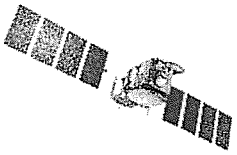
Altimetry mission for ocean observation.

JASON-2



CHARACTERISTICS

Mini-satellite from CNES PROTEUS series

CNES/NASA/EUMETSAT/NOAA collaboration

Instruments: one altimeter, one radiometer, DORIS, GPS, one laser reflector for precise orbitography, and three passengers: T2L2, CARMEN-2, LPT.

Measurement of ocean surface topography, surface wind speed, wave height.

High inclination orbit at 1336 km altitude

Mission lifetime 5 years

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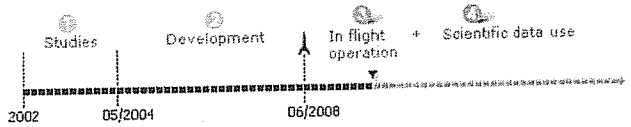
Jason-2: altimetry missions follow-on for ocean observation



The JASON-2 project is a response to the international demand for programmes to study and observe oceans and the climate, through a worldwide ocean observation system. It is a continuation to the TOPEX/POSEIDON and JASON-1 altimetry missions developed by CNES and NASA. Altimetry, i.e. the precise measurement of ocean surface topography, has indeed become since 1992 (launch of TOPEX/POSEIDON) an essential tool for the study of oceans on a global scale.

JASON-2 is part of cooperation between CNES, EUMETSAT, NASA and NOAA. Space and ground segments of the Jason-2 mission strongly inherit from the JASON-1 mission.

Onboard the **JASON-2** satellite, which uses a **PROTEUS** platform, the payload is composed of a **Poseidon-3 radar altimeter** supplied by CNES, an **Advanced Microwave Radiometer** (AMR) supplied by NASA/JPL, and a triple system for precise orbit determination: the **DORIS instrument** (CNES), **GPS receiver** and a **Laser Retroflector Array** (LRA) (NASA). Three further onboard instruments (T2L2, LPT, CARMEN-2) will also be included.

In order to ensure continuity and optimal inter-calibration of observations over the long term, JASON-2 will fly the same orbit as JASON-1 and TOPEX/POSEIDON. Moreover, data processing will be integrated into the CNES ground segment "**SALP**" (altimetry and precise positioning system), which already operates the altimetry missions TOPEX/POSEIDON, JASON-1, ENVISAT, GFO, whose data is distributed on the **AVISO** website.

Latest update 12/03/2010

NEWS

- **12 March 2010**
  A Jason-3 satellite to replace Jason-1 in 2013
- **5 August 2009**
  The Jason-2/OSTM GDRs are now available to the public
- **15 May 2009**
  A new DEM was successfully uploaded on OSTM/Jason-2
- **2 March 2009**
  First results for Jason-1/Jason-2 tandem
- **26 January 2009**
  End of the Jason-1/Jason-2 tandem phase: Jason-1 orbit change to an interleaved ground track
- **16 January 2009**
  Dissemination of IGDR products to all users by CNES via **AVISO website**
- **15 December 2008**
  Dissemination of OGDR products to all users, by EUMETSAT and NOAA operational centers
- **11-12 November 2008**
  Ocean Surface Topography Science Team (OSTST) meeting in Nice: first verification workshop for the Jason-2 mission

Altimetry mission for ocean observation.

OSTM/JASON-2
JASON-2

KEY EVENTS

June 20, 2008: Jason-2 launch

April 2006: 4-partners Memorandum of Understanding signature

December 2005: Preliminary Design Review (PDR)

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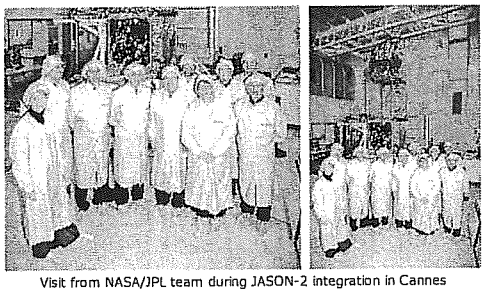
JASON-2 NEWS

12 March 2010	A nearly identical copy of Jason-2, Jason-3, Franco-American oceanography satellite, should be launched in 2013 to replace Jason-1 at 1336 km altitude. The contract has been signed on 24 february between CNES and Thales Alenia Space which will built it. **More details...**
5 August 2009	The Jason-2/OSTM Geophysical Data Records (GDRs) are now available to the public after one year of calibration/validation. **More details...**
15 May 2009	A new DEM was successfully uploaded on OSTM/Jason-2. **More details...**
2 March 2009	First results for the Jason-1/Jason-2 tandem. **More details...**
16 January 2009	Dissemination of IGDR products to all users by CNES via **AVISO website**
15 December 2008	Dissemination of OGDR products to all users, by EUMETSAT and NOAA operational centers
11-12 November 2008	Ocean Surface Topography Science Team (OSTST) meeting in Nice: first verification workshop for the Jason-2 mission
29 October 2008	Jason-2 handover of operations for satellite routine from CNES to NOAA
11 September 2008	Jason-2 receives in-flight acceptance
22 August 2008	IGDR (Interim Geophysical Data Record) product dissemination to scientific PIs
4 August 2008	OGDR product dissemination to scientific PIs
4 July 2008	Jason-2 reaches operational orbit - Start of the Jason-1/Jason-2 tandem phase
23 June 2008	First OGDR (Operational Geophysical Data Record, which is the operational near real-time non-validated product) product processed
June 20, 2008	Successful launch of Jason-2 by a Delta-2 rocket
June 9, 2008	Satellite transportation to its launch pad.
May 27, 2008	Mounting on the adaptor, Softride interface.
May 19, 2008	Satellite's hydrazine tanks filling and pressurization
April 29, 2008	Arrival of the satellite on its launch site (Vandenberg, California)
April 10, 2008	The satellite is packed in its container, ready to be sent (at first it was transported by road between Thales Alenia Space facilities in Cannes and Toulouse)
April 2008	Jason-2 scientific PIs (Principal Investigators) announcement
April 8, 2008	Operational Qualification Review
March 11, 2008	Satellite Qualification Review
October 2, 2007	Satellite Performances Key Point
September 2007	Deadline for the "OSTST" call for proposals for scientific research into Jason-2 data (in particular for calibration and validation work) for CNES EURMETSAT (deadline end of October for NASA/NOAA). After an inter-agency coordination phase for the selection of European and American proposals, the official results are expected in March 2008.
June 2007 - January 2008	Satellite Assembly, Integration and Test (AIT)
June 2007	End of payload instruments integration and tests (DORIS and GPS)
April 2007- May 2008	Qualification tests of the ground segment
December 2006	Start of integration and testing of instruments on payload (DORIS and GPS)



Visit from NASA/JPL team during JASON-2 integration in Cannes

December 2006	System Interface Review
October 2006	Satellite Critical Design Review (CDR)
April 2006	Signature of the 4-partners Memorandum of Understanding
December 2005	Preliminary Design Review (PDR)

Latest update 12/03/2010

Altimetry mission for ocean observation.

OSTM JASON-2
JASON-2

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JASON-2 SCIENTIFIC OBJECTIVES

Variations in sea level

Satellite altimetry is used to measure precisely (at centimetre level), globally and almost instantaneously (at the scale of ocean dynamics) sea level variations. Ocean surface topography is variable on several scales of time and space, reflecting a large number of phenomena:

- Constant deviation with regards to the reference ellipsoid (approximately 100 meters) is mainly attributed to the geographical structure of the Earth geoid, i.e. the uneven distribution of mass inside our planet.

- Sea surface deviation with regards to the earth geoid (that can be determined independently using gravimetric satellites such as CHAMP and GRACE), with amplitudes of the order of one meter, is known as "dynamic topography". Such deformations on the sea's surface are related to global oceanic circulation. In a similar manner to atmospheric pressure maps used for meteorology, ocean surface currents follow level curves with a speed proportional to its local slope. We can thus map the main sea currents, such as the Gulf Stream or the Kuroshio.

- Temporal variations in surface topography are also used to observe and monitor ocean variability (vortex, Rossby waves, etc.), tides, seasonal and/or climatic phenomena, such as El Niño.

- Finally, in the long term it is possible to monitor the average sea level. Since the beginning of the TOPEX/POSEIDON mission in 1992, an average global increase in sea levels of around 3 mm has been observed, with strong spatial variability (up to ± 20 mm/yr according to the region). This increase is an indicator of global warming, and in this respect sustaining the continuity and precision of these measurements is a major challenge for altimetry missions.

Products derived from altimetry measurements

In addition to surface topography, the signal recorded by altimeters is used to measure two other very useful parameters for marine meteorology: the significant wave height (SWH: average wave height over the footprint of the altimeter) and the surface wind speed. Available in almost real-time, these measurements are used for meteorological forecasts.

