#innovacion
#financiacion
#asesoramiento
#internacionalizacion

MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

CDTI Centro para el Desarrollo Tecnológico Industrial

@CDTIoficial

SEOSAT/Ingenio:

Spanish Earth Observation SATellite

Carlos Castaño Climent
SEOSAT/Ingenio Head of Programme

62nd COPUOS/UNOOSA, Vienna 20/06/2019

esa

SEOSAT/Ingenio:

- **The mission**
- **System, products and performance**
- **Status and Outlook**

Images courtesy © of AIRBUS D&S and SENER

SEOSAT/Ingenio: The mission

The SEOSAT/Ingenio mission

SEOSAT (Spanish Earth Observation SATellite)

- **High-spatial-resolution optical imaging mission**
- **Developed under the Spanish Earth Observation National Program by Satellites (PNOTS) (which includes also the radar satellite PAZ).**
- **SEOSAT/Ingenio programme is funded by the Government of Spain through an agreement signed between CDTI and ESA**

CDTI is responsible for the programmatic aspects of the mission and the financial management of the programme

ESA is entrusted with the technical and contractual management of the Industrial activities

Industrial consortium involving a large number of Spanish companies together with several European firms led by AIRBUS D&S in Spain (FS) and INDRA (GS)

Objectives of SEOSAT/Ingenio

OBJETIVE 1: QUALIFY THE SPANISH INDUSTRY✓

- **SEOSAT/INGENIO has given the Spanish industry the capabilities to lead the whole industrial development of space missions.**

New missions industrially led by Spain thanks to the achieved capabilities:

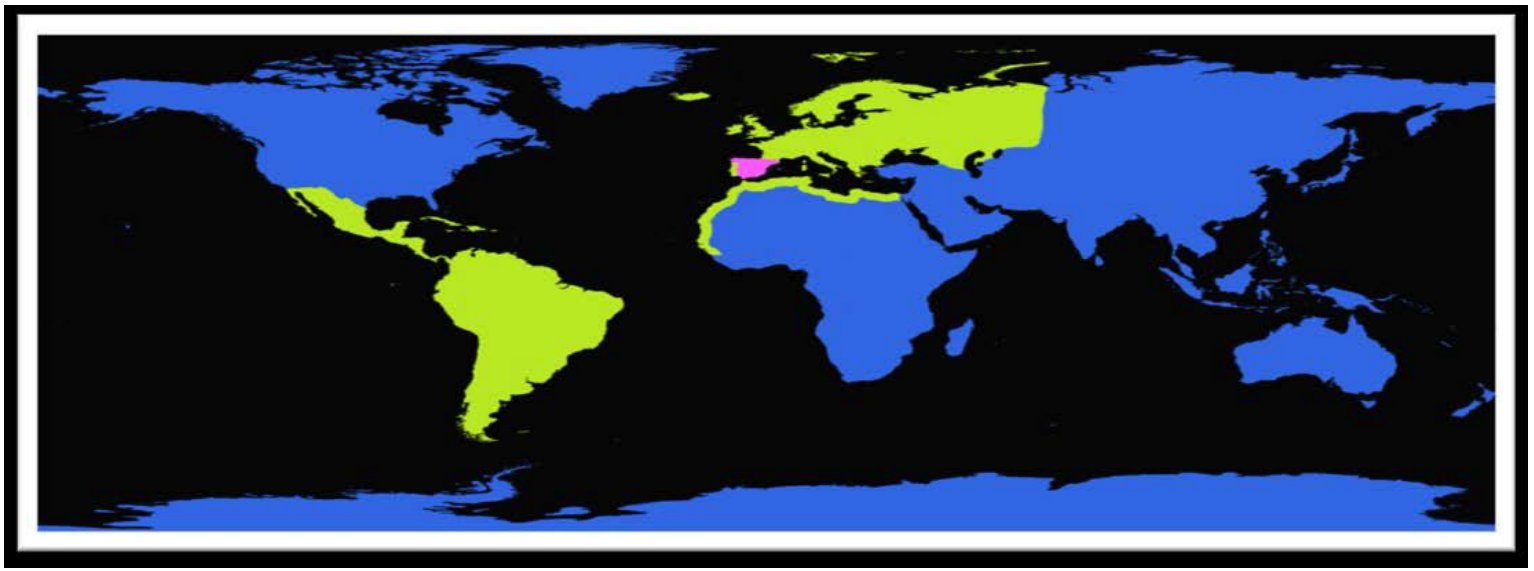
- **CHEOPS (ESA scientific satellite for the characterization of exoplanets)**
- **Others comming …**

