

ARCHIVED REPORT

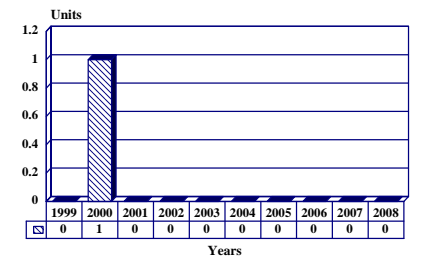
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Signaal LW.08 - Archived 4/99

Outlook

- Last order expected to be delivered in 2000 to Thai Navy
- Signaal has ceased pushing LW.08 in favor of SMART-L

10 Year Unit Production Forecast
1999 - 2008



Orientation

Description. D-band 2-D naval radar used for long-range air warning and surface search.

Sponsor

Hollandse Signaalapparaten BV
PO Box 42
NL-7550 GD Hengelo Ov
The Netherlands
Tel: +31 74 488111
Telex: 44310

Ministry of Defense
Plein 4
PO Box 20701
NL-2500 The Hague
The Netherlands

Ministry of Defence (Procurement Executive)
CB/Admin 3
St. Georges Court
14 New Oxford Street
London WC1A 1EG
United Kingdom
Tel: +44 171 632 3615

Contractors

Hollandse Signaalapparaten (Signaal) BV
PO Box 42
NL-7550 GD Hengelo Ov
The Netherlands
Tel: +31 74 488111
Telex: 44310
(prime)

Cossor Electronics

The Pinnacles
Harlow
Essex CM19 5BB
United Kingdom
(produces the IFF where it is fitted)

Licensees

GEC-Marconi Radar Systems Limited
Writtle Road
Chelmsford
Essex CM1 3BN
United Kingdom
Tel: +44 1245 267111
Telex: 99108

(produces the LW.08 with a Marconi squintless feed antenna, under the designation Type 1022)

Bharat Electronics Limited (BEL)

Trade Center
29/4 Racecourse Road
Bangalore 560001
India
Tel: +91 812 2751/2
Telex: 043477

(producer of a highly derivative version of the LW.08, under the designation RAWL-02)

Status. In production and in service.

Total Produced. An estimated 79 systems have been installed, or have been ordered for, warship applications.

Application. The LW.08 is intended to act as the prime long-range air warning and surface search radar. In the UK Royal Navy, it is deployed with the GWS.30 Sea Dart area defense missile system and designated as the Type 1022. LAR 2 is a long-range radar system for Air Traffic Control (ATC) applications. It is essentially a civilian version of the LW.08 radar.

Platform. The radar was designed for major warships including aircraft carriers, cruisers and destroyers. A large number of installations are on frigates around the world.

Price Range. A cost of US\$8 million for LW.08 has been estimated, based on known prices for similar US equipment.

Antenna:

Type Horn fed parabolic reflector
Rotational speed 7.5 to 15 rpm (selectable)

Transmitter: US

Frequency D-band
Peak pulse power 150 kW
Mean power 5.2 kW

Design Features. The LW.08 series radars feature a larger antenna than the DA.08, weighing about 6,500 kg as opposed to 2,500 kg. The antenna is either hy-

Technical Data

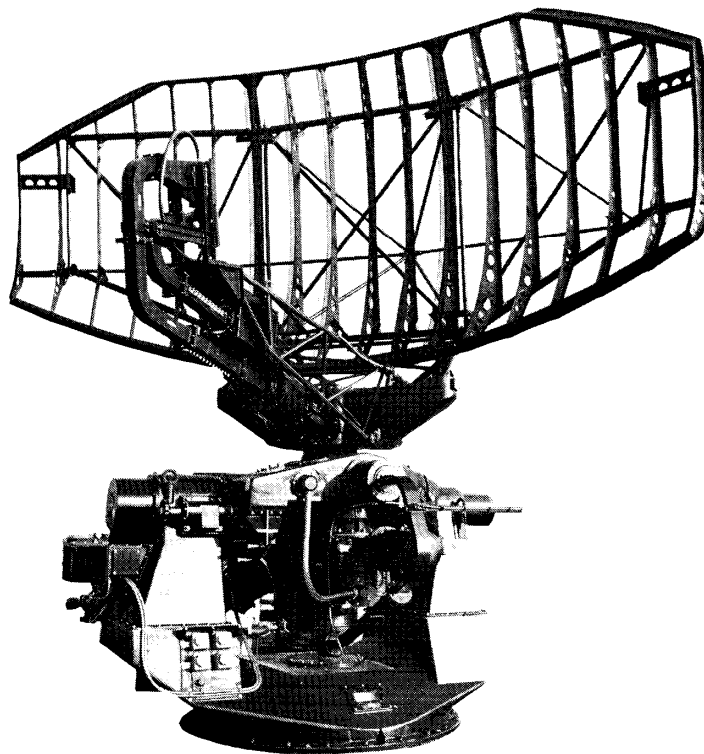
Specifications

Range:

Air targets
Surface targets
Azimuth resolution
Range resolution

Metric

270-400 km
900 meters to horizon
2.2 degrees
100 m



LW.08 Naval Radar

Source: Signaal

draulically or electro-mechanically stabilized for naval use. The characteristics and subsystems of the LW.08 are almost identical to those of the DA.08 series, comprising four distinct cabinets: a waveguide drier and cooling; transmitter; antenna control; and receiver cabinets. There is also a remote control unit which may be configured at any suitable location aboard ship.

The LW.08 radar features high elevation coverage with short minimum range. A high mean power TWT transmitter ensures good range performance and frequency flexibility. A pulse compression receiver with digital MTI provides good performance in clutter. ECCM facilities are incorporated. The LW.08 series can be supplied with integrated IFF by Cossor, or other client-nominated suppliers. Other features of the LW.08 series include high resolution, frequency agility, digital video processing with Built-In Test Equipment (BITE) and monitoring facilities.

Operational Characteristics. The Jacob Van Heemskerck class ships feature an LW.08 antenna fitted with two feed horns. This could be indicative of dual beam operation (as in the I/J band weapon control family), which could give the LW.08 an enhanced performance in a particular area (low altitude coverage is a probability). It is unlikely that anything other than crude height finding capability would be possible with such an arrangement, suggesting that the two feed horn arrangement is not indicative of 3-D capability.

The Type 1022 radar differs from the LW.08 in using a Marconi squintless feed antenna providing tapered illumination of the main reflector. A secondary radar is thought to be integrated with the primary antenna. The electronics cabinets are supplied by Signaal.

Variants/Upgrades

DRBV-26/LW.08 Hybrid. The DRBV-26/LW.08 hybrid is one of the earliest fruits of the Thomson-CSF acquisition of Signaal. The motivation behind its development appears to be the need to combine the much more efficient and effective Signaal antenna with a below-decks unit compatible with the highly centralized and inflexible Tavitac command system. It can thus be considered an intermediate stage on the way to the development of a new long-range air search radar exploiting Signaal naval technology with such Thomson-CSF input as is needed.

The next stage in this process is the introduction of the D-SSTX transmitter unit for LW.08. This is believed to feature in future French developments of the Jupiter radar, leading to the suspicion that the Jupiter family is becoming progressively more difficult to distinguish from LW.08.

Jupiter 08. A hybrid formed by the combination of the LW.08 antenna with the Thomson-CSF Jupiter II below-decks equipment. This variant is examined in greater detail in the report on Jupiter.

Jupiter-LA. This is a lightweight version which features a stripline antenna. Additionally, the radar can be provided with a lightweight, hydraulically controlled stabilization platform for improved detection, tracking and accuracy.

Jupiter-RE. This is the extended range version of Jupiter which has been fitted with two parallel-mounted transmitter cabinets that supplying twice the power.

LAR-2. Land-based civilian ATC version of the LW.08 (see below).

LORADS. (Long Range Radar and Display System) is the Signaal designation for an integrated ATC system supplied for export. It incorporates the LAR 2 radar system as prime sensor. The LAR-2 is a land-based LW.08 radar.

LW.09. The original LW.08 radar fitted with the new solid-state D-SSTX transmitter unit. This transmitter consists of seven solid-state units in parallel, each having up to 216 parallel transistor junctions. This arrangement can produce a total of 300 W peak power. When employed in a one-driving-four configuration, terminating in 16 transistors in parallel, a basic amplifier designated the PA module produces 4 kW. Combining up to 32 PA modules enables power to be boosted to 100 kW peak power. Since this is generated by 512 transistors, a single failure is inconsequential while the failure of 10 of the 32 PA modules reduces range by only 10 percent. The transmitter unit is microprocessor-controlled and offers remote status and control by serial data link.

RAWL-02. The highly derivative version of the LW.08, produced in India by Bharat Electronics (BEL).

SPQ-502. Canadian designation of the LW.08 system.