Altimetry on the continents

Although designed to measure the height of ocean waters (of which the "radar signature" is correctly identified), altimeters also have the capacity to obtain observations above continents, particularly on any water expanse that is large enough to be detected. This capacity has opened new perspectives for continental hydrology. Using altimetry satellites thus makes it possible to monitor seasonal variations in lake levels and certain major rivers. These applications are particularly important in remote and/or poorly instrumented areas, such as the Amazon basin.

Combination of altimetry and in-situ measurements: operational oceanography

Data assimilation consists of combining observations and models to make precise predictions about evolutions in complex systems. Classicly used for meteorological forecasts, this technique can be transposed to operational oceanography. In 2003 was initiated the international GODAE (Global Ocean Data Assimilation Experiment) experiment, the first "full scale" international operational oceanography experiment. It aimed to demonstrate that it is possible to observe, model and predict the global ocean in three dimensions, routinely and in real-time.

Pilot systems from the GODAE programme, the Public Interest Group **Mercator Ocean**, created in April 2002, implemented a system used to describe the state of the ocean, an essential component of our environment, at any time and from any corner of our blue planet.

The Mercator system is "fed" through inputs consisting of observations of the ocean measured by satellites (altimetry, and also surface temperature and salinity) as well as in situ measurements (drifting buoys, sensors and temperature, salinity and current profilers). These measurements are "ingested" (assimilated) by the analysis and prediction model. Assimilating observation data in a model is thus used to describe and predict the ocean over periods of up to 14 days. Since October 2005, Mercator has been operating a global oceanographic prediction model with ¼° resolution, i.e. approximately 28 kilometres from the equator.

Latest update 01/04/2008

Mission d'altimétrie pour l'observation des océans.

Missions spatiales

OSTM JASON2

JASON-2

MISSION

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JASON-2 MISSION

The programmatic context

The OSTM (Ocean Surface Topography Mission) follows in the footsteps of the TOPEX/POSEIDON missions and JASON-1 and provides continuity between those missions. OSTM mission aims to run for 20 years and is conducted by a series of satellites, the first of which is JASON-2. The planned service life of JASON-2 stands at five years (including extended observation phase) after its launch. The mission objective is therefore to provide operational continuity for the collection and distribution of high-precision data for the study of ocean currents and the measurement of sea levels, with a view to improving understanding of these phenomena and their impact on the climate.

The JASON-2 project is part of a French development programme for operational oceanography, including the development of in situ measurements (CORIOLIS project) and the development of an analysis and prediction centre (**MERCATOR** project). These two programmes constitute the French contribution to GODAE (Global Ocean Data Assimilation Experiment), the first international operational oceanography experiment.

This mission was determined as part of an agreement between four partners: CNES, NASA, NOAA and EUMETSAT.

The elementary mission requirements

Ocean circulation is studied by measuring the sea level height, derived from two elementary data elements:

- the altimetric distance, between the satellite and the sea level, deduced from altimetry measurements,
- satellite radial height in relation to the reference ellipsoid deduced from measurements taken from different positioning systems.

In addition, the altimetric range measurement must be corrected from propagation effects, as the radar signal is delayed in the troposphere and ionosphere. The ionospheric delay is estimated by combining range estimates on two frequencies), and the tropospheric delay is calculated from water content estimates. Therefore, the POSEIDON-3 altimeter is dual frequency, and the payload includes a radiometer, which is used to calculate the water content in the troposphere.

The TOPEX/POSEIDON, JASON-1 and JASON-2 satellites use the same circular, non-heliosynchronous orbit, inclined at 66° and at an altitude of 1,336 km. The satellite passes over the same points on the ground every 10 days, thus providing homogeneous sampling of the globe's surface over a given period. The orbit altitude is related to the need for precise orbit determination (negligible atmospheric drag and small-scale variations in the Earth's gravitational field have little impact at this altitude). More importantly, an non sun-synchronous orbit permits that major tidal components (diurnal) can therefore be monitored.

Latest update 01/04/2008

Altimetry mission for ocean observation.

OSTM JASON-2

JASON-2

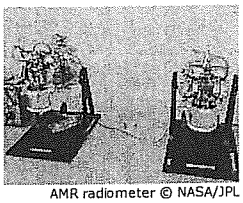
CHARACTERISTICS

Mass: 525 kg

Power: 511 W

Telemetry: 838.86 kbits/s

Mission lifetime: 5 years



AMR radiometer © NASA/JPL

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JASON-2 SATELLITE

The JASON-2 satellite is composed of:

- a **PROTEUS platform** (Plate-forme Reconfigurable pour l'Observation, pour les Télécommunications et les Usages Scientifiques). This platform is designed for satellites weighing approximately 500 kg when launched.

- a **payload** with the following main instruments:

  - A **Poseidon-3** altimeter, measuring the distance between the satellite and the sea surface, and used to perform precise corrections in relation to the signal trajectory in the ionosphere (CNES contribution)
  - An **AMR (Advanced Microwave Radiometer)**, designed to identify the water content in the troposphere (NASA contribution)
  - A **DORIS** system used for precise orbit determination (CNES contribution)
  - A GPSP system (GPS Payload), in addition to DORIS, to calculate satellite positioning (NASA contribution)
  - An LRA (Laser Reflected Area) instrument used for the precise calibration of other instruments for the analysis of laser pulses conducted from the ground and reflected onboard by a array of mirrors (NASA contribution)

  and three 'passenger' instruments:

  - **CARMEN2** dosimeter used to improve knowledge of particularly aggressive radiation in Jason's orbit (DORIS, electronic risk assessment) (CNES contribution)
  - LPT (Light Particles Telescope) another dosimeter (JAXA/CNES contribution)
  - **T2L2** (Transfert de Temps par Lien Laser) used to synchronise remote clocks with very high precision (CNES contribution)

JASON-2 satellite main characteristics

Mass	525 kg
Power	511 W
S band telemetry bande S	838.86 kbits/s for telemetry, 4 kbits/s for telecommand
Mission lifetime	5 years

The satellite was sent into orbit by a Delta2 launch vehicle supplied by NASA on June 20th, 2008, the takeoff took place from Vandenberg.

Latest update 28/10/2008

Altimetry mission for ocean observation.

OSTM JASON-2

JASON-2

GROUND SEGMENT

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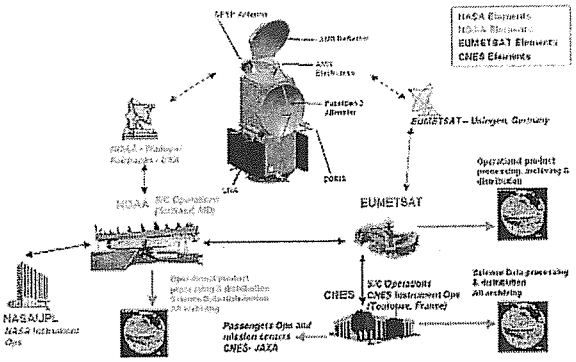
JASON-2 GROUND SEGMENT

The ground segment is a distributed system that uses resources from NASA, CNES, EUMETSAT and NOAA. Its operation and relationship with other elements in the JASON-2 mission are presented in the diagram below.



In accordance with the 4-partner agreement for the Jason-2 project:

- raw altimetry data from POSEIDON3, DORIS and the radiometer will be processed by the NOAA and EUMETSAT centres to produce near-real time altimetry products (OGDR: Operational Geophysical Data Record);
- raw altimetry data from POSEIDON3 and the radiometer will only be processed by the CNES mission centre to produce delayed time altimetry products (GDR: Geophysical Data Record, IGDR, S-IGDR and S-GDR);
- production of preliminary and precise orbit missions for the satellite is undertaken by CNES, using data from the DORIS system, supplemented, for precise orbits, by data from the GPS system (ground data and GPSP) and from the laser system;
- near real time altimetry products (OGDR) are distributed by the NOAA and EUMETSAT centres. They are archived by the NOAA, EUMETSAT and CNES centres;
- delayed time altimetric products are archived and distributed by the NOAA and CNES centres;
- all housekeeping and scientific telemetry and all auxiliary data are archived by the NOAA and CNES centres, whatever the data source;
- added-value products from the DUACS system (Data Unification and Altimeter Combination System) generated by CNES are archived and distributed under CNES responsibility.

Latest update 01/04/2008

Altimetry mission for ocean observation.

