

# ARCHIVED REPORT

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## Leostar/Astrobus

### Outlook

- Large market for low-Earth orbit (LEO) communications satellites never materialized, taking away the primary market for the Leostar
- Astrium marketed the bus for LEO remote sensing applications, but the bus is considered too small to meet the needs of modern remote sensing operators
- Astrium-built remote sensing satellites such as Pleiades are based on Leostar/Astrobus family, but fall out of the scope of this report
- This report will be archived in 2011.

### Orientation

**Description.** Leostar is a series of small spacecraft for deployment to low-Earth orbits (LEOs).

**Sponsor.** Privately sponsored by the contracting agency.

**Status.** Leostar/Astrobus form the basis of newer satellite buses.

**Total Produced.** One: Rocsat-2 was delivered in 2004.

**Application.** Leostar spacecraft are designed to carry communications, science, or remote sensing payloads to LEO.

**Price Range.** The completed Rocsat-2 spacecraft with a high-resolution imaging payload costs approximately \$75 million. The standard Leostar platform is approximately \$12 million.

### Contractors

#### Prime

<b>Astrium, Space Division</b>	<a href="http://www.astrium.eads.net/en">http://www.astrium.eads.net/en</a> , 31, Ave des Cosmonautes, ZI du Palays, Toulouse, 31402 France, Tel: + 33 5 62 19 62 19, Fax: + 33 5 61 54 57 10, Prime
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#### Subcontractor

<b>Astrium</b>	<a href="http://www.astrium.eads.net/en">http://www.astrium.eads.net/en</a> , Gunnels Wood Rd, Stevenage, SG1 2AS United Kingdom, Tel: + 44 1438 313 456, Fax: + 44 1438 773 637 (Satellite Structures)
<b>Astrium</b>	<a href="http://www.space.eads.net">http://www.space.eads.net</a> , PO Box 801109, Munich, 81663 Germany, Tel: + 49 89 607 0, Fax: + 49 89 607 264 81 (Mechanical and Thermal Structures)

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## Technical Data

**Design Features.** The Leostar bus design revolves around a generic core avionics suite. The heart of this package is the On-Board Management Unit (OBMU), which performs processing functions and provides optional services to the satellite payload.

Originally, Leostar satellites came in two versions: the Leostar 500, optimized for 500-kilogram payloads and suitable for launchers such as the Cosmos, Rocket, Athena, Taurus, Polar Satellite Launch Vehicle (PSLV), and Leostar 200, which is aimed at 200-kilogram payloads and meant for smaller boosters such as Pegasus XL, Start, Shavit, and Satellite Launch Vehicle.

In an aggressive change in focus from telecommunication to Earth observation applications, Astrium scrapped the two earlier models and made Leostar 500-XO the benchmark of the Leostar family. Specifically designed for high-resolution observation missions, Leostar 500-XO can easily accommodate any type of payload with a typical mass of 500 kilograms, but can handle up to 1,000 kilograms. Its low inertia and high stiffness make it a very agile spacecraft and enhance its line-of-sight pointing performances. Its modular design allows for a wide array of options to best suit the mission's required orbit, mass, power, propulsion, and data transmission capabilities.

### LEOSTAR 500-XO

	<u>Metric</u>	<u>U.S.</u>
<b>Dimensions</b>		
Bus main body size	1.5 m high, 1.5 m dia hexagon	4.9 ft x 4.9 ft
Spacecraft mass	500-1,000 kg	1,105-2,205 lb
Bus dry mass	350-400 kg	772-882 lb
<b>Performance</b>		
Orbits	450-1,500 km altitude	279-932 mi
Inclination	Any	
Propulsion	up to 80 kg hydrazine	
Stabilization	3-axis, nadir, or inertial pointing	
<b>Power</b>		
Modular solar panels	600-900 W	
Platform power consumption	150-350 W	
<b>Agility</b>		
	10° in less than 25 s	
	30° in less than 45 s	
	45° in less than 60 s	
Line of sight	Pointing: 100-250 m @ 700 km Localization: 20-70 m @ 700 km Stability: better than 10 <sup>-4</sup> %/s	
Design lifetime	5 years	
Reliability	0.85 over 5 years	

## Variants/Upgrades

**Leostar 200.** Canceled

**Leostar 500.** Canceled

**Leostar 500-XO.** Designed specifically for high-resolution Earth observation missions. In development.

**Pleiades.** Larger version of Leostar adapted for France's commitment to Cosmo-Pleiades. In production.

**Astrobus.** A customizable satellite bus based on Leostar and Flexbus. In development.

## Leostar/Astrobus



Artist's Depiction of the Rocsat-2 on a Leostar Bus

Source: EADS Astrium

## Program Review

**Background.** Astrium (formerly Matra Marconi Space, now EADS Astrium), manufacturer of the large Eurostar series of commercial communications satellites, introduced the Leostar family of small spacecraft in 1996. Unlike Eurostars, which are deployed to geosynchronous orbits, Leostar spacecraft are earmarked for low-Earth orbits (LEO), where they may perform communications, science, and remote-sensing duties.