OBJETIVE 2: PROVIDE EARTH OBSERVATION SERVICES

- **SEOSAT/INGENIO will provide optical imagery of the Earth (panchromatic and multi-spectral) to public and private users and aims to become a Copernicus contributing mission.**
- **The images provided will be appropriate for applications in cartography, land use and mapping, urban and coastal management, agriculture monitoring, precision agriculture, water management, environmental management, risk management and land security.**

SEOSAT/Ingenio areas of interest

- World-wide coverage capability
- The area of main interest is the Spanish territory and other areas of interest are Europe, north of Africa and Latin America
- Imaging capability up to 2.5 MKm2 per day



Key mission parameters

- Polar heliosyncronous orbit at 670 km altitude, repeat cycle of 14+32/49 rev/day
- LTDN 10:30
- 55 km min swath
- 30-day revisit at nominal OZA (±5°)
- Full image of Spanish territory in 2 months
- World-wide accesibility in less than 3 days at OZA ±35° (emergencies)

SEOSAT/Ingenio: System, products and performance

Imaging performance

- **Push-broom acquisition, high-spatial resolution**
  GSD= 2,5 m resolution in Panchromatic (PAN)
  GSD= 10 m multi-spectral (B,G,R, NIR)

- **Swath: 55 km min**

- **High image quality: SW/SSD <1.1**

- **Absolute pointing accuracy of the satellite is 44 m across-track and better than 250 m along-track, at 2σ confidence level**

- **Image geo-location accuracy**
  < 50 m (2 σ) without GCPs (at level 1B)
  < 2,5 m rms with GCPs (at level 1C)