Space Missions

OSTM/JASON-2

JASON-2

ORGANIZATION

Cooperation:

CNES, NASA, EUMETSAT, NOAA

Other involved organisms:

JAXA, OSTST

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JASON-2 GENERAL ORGANIZATION

As for JASON-1, the execution framework of JASON-2 is an international cooperation. However, this cooperation has expanded: in the United States, the NOAA is associated with NASA and in Europe, EUMETSAT is associated with CNES. The distribution of responsibility for the OSTM/JASON-2 mission is the same as that adopted for JASON-1 whilst taking account of the projects expansion with the two operational agencies, NOAA and EUMETSAT.

Furthermore, the development and execution of the Carmen2/LPT (Light Particle Telescope) experiment is the subject of a specific agreement between CNES/JAXA.

A more detailed breakdown of this cooperation is found below:

- CNES
  - is responsible for the overall management of the project and the system,
  - is the prime contractor for the satellite system that uses the PROTEUS platformS,
  - contributes to the payload by supplying the POSEIDON3 nadir altimeter, the DORIS onboard system, the technological "passengers" T2L2, Carmen2 and LTP,
  - provides the satellite control centre and a ground station that will be installed in Germany for EUMETSAT,
  - is responsible for the definition and execution of all system tests,
  - operates the satellite during the in-flight acceptance phase and the critical phases, provides the production of steering controls and orbit control and satellite expertise throughout the satellite's entire service life,
  - processes, archives and distributes scientific data,
  - archives operational data.
- EUMETSAT
  - supplies the infrastructure for the ground station and provides its maintenance operations,
  - processes and distributes operational data,
  - acts as an interface between operational users.
- NASA
  - supports CNES in the overall management of the system,
  - supplies the vehicle launcher, launch operations and associated infrastructures,
  - contributes to the payload by supplying the UHF radiometer (designed for tropospheric corrections), the GPS receiver and the laser retroreflector (for precise orbit determination).
- NOAA
  - supplies two ground stations,
  - suppliers an operations centre and conducts routine operations on the satellite after transfer to the CNES control centre,
  - processes and distributes operational data,
  - acts as an interface with operational users,
  - archives and distributes scientific data.

CNES/JAXA cooperation on LPT/Carmen2 is broken down as follows:

- CNES
  - is responsible for this experiment with regards to the three JASON-2 partners,
  - supplies the Carmen2 instrument,
  - carries out engineering studies required to host the instruments and integrate them into the satellite,
  - process data.
- JAXA
  - provides the LPT instrument, supports its integration on the satellite,
  - processes data.

High-level management of the project is provided by the "Joint Steering Group" (JSG), made up of representatives from the four agencies CNES/EUMETSAT/NASA/NOAA. This group is responsible for monitoring scheduling activities of the JASON-2 mission and high-level decisions.

- Role of OSTST

To conclude, an international group of scientists, the "Ocean Surface Topography Science Team" (OSTST), provides an independent assessment of scientific objectives and advances and contributes to wider distribution of advances achieved in an international context.

Latest update 01/04/2008

Altimetry mission for ocean observation.

JASON-2 CONTACT POINTS

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John Lillibridge

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Altimetry mission for ocean observation.

Space Missions

OTHER SITES LINKED TO JASON-2 MISSION:

- AVISO website — http://www.jason.oceanobs.com/
- JPL PO.DAAC website (Physical Oceanography Distributed Active Archive Center) — http://podaac.jpl.nasa.gov/
- Eumetsat website — http://www.eumetsat.int/
- NOAA website — http://www.noaa.gov/
- Blog dedicated to the space oceanography — http://www.cnes.fr/blog_jason/

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Dual optical system for metric resolution observations.

PLEIADES

PLEIADES-HR SATELLITE

Very high resolution panchromatic and multispectral Earth observation satellite.

Altitude: 694 km

Sun-synchronous, phased and almost circular orbit.

Lifetime: 5 years

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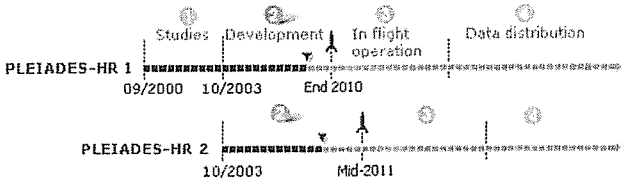
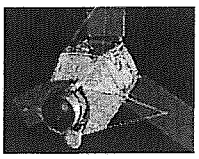
The project main steps



Pleiades: a multi-missions concept and a partnership program.

The decision about the setting up of the Pleiades program is the result of an in-depth study about the user needs evolution. A cooperation program was initiated between France and Italy, taking advantage of all the CNES Earth observation skills, to develop ORFEO, a dual Earth observation system with metric resolution, in which Pleiades (France) is the optic component and Cosmo-Skymed (Italy) is the radar component.



This component is made of two "small satellites" (mass of one ton) offering a spatial resolution at nadir of 0.7 m and a field of view of 20 km. Their great agility enables a daily access all over the world, which is a critical need for defence and civil security applications, and a coverage capacity necessary for the cartography kind of applications at scales better than those accessible to SPOT family satellites. Moreover, PLEIADES have stereoscopic acquisition capacity to meet the fine cartography needs, notably in urban regions, and to bring complete information given by aerial photography.

With respect to the constraints of the franco-italian agreement, cooperations have been set up for the PLEIADES optical component with Sweden, Belgium, Spain and Austria.

Latest update 14/12/2009

NEWS

- **December 4, 2009**
  Beginning of the System Technical Qualification Review
- **November 19, 2009**
  Delivery by Thales Alenia Space of the instrument Flight Model 2 to Astrium
- **November 12, 2009**
  Delivery by Astrium of the Satellite Flight Model 1 to CNES
- **September 2009**
  Rendez-vous between the satellite, the controle center (SDGC) and the mission centres for the complete system tests
- **February to end of July 2009**
  Satellite Flight Model 1 environment tests at Intespace
- **January 2009**
  Rendez-vous between the satellite, the controle center (SDGC) and the mission centres for the complete system tests

Dual optical system for metric resolution observations.

PLEIADES

CHARACTERISTICS

Mass: 1000 kg

Panchromatic resolution: 0.7 m at nadir

Multispectral resolution: 4 times panchromatic resolution

Swath: 20 km at nadir

Sun-synchronous, quasi circular orbit at 694 km altitude

Acquisition capability: up to 450 images/day

Solar generator power: 1500 W

Intrument TM link rate: 450 Mbits/s

On board mass memory: 600 Gbits

Lifetime: 5 years

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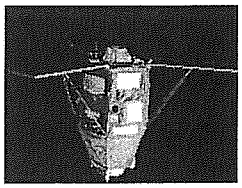
PLEIADES HIGH RESOLUTION SATELLITE

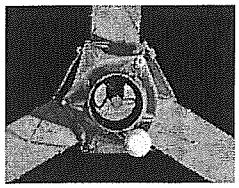
The satellite

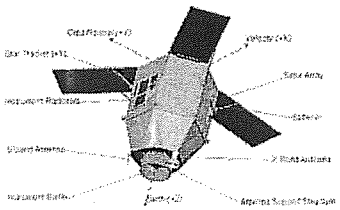
The main design drivers for the satellite architecture are the image quality, the agility and the image location accuracy. The image quality drives the instrument size. A high agility requires a very compact design, with a few stiff appendages. As a consequence, the instrument is integrated inside the bus. A high image location accuracy is achieved by minimizing the interface between the instrument and the bus. The star trackers and the gyroscope heads are directly supported by the instrument to avoid any thermal distortion that could be induced by the bus.

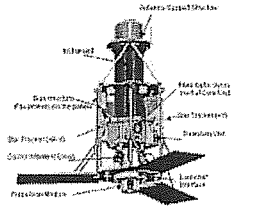
The bus structure is build on an hexagonal shape, with three solar arrays at 120 deg, and three star trackers in a quasi tetrahedron configuration, optimizing the attitude determination accuracy. This configuration authorizes accommodation of the instrument focal plane radiator for maximum heat dissipation. An antenna support structure is used to carry the Earth-pointing antennas and for the instrument baffle.

The solar arrays are mounted directly on the bus structure without any drive mechanism to ensure a maximum stability. Their first flexion mode frequency is increased by the use of stiffeners when deployed. Moreover the high compacity and low mass of the satellite (<1000 kg) make it compatible with a large series of low cost small launchers (among them Soyouz and Rockot). **The two Pleiades satellites will be launched by Soyouz** from Europe's spaceport in Kourou, French Guiana.









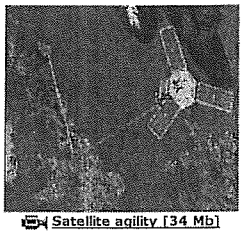
Latest update 12/05/2006

SATELLITE
- The satellite
- Pleiades-HR instrument
- The bus

Dual optical system for metric resolution observations.

