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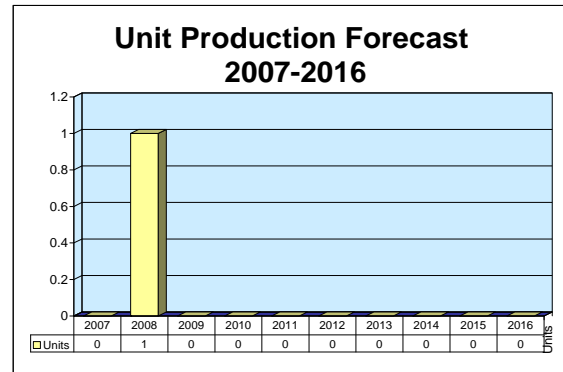
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LW.08 - Archived 4/2008

Outlook

- RAWL-02 radar system (Bharat Electronics' variant of the LW.08) is the only version currently in production
- This 2-D product is losing market share to 3-D products, such as Thales SMART-L and Thales/BAE Insyte S1850M radar
- Barring the release of new information, Forecast International will archive this report in 2008



Orientation

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

Sponsor

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Status. In service and production.

Application. The LW.08 is intended to act as the prime, long-range, air warning and surface search radar. In the U.K. Royal Navy, it is deployed with the GWS.30 Sea Dart area defense missile system and designated the Type 1022.

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 \$8 million for the LW.08 has been estimated, based on known prices for similar U.S. equipment.

LW.08

Contractors

Prime

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Technical Data

	<u>Metric</u>	<u>U.S.</u>
Specifications		
Range		
Air targets	270-400 km	167.8-248.5 mi
Surface targets	900 m to horizon	984.25 yd
Azimuth resolution	2.2°	
Range resolution	100 m	109.36 yd
Antenna		
Type	Horn-fed parabolic reflector	
Rotational speed	7.5 to 15 rpm (selectable)	
Transmitter		
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, and weigh about 3,100 kilograms as opposed to 2,500 kilograms. The antenna is either hydraulically or electromechanically 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 cooler, a transmitter, an antenna control, and receiver cabinets. There is also a remote control unit that 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 traveling wave tube (TWT) transmitter ensures good range performance and frequency flexibility. A pulse compression receiver with digital moving target indicator (MTI) provides good performance in clutter. ECCM (electronic counter-countermeasure) facilities are incorporated. The LW.08 series can be supplied with integrated Identification Friend or Foe (IFF) by

Cossor or other suppliers. The LW.08 series also features high resolution and frequency agility, and is equipped with 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 enhance performance of the LW.08 in a particular area (such as low-altitude coverage). The only advantage of such an arrangement would be the provision of a crude height-finding capability, suggesting that it is not indicative of 3-D capability.

The Type 1022 radar differs from the LW.08 in that it uses a Marconi squintless feed antenna providing tapered illumination of the main reflector. A secondary radar is thought to be integrated with the primary antenna.

Variants/Upgrades

DRBV-26/LW.08 Hybrid. This hybrid is one of the earliest fruits of the Thomson-CSF (now Thales) acquisition of Signaal (now Thales Nederland). 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.

Jupiter 08. A hybrid formed by the combination of the LW.08 antenna with the Thomson-CSF (now Thales) Jupiter II below-decks equipment.

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

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

RAWL-02 (PLN 517). This is an L-band variant produced by Bharat Electronics Ltd of India.



LW.08 (Jupiter) D-Band 2-D Naval Radar

Source: Thales Nederland

Program Review

Background. The DRBV-26/LW.08 radar is the direct descendant of earlier Hollandse Signaalapparaten BV (now Thales Nederland BV) naval surveillance radar programs, notably the LW.02 and LW.04.

The first known purchase of the DRBV-26A radar was for France's two Tourville class (Type F67) destroyers. The first-in-class, *Tourville* was laid down in 1970, and the *De Grasse* in 1972. The first of France's Georges Leygues class (Type F70) destroyers was laid down in September 1974, with the second, *Dupleix* (D641), laid the following year. Both of these were fitted with the DRBV-26A radar. The fourth ship, *Jean De Vienne* (D643), has the DRBV-26A, while D642, *Moncalm* and D644-D646 were fitted with a different radar package.