The company's decision to develop small spacecraft coincided with the anticipated growth in satellite systems slated for use from LEO. Literally hundreds of satellites were scheduled for production and launch in the late 1990s and early 2000s, most for mobile communications purposes and some for remote-sensing applications.

When demand failed to materialize as expected, the bottom fell out of the little LEO mobile communications market. Larger operators like Iridium and Globalstar filed for bankruptcy, while hopefuls like Teledesic bowed out altogether after spending millions to develop their constellations. Small satellite manufacturers are still suffering from the canceled orders, although the blow has been somewhat cushioned by a growing demand in the scientific remote sensing sector. In fact, remote sensing is the only application for which Leostar has received serious consideration.

In 1997, Astrium negotiated with Thailand to supply a Leostar spacecraft for what would have been the country's first remote-sensing application. However, the program never materialized.

Off to a rough start, the program experienced two more cancellations when ECCO and Starsys abandoned plans for their telecommunications constellations. Astrium was chosen as prime contractor for both programs.

**Rocsat-2.** In 1999, Astrium received a \$75 million contract from Taiwan to design and build the Rocsat-2 high-resolution Earth imaging spacecraft. The award was originally handed to DaimlerChrysler Aerospace (DASA), which had to forfeit the award when Germany refused to grant the necessary export license. Ironically, DASA merged with Matra Marconi the following year to form Astrium.

Rocsat-2 launched in May 2004 from Vandenberg Air Force Base, California, aboard an Orbital Sciences Taurus XL.

**Pleiades.** In 2000, France and Italy announced plans to merge the Pleiades and Cosmo-Skymed Earth observation programs into a dual-use system, providing imagery to the military and civil sectors. The French Space Agency (CNES) is responsible for the two Pleiades optical spacecraft and had been planning to base them on the Leostar 500 platform.

## Leostar/Astrobus

In expanding the Leostar bus to build the two satellites, EADS Astrium decided to make Pleiades its own platform. The Pleiades variant is heavier and larger than the original Leostar, to accommodate about 1,000 kilograms of payload. Its solar panels feature 1,400 watts of power, compared with Leostar's 600 to 900 watts. Like Leostar, it is three-axis stabilized and carries up to 80 kilograms of hydrazine propellant to accommodate its five-year lifetime.

Each Pleiades spacecraft will include an optical imager capable of detecting ground objects 70 centimeters wide with an image swath of 20 kilometers. The contract was signed in October 2003 and is worth \$360 million. The two Pleiades spacecraft will launch in 2010 or 2011 and will serve as the successor to France's SPOT program.

Astrobus. While EADS Astrium has designed the Leostar 500-XO specifically for high-resolution observation missions, its new Astrobus offering actually consists of an array of options for building a custom-made Earth observation and scientific satellite. Under the Astrobus concept, EADS Astrium will draw on its Flexbus and Leostar platform designs, and using proven commercial, off-the-shelf instruments to minimize costs, build a satellite to the customer's specifications. The beauty in this approach is that Astrium has no initial investment, and the customer gets what it wants as long as the payload weight remains around 500 kilograms. An Astrobus satellite can be launched aboard a Start 1, Athena, Cosmos, Rockot, Dnepr, or Delta rocket.

## Timetable

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<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1996	Matra Marconi Space introduces Leostar model
May	2004	Launch of Rocsat-2 on Taurus XL

## Forecast Rationale

Astrium designed the Leostar satellite bus during the 1990s when many space industry officials expected the low-Earth orbit communications satellite market to explode. That market, however, never materialized. Consequently, Astrium never experienced the success it expected with Leostar and had with its larger geosynchronous Eurostar bus.

With orders for low-Earth orbit communications satellites remaining low, Astrium marketed the Leostar for low-Earth orbit remote sensing applications.

Although Astrium has had success in the remote sensing market, the Leostar is too small to compete with modern remote sensing systems.

The Leostar does form the basis of many modern satellite buses, including the bus for Pleiades, Spot 6, and Spot 7. However, these do not fall within the scope of this report.

No firm orders have been received for Leostar that will be delivered over the next 10 years.

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