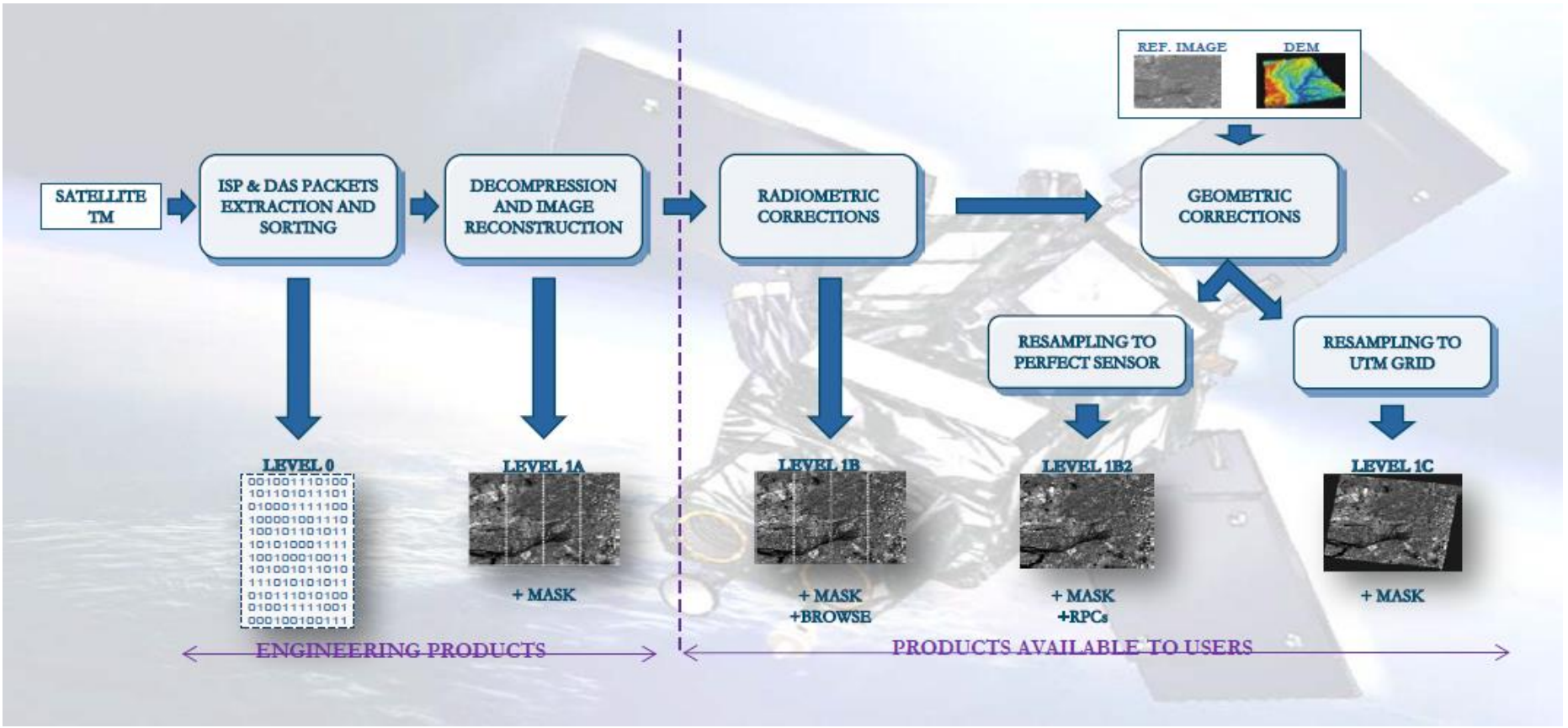
Image products

- **The Payload Data Ground Segment (PDGS) will generate and distribute to users panchromatic (PAN) and Multi-spectral (MS) images processed at**
  - **Level 1B (radiometrically calibrated)**
  - **Level 1B-2 (perfect sensor geometry) with RPC's appended**
  - **Level 1C (radiometrically calibrated and orto-rectified)**

- **Catalogue consultation, archive search and retrieval service will be set up and made accessible through a User Service.**

- **Higher level products will be left to the user community**

Processing scheme and products

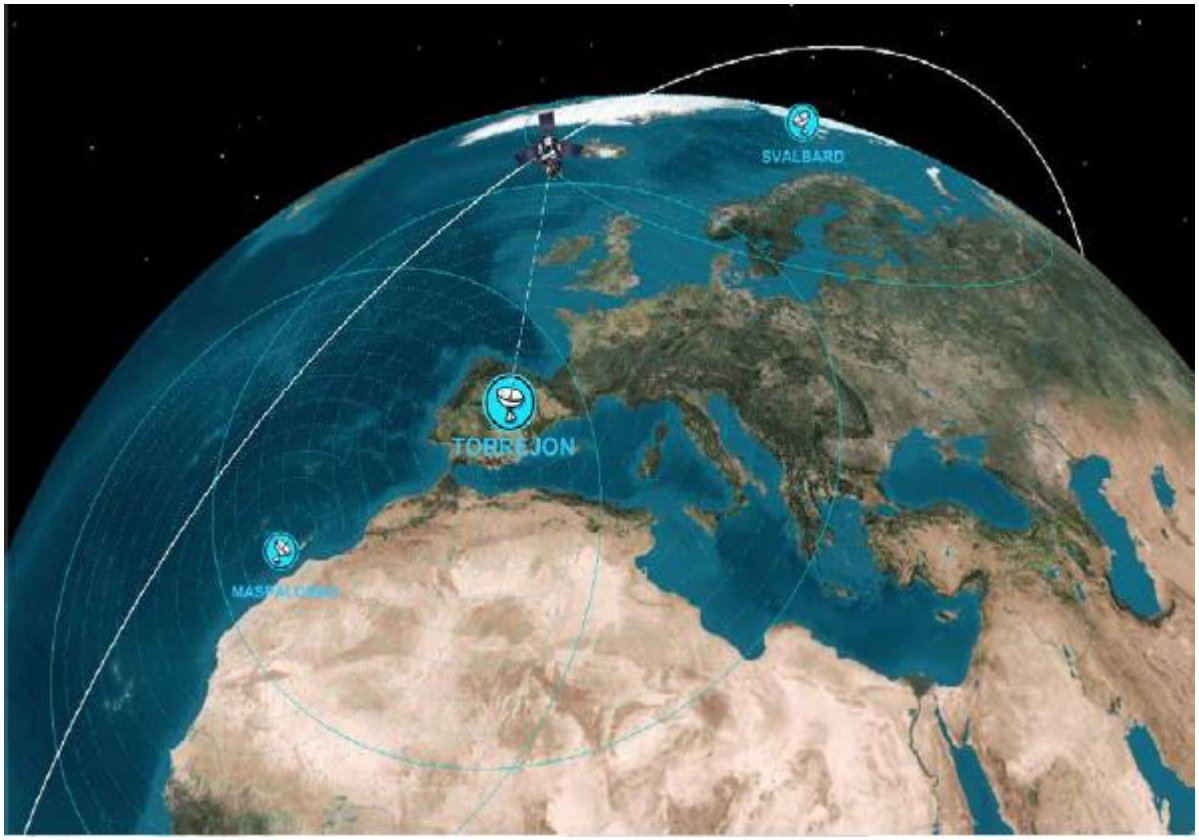


Ground segment. Operations

- **Data transmission:**

- Data downlink: 280 Mbps in X-Band

- Almost lossless 6/2 bpp (5 selectable compression rates)



