

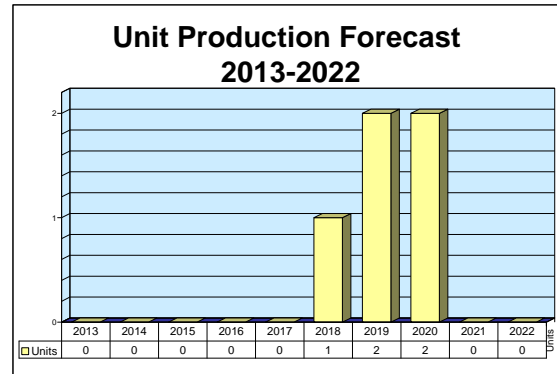
# ARCHIVED REPORT

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## SAR Lupe

### Outlook

- OHB-System was awarded a contract in April 2010 to operate ground systems for France and Germany to provide both countries with SAR Lupe and Helios 2 data
- Germany has begun a study program called SARah to define the second-generation SAR satellite network
- Current SAR Lupe system should last until end of the decade



### Orientation

**Description.** SAR Lupe is a five-satellite military reconnaissance system. SAR stands for synthetic aperture radar, and Lupe is the German word for "magnifying glass."

**Sponsor.** The German Federal Ministry of Defense, Berlin/Bonn, and the German Federal Office of Defense Technology and Procurement (BWB), Koblenz.

**Status.** Operational

**Total Produced.** Five

**Application.** SAR Lupe satellites provide the German military with all-weather, 24-hour SAR imagery of nearly every region on Earth.

**Price Range.** Horus, the predecessor to SAR Lupe, was estimated to cost \$1.3 billion when the system was first proposed in 1992. The cost eventually rose to more than \$2 billion before the German Ministry of Defense decided to seek a less expensive alternative. In 2005, OHB-System's SAR Lupe contract was valued at \$360 million.

### Contractors

#### Prime

<b>OHB-System AG</b>	<a href="http://www.ohb-system.de">http://www.ohb-system.de</a> , Universitätsallee 27-29, Bremen, 28359 Germany, Tel: + 49 0421 2020 8, Fax: + 49 0421 2020 700, Email: <a href="mailto:ohb@ohb-system.de">ohb@ohb-system.de</a> , Prime
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#### Subcontractor

<b>Cassidian Electronics (EADS)</b>	<a href="http://www.cassidian.com">http://www.cassidian.com</a> , Claude-Dornier-Strasse, Friedrichshafen, 88039 Germany, Tel: + 49 7545 8 00, Fax: + 49 7545 8 4411 (Ground Segment)
<b>EaglePicher Technologies LLC</b>	<a href="http://www.eaglepicher.com">http://www.eaglepicher.com</a> , PO Box 47, Joplin, MO 64802 United States, Tel: + 1 (417) 623-8000, Fax: + 1 (417) 781-1910, Email: <a href="mailto:inquiry.technologies@eaglepicher.com">inquiry.technologies@eaglepicher.com</a> (NiH2 Single Pressure Vessel Batteries)

## SAR Lupe

<b>Integral Systems Europe</b>	<a href="http://www.integ.com">http://www.integ.com</a> , High Tech Buro C, Voie 3, Toulouse, 31677 France, Tel: + 33 5 61 0022 10, Fax: + 33 5 61 0022 13 (Ferrite Switch Technology)
<b>RUAG Space AB</b>	<a href="http://www.ruag.com/Space/">http://www.ruag.com/Space/</a> , Solhusgatan 11, Göteborg, 405 15 Sweden, Tel: + 46 31 735 00 00, Fax: + 46 31 735 40 00 (SAR Antennae)

