THALES ALENIA SPACE
SPACEBUS-L FAMILY HERITAGE
AND KEY FEATURES
The Spacebus-L family

Spacebus-L 100 (M< 150 Kg)

- microsatellite based on the Myriade platform
- platform cubic size of 0.6 m and a mass lower than 100 kg
- Configuration compatible with a wide range of launchers
- very stable interface to the instrument and the fine sensors for optimizing the radiometric and geometric image quality
- roll maneuverability for a large observation accessibility area
Mission: IR Earth Observation to prepare a future Early Warning System

Key performances:
- Adapted to GTO orbit
- Depointing capacity ±30°
- Line of sight stability better than 50 μrad/s
- Launch mass < 120kg
- Power 100 W (mean)

Status:
- Phase B started January 2004
- Phase C/D started June 2005
- Launch planned end 2008
- 18 months lifetime
Spacebus-L 500 (M< 1 T)

- minisatellite based on the Proteus Platform
- new Thales Alenia Space Avionics for LEO platforms (ERC-32 processor module)
- Power subsystem benefits from GLOBALSTAR 2: AsGa solar arrays, SADM and PCDU units
- S-Band Ground link provides command, telemetry and ranging according to ESA standards
- compatible with small and medium launch vehicles fairing, like Rockot, Dnepr, Vega, Soyuz, Delta-2, PSLV, Long March 2C.
The Spacebus-L family

- SOYUZ Ø 3435 mm
- LM2C Ø 3000 mm
- VEGA Ø 2380 mm
- ROCKOT Ø 2250 mm
- DNEPR Ø 2010 mm
- DELTA2 up Ø 2743 mm
- DELTA2 low Ø 2330 mm

Payload volume

Spacebus L500
PROTEUS flight domain

- Any orbit in the 600-1500 km range
- Orbit inclination > 30 deg
- Will be validated by 5 missions end of 2008

PROTEUS FLIGHT ENVELOPE

Allowed with life duration (radiations) and other restrictions at upper altitudes

Allowed with life duration (monoatomic oxygen, atmos. drag) and ground station visibility

(Sun synchronous orbits)
<table>
<thead>
<tr>
<th>Orbit</th>
<th>Launch vehicles</th>
<th>Mass</th>
<th>Lifetime</th>
<th>Pointing Attitude restitution</th>
<th>Power</th>
<th>Data storage</th>
<th>Down link</th>
<th>Up link</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>any orbit altitude in 600 - 1500 km orbit inclination higher than 30 deg.</td>
<td>compatible with all launch vehicle with fairing diameter &gt; 1.9 m</td>
<td>dry platform mass w/o STA = 262 kg</td>
<td>28 kg hydrazine capacity</td>
<td>Payload mass = 100 to 400 kg</td>
<td>3 to 5 years</td>
<td>0.05 deg (3 sigmas) on each axis</td>
<td>bus maximum consumption = 300 W</td>
<td>Payload consumption class = 300 W</td>
<td>722.116 kbit/s (S-band)</td>
</tr>
</tbody>
</table>

**PROTEUS main characteristics**

- Provides a wide range of payload pointing capabilities
- 500-600 kg class satellite
- Payload weighing up to 400 kg, consuming up to 300 W power
Proteus Platform Heritage

PROTEUS system architecture

- Standard platform
- Standard control command ground system (SSGP)
- PROTEUS is the only mini-sat non-US platform selected in the NASA reference catalog (RSDO catalog)

- On October 2006, a PROTEUS-derived platform has been selected for the Globalstar 2 program, a US private contract for the renewal of the Globalstar 1 constellation (delivery of 48 satellites)
# Proteus on-going missions