Type 1022. This unit is the result of a collaboration between Marconi Radar Systems Limited and Signaal. Hurriedly developed as an interim replacement for the

UKRN's Type 965 radar, the system has been fitted to those ships assigned an area-defense role within the

UKRN. Type 1022 is currently being upgraded to eliminate maintenance problems and increase reliability.

Program Review

Background. The LW.08 radar is the direct descendant of earlier Hollandse Signaalapparaten BV (Signaal) naval surveillance radar programs, notably the LW.02 and LW.04. The first of the Royal Netherlands Navy Kortenaer class was laid down in 1975, and the LW.08 radar was ordered for the vessel. Subsequently nine more ships have been built, and all of them feature LW.08. In 1983 and 1984 respectively, the frigates *KNS Jacob Van Heemskerck* and *KNS Witte de With* were commissioned into the Dutch navy. Both these vessels feature the LW.08 radar.

The first export order for LW.08 came from the UK Royal Navy (UKRN), and concerned a hybrid version (Type 1022) of the system for fitting to the light aircraft carrier *HMS Invincible*. *HMS Invincible* was launched in 1977, and two further ships of the class have followed her into service. During the Falklands campaign, the Type 965M radar had proved virtually useless due to its lack of plot extraction or MTI. Following the conflict, the UKRN ordered 12 more LW.08/Type 1022 systems, all of which have been installed on Type 42 destroyers. One additional set has been installed at Fort Drake, overlooking Portsmouth Harbor.

Combat experience during the Persian Gulf War proved the Type 1022 radar to be effective. On January 24, 1991, *HMS Cardiff*, a Type 1022 equipped destroyer, detected three Exocet-equipped Iraqi Mirage F-1 aircraft at a range of over 170 nautical miles and, in cooperation with a USAF E-3 AWACS, vectored a Saudi Arabian F-15 in to perform the necessary intercept. Two of the three Mirage F-1Es were shot down.

When first introduced, the LW.08 received only limited export attention with the Indian navy being the major user of the system (nine sets installed). Greek acquisition of the LW.08 was almost accidental, the result of purchasing two Dutch frigates already under construction. The Peruvian installation on the cruiser *Almirante Grau* was the sole case of an LW.08 radar being purchased by an export customer. This situation changed though when the LW.08 was specified for installation in the four West German F-123 class frigates. Also at the same time, New Zealand was contemplating ordering the LW.08 for its ANZAC frigates. Later, however, this was reversed and Swedish equipment was chosen instead, presumably due to cost issues.

At the 1991 Navy League exhibition in Washington it was revealed that a version of the DRBV-26 had been developed. This combined the below-decks portion of DRBV-26C with the antenna of the Signaal LW.08. The resulting system is designated DRBV-26D in French service and Jupiter 08 for export. This version has been ordered for the aircraft carrier *Charles de Gaulle* and is the standard set on the appropriate French export warships.

In 1992, Signaal introduced an upgrade package for the LW.08 radars. This comprises a solid state D-band transmitted unit, designated D-SSTX, which improves serviceability by reducing the probability of total shutdown resulting from a single component failure. This has previously been a noted drawback associated with the linear amplifier devices previously used in the LW.08 radars. The D-SSTX transmitter has been delivered to the Royal Netherlands Navy and will be used to retrofit existing installations. The LW.08 radars equipped with the new transmitter units, whether supplied as such or older models retrofitted, will be known as LW.09 systems. The same transmitter assembly will also be used on the SMART-L radar.

The UKRN has announced that the Type 1022 radars in service are to be substantially upgraded. This is believed to refer to adoption of the new D-SSTX transmitter unit. The number of Type 1022 radars ordered by the UKRN exceeds the number of those in service; a factor emphasized by the removal of the Type 1022 radar from the obsolete training hulk *HMS Bristol* and its replacement by a Type 965 antenna. Support costs and spares consumption by the Type 1022s are reported to be high, explaining the high stock-holding for this equipment, the stripping of *HMS Bristol* and the urgency of the new upgrade program.

An order for two sets of LW.08 was received from the Royal Thai Navy. These were to equip the two Project F-25T Naresuan class frigates, built in China for the Thai navy.

The LW.08 radar family is the primary long-range air surveillance radar in both Dutch and British area air warfare ships. The major limitation for the LW.08 and Type 1022 is the 2-D nature of their operation. The

British Type 996 and the Signaal Smart 3-D systems are supplementing, rather than replacing, the LW.08. The long-range LW.08 radars are maintaining their market position by being specified in conjunction with the more advanced but shorter-ranged 3-D systems. A standardized fit of the LW.08 surveillance radar combined with SMART or MW.08 target acquisition and the Signaal STIR tracking radars is becoming apparent. This potent and efficient combination features heavily in sales bids based around the German MEKO design.

