

# ARCHIVED REPORT

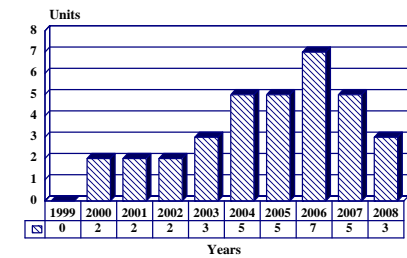
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## Sampson - Archived 6/99

### Outlook

- System still in competition for RAN WIP program
- UK Type 23 upgrade appears to be biggest application followed by Horizon
- System changed from triangular wedge-head to lighter, more reliable rounded bi-head design
- UK threat to pull out of the Horizon program in early 1999 appears to be an empty one

10 Year Unit Production Forecast  
1999 - 2008



### Orientation

**Description.** A 3-D active-array naval surveillance/fire control radar.

#### Sponsor

Siemens-Plessey Systems  
Air Defence Division  
Newport Road  
Somerton, Cowes  
Isle of Wight PO31 8PF  
United Kingdom  
Tel: +44 0 1983 294 141  
Fax: +44 0 1983 202 840

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

**Status.** Advanced development.

**Total Produced.** No production units, but at least two prototypes are believed to have been built.

**Application.** Primary medium-range air and surface search radar, to provide hemispherical search, track and missile communications as part of a local area missile system.

**Platform.** Replacing the Type 996 radar, the initial platforms will be the retrofitted Type 23 frigates and the Project Horizon Common New Generation Frigate.

**Price Range.** At this early stage in development, a unit cost assessment is necessarily approximate. However, a figure of around US\$15 million would seem appropriate.

## Technical Data

	<u>Metric</u>	<u>US</u>
<b>Characteristics</b>		
Surveillance band:	E/F-band	S-band
Tracking band:	H/I-band	X-band
Rotation rate:	10 rpm	
Range (0.008 m <sup>2</sup> target):	105.0 km	57.4 nm
Range (0.0016 m <sup>2</sup> target):	70.0 km	38.2 nm
Range (0.0002 m <sup>2</sup> target):	42.0 km	22.9 nm

**Design Features.** Sampson is an operational development of the MESAR technology demonstration system. The radar array consists of three MESAR faces, each with 2,560 independent transceivers. The transceivers are arranged in quadpacks in which a single controller runs four gallium arsenide (GaAs) modules. The returns from the faces are integrated by software. The complete array rotates at 10 rpm which, allowing for the three faces, equates to the 30-rpm revolution rate (and thus to the data rate) of the existing Type 996 radar.

H/I-band uplinks for missile command guidance are accommodated between the main faces of the array. A fourth, zenith face is provided on top of the rotating array to permit full hemispheric coverage. A three-face H/I-band missile tracking subsystem, designated Trixar, is mounted above the main faces of the arrays. Unlike many active phased-array systems, the Sampson system does not require a below-decks transmitter or provision for chilled water cooling to the array modules.

**Operational Characteristics.** Sampson is claimed to provide a combination of low-PRF long-range surveillance and high-PRF horizon search within the same set. Jamming would be overcome by steering antenna nulls into the jamming beam. Pointing errors in single-face

phased-array systems increase sharply as the target moves away from the broadside. Siemens-Plessey claims that the use of a three-face array limits this effect and also makes for a high data rate at low scanning speeds.

Siemens-Plessey also claims to be developing special algorithms which will utilize the very wide bandwidth of Sampson to improve angular accuracy. Finally, efforts to avoid multipathing effects are being made by using frequency agility.

As part of the ship's PAAMS (Principal Anti-Air Missile System), an AAW command and control system first evaluates the tracks and assigns priorities for counter-attack measures. After the launch data are fed into the missiles, the booster is ignited for take-off, launching a salvo. The multifunction radar's task is now to gather the outflying rounds with a single rotation as they turn over toward the target, and the tracks are added to the command system tracking plot. Target location and velocity data are provided via the radar uplink once a second. This information is used to guide the missile toward an interception point, with the trajectory shaped so the target is approached from outside any jammed sectors.

## Variants/Upgrades

HPR. Siemens-Plessey Defense Systems is developing a new land-based radar, designated the High Performance Radar or HPR. This development originated in response to a now-defunct British requirement for a medium-range air defense missile system. The Siemens-Plessey proposal was made as part of a consortium with Hughes and NFT. The HPR would not have been featured in the initial missile installations but was available as a preplanned product improvement. The HPR is effectively a single-faced version of Sampson.

Spherical-Head Variant. In December 1998, BAe debuted an enhanced antenna configuration for Sampson. This incorporated a new, spherical form that generates lower windage and significantly lowers the above-deck weight by over 1,000 pounds.