PLEIADES

MISSION



Satellite agility [34 Mb]

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MAIN CHARACTERISTICS OF THE PLEIADES MISSION

Pleiades is the optical component of the ORFEO system developed in cooperation with Italy.

The Pleiades system is an optical observation system with a metric resolution designed to offer a high acquisition capability with a revisit lower than 24 hours to satisfy both civilian and military needs.

Moreover, to meet the needs for detailed mapping, specially in urban areas and to complement aerial photography, Pleiades will offer instantaneous stereoscopic acquisition and the capability to cover large areas.

For applications such as forestry, geology and marine environment, and using its spectral characteristics and its tridimensional characterization of surfaces, Pleiades should complete the information supplied by other sensors, such as Spot 5, by offering information with a better spatial resolution.

At last, to meet the defence and civil security missions, Pleiades system should enable to:

- Supply the information in a very short delay (typically less than 24 hours).
- Insure to the defence users a priority in the daily programming of the 50 acquisition demands.
- Insure to the defence users the confidentiality of these demands as well as the security of the communications.
- Enable the capability of prioritarian acquisitions on a predefined area with a "crisis" mode implementation.

For this, the Pleiades system is constituted of a constellation of two optical satellites (visible and near infrared domain) on a Sun-synchronous orbit at 694 km. This number of satellites is essential to guarantee the accessibility and revisit frequency required to operationally answer to defence and civil security missions.

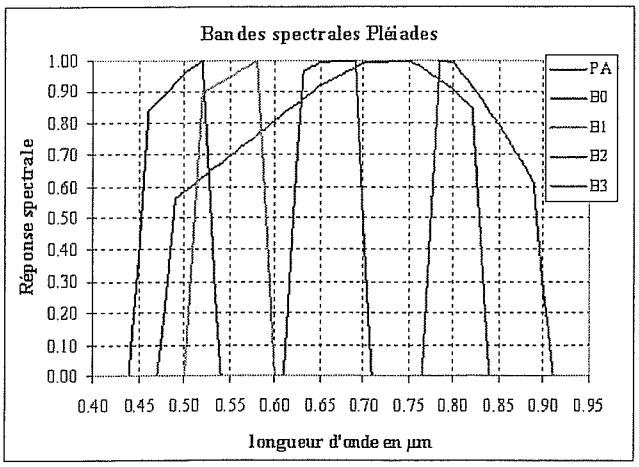
With its two agile satellites the Pleiades system will offer:

- a daily access to every point on Earth,
- a resolution of 0.7 m in vertical viewing in panchromatic,
- four spectral bands (blue, green, red and near infrared) with a resolution of 2.8 m in vertical viewing,
- a field of view of 20 km,
- an acquisition of a 120 km x 120 km image mosaic in the same orbit,
- the acquisition of nearly instantaneous stereoscopic couples (or even triplet) of 20 km by 300 km,
- the acquisition of cloud free images covering 2 500 000 km² per year,
- a very accurate localisation of the images (<1 m with ground control points) enabling an optimal use of the data in the Geographical Information Systems (GIS).

Moreover, the great agility of the satellites will enable to minimize the programming conflicts, particularly during the dual use, and to better meet the users' needs.

The main characteristics of the Pleiades optical component are in the table below:

Image Specification	resolution field of view colour	0.7 m 20 km blue, green, red and near infrared
Images localisation	with ground points without ground points	1 m / 1000 km < 10 m
Acquisition capabilities	km² by orbit (maxi) mosaic stereoscopy max target number on 100 km x 200 km	30 000 km² 120 km x 120 km 20 km x 300 km 30 (crisis mode)



Latest update 12/05/2006

Dual optical system for metric resolution observations.

PLEIADES

KEY EVENTS

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PLEIADES EVENTS

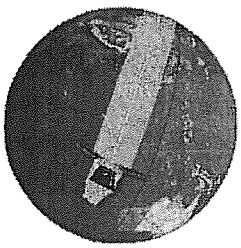
04/12/2009	Beginning of the System Technical Qualification Review
19/11/2009	Delivery by Thales Alenia Space of the instrument Flight Model 2 to Astrium
12/11/2009	Delivery by Astrium of the Satellite Flight Model 1 to CNES
September 2009	Rendez-vous between the satellite, the controle center (SDGC) and the mission centres for the complete system tests
February to end of July 2009	The satellite Flight Model 1 successfully passed the environment tests at Intespace: thermal, mechanical, solar generators deploiment and electro-magnetic tests.
January 2009	Rendez-vous between the satellite, the controle center (SDGC) and the mission centres for the complete system tests
End of July 2008 to mid-November 2009	Satellite Assembly Integration and Tests (AIT)
1st half of 2008	Instrument Assembly Integration and Tests (AIT)
November 2007	First programming test of the satellite Flight Model 1. The programming message, generated with the first version newly commissionned of the Programming Chain, was executed on the Satellite Flight Model 1 (in integration at Astrium in Toulouse) and enabled to acquire about 250 images. These images, downloaded using on board equipments representative of the Pleiades X-band station, are being processed on the Imaging Chain, itself newly delivered to CNES. The success of this test is very promissing and demonstrates a maturity level reassuring while the system tests have not begun yet, over two years before the launch, now schedulled for the beginning of 2010.
July 2007	End of first bus integration.
June 2007	Satellite Critical Design Review.
October 2006	Instrument Critical Design Review.
June 2006	System Interface Review.
February 2006	Multispectral filters flight model delivery.
February 2006	Call for Tender for Users Centers Integration
December 2005	Programming chain: the Software Specification Review was successful. The authorisation to begin the preliminary design phase was given.
December 2005	Command Control chain: the Software Specification Review was successful. The authorisation to begin the preliminary design phase was given.
December 2005	The compatibility tests between image telemetry reception stations and the on board telemetry equipment were successful.
November 2005	Users Centers Integration: The Preliminary Design Review took place. The preparation phase for the corresponding call for tender begins.
October 2005	Image chain: the Software Specification Review was successful. The authorisation to begin the preliminary design phase was given.
October 2005	Call for Tender for BPD/GIDE
October 2005	Multispectral detectors flight model delivery
June 2005	Attribution of the encrypting server for the TC link and the decipherer for the instrument TM contract to Thales-Com.
June 2005	Attribution of the Ground Segment parts supplying contracts: • Programming chain: attributed to CAP Gemini - CSSI industrial consortium • Image chain: attributed to Thales-IS • Image receiving station: attributed to IN-SNEC • Command-Control Center: attributed to CSSI
April 2005	Signature of the Agreement with Spain (**Instituto Nacional de Tecnica Aerospacial**).
March 2005	Signature of the Agreement with Sweden (**Swedish Natioanl Space Board**).
December 2004	Attribution of the launch contract to Arianespace, for a launch by a Soyouz rocket from Kourou.
September 2004	Ratification of the Turin agreement, signed in September 2001
March 2004	PLEIADES cooperation agreement signature with Sweden
December 2003	ORFEO System Definition Review
October 2003	Satellites supplying contract signature with Astrium
22-23/05/2003	**"Very High Spatial Resolution Workshop at CNES**
1-2/04/2003	**ORFEO users' seminar**
February 2003	Pleiades-HR Instrument Preliminary Definition Review
December 2002	Pleaides-HR System Design Review
28-29/05/2002	Pleaides internal seminar
April 2002	Pleaides-HR Satellite Preliminary Definition Review
March 2002	ORFEO Intermediate System Definition Review

- **22/06/2001** — **Signature of a memorandum of agreement between CNES and ASI.**
  At the last Paris Air Show (June 2001), **a memorandum of agreement** was signed between the Centre National d'Etudes Spatiales (French space agency) and the Agenzia Spaziale Italiana (Italian space agency) for the definition phase of a Dual System with an Earth observation capability using optical satellites, radar satellites and an associated ground segment.
  The Dual System to be developed is composed of the following elements:
  - An optical component composed of 2 satellites and the corresponding ground functions, developed under french control,
  - A radar component composed of 4 satellites and the corresponding ground functions, developed under italian control,
  - A user ground segment developed jointly by France and Italy
- **29/01/2001** — Signature in Turin of a governmental agreement between France and Italy for cooperation in the field of Earth Observation.
- **10/05/2000** — Pleaides **workshop** "Conceivable Systems for Pleaides"
- **08/03/2000** — "Pleaides Requirements" users' **workshop**

Latest update 14/12/2009

Dual optical system for metric resolution observations.

PLEIADES



PLEIADES SYSTEM

A complex system:

To reconcile the civilian and defence observation needs.

To optimize the programmation, the image acquisition and production reactivity.

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THE PLEIADES SYSTEM

The Pleiades system is a dual system which purpose is to deliver high resolution optical images to defence clients as well as civilian clients, while respecting the strong requirements of each one.

