Hull, Quebec
Canada
(Canadian Government contracting agency)

Contractors

Lockheed Martin Corp
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Status. SAR-8 Full Scale Engineering Development completed in 1991. Program superseded by the advanced Infrared Search and Track (IRST) system development.

Total Produced. Two developmental SAR-8 systems have been built.

Application. The system was designed to complement the active radar surveillance capability of modern warships by providing a passive surveillance and targeting function.

Price Range. SAR-8 system cost was estimated at US$2 million for production systems.

Technical Data

Design Features. The passive SAR-8 infrared search and target designation system consists of an above-decks stabilized scanning assembly and below-decks processing, control and display consoles. The above- deck optical mount assembly weighs less than 1,400 lb and the below-decks equipment suite weighs approximately 6,000 pounds.

The SAR-8 is able to scan a full 360° in azimuth and supplies elevation and azimuth angles, as well as associated target data, to countermeasures equipment fitted onboard the platform. The scanning optics are cryogen-ically cooled. The system functions by thermally contrasting objects such as sea-skimming missiles against ambient temperature backgrounds. High contrast sensitivity is achieved through the use of processing equipment that utilizes low level amplifiers to amplify the IR detector outputs. Other processor capabilities include clutter suppression, track filters to enhance and identify thermal characteristics, and signal processing. The SAR-8/IRSTD is comprised of six subsystems:

Infrared Scanner Subsystem — contains the reflective telescope, cryogenic cooling subsystem, and pre-processing/multiplexing electronics.

Stabilization Subsystem — consists of an electro-hydraulic stabilized platform which compensates for ship motion and maneuvers, and rotates the sensor head.

Electronic Processing Equipment Subsystem — performs the processing functions required for the detection, tracking, and discrimination of air targets.

Control/Status/Maintenance Subsystem — maintains control of SAR-8 operations, including maintenance operation, operability check, Built-in-Test (BIT), and system initialization.

Image Processing Subsystem — provides scan conversion, image enhancement, and video mixing functions for up to three control/display consoles.

Interface Subsystem — achieves the interface between the SAR-8 and other shipboard combat systems. This subsystem performs three functions: 1) interface controller — transfers data to combat systems and control/display consoles; 2) video interfaces — provides air and surface video output for control and display; and 3) support interfaces — between SAR-8 and ship support systems (mechanical, electrical, cooling water, conditioned air, and navigation data).

Operational Characteristics. The primary objectives behind the development of the SAR-8 were to provide a passive surveillance capability for the detection of oncoming missiles and aircraft, as well as observing important surface features such as ships, coastlines and icebergs. As a result of the combination of recent weapons system technological advances and the current threat situation, it is not always advisable to use active emitters, such as radars, for surveillance and/or the detection and tracking of intended targets. The SAR-8 was developed as an alternative passive detection capability that could be used in threat situations, especially when anti-radiation missiles can be expected or heavy jamming is encountered. The system would also have had applications for navigation and station keeping in darkness and inclement weather conditions during situations where radar and radio silence have been imposed.

In surface ship applications, the SAR-8 was designed to automatically supply automatic detection and tracking data to the platform's combat weapon systems. The SAR-8 was specifically planned for application as an upgraded version of the Mk 23 TAS (Target Acquisition System) that forms the fire control element of the NATO Sea Sparrow anti-aircraft missile system.

Variants/Upgrades

No known variants or upgrades identified. The SAR-8 has been superseded by the IRST development.

Program Review

Background. The SAR-8 began as a joint US/Canadian program, with the US providing two thirds of the funding and the Canadians one third. The system saw its genesis in the joint Spar/General Electric IRST program. This mid-1970s program, also a joint US/Canadian effort, saw developmental IRSTs undergo trial evaluations onboard the Canadian Navy escort DDH 283 Algonquin and the US Navy Spruance-class destroyer DD 965 Kinkaid. The program was canceled by Congress in favor of the Seafire fire control system, which, in turn, was canceled in the

early 1980s. The IRSTD program was resurrected and renamed the SAR-8 in 1984, when the joint program was reinstated and full-scale engineering development began.

By May 1992, the cost for developing the two demonstration SAR-8 IRST systems had reached approximately US$160 million as schedule delays and cost increases plagued the program with first production not even slated to begin until 1994. As a result, the US Navy once again shelved plans to build an infrared tracking system for ships and reassessed its approach on how to best proceed with the development of a next-generation ship-based system.

While the SAR-8 program has been terminated and will not go beyond the two EDM models already built, those EDMs have been used in a test program to develop a new IRST that can be fielded onboard all appropriate ships. Although the SAR-8 was able to satisfy operational performance requirements, its weight and cost made its continued development unfeasible. Weight was a particularly important factor due to the need to locate this type of system fairly high on a ship's profile in order to enhance surveillance range.