- **Ground stations:**

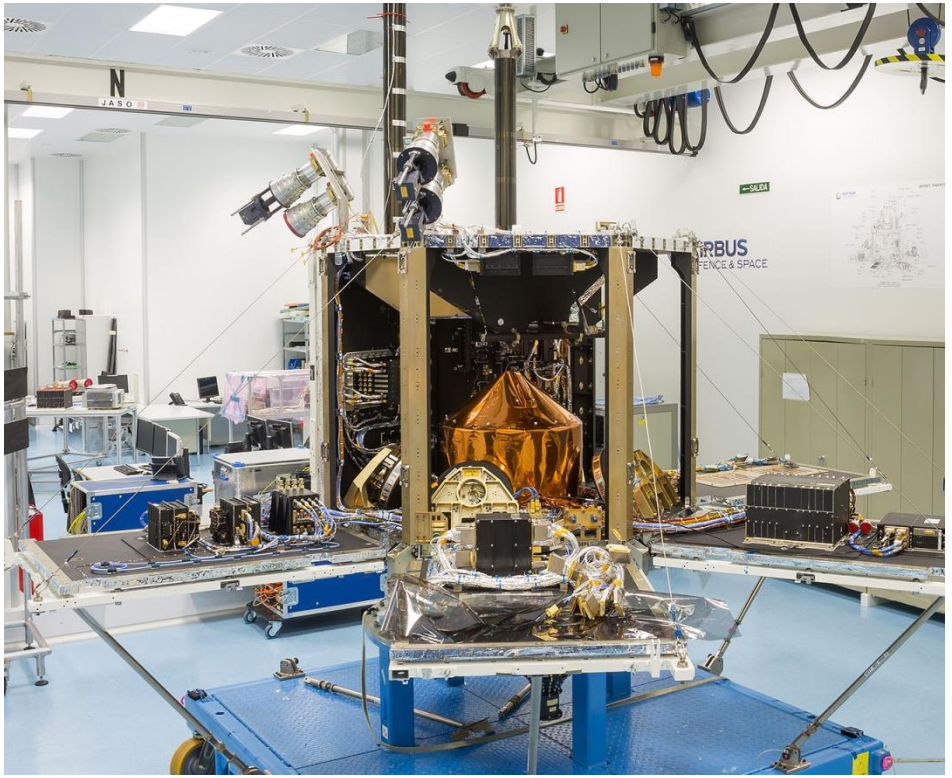
- Torrejón de Ardoz (Spain) Primary control centre

- Maspalomas (Canary Islands, Spain) Optional backup station

- Polar station (ie. Svalvard) foreseen to increase accessibility and ensure 2.5 Mkm2/day data throughput