The system reconciles civilian needs:

- Diversity of users (institutional uers, GMES, scientific users, commercial users)
- Access to the system from public network

with defence needs:

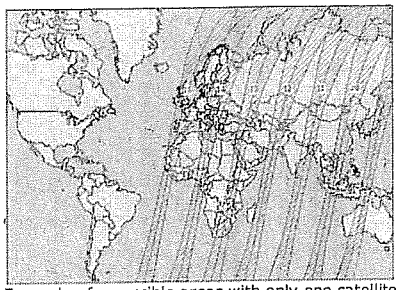
- Priority given to defence programmation
- Classification of the defence order book
- Protection of communication networks as well as User Centers and Command-Control Centers

while implementing common needs:

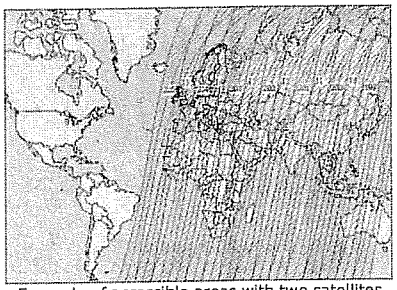
- Numerous images
- System flexibity (agility, answer to the emergency)
- Access and revisit delays
- System perenniality through time.

Orbit and accessibility:

- Orbit:
  - Sunsynchronous, phased and quasi-circular at 694 km.
  - 26 days cycle and local time 10h15 at the descending node.
  - 180° dephasing between the two satellites
- Global access:
  - With one satellite: in 2 days (require a viewing angle of 47°)
  - With two satellites: daily (a viewing angle of 43° is enough).



Example of accessible areas with only one satellite each day with a depointing of 30°



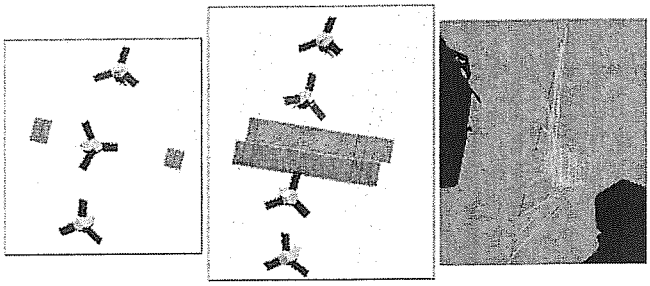
Example of accessible areas with two satellites each day with a depointing of 30°

Agility:

Main characteristics:

- Data acquisition
  - 300 images per day per satellite on average
  - Only one acquisition mode: simultaneously panchromatic + multispectral.
- Agility
  - Roll pitch:
    - 5° in 8 secondes
    - 10° in 10 secondes
    - 60° in 25 secondes

- Stereoscopy and tri-stereoscopy along track.
- Mosaics in one pass.



Acquisition capabilities over large area:

The following diagram illustrates the satellite capabilities to image a 1000 x 1000 km² area, during a single fly-by, with about 20 targets in one pass for a depointing of 20°.

- "Instantaneous" capabilities:
  - Commercial mission over Europe:
    - 40 targets of 15 km diameter accessible on the orbit,
    - Over an interest area of 1000 x 1000 km².

Satellite capabilities to image a 1000 x 1000 km² area, during a single fly-by, with about 20 targets in one pass for a depointing of 20°

Acquisition capabilities over small area:

The following diagram illustrates the satellite capabilities to image a crisis area during a single fly-by. The results are given for the case where the user has limited the authorized viewing angle to 20°.

- "Instantaneous" capabilities:
  - Crisis operational scene:
    - 30 targets of 15 km diameter accessible on the orbit,
    - Over an interest area of 100 x 200 km².

Satellite capabilities to image a 100 x 200 km² area, during a single fly-by, with about 10 targets in one pass for a depointing of 20°

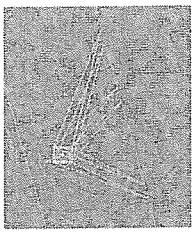
Stereoscopic cover capabilities

A great innovation of the Pleiades system is to offer a stereoscopic cover capability with a high resolution. The stereoscopic cover is realized by only one flyby of the area, which enables to get an homogeneous product quickly.

As shown below, the system offers the possibility to realise a "classical" stereoscopic imaging, composed of two images for which the angular difference (B/H) can be adjusted, but also stereoscopic imaging with an additional quasi vertical image (tri-stereoscopy), thus enabling the user to have an image and its stereoscopic environment.

Stereo	
B/H	length
0.15	20 km
0.2	60 km
0.3	120 km
0.4	175 km
0.5	225 km
0.6	280 km

and



Tri-stereo	
B/H	Length
0.3	20 km
0.4	60 km
0.5	90 km
0.6	120 km
0.7	145 km
0.8	175 km

Dual optical system for metric resolution observations.

WEBSITES OF THE SPACE AGENCIES COOPERATING TO PLEIADES

- Austria Space Agency - ASA — http://www.asaspace.at/
- Belgian Space Agency - BELSPO — http://www.belspo.be/
- Italian Space Agency - ASI — http://www.asi.it/
  - ASI's Cosmo-skymed Site — http://www.asi.it/it/attivita/osservazione_terra/cosmoskymed
- Spanish Space Agency - INTA — http://www.inta.es/
- Swedish National Space board - SNSB — http://www.snsb.se/dyn_aktuellt.asp?languageId=2

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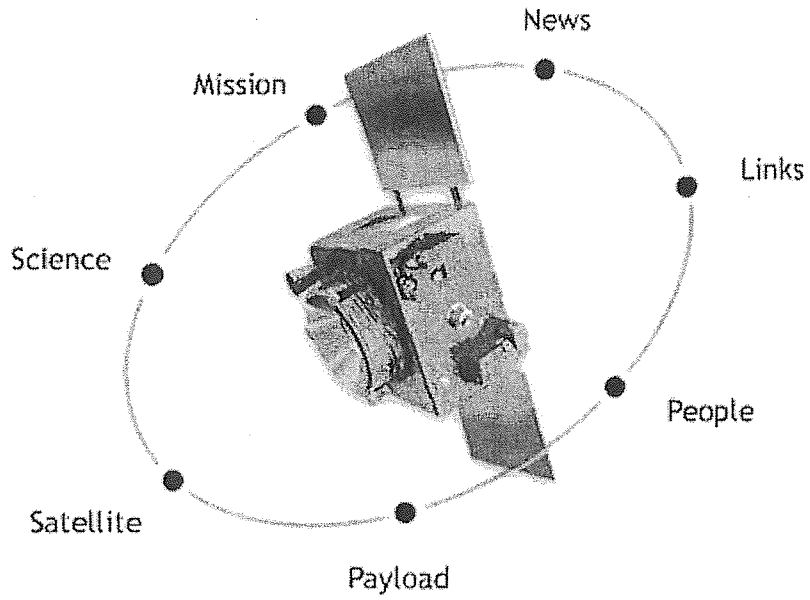
MICROSCOPE : MICRO-Satellite à traînée Compensée pour l'Observation du Principe d'Equivalence



Proposed to CNES by ONERA and the OCA, the MICROSCOPE mission will allow in late 2014 a test of the Equivalence Principle with a precision of 10^{-15}. After DEMETER and PARASOL, MICROSCOPE is the third mission of the microsatellite program MYRIADE. The weak equivalence principle, or universality of free fall, states :

The trajectory of a falling test body depends only on its initial position and velocity, and is independent of its composition.

This theory has been tested using numerous methods (torsion balances, laser ranging etc.), but the noise and vibrations inherent in any Earth-bound test environment limit the accuracy to less than 10^{-13}. New physics theories such as string theory or supergravity propose a possible EP violation under 10^{-13} : the need to go below this level shows the significance of the mission which uses as a test environment space, in a drag-free satellite.

NB: This site contains excerpts from articles published by the Microscope team.

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MICROSCOPE : MICRO-Satellite à traînée Compensée pour l'Observation du Principe d'Equivalence

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The MICROSCOPE space mission is the first selected mission (to be launched 2010) aiming at testing the EP to an accuracy of at least 10^{-15}. This mission takes advantage of specific competence developed in ONERA, OCA and CNES. Three-axis electrostatic accelerometers, recently produced for space applications, can exhibit at room temperature ultra high sensitivities compatible with femto-g resolution . Micro-satellites are now available with low cost launch opportunities,as secondary passengers of ARIANE V for instance. The satellite mass being less than 200 kg allows a payload of about 40 kg, 50 litres and 40 to 50 watt.

The MICROSCOPE satellite will fly at an altitude of 800km along a quasi-polar and heliosynchronous orbit with a 5.10^{-3} eccentricity. It takes advantage of this low eclipse rate orbit to maintain the payload in a very stable thermal environment.