The first of the Royal Netherlands Navy Kortenaer class was laid down in 1975, and the LW.08 radar was ordered for that vessel. Subsequently, nine more ships have been built, and all of them feature the 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.

Type 1022 Radar Proves its Worth During the Persian Gulf War

The first export order for the LW.08 came from the U.K. Royal Navy (UKRN), and concerned a hybrid version (Type 1022) of the system for fitting to the light aircraft carrier HMS *Invincible*. The *Invincible* was launched in 1977, and two additional ships of the class have followed it into service. During the Falklands campaign, the Type 965M radar was virtually useless because it had neither plot extraction nor moving target identification. 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.

LW.08

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.

LW.08 Radar – Slow to Catch On

When introduced, the LW.08 received only limited export attention – the Indian Navy was the major user of the system. Greek acquisition of the LW.08 was almost accidental, the result of purchasing two Dutch frigates already under construction. Peru bought one system and installed it on the cruiser *Almirante Grau*. This situation changed, though, when the LW.08 was specified for installation in the four West German F-123 class frigates. At the same time, New Zealand was contemplating ordering the LW.08 for its ANZAC frigates. In the end, Swedish equipment was chosen.

In 1992, Signaal introduced an upgrade for the LW.08 radar. The upgrade is a solid-state D-band transmitter, designated D-SSTX, which improves serviceability by reducing the probability of total shutdown when a single component fails. Such failures had been a noted drawback of the linear amplifier devices used in the LW.08 radar. The D-SSTX transmitter was delivered to the Royal Netherlands Navy and used to retrofit existing installations.

An order for two sets of LW.08s was received from the Royal Thai Navy in 1995. The systems were installed in two Project F-25T Naresuan class frigates, built in China.

DRBV-26C/D Radar for France and Saudi Arabia

France's Cassard class (Type 70) guided missile destroyers carry the DRBV-26C. This is the upgraded

DRBV-26A with a solid-state transmitter. It is unclear if they were originally fitted with this radar or if it was part of a 1992 upgrade package.

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 the 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. The aircraft carrier *Charles de Gaulle*, which was launched in May 1994 and went into service in May 2001, is equipped with the DRBV-25D version.

In November 1994, Saudi Arabia and France signed a \$2.5 billion Franco-Saudi "Sawari II" accord for two F 3000S frigates equipped with Thales DRBV-26D (Jupiter) radar. A May 1997 extension upgraded the quantity to three ships and enhanced systems. The first-in-class, *Al Riyadh* (812), was laid down in 1999 and delivered in July 2002. The *Makkan* was delivered in April 2003 and the *Al Damman* was handed over to the Royal Saudi Naval Forces (RSNF) in January 2004.

India's Version: RAWL-02

The most recent LW.08 system produced is the Bharat Electronics Ltd variant, the RAWL-02, which was installed on India's new Improved Godavari class frigates. These RAWL-02-equipped frigates were already launched, in 1994, 1998 and 2004. The original three Godavari frigates were equipped with the RAWL-02 in the early 1980s. In early 2001, the V/STOL aircraft carrier INS *Viraat* (ex-HMS *Hermes* of the U.K.) displayed its new upgrades, including RAWL-2/PLN 517 long-range radar. In addition to these ships, the Indian Navy is fitting the RAWL-02 on three new Shivalik class (Project 17) vessels. The first of these was laid down in 2001 and was scheduled to be in service by the end of 2005, and the remaining two are anticipated to be in service by 2007 and 2009.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1975	The Netherlands orders LW.08 for Kortenaer frigates
	1989	Germany orders LW.08 for F-123 frigates
Oct	1992	First D-SSTX upgrade unit delivered to Royal Netherlands Navy
Jan	1994	First RAWL-02-equipped Improved Godavari frigate launched
May	1994	DRBV-26D-equipped aircraft carrier <i>Charles de Gaulle</i> launched
Jul	1995	Specified by Thailand for Naresuan class
Feb	1998	Second RAWL-02-equipped Improved Godavari frigate launched
Jan	2000	First DRBV-26-equipped Saudi Al Riyadh frigate launched
Sep	2000	DRBV-26D-equipped aircraft carrier <i>Charles de Gaulle</i> delivered
Feb	2001	V/STOL Aircraft Carrier INS <i>Viraat</i> upgraded with RAWL-2/PLN 517
Jul	2001	Second DRBV-26-equipped Saudi Al Riyadh frigate launched