## SAR Lupe

<b>Temex</b>	<a href="http://www.temex.net">http://www.temex.net</a> , 299, route des Crêtes - BP 232, Sophia-Antipolis, 06904 France, Tel: + 33 497 233 000, Fax: + 33 497 233 915, Email: info@temex.com (Crystal Oscillators)
<b>Tesat-Spacecom GmbH &amp; Co KG</b>	<a href="http://www.tesat.de">http://www.tesat.de</a> , Gerberstrasse 49, Backnang, D-71522 Germany, Tel: + 49 7191 930 0, Fax: + 49 7191 930 1835, Email: Peter.Lust@electronicnote.com (High Performance Amplifier)
<b>Thales Alenia Space France</b>	<a href="http://www.thalesgroup.com">http://www.thalesgroup.com</a> , 26 ave JF Champollion, BP 1187, Toulouse, 31037 France, Tel: + 33 05 34 35 36 37, Fax: + 33 05 61 44 49 90 (Synthetic Aperture Radar)
<b>Thales Electron Devices GmbH</b>	<a href="http://www.thalesgroup.com/security/">http://www.thalesgroup.com/security/</a> , Söflingerstrasse 100, Ulm, 89077 Germany, Tel: + 49 7 31 93 30 5, Fax: + 49 7 31 93 31 25 2 (Ground Segment)

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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

## Technical Data

**Design Features.** SAR Lupe consists of five 4m x 3m x 2m, 770-kilogram spacecraft orbiting at an approximate altitude of 500 kilometers. The design also includes an innovative integrated platform and SAR sensor system, as well as flight-proven technology. The satellites have a resolution of at least 1 meter.

	<u>Metric</u>	<u>U.S.</u>
<b>Weight</b>		
SAR Lupe Launch Mass (each)	770 kg	1,694 lb
<b>Performance</b>		
Altitude (near polar orbit)	500 km	311 mi
Design Life	10 yrs	
Average Power Consumption	250 W	
Telemetry	X-band for data transmission; encrypted S-band for command	
Orbit Control	Hydrazine thrusters	
Attitude Control	Reaction wheels and magnet torquers	
Intersatellite Link	S-band	

## Program Review

**Background.** SAR Lupe is a replacement for the defunct Horus satellite program (previously called Osiris), which first surfaced in the early 1990s. At the time, France was working on a number of satellite programs, including Helios optical satellites and Ceris electronic intelligence satellites.

French defense officials had hoped to sign on international partners – particularly Germany – to fund Horus development. Under a basic framework agreed upon between the two nations, Germany would get a lesser share of Helios 2 work, since French companies had already done some development. In return, Germany would receive a larger portion of Horus development responsibility – with the net effect being that both countries would split the overall work on the two programs approximately 50/50.

Despite this basic framework, no agreement could be reached. By 1994, France had announced a six-year spending program that did not include Horus, and in 1996, a Franco-German summit failed to resolve Helios-Horus issues.

With Horus essentially a dead program, the German Ministry of Defense decided to pursue its own radar satellite program, known as SAR Lupe. In 1998, Berlin released two design study contracts for a small radar reconnaissance satellite to Dornier and OHB-System.

### *OHB Wins Production Contract*

In August 2001, the German Federal Office of Defense Technology announced that it would award OHB-System the contract to produce the SAR Lupe constellation. The contract, worth EUR300 million

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(\$268 million at the time of the contract award), was formally awarded during a signing ceremony in December that same year.

Launches of five satellites were originally to begin in 2003 and conclude in 2005, but were rescheduled for a 2006 start and 2008 completion date.

**A Joint Resolution.** In mid-2002, Germany and France began exploring methods to technologically link the SAR Lupe and Helios 2 constellations.

In December 2002, in Ulm, Germany, Thales Electron Devices GmbH successfully demonstrated the capabilities of the traveling wave tube, a key element of the high-performance amplifier for the SAR Lupe radar. Tesat-Spacecom GmbH & Co KG is developing the amplifier. This was a major technological advance, since the powerful transmitter tube will aid in generating high-resolution images by amplifying the microwaves that the satellites transmit to Earth.

