

# ARCHIVED REPORT

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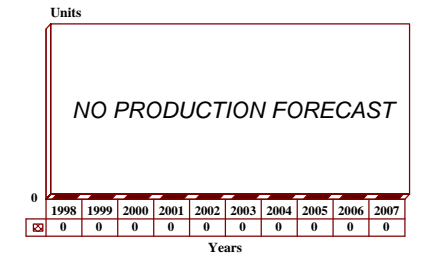
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## MESAR - Archived 6/99

### Outlook

- All testbed prototypes believed to have been delivered
- Technology demonstration program only; MESAR has no market potential itself
- MESAR used as basis for Sampson naval radar and HPR land variant
- **BARRING ADDITIONAL INFORMATION, THIS REPORT WILL BE DROPPED IN 1999**

10 Year Unit Production Forecast  
1998-2007



### Orientation

**Description.** The Multi-function Electronically Scanned Adaptive Radar (MESAR) is a technology demonstrator of a multi-mode active-array radar.

#### Sponsor

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**Licensee.** No production licenses have been granted.

**Status.** Demonstrators have been delivered; some testing believed to be ongoing to maintain baseline data for Sampson and HPR projects.

**Total Produced.** At least one technology demonstrator and two prototype radars have been completed.

**Application.** MESAR was a jointly funded demonstrator program between the Defense Evaluation and Research Agency and Siemens-Plessey Radar aimed at establishing the design, performance and production techniques for the manufacture of multi-function radars over the next 20 years. Key technology areas that were addressed in the program included the use of low-cost gallium arsenide (GaAs) modules, array technology, adaptive nulling for ECCM and beam management, and data handling software.

**Price Range.** As MESAR was a developmental project there is no price range *per se* for the demonstrator units. The overall program cost is also unknown, but is probably comparable to the US SPY-1 radar program.

## Technical Data

### Characteristics

Frequency band:	E/F-band
Azimuth scan coverage:	+/- 45 deg
Elevation scan coverage:	-35 to +37.5 deg
Module power:	2 watts (maximum)
Pulse length:	Variable between 0.1 micro to 1 millise
Target velocity:	Up to 1,000 m/sec
Range discrimination:	30 m
Clutter processing:	Coherent/non-coherent MTI + pulse-Doppler

**Design Features.** The Multi-function Electronically Scanned Adaptive Radar (MESAR) was a Siemens-Plessey program which enjoyed the active support and participation of the Defense Evaluation and Research Agency (DERA).

DERA was responsible for MESAR's data processing and pulse-by-pulse control, while Plessey's responsibility encompassed the rest of the system. The antenna employs gallium arsenide (GaAs) technology and operates in the E/F-band. Siemens-Plessey's E/F-band modules measure 40 x 95 x 10 mm, and weigh about 130 gm. A definitive antenna would contain up to 2,000 such modules and would be considerably lighter than the single transmitter phased array used in the SPY-1 systems.

The Caswell Research Center focused primarily on the development and production of an E/F-band transceiver module, though the technology acquired is applicable to

all frequencies currently used by mainstream military radar (E- to K-bands).

**Operational Characteristics.** A MESAR array will cover 90 degrees in both azimuth and elevation and will be deployable in fixed or rotating configurations. Siemens-Plessey has indicated that it has a preference for a fixed masthead solution incorporating four panels canted at 20 degrees to the vertical. This would leave a requirement for a horizontally mounted array providing vertical coverage to counter the steep diving missile threat, but a masthead mounting will not be mandatory for the fifth face. Siemens-Plessey has revealed that the weight of a five-face static display would be in the region of 5 tonnes. This would constitute the major weight of the system, the below-deck equipment being limited to control, processing and display functions.

## Variants/Upgrades

The MESAR program, due to its status as a developmental testbed program, has not spawned variants of itself, but rather has aided in the development of at least three other systems as follows:

**High Performance Radar.** A spin-off from the MESAR program is the new High Performance Radar (HPR) being developed by Siemens-Plessey for incorporation into the new UK air defense missile requirement. A consortia composed of Hughes, NFT and Siemens-Plessey proposes that a system based on the AIM-120 and/or an enhanced version of that missile be adopted as an interim and subsequently upgraded with the HPR when that radar becomes available.

**MESAR-2.** An additional test radar in the MESAR series is MESAR-2. This is assembled and configured to fit within a standard ISO container for C-130 transportation. It is substantially more powerful than the original system.

**Sampson.** The Sampson radar is a direct development of MESAR. Sampson is scheduled to be used on at least the UK versions of the Project Horizon frigate and may be retrofitted to existing UK ships. See separate report titled Sampson in the Warships, Land & Sea-Based Electronics, or Radar binder.

## Program Review

**Background.** Work on MESAR started in 1982, when the DERA sought the participation of British Industry to work on a new long-term naval radar project as a joint venture. The project was intended to lead to an eventual replacement for Type 996 radar, now entering service on board the RN's Seawolf-equipped warships. Marconi apparently declined the offer, but Siemens-Plessey accepted.

In 1983, Siemens-Plessey established a new engineering development unit and a 3,500-ft production facility at the company's Caswell Research Center as part of a US\$75 million investment plan. The aim was to investigate ways to mass produce gallium arsenide (GaAs) integrated circuits (ICs) for (among other things) RF application. The successful development of MESAR as an operational concept is largely a result of this early commitment by Siemens-Plessey.

A technology demonstrator radar has been under evaluation since the middle of 1988. The knowledge gained from this is being used in the construction of a prototype radar which was completed on schedule in April 1991. A test program aimed at "demonstrating system functionality" and to confirm the predicted performance in heavy ECM and cluttered environments against high-speed maneuvering and stealthy targets has been initiated.

