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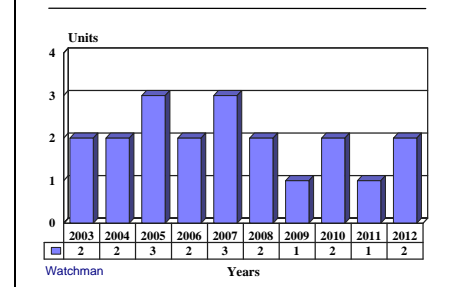
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Watchman - Archived 5/2004

Outlook

- Prospects for continued production seem to have improved with system's transfer in April 2001 from BAE Systems to Alenia Marconi
- No new contracts made public since the early 1990s

10 Year Unit Production Forecast
2003 - 2012



Orientation

Description. E/F-band medium-range 2D radar tasked with medium-range Air Traffic Control (ATC) and surveillance (and surface vessel movement for CSR version).

Sponsor

BAE Systems

(formerly British Aerospace Defense Systems, and before that Siemens-Plessey Systems)

Grange Road

Christchurch, Dorset BH234JE

United Kingdom

Tel: +001 44 1202 486344

Web site: www.baesystems.com

Contractors

Alenia Marconi

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00131 Rome

Italy

Tel: +1 39 06 41503452

Web site: <http://www.amsjv.com>

BAE Systems

(formerly British Aerospace Defense Systems, and before that Siemens-Plessey Systems)

Grange Road

Christchurch, Dorset BH234JE

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Tel: +011 44 1202 486344

Web site: www.baesystems.com

Licensee. No known production licenses have been granted.

Status. In production and service.

Total Produced. An estimated 100 units were produced through 2002.

Application. Watchman radars can be deployed in mobile or fixed configuration. Current operational deployment consists of a spectrum of commercial and military ATC and surveillance applications. An advanced technology solid-state transmitter upgrade is under development.

Price Range. Exact figures have been difficult to confirm due to the various deals between customers and the number of years the system has been available. Prices have varied between US\$1.5 million and US\$2 million per system, depending on the type of ancillary equipment ordered and the extent of the electronic countermeasures (ECM) package. The USAF order for a single Watchman radar was worth US\$3.125 million.

Technical Data

Characteristics

Frequency	E/F-band (2,750-3,050 MHz)
Rotation rate	15 rpm
MTI improvement	46 dB
Range 3 sq m target	80 nm at 30,000 ft/148 km at 9,150 m 60 nm at 10,000 ft/111 km at 3,050 m

Design Features. Watchman is the designation of the highly flexible family of BAE Systems' E/F-band, medium-range surveillance radar series, which is targeted for the following missions: high performance in terminal area and approach surveillance, fighter recovery, ground control approach surveillance, approach control, radar sequencing control, outbound control, and helicopter surveillance.

A dual pulse train is used; it has a very short pulse (0.4 microseconds) for high discrimination at short ranges and a much longer pulse (20 microseconds) for long-range detection of aircraft with small radar cross sections. The long pulse is compressed in the receiver using a surface acoustic wave equalizer. Signal separation is achieved by using different radio frequencies for the long and short pulses. Target detection is further enhanced by interchanging frequencies at nine pulse repetition intervals. Watchman thus provides frequency diversity using a single transmitter. The resulting overall stability contributes significantly to anti-clutter performance.

Radar returns are processed in parallel through normal radar ground clutter filter and moving clutter filter channels, each of which uses both in-phase and quadrature processing. Target detection from all three processing channels is automatically integrated and passed on for transmission to the display system. This ensures that the operator views a clean video picture and also provides considerable fail-safe capability. Compatibility with staggered pulse repetition frequency operation ensures good velocity response free from blind speeds and immune to second-time-around clutter returns.

Designed for high reliability and ease of installation and operation, each console incorporates all the requisite hardware and software facilities associated with the display of primary radar signals. A selection of high-resolution digital maps may be generated from internally stored data. Where applicable, Identification Friend or Foe/secondary surveillance radar (IFF/SSR) data can be selectively displayed with or without primary radar video. For the military requirement, the

system is likely to operate in a jamming environment and provides a basic control service.

Watchman (T). Two basic configurations are available. The first is composed of a single equipment cabin and antenna, with both units transportable by road (trailer) or air. It can be set up in under an hour. The antenna is mounted on the cabin during operation. The cabin contains an IFF interrogator/receiver and interference blanker, two operational displays, and VHF/UHF communication equipment.