Also in late 2002, SAR Lupe's Critical Design Review was successfully completed by the German Federal Office of Defense Technology and Procurement.

### ***Russian Launch Provider Selected***

OHB-System and the German government have signed a contract with the Russian military export agency Rosoboronexport to provide vehicles to launch all five SAR Lupe spacecraft. The first SAR Lupe was launched on a Cosmos 3M in December 2006.

### ***Ground Segment Contract Awarded***

Integral Systems Europe, a wholly owned subsidiary of Integral Systems Inc of Lanham, Maryland, has won a contract from Carlo Gavazzi Space to provide the

ground system for the SAR Lupe system. Integral did not release financial details of the contract. The system will be based on Integral's Epoch 2000 command and control software.

### ***First Spacecraft Launched***

A Russian Cosmos rocket lifted off from the Plesetsk Cosmodrome in northern Russia at 9 a.m. EST (1400 GMT, 5 p.m. Moscow time) on December 19, 2006, and placed the SAR Lupe-1 into a 500-kilometer low-Earth orbit about half an hour later. By the end of 2008, all five satellites had been launched.

Germany has begun a study program, called SARah, to define the second-generation SAR satellite network. Berlin could award contracts worth up to \$20 million to OHB and EADS Astrium to continue program studies.

In April 2010, OHB-System was awarded a contract to operate ground stations that will allow France to access Germany's SAR Lupe satellites and Germany to access French Helios 2 satellites. The contract was awarded under the Europeanization of Satellite-Based Reconnaissance (E-SGA) program. The contract is worth EUR7.6 million (\$10.1 million).

The SAR Lupe program has been complicated by pan-European efforts to develop a joint satellite observation system. Current discussions focus on the MUSIS program, which calls for European nations to develop their own satellite systems with a common ground system architecture, allowing them to share data. However, delays over funding and an unwillingness to share sensitive military intelligence have forced some countries to proceed on their own. France, for example, recently awarded a production contract for Helios observation satellite replacements.

## Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1998	Horus program scrapped due to lack of funds
Nov	1998	German Ministry of Defense issues two design study contracts for SAR Lupe
Nov	1999	Design studies released
Dec	2001	OHB-System awarded production contract
Jun	2003	Integral Systems Europe awarded ground system contract
Dec	2006	First SAR Lupe satellite launched on Cosmos 3M
Jul	2007	SAR Lupe-2 launched on Cosmos 3M
Nov	2007	SAR Lupe-3 launched on Cosmos 3M
Mar	2008	SAR Lupe-4 launched on Cosmos 3M
Jul	2008	SAR Lupe-5 launched on Cosmos 3M

## Forecast Rationale

Production of the SAR Lupe constellation was completed in July 2008. With an expected lifespan of 10 years each, SAR Lupe satellites are expected to

remain in service until the end of the decade. At that time, they will need to be replaced to prevent a gap in Germany's radar satellite coverage.

## SAR Lupe

Despite difficulty with large-scale international satellite cooperation projects in Europe, France and Germany continue to cooperate on a smaller scale. In April 2010, OHB-System was selected to operate ground systems for France and Germany that would allow both countries to access data from Helios and SAR Lupe satellites.

During the forecast period, Germany will continue to focus on developing Synthetic Aperture Radar satellite

systems. The specifics regarding international cooperation will continue to be worked out, but the German military must develop and launch new satellites before the current generation of SAR Lupe satellites reach the end of their lifespans, which is expected at the end of the decade. For that reason, Forecast International projects delivery of five replacement SAR satellites to begin around 2018, regardless of international agreements. Additional satellites will likely not be delivered until late in the next decade.

## Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
<b>MFR Not Selected</b>												
<b>SAR Lupe Follow-On</b>												
	0	0	0	0	0	0	1	2	2	0	0	5
<b>Total</b>	0	0	0	0	0	0	1	2	2	0	0	5