



Orbital Characteristics of the Helios system

Orbit :

- **Low:** suitable for High Resolution imagery.
- **Sun-synchronous:** allows for regular illumination of the observed zones as the satellite always passes over a given latitude at the same solar time.
- **Quasi-polar:** offers complete coverage of emerged land masses.
- **Phased:** guarantees similar imaging conditions after a specific number of days.
- **Specific positioning:** reduces delays in access to information.

These different characteristics facilitate access to the areas of interest anywhere on the globe in the shortest possible time and so reduce the age of the information supplied to defence and government authorities as well as the armed forces. The IR capability of the HR instrument can observe signs of activity both at night and during the day and thus offers access up to twice a day for any given site.

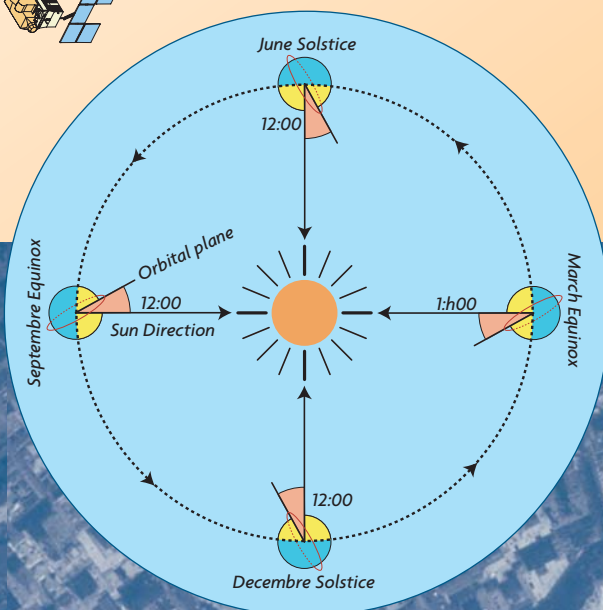
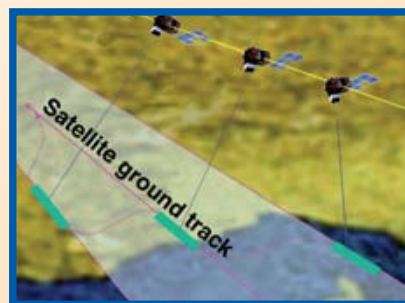
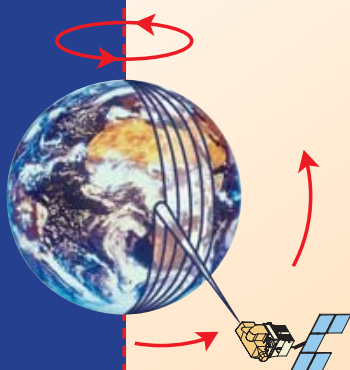
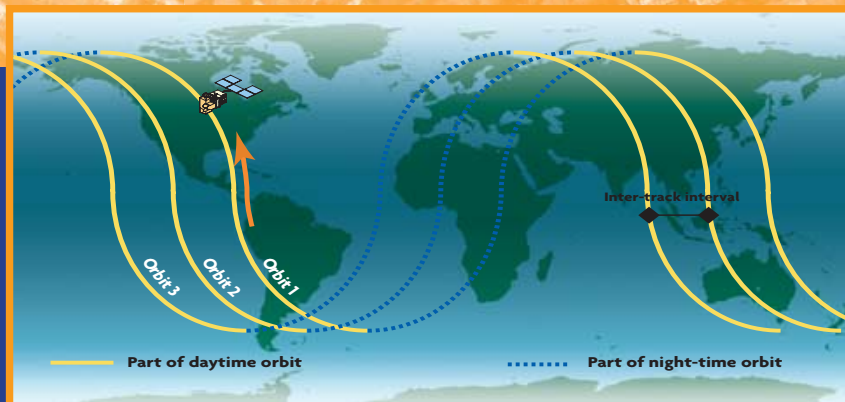




How the Helios system works

The Helios system has the particularity of being a *quasi polar sun-synchronous system*: it combines the rotation of the Earth and that of the satellite in order to scan all points of the globe in 24 hours. Optical imaging of a point on the Earth can thus be done with the same illumination, no matter what the date of the image acquisition.