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Jul	2002	First DRBV-26-equipped Saudi Al Riyadh frigate delivered
Sep	2002	Last DRBV-26-equipped Saudi Al Riyadh frigate launched
Apr	2003	First RAWL-02-equipped Shivalik frigate launched
Apr	2003	Second DRBV-26-equipped Saudi Al Riyadh frigate delivered
Jan	2004	Last DRBV-26-equipped Saudi Al Riyadh frigate delivered
Apr	2004	Second RAWL-02-equipped Shivalik frigate launched
	2004	Final RAWL-02-equipped Improved Godavari frigate launched
Q4	2005	First RAWL-02-equipped Shivalik frigate scheduled to enter service
	2007	Second RAWL-02-equipped Shivalik frigate scheduled to enter service
	2009	Final RAWL-02-equipped Shivalik frigate scheduled to be commissioned

Worldwide Distribution/Inventories

Argentina. One was on the *Veinticinco de Mayo* aircraft carrier, which was decommissioned in the mid-1980s

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 RAWL-02 designation. Four on Leander class, three on Delhi class, one on V/STOL aircraft carrier, six on Godavari and Improved Godavari class frigates, and three on new Shivalik class frigates

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

New Zealand. One on Leander class frigates

Peru. One system on *Almirante Grau* cruiser

Saudi Arabia. Three DRBV-26D radars on F 3000S Al Riyadh class frigates

Thailand. Two on Naresuan class frigates

UAE. Two on ex-Netherlands Kortenaer (Abu Dhabi) class frigates

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

Forecast Rationale

LW.08: Approaching Middle Age

This family of radars has been around for 30 years and there has been very little activity in recent years. The last known DRBV-26D contract was signed in 1994 and the last known LW.08 contract was awarded in 1995. Other, more technologically advanced 3-D systems are edging the LW.08 out of the market.

In November 2002, the Greek Council on Foreign Affairs and Defense approved the mid-life upgrade of six Greek Elli class frigates. Among the ship systems and sensors to be upgraded is the LW.08 radar system. *Jane's Navy International* reported that the first of six Elli class frigates was modernized and returned to the Hellenic Navy in September 2006. This modernization effort should be completed in the near future.

The Only Current Customer: India

This radar's most recent installation occurred in India. India mounted the RAWL-02 (PLN 517) on the improved Godavari class. PLN 517 long-range radar is reportedly a variant of the LW.02 produced by Bharat

Electronics Ltd of India. The final of three ships was launched in 2004. Three other Indian frigates of the Shivalik class (a.k.a. Project 17) are believed to be in the process of being equipped with the RAWL-02 system. The first ship was laid down in 2001, and the final Shivalik class ship is scheduled to be commissioned in 2009. More ships of this class may be produced; however, some of the systems, such as the RAWL-02, will be replaced with more advanced products from Indian or foreign suppliers.

However, India is ordering Talwar class frigates from Russia, and in the future may order more Talwar frigates instead of Shivalik class frigates.

3-D Dominates the Market

Outside India, there is no documented interest in this system. Three-dimensional systems such as the Thales SMART-L and Thales/BAE Systems Integrated System Technologies (Insyte) S1850M will dominate the market. Some upgrades are likely, but new production of the LW.08 is not expected.

LW.08

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence				Good Confidence			Speculative				
	Thru 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Bharat Electronics Limited												
LW.08 RAWL-02 <> India <> Navy												
	16	0	1	0	0	0	0	0	0	0	0	1
Total	16	0	1	0	0	0	0	0	0	0	0	1