This unit also appears to be a bi-faced antenna suggesting that the system would require a rotation rate 50 percent faster if the data rate is to be maintained. This design is expected to be able to give Sampson tracking capability of up to 500-1,000 targets simultaneously, and an ability to engage 12 of those. Range, meanwhile, would be in the neighborhood of 400 km, which is presumably of particular interest to the British navy considering its intended applications.

Furthermore, Sampson is presently being referred to as a family of radars, instead of as a single, specific system.

LRHPR (Long-Range HPR). An extended-range version of the HPR.

## Program Review

**Background.** Development of the Sampson operational derivative of the MESAR technology demonstrator began in 1989 and was first publicly revealed in 1991. No prototype has yet been constructed; originally Siemens-Plessey estimated that Sampson would be ready for production in 1994. This turned out to be very optimistic, and work on producing a prototype had only started by that time, implying that the radar in reality would not be available before the 1996-97 time frame.

In September 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 single-faced radar mechanically rotating at 10 rpm and operating in the E/F-band. The gallium arsenide (GaAs) 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 was particularly aimed at the British MSAMS requirement. The HPR is basically a single-faced, land-mobile derivative of the Sampson radar.

In January 1993, the Italian navy formally joined the Anglo-French Air Defense Frigate Program. As a result, the addition of four ships for the Italian navy increased the planned procurement from 16 ships (12 British and four to six French) to a total of 20-22. In its trinational form, the program became known as the Project Horizon Common New Generation Frigate (CNGF). This was envisaged as mounting the Astral long-range search radar and EMPAR multifunctional radars (MFR) for the target acquisition and fire control roles. Due to extreme bureaucratic delays in finalizing the design requirements and almost irreconcilable differences between the partners in design approach, the production of an initial baseline design was delayed until March 1994.

This pushed the initial entry to service date back to 2002 at the earliest, meaning that the build schedule for the CNGF would be aligned with that of Sampson. Accordingly, the British suggested that Sampson replace EMPAR as the CNGF MFR, with a resulting substantial increase in the combat efficiency of the ships.

This proposal was fiercely resisted by the French and Italians, the latter on the grounds that EMPAR was the only system of note they were contributing to the design and the former because the change of radar would fundamentally alter the nature of the ships' air warfare

system — which was of French design. The partners' response to the British proposal was to delay the development contract awards for the ship command system in an attempt to pressure the British into accepting the existing radar fit.

In late March 1994, the Joint Indicative Design for the CNGF was released by the Joint Project Office. This revealed an outline design reflecting the British 6,400 L-series designs prepared prior to French and Italian involvement. Only superficial changes had been made, including the provision of a raised boat deck midship, doubling the anti-ship missile armament from eight to 16 rounds and halving the number of inner-layer missile system launchers from four to two. The nature of the MFR was left ambiguous, suggesting that the political dispute over the system had yet to be resolved.

The solution to the radar problem and to a number of other equipment fit issues was provision for transparent interfaces in the command system. These provide individual countries with the option of fitting national preference equipment without disturbing commonality within the command system. As a result of this philosophy, the UK will be selecting the Sampson radar for its ships regardless of the attitudes of its partners.

In March 1995, the in-service date for the first of class Project Horizon ships was abruptly classified. This would suggest that unofficial reports of a three-year delay in the project are correct and that the IOC has now dropped back to 2005/2006 at the earliest. This also significantly strengthens the British case for using the Sampson radar. In early 1996, the fact of such delays was confirmed although their extent was not. Very ambiguously worded MoUs for Project Horizon were signed in April 1996.

More recently, in late 1996 and early '97, the future of Project Horizon began to appear even more distant, as disagreements over the command and control system, as well as the above-mentioned missile and radar issues, became public knowledge through the press. It is now believed that if the project proceeds at all, the first ship will not enter service until 2005/2006.

This also means that the number of ships to be built will be cut back from the original plans. If France stays with the program it will likely not buy more than two of these ships; Italy's financial woes are so overwhelming that it is difficult to foresee any procurement at all of the Horizon in today's environment. On the other hand, admittedly, Italy has a direct need for a ship of the Horizon type for its Mediterranean coverage. Its

commitment is for four Horizons, but the real number is likely to be contingent on receiving funding for them.

Furthermore, shipbuilding projects are always highly political issues for each country involved, due to their employment impact. For this reason alone, it is unlikely that the project would be scrapped altogether by any of the partner countries. It is also necessary to point out that if one or more members of the team drop out, developing a substitute will take even longer, and the money thrown into Horizon remains unrecoverable. Britain's commitment as of now is for an unspecified number but no more than 12 Horizons.

Consequently, the European market outlook for Sampson is rather slim. Meanwhile, however, it appears that Britain in particular is deeply committed to the concepts and capabilities of Sampson/MESAR. Especially noteworthy is the fact that the US Ballistic Missile Defense Organization funded the 1994 trials of MESAR, which gives added credence to these technologies and their role within these NATO forces.