The agility of the Helios satellite is due to the highly efficient Attitude and Orbit Control System (AOCS) which means it is capable of covering any point on the Earth in 24 h, and even of observing the same area several times a day from different viewing angles.





The Helios 2 satellite

The satellite consists of:

- a wide field-of-view instrument, similar to that carried on Spot 5, which also covers the visible and the near infra-red ranges.
- a dedicated High (HR) and Very High Resolution (VHR) instrument, operating in the visible and infra-red (IR) ranges.
- an agile satellite platform
- a payload bay containing mass storage memories.

Helios 2 incorporates major technological advances in agility, reactivity, storage capacity and significantly improved resolution which means that France and its partners now have greater capacity for autonomous appraisal of high-quality data.



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Architecture of the Helios 2 satellite

VHR Instrument

Very High Resolution visible and infrared cryogenic system

Propulsion Module

central tube made of titanium - 4 fuel tanks
attitude control sensors
TM-TC liaison antenna

Housekeeping Module

links, on board data handling, power supply, positioning using the Doris system, new reaction wheels with magnetic bearings

Solar Array

two GaAs panels
three silicon panels

Wide Field of View Instrument

agile viewing change mirror
same structure & optics as Spot 5
dedicated sensor unit

Star Measurement Unit

Payload Bay

video electronics
variable rate compressors
solid state memory
image telemetry with solid state amplifiers

GaAs: Gallium Arsenide
VHR: Very High Resolution
TM/TC: TeleMetry / TeleCommand



The Helios 2 payload

Simplified Architecture

Acquisition

High Resolution
Instrument
HR, VHR and IR
Imagery

Wide Field of View
Instrument
Panchro and
Near IR Imagery

Compressor

Location data

Data storage:

Static memory buffer (MTS)

Photo of a memory module
(ten 16 Mbits DRAM memory
chips and an ASIC circuit)



Photo of a memory card

Transmission

Encoder

Modulator

Antenna

Acquisition of images

- 1 - The instruments acquire data then amplify and digitize the images,
- 2 - Compressors reduce the volume of image data,
- 3 - As the images are being taken, the satellite's central computer generates data for accurate location of the image on the ground,
- 4 - The Static Memory Buffer (Semi-conductor mass storage memory) with a capacity 90 Gbits (consisting of 5760 memory chips), records and handles the image and location files,

- 5 - The memory buffer formats the data from the image and location files into a transmission frame at a rate of 50 Mbits/s,
- 6 - The encoder guarantees the confidentiality of the data,
- 7 - The TMI channel, equipped with a modulator and a 20 W solid state amplifier, modulates, amplifies and sends the data in X band (8 GHz).



The Helios system

The system consists of:

→ a *Helios Space segment* made up of:

- **satellites** belonging to the Helios families.
- a satellite **positioning and operations control centre** for maintaining the satellites during operations.
- an **Icare network of 2 GHz stations** for tracking satellites and uploading programming.

→ a *Ground User segment* made up of:

- the **main Helios Centres** in each participating country. Each centre has an antenna for image reception, image storage and handling systems as well as tools for registering specific image acquisitions.
- **distant cells**, request and operation stations allowing users to have local access to Helios data.

Helios 2 was first developed by France, and then opened to cooperation successively with Belgium, Spain, Italy, Greece and Germany.





A daily operational mission following a precise timetable

- 1 - Each country draws up a list of images to be acquired.
- 2 - The partners then discuss which requests should be given priority.
- 3 - Work plans are transmitted to the satellite positioning and operations control centre (CMP) which converts them into executable telecommands and sends them to the satellite.
- 4 - The satellite acquires the images and stores them on board.
- 5 - During a pass above a centre, the encoded images are downloaded.
- 6 - The images obtained by the ground segment are then distributed via a network to the users who requested them.