The second configuration consists of two smaller equipment cabins and an antenna mounted on a pallet. All three units are mounted on mobilizers for transport, providing cross-country mobility. The system can be transported by helicopter or in medium-sized air transport. During operation, the antenna is mounted on the primary radar cabin, together with the IFF interrogator/receiver and monitor display. The second cabin contains two or three autonomous displays and VHF/UHF communications equipment.

Watchman (S). Watchman (S) is an advanced-technology, solid-state transmitter upgrade of the current production Watchmen (T) equipment set. The developmental system employs an active array of 16 low-power, solid-state transmitter modules, which increases reliability and provides a graceful degradation in resolution and detection performance in the event of an element failure.

Solid-state radars can achieve full power within one second after turn on, improving their suitability for use in intermittent operations characterized by frequent equipment on/off cycling.

The following performance characteristics are reported for Watchman (S):

Frequency:	2,700-2,900 MHz
Detection range:	to 70 nm and 40,000 ft/130 km and 12,200 m

Guardsman-S. The Guardsman has extensive target tracking and data-handling facilities for the coastal defense role. The system is designed for operational use either in a static role (containers or custom-built

facilities) or in transportable configuration for transport by road, rail, or air.

Guardsman-S consists of a frequency agile transceiver, with signal, MTI (moving target indication), and IFF

processing units mounted inside a cabin. A high-performance, dual-beam primary antenna incorporating IFF is mounted on top. A second cabin contains the necessary data-processing facilities, autonomous display consoles, and communications suite.

Variants/Upgrades

Watchman (ASR). The Royal Air Force (RAF) requirement was for an all-weather civil and military air surveillance radar to provide medium-range radar cover for local air surveillance of over-flying aircraft, and to guide departing aircraft onto the appropriate runways and approaching aircraft to a position where hand-over to precision landing aids can be accomplished.

Watchman (T). Watchman (T) is a transportable or relocatable version of the system for rapid deployment in any number of roles.

Watchman (S). Watchman (S) is an advanced-technology, solid-state transmitter-based system being developed as the next-generation equipment set for Watchman applications.

Guardsman-S. This variant is designed to detect and identify all types of coastal traffic, including surface vessels and fixed/rotary-wing aircraft. It is also intended to operate under adverse conditions of rain, high sea states, land clutter, and electronic countermeasures (ECM).

Guardsman-C (a.k.a. Guardsman II). An advanced version of the Guardsman coast defense radar, Guardsman II provides a limited 3D capability through the incorporation of extra transmit beams. Its architecture and capabilities make it more a member of the AWS-6 family than a derivative of Watchman.

Program Review

Background. The Watchman development project was initiated by Siemens-Plessey (now BAE Systems) to meet an anticipated demand for new air surveillance radars in the mid-1980s. In 1982 a production Watchman was unveiled at Farnborough. In 1983 the UK Ministry of Defence (MoD) placed an order with Siemens-Plessey Radar for an initial 30 Watchman systems. Delivery of Watchman to the UK Royal Air Force began in 1986, with the eventual total reaching 47 systems.

In 1986 Siemens-Plessey exhibited an example of Watchman (T) at the Farnborough Air Show. Also at Farnborough, a variant of the standard Watchman display was unveiled. Designated Bright High Resolution Display, it is designed for use in bright environments such as visual control rooms.

The first complete Watchman radar was handed over to the RAF at Lyneham, Wiltshire, in September 1986. The hand-over marked the end of extensive trials carried out to ensure a smooth transition into service. The MoD had ordered Watchman for all RAF and UK Royal Naval Air Stations as well as for research facility airfields at Boscombe Down, Farnborough, and Bedford UK Royal Aircraft Establishments (RAE). Earlier that month, the first operational Watchman Display System was handed over to the RAF at Waddington.

Siemens-Plessey announced that it had been successful in its bid to have Watchman adopted for the United

Kingdom Civil Aviation Authority's Cromer Radar requirement in mid-1987. The radar is sited on the Norfolk coast and provides low-level surveillance of the southern North Sea. In November 1987, the company also announced that Finland had taken up a US\$1 million option on a further four Watchman radar systems. Delivery began in 1989. In the press release, Siemens-Plessey announced that the total number of Watchman radar systems delivered or on order had reached 60. Also, the press release confirmed that China, Spain, Oman, Dubai, Bahrain, and Ghana had all ordered Watchman.

The Indian Ministry of Defence awarded Siemens-Plessey a contract on January 6, 1988, for a single Watchman radar system. It was to be used by the Defence Research & Development Organization for the surveillance of both air and sea targets at a test range in India. A delivery time of four months was offered by Siemens-Plessey, and this proved helpful in winning the order.

