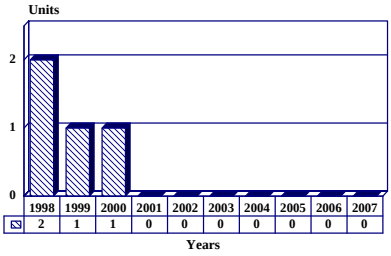
Jupiter - Archived 2/99

Outlook

- France's standby radar system for almost 30 years
- Many generations of updates and modifications
- Few new sales expected anymore
- Competition comes from less expensive, more compact units
- Last units to be produced around 2000, for Saudi Arabia, Taiwan



Orientation

Description. Family of naval long-range D-band air search radars.

Sponsor

Département de Construction Navale (DCN)
Délégation Générale pour l'Armament (DGA)
10/14 Rue Saint Dominique
F-75997 Paris Armeés
France

Contractor

Thomson-CSF
Detection Systems Group
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Licensees. No production licenses have been granted.

Status. Production and service.

Total Produced. An estimated 34 systems have been produced to date.

Application. Air surveillance providing early warning against attacks at all altitudes.

Platform. Frigates, destroyers and larger warships. Currently deployed onboard the Cassard and Leygues class destroyers, and has been ordered for the Saudi Lafayette class as well as the French *Charles de Gaulle* aircraft carrier.

Price Range. A unit cost of US$8 million is estimated, based on the known costs for comparable systems.

Technical Data

Specifications	**Metric**	**US**
Operating band:	D-band	L-band
Peak power:	2 MW	
Gain:	29 dB	
Pulse width:	2.5 microsec	
PRF:	450 pps	

Scan rate:	7.5 or 15 rpm	
Max range:	215 km	150 nm
Range resolution:	400 m	441 yd
Bearing resolution:	2 degrees	
Dimensions	**Metric**	**US**
Antenna width:	7,54 m	25 ft
Antenna height:	3,05 m	10 ft
Antenna weight:	1.000 kg	2,200 lb
Total system weight:	1.450 kg	3,190 lb

Design Features. The current production version, the DRBV-26C Jupiter IIS, has a pulse compression transmitter (130 microsec compressed to 0.8) and is frequency-agile on a burst-to-burst or pulse-to-pulse basis. The set uses a solid-state transmitter consisting of 16 modules in parallel. If desired, an additional module unit can be added to the basic array, increasing the effective range against incoming fighters from 250 to 280 kilometers. Operating voltage in the transmitter units is restricted to 50 volts.

A frequency synthesizer is used to stabilize the transmission frequency and to permit the use of more sophisticated types of signals processing, including Doppler filtering using Fast Fourier Transforms (FFT). This enables the radar to participate in long-range missile surveillance as well. Air tracks are automatically initiated and followed, while surface tracks are automatically tracked after manual acquisition. The radar can track up to 64 targets, automatically handing their co-ordinates over to the action information system. An identification friend-or-foe (IFF) antenna is integrated with the main antenna.

Operational Characteristics. The TRS 3011 Jupiter family of 2-D surveillance radars (French navy designation DRBV-26 for the current versions) was developed to provide greatly enhanced protection against false alarms, reduced clutter, an MTI facility, and filters for protection against nearby radars and jamming. Reliability over the earlier DRBV-23 is reported to be greatly enhanced.

The DRBV-26C version purportedly has further enhanced reliability over earlier members of the series. A mean time between failure of 6,060 hours for each module in the transmitter unit is claimed, while the transmitter unit as a whole is stated to have an MTBF of 2,180 hours. Claimed mean times to repair are 15 minutes for the transmitter and 4.5 minutes per module. Thanks to its extremely favorable graceful degradation capability, the radar can be repaired even without switching off the equipment. Thomson-CSF states that the DRBV-26C radar transmitter has a service life six times greater than earlier systems and better than 99 percent reliability.

The data provided by the radar can be processed by the TAVITAC, TAVITAC 2000 or TAVITAC NT tactical data systems made by Thomson-CSF.

Variants/Upgrades

DRBV-22/23 (Jupiter)/THD-1077. The original Jupiter air search radars, reportedly based on the US SPS-6B system. Development of this family began in 1961. DRBV-22C came with a new and much more powerful transmitter unit; that in turn was combined with a new elliptical stabilized antenna, resulting in the DRBV-23.

DRBV-26 (Jupiter II)/TRS-3010. The initial production version of DRBV-26 Jupiter II using a traveling wave tube transmitter unit.

DRBV-26C (Jupiter IIS)/TRS-3011. The current production version. It can be also intended for medium- or short-range air surveillance, with the addition of a separate processing channel for surface surveillance.

DRBV-26D (Jupiter ER). This Extended Range system combines the below-decks electronics of the DRBV-26C and two solid-state transmitters with the antenna array of the Signaal LW.08 antenna. This particular version has been acquired for the aircraft carrier *Charles de Gaulle* and replaces DRBV-15 on exported Lafayette class frigates. Its maximum range is quoted as between 280 and 370 km. All DRBV-26s in the future will also use the Signaal LW.08 antennas, thanks to their superior electrical and elevation coverage characteristics.