The Sampson radar was also proposed for the Australian FFG-7 upgrade program. The Australian navy, which has a very high regard for the Arleigh Burke-class design, is investigating a major enhance-

ment of these ships in order to better exploit the excellent characteristics of the design. One option is a major increase in target handling capability, by the installation of Sampson in conjunction with a VLS launcher for Standard and Evolved Sea Sparrow missiles.

Meanwhile, the delays in the Horizon program in Europe are pushing the dates for Sampson's projected service entry up as well. If the Horizon does happen, the first three ships are not likely to begin sea trials before 2005, and an actual in-service date for the British ships of 2006 would therefore seem realistic. The unknown factor is whether Sampson as a program can sustain such delays, or will it be scrapped altogether for ship applications, with APAR instead being chosen for the UK Horizons.

In late 1998, BAe debuted its new and improved Sampson spherical head. This new antenna head will replace the previously designed triangular wedge-shaped head. The new form is over 1,000 pounds lighter, has less wind resistance and incorporates an air vent as part of a closed loop cooling system. These changes do not alter the radars capability or detection range, but improve its reliability and availability.

## Funding

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Sampson is being developed as a private venture using corporate resources.

## Recent Contracts

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No contractual information is currently available.

## Timetable

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<u>Year</u>	<u>Major Development</u>
1989	Sampson development started
1991	Sampson publicly revealed
1992	HPR publicly revealed
1994	Estimated date of prototype trials
1997	Projected contract for full development and initial production models
1999	Full-scale production likely to begin
2000	Anticipated availability of first operational units

## Worldwide Distribution

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No Sampson systems have yet been produced.

## Forecast Rationale

The Sampson radar has continued to weather the ups and downs of the UK portion of the Project Horizon Tri-National Frigate program. The initial fight to get Sampson on board the Italian and French was lost when both parties opted for the EMPAR as the main sensor for the PAAMS anti-air system. The UK, which would be purchasing the bulk of the frigates, will instead use Sampson.

However, in early 1999 the Sampson program managers must have received a shock when the UK, dissatisfied with the pace of the Horizon program, very loudly and publicly stated that they were going to pull out of the program and start over on a 100 percent UK-designed next-generation frigate. Without UK participation neither France or Italy would have the necessary funds to finish off the program or procure what would be significantly higher priced frigates. Many analysts believed that this was just a temper tantrum that has been exhibited in one form or another by all participants in the past. This in fact was borne out in the following months as the UK quietly went back to work on the program.

Even with the possible cancellation of Horizon looming over their heads, BAe still maintains a good base with which to begin production of Sampson. The UK Royal Navy plans to upgrade or retrofit Sampson onto the 16 Type 23 frigates. The first ship is scheduled to receive the upgrade in 2000 with the entire class retrofitted by 2008.

A brief discussion ensued as to whether or not the UKRN should also retrofit the Type 42 destroyers. The fact that no apparent move has been made in this direction coupled with the age of the Type 42, and that Horizon will replace these vessels, indicates that Sampson will not be retrofitted.

While no known export orders have been awarded, the Sampson radar continues to compete for the Royal Australian Navy's (RAN) Warfighting Improvement Program (WIP) for the FFG-7 class of vessels. Sampson's main competition is from Hollandse Signaalapparaten/Raytheon Naval & Marine APAR, the CEA Technologies CEA-FAR, and the Lockheed Martin AN/SPY-1F systems. Of these it is felt that the SPY-1F system will be eliminated due to cost and size.

The 10-year forecast is currently based on the production of the Horizon frigate as well as the retrofit of the Type 23. These two programs will be responsible for the bulk of Sampson procurement between 2000-2008.

Additional orders are also expected in the years to come and have been indicated in the "Various" line. It should be noted that the first four years indicate the projected schedule of the RAN FFG-7 upgrade which could fall through. As such this line should be treated as highly speculative until a final decision is made regarding the FFG-7 upgrade.

## Ten-Year Outlook

### ESTIMATED CALENDAR YEAR PRODUCTION

Designation	Application	<u>High Confidence</u>				<u>Good Confidence</u>				<u>Speculative</u>		Total	
		thru 98	99	00	01	02	03	04	05	06	07		08
SAMPSON	DDG/FFG (VARIOUS)	0	0	0	0	0	1	2	1	2	1	1	8
SAMPSON	HORIZON FRIGATE (UK)	0	0	0	0	0	0	1	2	3	2	0	8
SAMPSON	TYPE 23 FRIGATE (UK)	0	0	2	2	2	2	2	2	2	2	2	18
Total Production		0	0	2	2	2	3	5	5	7	5	3	34