The Indian navy, a major user of LW.08, ordered three more Godavari class frigates from Calcutta's Garden Reach shipyard. The construction has been very slow, presumably because of delivery problems with the Russian equipment, and the first of the set of three (follow-up to the first three, built by Mazagon Dock), was scheduled for sea trials in 1997. All three frigates of the new Delhi class design have already been launched by now. These ships are derived from the Russian Kashin class destroyers. India has developed a local version of the LW.08, the RALW-02, which is fitted on these ships.

Funding

The LW.08 radar was developed using corporate funding. The British Type 1022 version was funded by the UK MoD.

Recent Contracts

No known additional orders since 1995 Thai Navy contract.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1975	Netherlands orders LW.08 for Kortenaer frigates
	1976	India orders LW.08 for Himgiri frigates
	1977	Greece orders LW.08 for Elli frigates
	1978	India orders LW.08 for first Godavari frigates
	1980	<i>HMS Bristol</i> refitted with Type 1022 radar
Jul	1980	<i>HMS Invincible</i> commissioned with Type 1022 radar
	1981	Netherlands orders LW.08 for Heemskerck frigates
	1982	Argentina orders LW.08 for aircraft carrier
	1985	Netherlands orders LW.08 for Doorman frigates
Aug	1985	Last RN ship to have Type 1022 commissioned
	1986	India orders LW.08 for second Godavari frigates
	1987	Canada orders LW.08 for Iroquois class destroyer refit
	1989	Germany orders LW.08 for F-123 frigates
Jan	1991	First known combat use of Type 1022/LW.08
Oct	1992	First D-SSTX upgrade unit delivered to Royal Netherlands Navy
Jul	1995	Specified by Thailand for Naresuan class

Worldwide Distribution

Argentina. One on *Veinticinco de Mayo* aircraft carrier

Canada. Uses SPQ-502 designation. Four on Iroquois class destroyers

Germany. Four systems on F-123 Brandenburg class frigates

Greece. Six on Elli class frigates

India. Uses RALW designation. Five on Nilgiri class, three on Delhi class and six will be on Godavari class frigates

Netherlands. Two on Van Heemskerck frigates, four on Kortenaer frigates, eight on Karel Doorman frigates

New Zealand. Two on Leander class frigates

Peru. One system on *Almirante Grau* cruiser

Thailand. Two on Naresuan class frigates

United Kingdom. Uses Type 1022 designation. Three Invincible class CVS, 12 Type 42 destroyers

LAR 2 is the civilian ATC version of LW.08 naval surveillance radar. Known sales of the system are to **Paraguay** (1978), **Portugal** (1982, two sets), **Saudi Arabia** (1983, two sets), **Singapore** (1978) and **UK** (six hybrid AEG/Signaal LAR 2 radars ordered in 1980, two more stations ordered in 1983 and 1984 respectively).

Forecast Rationale

The Signaal LW.08 air search radar is a rather antiquated 2-D system that is over twenty years old. Many nations have been upgrading their 2-D to 3-D standards in the last few years, which has adversely affected any future sales potential of the LW.08. Even Signaal has realized this and has ceased pushing the LW.08 in favor of its 3-D follow-on, the SMART-L.

The ten-year forecast is based on the last known commissioning date of the final platform that will

receive this system: a Godavari class FFG for the Indian Navy. After delivery of this system, no further orders are expected to be delivered. Some time after 2000, the line is expected to be closed as Signaal focuses on the SMART-L systems.

No further orders are expected in the civilian air traffic control (ATC) market either. The last of the LW.08 ATC derivatives, designated the LAR 2, was delivered in 1984 with no follow-on orders after that time frame.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION														
Designation	Application	thru	High Confidence Level				Good Confidence Level				Speculative		Total 99-08	
			98	99	00	01	02	03	04	05	06	07		08
LAR 2	Prior Prod'n:	14	0	0	0	0	0	0	0	0	0	0	0	0
SIGNAAL LW.08	CVL/DD/FF (INDIAN NAVY)	13	0	1	0	0	0	0	0	0	0	0	0	1
SIGNAAL LW.08	Prior Prod'n:	34	0	0	0	0	0	0	0	0	0	0	0	0
SIGNAAL LW.08 (TYPE 1022)	Prior Prod'n:	15	0	0	0	0	0	0	0	0	0	0	0	0
Total Production		76	0	1	0	0	0	0	0	0	0	0	0	1