The Navy's continued interest in a new IRST system is fueled by the objective to develop a truly integrated ship self-defense system which relies primarily on communication between existing weapon and sensor systems to permit these system elements to operate in a coordinated and highly automated fashion. Although a number of different IRST systems designed for use onboard aircraft and ground vehicles existed during the SAR-8 development timeframe, their relatively short range reduced their potential usefulness to the Navy's surface ships, which must respond in a few seconds to defend against an attack by anti-ship cruise missiles. This threat identified the specific need for a system that is both more sensitive and has a much longer range capability. The need to satisfy these requirement parameters has been reinforced by the Navy's shifting emphasis to littoral warfare.

In its FY93 objectives, the Navy transferred the SAR-8 development models to the Surface Warfare Research Center in Dahlgren, VA, to be used as a test system to aid in the technical definition of the desired IRST replacement program. It has been reported that one of the SAR-8 EDMs was used to support SSDS Mk1 trials conducted onboard the USS *Whidbey Island* in June 1993, which were successful in demonstrating integrated signal and data processing. Working with US$5 million in funding from the IRST FY92 budget, the Navy strategy was to stretch this funding through FY93 by concentrating on small focused research activities until a new IRST program could be formulated and launched in the FY94 funding.

The Navy completed a cost and operational effectiveness analysis (COEA) in FY94 which considered critical issues concerning the development of IR sensors under the Ship Self Defense program. The studies performed considered the sophistication and diversity of threats facing naval surface combatants, specifically the increasing development of low radar cross-section technology, use of passive anti-radiation missiles and increased speed/lower altitude attack mission flight envelopes. Apparently, a number of iterations of the so-called Ship Self Defense System were considered, including one which was reported to be based on the SAR-8 EDM, and was used in the USS *Whidbey Island* SSDS Mk1 trials.

FY94 became a transitional year for the program, with funding coming from PE0603755N, Project Z2138 in preparation for the FY94 program "relaunch." When the program emerged as one of several initiatives, Project J0665, IR Search and Track, under PE0603755N, it provided funding for the acquisition of two infrared sensors, the Infrared Search and Track (IRST) sensor and the Thermal Imaging Sensor System (TISS). The IRST provides passive augmentation to complement radar, electronic support measures (ESM) and visual surveillance systems for airborne targets. The TISS provides surface ships with a day/night high resolution surveillance capability for small cross-section targets. TISS supports anti-surface warfare (ASuW), mine warfare (MIW) and anti-submarine (ASW) missions, and was identified as a nondevelopmental item (NDI) procurement.

Further accomplishments listed for FY94 included development of IRST and TISS specifications, preparation of the RFQ(s), preparation of acquisition plans and work to prepare for a Milestone II decision to enter the EMD phase, and finally, work toward awarding the TISS EMD contract.

During FY94, however, the program suffered a general funding reduction; released funding was reprogrammed. The net result was a one-year delay in IRST development caused by a delay in the finalization of requirements and a subsequent two-year slip in the EMD phase to accommodate a 2-phase development approach.

As a result, program emphasis in FY95 was on TISS. The FY95 plan included the following TISS activities: delivery of TISS EMD units and integration within the Land Based Test Site (LBTS), the technical evaluation (TECHVAL) and operational assessment, and preparation to obtain a Milestone III decision to enter full-rate production. Overall program risk reduction efforts were also scheduled to be continued.

Prior to the program delay, Spar Aerospace, in conjunction with Loral Defense Systems — Akron, Ohio, was identified as a highly competitive bidder for the IRST program. Spar has developed the LWIRST (Light Weight

Infrared Search and Track), a dual-band system that retains the large aperture, high sensitivity, and basic hardware/software architecture of the SAR-8, but is significantly lighter and less expensive. The shipboard LWIRST scans through a 360-degree azimuth window at 60 rpm, with elevation coverage from -1° to +24°. The unit is reported to be able to handle more than 200 tracks simultaneously. The LWIRST is designed to be able to detect a supersonic sea-skimming anti-ship missile at 30.5 km range under average weather conditions, measure the missile's bearing to better than 0.1°, and estimate its range to within 20 percent. Designer specifications indicate the system would weigh only about 1,830 pounds.

The IRST project is now (1997) referred to as Project U0665 IR Search & Track within Program Element 0604755N in government documentation. It is the Navy's response to the sophistication and diversity of threats facing naval surface combatants which has been increasing with respect to lower radar cross-section, use of passive anti-radiation missile (ARM), increased speed, and lower altitudes. It continues to fund development of two infrared sensors: the IRST as well as the TISS (thermal imaging sensor system), as described above.