DRBV-26C/D (Jupiter-LA)/TRS-3011. The LA variant features a lightweight (750 kg) stripline antenna and

only one transmitter. The range is quoted as 200 km and over. Antenna's rotating speed is 6 and 12 rpm.

DRBV-21A (Mars)/TRS-3015. Mars, which is some sources is treated as a separate product line is discussed here in the same report, sharing much of its architecture, functions and ancestry with the TRS-3011. Mars is essentially a simplified, medium-range version of Jupiter IIS intended for deployment on the Floréal class frigates. The below-decks units are compressed into a single cabinet. Mars has a two-module transmitter (as opposed to the 16 modules in Jupiter IIS), with a total of 32 rather than 16 power elements. The antenna weighs 600 kg and is derived from that of the DRBV-22. Instrumented range is 110 km in air search, 80 km in surface search. The radar has a gain of 26 dB and scans at 12 rpm.

Mars 05. An export version of the DRBV-24, using the Signaal DA.05 antenna.

DRBV-27 (Astral)/TRS-3505. A long-range next-generation 3-D radar originally intended to act as the long-range surveillance radar system for the Project Horizon CNGF. DRBV-27 combines the below-decks electronics of the DRBV-26C with a new planar-array antenna weighing 3,500 kg. This scans electronically in elevation from zero to 45 degrees, to a maximum range of 275 km. Maximum instrumented range is 400 km. The radar is fitted with automated data extraction with a capacity of 300 tracks. Astral is a digital pulse compression radar using Doppler speed filtering, the beam being elevated by phase shifters rather than frequency scanning.

Program Review

Background. The original Jupiter radars were developed in 1961, apparently on the basis of technology derived from the US Navy SPS-6B radar. The initial DRBV-22A and B systems had a maximum range of about 70 nautical miles and were installed on the frigate *FS Aconit* and the Surcouf class destroyers. During the late 1960s, this system was improved by the addition of a new elliptical stabilized antenna, resulting in the DRBV-22C. This was produced in very small quantities and was, in effect, a developmental step in the evolution of the next major version, the DRBV-23. This involved installing a new and more powerful transmitter unit which increased system range to 160 nautical miles. During the late 1970s and early 1980s, most DRBV-22 platforms were either scrapped or sold to other users. Few now remain in French service and those that do will shortly be sold out of service or replaced by the DRBV-26.

Development of the next-generation DRBV-26 Jupiter II was started in 1972 to provide a radar search capability for the next generation of French navy missile ships. Although the new radar showed significant gains in range and resistance to jamming and interference, the major emphasis appears to have been on increasing the reliability of the system. The initial platforms for the DRBV-26B were to have been the seven ships of the Georges Leygues class. These turned out to be unreliable ships, however, and the last three ships in the class were extensively redesigned to improve their seakeeping. This redesign involved raising the bridge by an additional deck and moving the superstructure block back seven feet. The resulting increase in topweight prohibited the installation of DRBV-26, so the much lighter DRBV-15 was installed instead.

A further major upgrade resulted in the development of the DRBV-26C radar. This featured solid-state transmitter components in order to further enhance reliability. The DRBV-26C was originally intended to equip the Cassard class destroyers. Development problems with the new transmitter meant that the *FS Cassard* had to enter service without the radar and did not receive the set until January 1991. The *FS Jean Bart* entered service in October 1991 with the radar in place.

At the 1991 Navy League exhibition in Washington it was revealed that a further 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 *FS Charles de Gaulle* and will probably be the standard set on French export warships.

In 1992, the French government finalized an order from Taiwan for Lafayette class frigates. This had first been mooted a year earlier but had been canceled following objections from China. An initial order for six ships was placed; this could even be increased to 16 if the program runs to completion. Originally the plans were for the ships to be constructed in France but delivered disarmed and completed in Taiwanese yards. This has now been abandoned and the ships will be completed in France. Reports that all ships in this program will be equipped with the DRBV-26D Jupiter 08 radar have now been confirmed.

In September 1993, the French navy ordered three additional DRBV-21A radars. One was to be used to equip the LSD *Foudre* when it enters its next refit; the second will be installed on a naval base in the Pacific; and the third used for training purposes. An additional radar will be procured to equip the second Foudre class LSD, the *FS Siroco*.

After a period of negotiations, the Project Horizon Common New Generation Frigate (CNGF) program, to design an AAW warship for the UK, Italian and French navies, established itself during the early months of 1993. Establishing a common design for this program has proved a difficult undertaking, with firmly defended national opinions on virtually every major design feature. As these debates have slowed the design process, pushing back the projected IOC of the ships, early equipment choices have now come into question.