The US Air Force (USAF) evaluated Watchman in July 1988 as a possible candidate to fulfill a requirement for mobile radar systems. Following this evaluation, a single Watchman (T) radar was ordered by USAF at a cost of US\$3.125 million. It was evaluated in detail at a number of sites chosen specifically to provide challenging operational conditions. (The Watchman is reportedly in service with some units of the US Air National Guard.)

In January 1992, Siemens-Plessey announced that it had been awarded a full turnkey contract worth over US\$60 million for new radars to equip the Scottish Flight Information Region. The contract included a single Watchman primary radar to be installed at Allanshill near Fraserburgh and two Routeman D-band radars for installation at Lowther Hill and Perwinnes.

In the early 1990s, Siemens-Plessey marketed a coastal defense version of Watchman, designated Guardsman, apparently without significant success. This system was upgraded to Guardsman-C (the older version becoming Guardsman-S) by the addition of a third primary beam to give a limited 3D radar capability. There are no known orders extant for this system.

In summer 1994, Siemens-Plessey unveiled its solid-state transmitter Watchman (S) development system,

displaying the equipment later that year at the Farnborough Air Show. Watchman (S) was developed at Siemens' Isle of Wight facility, where the company's CAD/CAE tools and antenna test range provide the development environment. The system was believed to be operational by 1996.

Siemens-Plessey was acquired by British Aerospace (now BAE Systems) in May 1998. After the takeover, no major orders for procurement of the Watchman radar were made public. At least one variant, however, Watchman-T, appears to be in very low-rate production for new-build orders and upgrades.

In April 2001 Watchman once again traded hands when it was transferred from BAE Systems to their joint venture with Italy's Finmeccanica, Alenia Marconi.

Funding

The Watchman family was developed as a private venture using corporate funding.

Recent Contracts

No known contracts have been awarded since 1994.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1980	Watchman developed by Plessey as private venture
	1983	UK MoD orders Watchman Finland orders Watchman
Mar	1984	Ghana and Dubai order Watchman Second Watchman order from Finland
	1985	Watchman (T) in production RAF and two other clients order Watchman (T) Spain and Bahrain order Watchman Watchman (CSR) enters production
Feb	1986	Oman and China order Watchman
Nov	1987	Finland orders four more Watchman radars
Jan	1988	India orders Watchman
Feb		UK CAA orders six Watchman systems Portuguese Air Force orders Watchman
Jul		USAF begins evaluation of Watchman
Nov		USAF orders one Watchman
Mar	1990	Switzerland orders Watchman
May		Completion of testing of USAF Watchman
Spring		Contract issued for USAF competition between Watchman and the TPS-73
Jan	1992	Scottish radar replacement program contract
Aug	1994	Watchman (S) development announced
Mar	1995	Upgraded Watchman installed at HMS Cambridge, a training and gunnery school of the UK Royal Navy
Mar	1998	British Aerospace acquires Siemens-Plessey, becoming BAE Systems
Apr	2001	Watchman transferred from BAE Systems to Alenia Marconi
	2003+	Ongoing production of Watchman (T)

Month Year Major Development

Worldwide Distribution

An estimated 100 Watchman systems have been procured since its inception. The following are known to use the Watchman: **Finland**, 7; **NATO**, 7; **Switzerland**, 3; **United Kingdom**, 47; **US**, at least 1.

The remaining 35 systems are believed to have been procured by **Bahrain, China, Dubai, Ghana, India, Oman, Pakistan, Portugal, and Spain**. There have also been several unidentified customers.

Forecast Rationale

With the April 2001 transfer of the Watchman radar from BAE Systems to Alenia Marconi, prospects for the family of advanced air traffic control (ATC) and naval surveillance systems have probably improved. Alenia Marconi, a joint venture between BAE Systems and Italy's Finmeccanica, is regarded as one of the leading suppliers of radar systems in the world.

As the standard ground control approach and range surveillance radar used by the North Atlantic Treaty Organization (NATO), and with its wide distribution throughout the United Kingdom, the Watchman system should also have an assured place in the European radar

market. The successful development of the solid-state (S) variant has the potential to further enhance its competitive posture in future procurements.

However, there has been a dearth of new information regarding the system, other than the fact that it is still in production and service. With no new contracts made public since the early 1990s, any forecast for specific production rates is inherently speculative. Suffice it to say that Watchman is expected to be around for a long time. This report will be updated as new information comes to light.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Designation	Application	Thru 02	High Confidence Level			Good Confidence Level			Speculative			Total 03-12	
			03	04	05	06	07	08	09	10	11		12
WATCHMAN	SURVEILLANCE/ATC RADAR (VARIOUS)	100	2	2	3	2	3	2	1	2	1	2	20