Having gotten back on track, the project continued IRST EDM design development, focusing on performance, safety, reliability, environmental suitability, human factors, and combat system integration. Work also involved IRST logistics support development, as well as preparation for test and evaluation and an IRST preliminary design review (PDR).

The construction of EDM-1 is scheduled to be completed in FY97, and the device delivered to the land-based test site (LBTS). Preparations will be made for IRST installation at the LBTS, and the IRST PDR is to be conducted.

The contract award for building the IRST was announced in August 1996: Lockheed Martin was the big winner. The company was awarded a US$14.9 million cost-plus-award-fee contract, which includes options that could bring the cumulative value up to US$44.9 million. In 1995 it was reported that Hughes was teamed with Lockheed Martin (then Martin Marietta), which would be prime, to compete for the IRST award. Competitors included Texas Instruments and Westinghouse.

Funding

US FUNDING

	FY94		FY95		FY96		FY97 (Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
PE#0604755N Ship Self Defense Project U0665[a]								
IRST	-	12.4	-	16.0	-	13.5	-	3.9

	FY98 (Req)		FY99 (Req)		FY00 (Req)		FY01 (Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
IRST	-	14.6	-	30.7	-	29.2	-	10.2

All US$ are in millions.

[a]Also falling under Project U0665 Infrared Search & Track is the Thermal Imaging Sensor System (TISS), which will provide surface ships with a high-resolution day/night surveillance capability.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Spar	85.8	Aug 1986 – Contract for full-scale engineering development of SAR-8.
Canadian Comm	5.3	Oct 1988 – Modification to contract for continued development of SAR-8 (N00024-86-C-5828).
	5.3	Oct 1988 – Modification to contract for continued development of SAR-8 (N00024-86-C-5828).
Lockheed Martin	14.9	Aug 1996 – Cost-plus-award-fee contract for Infrared Search & Track System (IRST). Includes options which, if exercised, will bring the cumulative value to $44.9 million. Work expected to be completed by second quarter of 2000 (N00024-96-C-5434).

Timetable

mid	1970s	US teamed with Canada in IRST program
early	1980s	IRST effort canceled
Jan	1983	FSED project agreement for the revived IRST (now SAR-8 IRSTD) signed
Aug	1984	Full-scale engineering development contract for the SAR-8 to Spar Aerospace
Sep	1989	Delivered EDM #1 to land-based test site
	FY90	Delivered EDM #2 to ship installation site.
	FY91	Developmental testing phase completed.
	FY92	SAR-8 program funding zeroed
Jun	1993	SAR-8 EDM model used in SSDS Mk1 trials
Jun	1994	System specifications developed
4th Qtr	FY95	Award IRST EMD Phase I
	FY96	IRST contract award to Lockheed Martin
3rd Qtr	FY96	IRST PDR
	FY98	Award IRST EMD Phase II

Worldwide Distribution

This program has been a joint **US**/**Canadian** development effort.

Forecast Rationale

The new-generation IRST effort has attracted a variety of contenders, including Spar Aerospace teamed with Loral Defense Systems, with systems from El-Op of Israel (Multi-Sensor Integrated Surveillance) and Rockwell's Tactical Infrared Staring System also considered contenders, although the latter systems may be better suited for the TISS requirement. Contractor selection, originally scheduled for 1994, was delayed until 1996, keeping many in suspense. Finally defense-industry giant Lockheed Martin was named the winner.

The significance of the Navy's IRST program is obvious. IRST is needed to bolster the defense of ships against the threat from anti-ship cruise missiles (ASCM), which has become a greater concern as the Navy conducts more operation in littoral regions and as ASCM technology continues to proliferate.

The IRST system will likely find a large and receptive foreign market in addition to its US Navy use. The UK Defence Research Agency has voiced its desire for such system on the Common New Generation Frigate (CNGF), and may combine IRST with a multisensor data fusion system and precision electronic support countermeasures (PESMs). Other nations throughout Europe, many of whom have been experimenting with similar concepts for years, could become interested as well if a top-quality system emerges, which, with Lockheed Martin at the

helm, seems abundantly likely. This is especially the case if Hughes is acting as second in command. Both companies have impressive track records in the electro-optical field. Lockheed Martin worked on the Navy's F-14D aircraft IRST, the Air Force's IRST, the Army's Advanced Air Defense Electro-optical Sensor System programs, and other second-generation electro-optic systems. Hughes was involved with the Navy's first IRST system, and has worked on second-generation systems with mid- and long-wave detectors.

Ten-Year Outlook

SAR-8 production is complete. A new production chart for IRST will be provided as soon as more information on the final requirement becomes available.

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