In the MICROSCOPE experiment, the Earth is the gravitational source about which free fall motion of two masses, composed of different materials, is observed and controlled taking care that both masses are submitted exactly to the same gravitational field. The controlled electrostatic field, added to break the experimentation symmetry by forcing the masses to remain on the same orbit is accurately measured: a defect of symmetry gives rise to evidence of an EP violation.

MICROSCOPE : MICRO-Satellite à traînée Compensée pour l'Observation du Principe d'Equivalence

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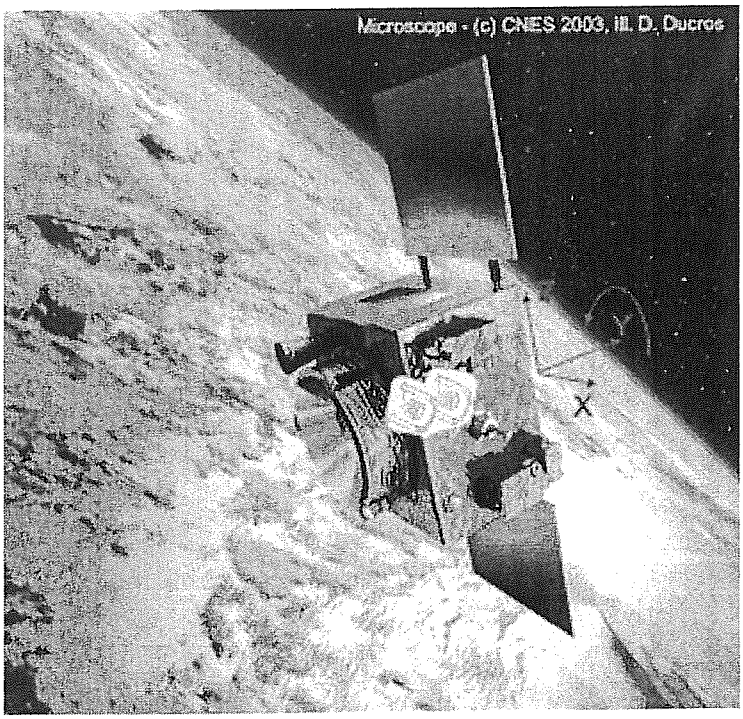
The satellite is roughly one meter-cube featuring two deployable solar panels on one side. The star tracker and mechanical and thermal interface of the payload are fixed on the opposite side. The two lateral sides carry four pods of three electrical thrusters used for the satellite attitude and orbit control.
The MICROSCOPE satellite includes a fine original drag-free control system which enables compensation of the applied surface forces, like solar pressure and residual atmosphere drag which deviate the orbit from a pure gravitational one. The actuation of the thrusters is performed with respect to the measurements delivered by the payload accelerometers and the star tracker. Both attitude and linear satellite motions are finely controlled to reduce the acceleration applied on the instrument, and thus enhance its resolution. The attitude and drag-free control should present motion reduction noises as low as 10^{-12}m.s^{-2}/Hz$^{1/2}$.



General configuration of the MICROSCOPE satellite in orbit (courtesy of Cnes)

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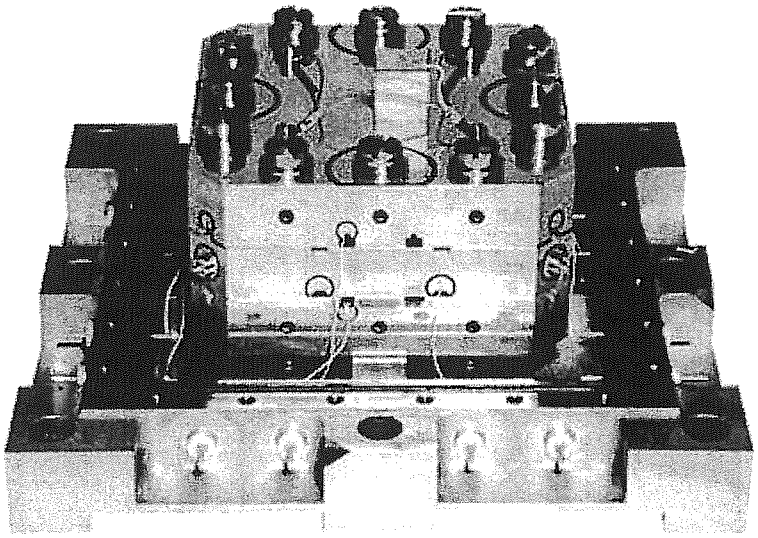
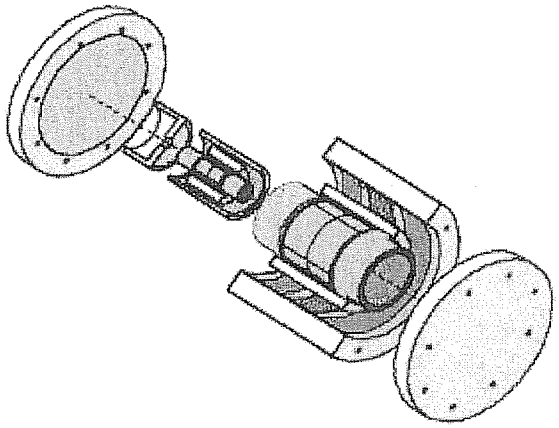
MICROSCOPE : MICRO-Satellite à traînée Compensée pour l'Observation du Principe d'Equivalence

The payload is made of the SAGE accelerometer for MICROSCOPE, based on a successful heritage of high sensitivity electrostatic accelerometers developed by ONERA, including STAR, used on the CHAMP mission (Reigber et al., 2002), and SuperSTAR, for the GRACE mission (Davis et al., 1999). The differential accelerometer, however, is a step away from previous instruments due to the necessity of positioning two proof masses with a common centre of mass.



STAR accelerometer for the CHAMP mission

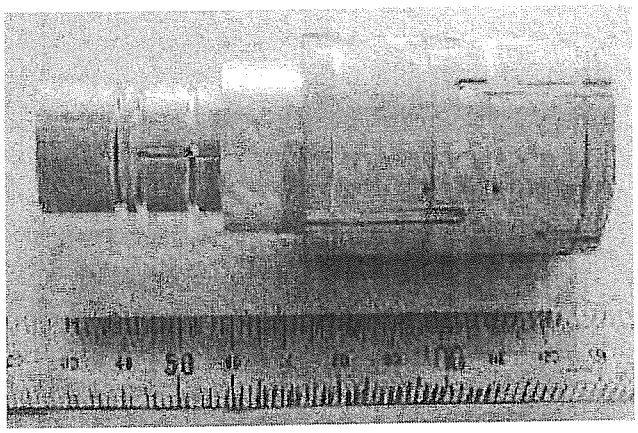
The Differential Electrostatic Accelerometer



Differential accelerometer sketch; the two masses (light-grey) are integrated each inside a silica core composed of inner and the outer cylinders which carry the electrodes (radial in mid-grey and axial dark-grey).

An electrostatic accelerometer consists, fundamentally, of a PM suspended in a highly stable electrode cage. The principle of operation is to measure the electrostatic forces required from the electrodes to maintain the position of the proof mass with respect to the cage. Because the suspended proof mass of a perfect sensor is susceptible only to gravitational forces and the electrostatic forces applied by the electrode cage, the force applied is proportional to the difference between the total acceleration of the cage and the gravitational acceleration of the proof mass. In the differential model, the two electrode cages experience the same acceleration, so that the differential measurement is the difference between the gravitational acceleration of the two masses.

There are three components to each SAGE instrument. The SU contains the two inertial sensors carefully aligned in a vacuum tight housing. This is electrically connected to the FEEU, which contains the low noise analog electronics, including DACs, ADCs, and position sensors, which require more thermal stability than the electronics of the ICU. This latter unit contains the remaining electronics for SU operation, specifically the digital proof mass position control loop, as well as the systems for general experiment control and the satellite interface.

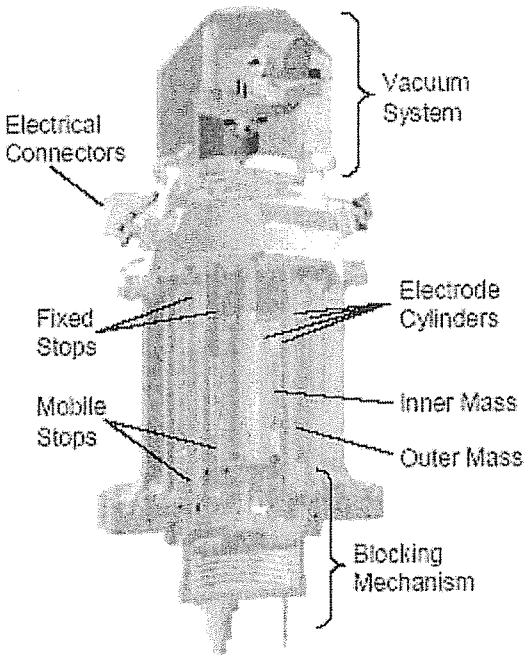


Prototype of one electrostatic accelerometer core: the inner gold-coated silica cylinder carries the radial electrodes; the silica mass is also gold coated and included inside the outer cylinder.