Siemens-Plessey was also awarded a contract by the US Army Strategic Defense Command (USASDC) to evaluate active-array technology for the provision of long-range surveillance detection against ballistic missiles. Under this contract, Siemens-Plessey studied module architectures and evaluated the performance of gallium arsenide technology for fire control radars.

The existing single-face array demonstrator underwent further evaluation in additional trials at Funtington on behalf of USASDC. A further series of trials, involving a full four-faced radar array, were started in January 1994 on behalf of the US Ballistic Missile Defense Organization. These took place at Freugh in Scotland and involved evaluating the performance of the radar against MIRVs in high-density jamming environments. They were completed in March 1994.

In 1992, Hughes and Siemens-Plessey signed a joint agreement for the development of the new High Performance Radar (HPR) to act as a primary sensor for the ADSAMS proposal to meet the British Medium Range

Surface to Air Missile System (MSAMS) requirement. The HPR is a derivative of the MESAR radar.

The HPR is a single-faced radar mechanically rotating at 10 rpm and operating in the E/F-band. The gallium arsenide technology developed as a part of the MESAR program will be combined with signals processing software from Hughes to produce the new radar. The agreement covers the use of HPR for any suitable program, but is particularly aimed at the British MSAMS requirement.

Initially, the Hughes/Siemens-Plessey/NFT bid for MSAMS was based on a combination of the TPQ-36A radar and a sextuple launcher for the AIM-120 AMRAAM missile. This combination has already been selected for the Norwegian air defense requirement, and the experience gained with that project is central to the team's bid.

The HPR is seen as a preplanned product improvement to the basic system which could be implemented in parallel with the basic system installation. Subsequently, the British abandoned the MSAMS requirement in favor of a longer term approach, including anti-tactical ballistic missile capability.

The UK Royal Navy had also expressed an interest in a naval version of MSAMS. This is fulfilled by the ASTER-30 missile at present but this has suffered serious development problems and the Royal Navy is very unhappy with it. The HPR/ADSAMS combination has also been bid to the United Arab Emirates (UAE) in response to its requirement for a medium-range air defense system. In this competition, the system is competing with the Patriot system and the Russian S-300 (SA-12).

In late 1995, Siemens-Plessey/DERA undertook the development of a new technology demonstrator version of MESAR, designated MESAR-2. This has been configured to fit within a standard ISO container for transport in a C-130 aircraft and is substantially more powerful than the prototype. On completion, MESAR-2 will be tested against faster, more complex (fragmenting) targets at longer ranges. This radar is being considered as an adjunct to the larger, less mobile Lockheed Martin Ground Based Radar (GBR) for the THAAD program.

In the mid-1990s, the MESAR program was used as the foundation for the Sampson radar. This radar is due to be fitted to the UK versions of the Project Horizon frigates and possibly the French and Italian versions also.

## Funding

Current development is funded as a joint venture between the Defense Research Agency and Siemens-Plessey Radar Ltd. Activities related to the US Strategic Defense Initiative have been funded by a contract issued from the US Ballistic Missile Defense Organization under PE#0603216C.

## Recent Contracts

<u>Contractor</u>	<u>Award</u> <u>(\$ millions)</u>	<u>Date/Description</u>
Siemens-Plessey	<sup>(a)</sup>	Aug 1995 – UK MoD contract to build and integrate a new antenna array for MESAR.
Siemens-Plessey	<sup>(a)</sup>	Nov 1995 – Contract to increase ballistic missile defense demonstration capability of MESAR system.
Siemens-Plessey	7.8	Aug 1996 – Extension to the Aug 1995 contract awarded by UK MoD to extend the scope of the system. Contract will cover preparation of the system for trials at the White Sands missile range in New Mexico, US.

<sup>(a)</sup> The dollar amount of the contract award is unknown.

## Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1981	Plessey/DERA discussions about GaAs phased-array technology
	1982	Work on MESAR began
	1983	Plessey commissioned new GaAs IC production facility
July	1989	MESAR phased-array radar contract
Apr	1991	Fully functional MESAR phased-array radar delivered
Sep	1992	HPR derivative of MESAR announced
Jan	1994	USADC trials of MESAR started
Mar	1994	USADC trials completed
	1995	MESAR-2 development started
Early	1999	MESAR-2 trials start

## Worldwide Distribution

At present, only prototype radars exist in the UK.

## Forecast Rationale

The MESAR technology-development program is still being evaluated following the delivery of a single prototype radar in April 1991. The experience gained with MESAR is being used to design the service-capable Sampson and HPR radars. These were originally scheduled for availability in 1994, but current plans are for the naval variant, Sampson, to be available possibly by the end of the decade (due to delays with the Project Horizon

as a whole), with a land-based system, the High Performance Radar or HPR, to follow in 2005-2010.

The naval Sampson system and its production future are covered in a separate Forecast International report in this binder. A similar report will be released covering the HPR radar, when the characteristics and potential of that system become established. When full development of the HPR

is undertaken, MESAR will have served its purpose and no production will be undertaken. The MESAR prototype will, of course, continue to be extensively used in support of the HPR and Sampson programs.

There can be little doubt that the highly advanced MESAR radar system will provide a technology base for many future military radars. Although it is being developed in response to a naval requirement, the basic technology can be applied across virtually the entire range of radar

functions. Indeed, it is possible that an adaptation of MESAR technology could find its way into air traffic control, where its unparalleled ability to track multiple targets will be invaluable.

There is no market for the MESAR system *per se* due to its testbed nature. However, systems developed from MESAR such as Sampson and HPR will have the ability to compete in their respective market niches.

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