<table>
<thead>
<tr>
<th>Satellite</th>
<th>JASON -1</th>
<th>CALIPSO</th>
<th>COROT</th>
<th>JASON -2</th>
<th>SMOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Launcher</td>
<td>Delta-2</td>
<td>Delta-2</td>
<td>Soyuz</td>
<td>Delta-2</td>
<td>EUMETSAT/NoAA</td>
</tr>
<tr>
<td>Mission</td>
<td>Ocean Altimetry</td>
<td>Atmosphere (optical/Lidar)</td>
<td>Astronomy (optical)</td>
<td>Ocean Altimetry</td>
<td>Ocean salinity (RF)</td>
</tr>
<tr>
<td>Orbit</td>
<td>Drift orbit 66° 1336 km 14 Hr SSO</td>
<td>705 km 900 km Polar orbit</td>
<td>1336 km 6-18 Hr SSO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pointing</td>
<td>+Z Nadir Yaw steering</td>
<td>+X Nadir Inertial pointing</td>
<td>+Z Nadir Yaw steering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SL mass</td>
<td>485 Kg</td>
<td>580 Kg</td>
<td>610 Kg</td>
<td>444 Kg</td>
<td>680 Kg</td>
</tr>
<tr>
<td>PL mass</td>
<td>175 Kg</td>
<td>270 Kg</td>
<td>300 Kg</td>
<td>144 Kg</td>
<td>360 Kg</td>
</tr>
<tr>
<td>SL power</td>
<td>440 W</td>
<td>560 W</td>
<td>450 W</td>
<td>510 W</td>
<td>800 W</td>
</tr>
<tr>
<td>PL power</td>
<td>165 W</td>
<td>282 W</td>
<td>150 W</td>
<td>210 W</td>
<td>500 W</td>
</tr>
<tr>
<td>Pointing accuracy (cone)</td>
<td>0.14°</td>
<td>0.08°</td>
<td>0.5 arc</td>
<td>0.14°</td>
<td>0.1°</td>
</tr>
</tbody>
</table>
The PROTEUS platform is currently used on five NASA, CNES, and ESA missions.

Using a standardized platform produced in batch, Proteus allows to fulfill a wide variety of missions and to accommodate very different payloads in size and nature.

**Jason 1**

**Joint NASA/CNES for oceanography / altimetry**

Launch: December 2001 Launcher: Delta-2

Fulfills perfectly its mission after 6 years in orbit

The ocean surface height is measured with 1 cm accuracy.
The PROTEUS platform is currently used on five NASA, CNES, and ESA missions.

CALIPSO
Joint NASA/CNES program for climatology: clouds and aerosol
Launch: April 2006 Launcher: Delta-2
100% mission availability since launch
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COROT

CNES program for astronomy: astrosismology and exoplanet detection

Launch: December 2006

Launcher: Soyuz

Outstanding pointing accuracy
The PROTEUS platform is currently used on five NASA, CNES, and ESA missions.

SMOS
ESA program for climatology:
soil moisture and ocean salinity
Launch planned in 2008 on a Rockot launcher
The PROTEUS platform is currently used on five NASA, CNES, and ESA missions.
### The Spacebus-L family

<table>
<thead>
<tr>
<th></th>
<th>Spacebus-L100</th>
<th>Spacebus-L500</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multimission platform:</strong></td>
<td>Observation, Navigation, Telecommunication</td>
<td></td>
</tr>
<tr>
<td><strong>Satellite Mass</strong></td>
<td>100 - 150 kg</td>
<td>500 - 800 kg</td>
</tr>
<tr>
<td><strong>Payload Mass</strong></td>
<td>70 kg</td>
<td>350 kg</td>
</tr>
<tr>
<td><strong>Payload Power</strong></td>
<td>80 W</td>
<td>300 W</td>
</tr>
<tr>
<td><strong>Typical Life Time</strong></td>
<td>3 - 5 years</td>
<td>7 - 10 years</td>
</tr>
</tbody>
</table>
Conclusion

With regard to the PROTEUS heritage (extensive operational return of experience) and the synergy with Globalstar 2, the Spacebus-L 500 proposed by Thales Alenia Space will bring, with the shortest time to market, a highly competitive platform in terms of performances, recurring price, and credibility for LEO satellites in the less than 1 ton mass class.

For the lower end (class 150 Kg), the Spacebus-L100, based on Myriade, is offered.