Sensor Unit

The objective of the MICROSCOPE mission is to compare the effect of gravity on two masses of different material, which requires subjecting them to the same gravitational field simultaneously. This requires precise alignment of the centre of mass of the PMs, but also careful consideration of

the shape of the mass to ensure the effects of gravity gradients are proportional between the two proof masses. The SAGE instrument uses concentric cylindrical proof masses with dimensions chosen to produce equal moments of inertia (2nd order) on each axis. This has the advantage of preventing errors due to the effects of the gravity gradients while remaining a feasible shape for instrument design and accurate machining. With equal moments of inertia, the gravity gradient effects will be independent of the PM orientation and therefore only proportional to its mass. This ensures that the effects of fluctuations in the self gravitation of the satellite can be sufficiently cancelled from the differential measurement (Willemenot, 1997). Since the rotation of perfectly round cylinder about its axis can not be detected, the SAGE proof masses have four narrow flat areas running the length of the outer surface of the cylinder to provide the required non-uniformity.



Sensor Unit cross section

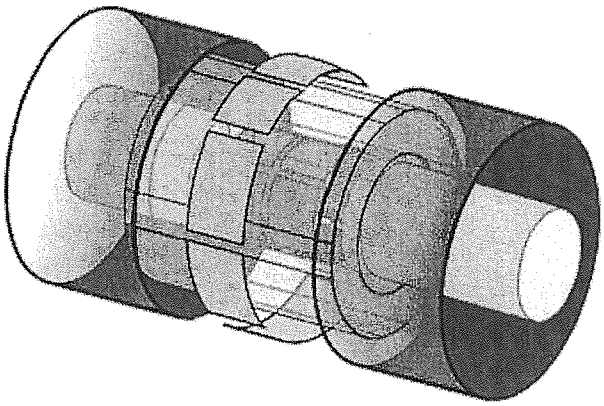
The sensor core of SAGE is therefore composed of two concentric, coaxial, cylindrical proof masses. The instrument providing the science base line has both masses in platinum-rhodium, while in the EP test instrument has the external mass in titanium and the internal in platinum-rhodium. The titanium mass has a nominal length of 79.9mm, outer radius of 35mm, and mass of 0.364 kg, while the smaller platinum mass has nominal dimensions of 43.51mm in length, 20mm in outer radius, and a mass of 0.473 kg. Each mass has a set of electrodes sufficient to control all six axes of motion (three linear, three rotational) engraved onto gold plated silica cylinders within and without the proof mass, so that the differential accelerometer is essentially one inertial sensor completely within the another as shown above. Hereafter the inertial sensors will be referred to as Sensors A and B, where Sensor A is internal to Sensor B.

The only physical contact on the proof mass is a thin gold wire, only 5µm wide, which is essential to control the charge on the mass, which would otherwise vary throughout the mission. This wire is also used to apply a sinusoidal voltage to the PM to enable accurate position measurement. Three stops at each end of the PM cylinder limit its motion along and about the cylinder axis to prevent stress on the gold wire. At one end the stops are mobile, to support the proof mass during launch but allow motion once in orbit. Stops placed on the interior electrode prevent contact between the proof mass and electrodes, however these stops are only necessary before control is obtained, or in the case of a loss of position control. The core of proof masses and electrode cylinders are mounted on a base plate which is designed to ensure precise alignment of the six cylinders during assembly.

This assembly is placed in a double walled housing in which a vacuum is maintained.

Electrodes

The same electrodes are used for both capacitive position sensing and electrostatic position control, and are arranged as shown below to control all six degrees of freedom. The inner cylinder contains four independent pairs of electrodes for the two radial axes, *y* and *z*, and the rotations about these axes, *phi* and *gamma*. Linear measurements are provided by averaging the measurements from adjacent electrode pairs, while the rotational measurements come from the difference between adjacent pairs. The outer cylinder contains eight pairs of electrodes which act in unison for measurement and control of the rotation, phi, about the cylinder axis by means of the four narrow flattened areas on the outside of the proof masses. The electrodes for the sensitive axis, *x*, are also on the outer cylinder, covering the entire circumference at either end.



Configuration of electrodes for proof mass position measurement and control in six degree of freedom

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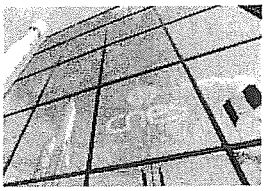
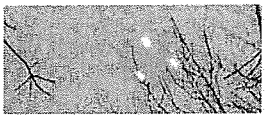
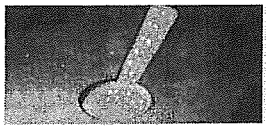


UFO PHOTOGRAPHS



UFO CASES DIRECTORY



TOPIC MENU

GEPAN / SEPRA / GEIPAN (France)

Since 1977, the national space agency of France CNES has been helping civilian and military authorities understand the precise nature of Un-identified Aerospace Phenomena (PAN). The unit involved is the Rare Aerospace Phenomena Study Department (SEPRA) based at the CNES technical centre in Toulouse. Since 1977, the department has developed a precise analytical methodology and today has accumulated a considerable database. The SEPRA database is comprised of more than 2200 different cases, with some 6000 eyewitness accounts and approximately 100 sightings from aircraft.

key articles, documents & resources

From GEPAN To SEPRA: Official UFO studies in France (PDF)
Gildas Bourdais, International UFO Reporter, Winter 2000-2001
It is well known that France created an official - or quasi-official – organization for the study of UFOs, first called GEPAN in 1977 and later SEPRA in 1988. But the real story is not so well known, even in France, mainly because it was surrounded by controversy.

GEIPAN - Offical website of France's UFO research program (2006)
Official website of GEIPAN, the new resumed version of France's GEPAN/SEPRA UFO study project. This program is an official French government project, and is conducted under the official French space agency CNES (the equivalent of NASA in the US). The new director, Yves Sillard, was a former director of CNES, and has numerous other high positions and achievements to his credit. (The site is in French.)

GEIPAN - Official website with background info about GEIPAN (English)
Official website of GEIPAN, the new resumed version of France's GEPAN/SEPRA UFO study project.

GEIPAN Official Website Containing Released Case Files (in French)
France became the first country to open its files on UFOs Thursday when the national space agency unveiled a website documenting more than 1,600 sightings spanning five decades.

Offical UFO Investigations in France: the GEPAN/SEPRA Project (Sturrock Panel Report on UFO Physical Evidence)
F. Louange and J.-J Velasco, Sturrock Panel Report - Physical Evidence Related to UFO Reports - Appendix 1
For more than 20 years, the French space agency has conducted a non-military but official investigation into UFO reports. In its first phase, the project was named GEPAN and its focus was primarily on UFO reports. Subsequently, the project was renamed SEPRA and was assigned a more general responsibility for studying all atmospheric reentry phenomena. This appendix gives a brief summary of the history, mission, operations and achievements of this project. R

Official French Gov't UFO study project to resume with new director
Various sources - October, 2005
The French Government, and its offical national space agency CNES, will restart its official UFO study program. The French govt has had an offical program to study UFOs for several decades, called GEPAN / SEPRA. It was closed recently, but after an audit, it will now be restarted, with a new director, Yves Sillard. R

other articles & documents

Assessment of the UFO phenomenon by GEPAN (1978)
Claude Poher, GEPAN Report to the Scientific Committee, June, 1978
Positive conclusions from the GEPAN Report to the Scientific Committee, June, 1978: "In 60% of the cases reported here, the description of this phenomenon is apparently one of a flying machine whose origin, modes of lifting and/or propulsion are totally outside our knowledge." R

Comments on closure of SEPRA
Gildas Bourdais, UFO Updates Mailing List, May 2004
In short, yes, the "SEPRA" no longer exists, but Jean-Jacques Velasco is still in charge of Ufos at CNES. Since he was alone at the job, it's not a big deal. R

France opens secret UFO files covering 50 years
AFP (Agence France Press), Mar. 22, 2007
France became the first country to open its files on UFOs Thursday when the national space agency unveiled a website documenting more than 1,600 sightings spanning five decades. R

France puts secret UFO archive on Web (Associated Press, 3-2007)
John Leicester, Associated Press, March 23, 2007
France is the first country to put its entire weird sightings archive online, said Jacques Patenet, who heads the space agency's UFO cell - the Group for Study and Information on Unidentified Aerospace Phenomena. R

French Gendarmerie Nationale is an official source of reports for SEPRA
UFOs at Close Sight
This document explains the relations between the French Gendarmerie Nationale (a part of the French army who deals with civilian police missions. A Gendarmerie Nationale's official duty is to collect and transmit to the SEPRA scientific panel any testimony, proof, picture, related to the UFO phenomenon. Gendarmerie takes great care of this, they never mock anyone reporting a ufo!