An apparent casualty of this effect is the selection of Astral as the long-range radar (LRR) for the CNGF. This radar has now been de-selected on instructions issued by all three defense ministries involved with the program. This decision was taken on the grounds that ASTRAL was too expensive, coming from a noncompetitive process, and that the costs of the LRR had to be reduced. Alternative bids for the LRR have been invited, with leading competitors being the Signaal SMART-L and the Alenia RAN-32S.

The development of a new British radar, possibly based on active array technology, has also been mooted. A further proposed option is developing a new version of the ASTRAL radar, either by using competitively bid components or by reducing performance. In the latter case, the reduction would be offset by increases in performance of the multirole radar.

In July 1994, this process was resolved by the selection of a navalized version of the Marconi Martello long-range 3-D search radar using some technology from the Signaal SMART-L radar. GEC-Marconi will be the prime contractor for the new radar with Signaal and Thomson-CSF as primary subcontractors. The new radar is designated the T-1850L and is nicknamed Smartello. This appears to leave the Astral radar without a confirmed platform.

The Jupiter series of radars have been the standard long-range air search radars in the French navy for almost 30 years. During that period they have been progressively modified and the latest members of the family bear little resemblance to the original DRBV-22A. Their future in this secure environment has now come to an end. Few French warships in the size and capability bracket matching the DRBV-26D are planned, and the only plausible candidates, the six Lafayette class frigates, will be carrying the less expensive DRBV-15 Sea Tiger for this role.

Funding

The Jupiter radars were developed by Thomson-CSF under French DGA contract.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Thomson-CSF	N/A	Sep 1993 – French navy order for three DRBV-21A Mars radars

Timetable

	1972	Development of Jupiter II started
	1979	First DRBV-26B Jupiter II in service
Jan	1990	First DRBV-26C Jupiter II radar installed
Apr	1991	Jupiter 08 revealed
	1992	Astral specified for CNGF
Sep	1993	Additional Mars radars ordered
Oct	1994	Astral de-selected for CNGF

Worldwide Distribution

France. 1 DRBV-26D Jupiter 08 on *Charles de Gaulle* aircraft carrier; 2 DRBV-23 Jupiter 1 on Clemenceau class aircraft carriers; 1 DRBV-22D Jupiter 1 on Jeanne d'Arc helicopter carrier; 7 DRBV-26 on Leygues destroyers; 3 DRBV-26 on Tourville destroyers; 6 DRBV-21A on Floréal frigates; 2 DRBV-21A (Mars) on Foudre LSD.

Portugal. 4 DRBV-22A on 4 Comandante João Belo corvettes

Saudi Arabia. 3 DRBV-26D Jupiter II ordered for 2 Lafayette frigates

Taiwan. 6 DRBV-26D for Kang Ding class (Lafayette) frigates

Uruguay. 3 DRBV-22A on Commandant Rivière class frigates

Forecast Rationale

French navy construction of dedicated air defense ships is currently set within the environment of the Project Horizon Common New Generation Frigate (CNGF). Although Astral was selected for these ships, it was later deselected and replaced. This leaves the Astral radar without a launch platform and its future is uncertain. Still, this project is not expected to offer a sale for Jupiter.

The export market will provide some support for this radar family. The export versions of the Lafayette class frigates ordered to date all carry the export version of the DRBV-26D, Jupiter 08. Two of these ships were ordered by Saudi Arabia in November 1994, significantly behind the original schedule.

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 more efficient and effective Signaal antenna with a below-decks unit compatible with the highly centralized and inflexible Tavitac command system. It can 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. Such a radar would form a useful complement to the SMART-L radar currently being developed by Signaal.

The following forecast is based on the commissioning of known platforms for Jupiter. Few export successes outside the Lafayette frigate program are predicted, since the Signaal LW.08 and the new SMART-L radars dominate the market today. There may be further sales of the Lafayette frigates themselves to satisfy requirements for a light frigate. The MEKO 140 design dominates this area, but the Lafayettes may score some success with customers who require enhanced AAW capability over the general-purpose MEKOs.

There is a slight possibility that the older DRBV-22 and -23 radars sold to other users will be replaced by the -26D. There is also a possibility that the French will decide to upgrade their Lafayettes with the DRBV-26D in place of the currently specified DRBV-15C. Any licensed production of Jupiter radars in China has not been included. The Taiwanese program involving Lafayettes with Jupiter/LW-08 fit may now not run beyond six hulls.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

			High Confidence Level				Good Confidence Level				Speculative		
Designation	Application	thru 97	98	99	00	01	02	03	04	05	06	07	Total 98-07
JUPITER	FF (SAUDI ARABIA)	2	0	0	1	0	0	0	0	0	0	0	1
JUPITER	FF (TAIWAN)	3	2	1	0	0	0	0	0	0	0	0	3
JUPITER	Prior Prod'n:	29	0	0	0	0	0	0	0	0	0	0	0
Total Production		34	2	1	1	0	0	0	0	0	0	0	4