French Get a Look at Nation's UFO Files (Washington Post - 3-2007)
The Washington Post, (March 23, 2007)
The voluntary decision by France's National Center for Space Studies to dump more than 100,000 pages of witness testimony, photographs, film footage and audiotapes from its secret UFO archives onto its Internet site, http://www.cnes.fr, for worldwide viewing is an unprecedented move among Western countries. R

G.E.P.A.N. (1977-1988) (in French)
R.R.O
History of the official French government program to study UFOs.

Interview with CNES spokesman regarding closure of SEPRA
Gregory Gutierez, May 28, 2004
Some news about the destiny of the french SEPRA. An interview with Arnaud Benedetti, who's in charge of the official communication of the French National Center for Space Studies (CNES). R

Open Letter to the Skeptics by Jean-Jacques Velasco of SEPRA
UFOs at Close Sight / Sciences Frontières, N. 29
A certain number of observations of UFO which were the subject of thorough investigations remain unexplained. By sharing his opinions on this complex matter, Jean-Jacques Velasco, director of the SEPRA, raises this question: Why are sciences known as "exact" not interested in studying UFOs, and why were the studies started in the years 70-80 stopped? R

SEPRA analyses film of daylight UFO 10m above the ground
UFOs at Close Sight
This article was published on 09.11.1998 in the French newspaper "La Depêche." Sunday evening, an amateur filmed during two minutes a mysterious unidentified object. The video cassette was handed to the CNES of Toulouse which considers the case "exceptional."

SEPRA closed, SEPRA not closed ... Open the archives to the public!
Patrick Gross / UFOs at Close Sight, May 2004
France has a long history of continuing official interest in UFO reports, in the shape of a service of its small NASA-equivalent called CNES, the Center for Space Studies. CNES spokesman Benedetti said that SEPRA as a service does not exist anymore since January 2004. A petition by French ufologists has been organized to safeguard and make publicly available the archives from the official government program. R

SEPRA Going Slowly Down, France 2004
UFOs at Close Sight / La Dépêche du Midi, June 8, 2004
Article in French newspaper reporting on the closure of the SEPRA program. "The rare Aerospace Phenomena Expertise Service (SEPRA), based at the National Center for Space Studies (CNES) in Toulouse, has been closed. While it does not appear in the new CNEW orgchart, activity is continued." R

The CNES and unusual phenomena
CNES Web Magazine
Since 1977, the French space agency has been helping civilian and military authorities understand the precise nature of Un-identified Aerospace Phenomena (PAN). The SEPRA database is comprised of more than 2200 different cases, with some 6000 eyewitness accounts and approximately 100 sightings from aircraft. R

The French GEPAN / SEPRA
UFOs at Close Sight
To this day only one scientific study of the UFO phenomenon as been conducted and it is positive. R

The French SEPRA: An Interview with Director Jean-Jacques Velasco
UFOs at Close Sight
This interview of Jean Jacques Velasco is an excellent introduction to the work of the french SEPRA Jean Jacques Velasco, member of the french CNES, leads the SEPRA (Service Expertises Phénomènes Rentrées Atmosphérique) which succeeded to the GEPAN in 1988. R

Times of London Article On Official French UFO Department
Times of London, February 5, 2003
"If the truth really is out there, the French are taking serious steps to find it." Article in the Times discussing the official French UFO research program, "the only permanent government- financed scientific project set up by a developed country to unravel fact from fiction in the debate about UFOs." R

'Yes, UFOs exist': Position statement by SEPRA head, Jean-Jacques Velasco
La Dépêche du Midi, Toulouse, France, April 18, 2004 / Reprinted by UFOs at Close Sight
Jean-Jacques Velasco speaks out at last. Velasco, in a book titled "UFOs... the Evidence", states today without ambiguity that, yes indeed, "they" exist, and yes, "they are of extraterrestrial origin." Velasco was the director of the official French government program to study UFOs, SEPRA, from 1983-2004. R

websites & organizations

Démocratie Soucoupique Libérons les archives du SEPRA (in French)
Articles and updates on SEPRA, as well as an online petition by French UFO researchers to safeguard and make public the full archives of SEPRA. (in French)

GEIPAN - Offical website of France's UFO research program (2006)
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Le S.E.P.R.A. (in French)
In-depth site with background and information on the French UFO study program, SEPRA. Includes a history of the program, technical studies and reports, and a brochure presentation. (in French)

SEPRA - Service d'Expertise des Phénomènes Rares Aérospatiaux (CNES - Centre National d'Etudes Spatiales)

The French GEPAN / SEPRA
UFOs at Close Sight
Only once in the world, a government asked a panel of scientist to study the phenomenon in order to come to some conclusions, and gave at least some means toward that end. It happened in France, the scientific group is the SEPRA (formerly GEPAN).

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BBC News

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eGov monitor - 4 hours ago
ESA's ice **mission** satellite will be placed into orbit 700 km above Earth by a Russian Dnepr rocket to be launched from the Baikonur Cosmodrome in Kazakhstan ...
Video: Cryosat launched from Baikanur Cosmodrome EUX.TV
Esa's Cryosat **mission** switches on radar instrument - BBC News
EU satellite to check climate change impact on ice - Las Vegas Sun
Los Angeles News Today
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CBC.ca

Third Spacewalk Completed

WINKNEWS.com - 2 hours ago
It's the third and final spacewalk of the **mission**. The **space agency** wants to ... and there will be limited room on the much smaller Russian, **European** and ...
Video: Raw Video: Astronauts Take 2nd Spacewalk The Associated Press
Spacewalking duo to wrap up station coolant tank swap - Spaceflight Now
'This Week In **Space**' – April 10, 2010 - True/Slant
The Associated Press - Indiana Gazette
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Ethiopian Review - 3 days ago
Consider also the meteorological **missions** that **Esa** and the weather satellite ... I've stuck with the big pan-**European missions**, the ones anchored in **Esa**. ...
European Space Agency Launched CryoSat-2 Satellite to Map Earth's ... - TopNews United States
Ice-Tracking Satellite Launched by **European Agency** - BusinessWeek
ESA Successfully Launches Cryosat-2 - Softpedia
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The Guardian

Space: the final career frontier

The Guardian - 2 days ago
Of the four previous British astronauts, three became US citizens; the other joined a Russian **mission** with private funding. The **ESA** plans to send one ...


Space News

Eurockot Receives Two ESA Satellite Launch Contracts

Softpedia - Tudor Vieru - 3 days ago
Today, April 9, the **European Space Agency** (**ESA**) has awarded two new contracts for upcoming satellite **missions** to the Bremen, ...
Eurockot to launch 2 **ESA** Earth observation **missions** - R & D Magazine
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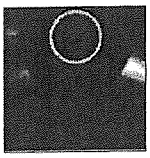
Coming in Contact to Life on Titan

Softpedia - Tudor Vieru - 6 hours ago
... on the celestial body could prove to be incredibly difficult, Space reports. ... space **missions**, either planned by NASA or the **European Space Agency** (**ESA**).


Space.com

New comet plunges into the sun as NASA watches

Mother Nature Network - Katherine Butler - 16 hours ago
Space.com reports that a previously unknown comet recently appeared from the ... the galaxy to a spacecraft monitored by NASA and the **European Space Agency**. ...
Comet eaten by the sun as spacecraft watches - msnbc.com
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Ripening stars uncovered near Rosette nebula

Xinhua - Xiong Tong - 6 hours ago
... the Herschel **Space** Observatory (HSO) has uncovered ripening stars near ... for the **mission** at NASA's JPL, headquartered in Pasadena, Los Angeles. ...


ABC Science Online

Volcanic Venus

MIT News - Morgan Bettex - 4 days ago
VIRTIS is a device that is located onboard the **European Space Agency's** Venus ... that has occurred in anticipation of a possible **mission** to the planet, ...
Volcanoes on Venus Could be Alive & Ready to Erupt - Discover Magazine (blog)
Venus still hot and active - ABC Online
Signs that Venus is geologically active have been detected - Examiner.com
Universe Today - Space Daily
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Lockheed, Austal submit bids for US Navy warships

Reuters - Andrea Shalal-Esa - Tim Dobbyn - 13 hours ago
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