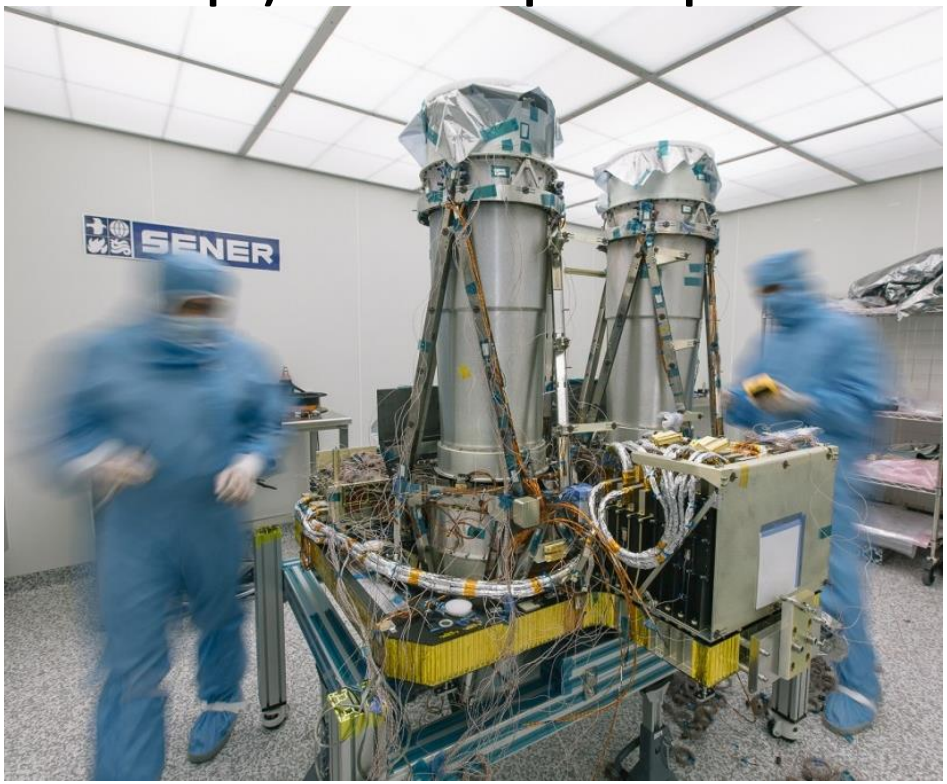
Flight segment. Satellite

- Astrobus-M platform (AIRBUS DS)
- 749 Kg dry mass
- N2H4 Propulsion (82 Kg fuel)
- Gyroless 3-axis estabilized AOCS
- Fine-pointing through dual star-trackers
- 3 single-panel deployable solar array
- Li-Ion 150 Ah batteries
- 580W average power
- OBDH run by a LEON-3 processor
- 0.512 Tb SS memory
- 7-year operational lifetime
- Controlled re-entry in 25 years
- Launch by Vega (Arianespace)



Flight segment. Instrument

- Ad-hoc developpement by SENER
- Two identical cameras (3-mirror Korsch telescope) 250 mm optical aperture
- Focal distance 3573.4 mm
- Thermo-elastic refocusing device at mirror 2
- Total FoV 5°
- FoV overlap by bias mounting
- Isostatically mounted (INVAR tripod struts and Ti optical bench)
- Zerodur mirror
- Staggered focal plane. Detectors installed on SiC plates
- 4 detectors (filters+CCD) per FP, 2 PAN, 2 MS
- Measured mass 154 kg
- Maximum power 220 W
- Assembly mounted on CFRP/Al honeycomb high stability panel



SEOSAT/Ingenio: Status and outlook

Status and outlook

- The instrument (PFM) is fully integrated, characterized , tested and installed on the satellite
- Satellite integration finished in AIRBUS DS in Madrid
- Enviromental test campaign at satellite level starts in June 2019 in Intespace (Toulouse)
- FAR in November 2019
- Delays in the development of the ground segment made necessary a staggered delivery in order to secure the launch slot so the In-Orbit Commissioning (IOC) will last more than expected.
- Launch by Vega foreseen in March 2020
- IOCR in January 2021


AIRBUS
DEFENCE & SPACE
E
AIRBUS
DEFENCE & SPACE
AIRBUS

Conclusion

- **This is a complex and challenging mission which means a huge effort of the industrial consortium, ESA and CDTI**
- **Acknoledgement for the great effort and implication of the Spanish space industry**
- **Acknowledgment for the support and advice received from the group of expert users IMAG (Ingenio Mission Advisory Group)**
- **Launch foreseen in March 2020**

¡Thank you!

carlos.castano@cdti.es

@CDTIoficial

Backup slides

Backup slides

How can it help SDG? (1)

- **#2: SEOSAT/Ingenio images will enable precission agriculture, this can be used to promote sustainable agriculture**

- **#6: SEOSAT/Ingenio images can be used to optimise the use of the water resources**

- **#8: SEOSAT/Ingenio images can be used to develop high technologic level applications in cartography, precision agriculture, water management, land management, etc, this kind of applications being highly innovative and one of the most sustainable and of highest economic growth in the space related market**

How can it help SDG? (2)

- **#13: SEOSAT/Ingenio images can be used to measure coastal line changes, one of the clearest effects of the climate change, which allows to check the accuracy of the scientific models and to verify the effects of the recovery measures**

- **#14: SEOSAT/Ingenio images can be used to monitore the health of the water in oceans and seas in certain circumstances: oil spill, plastic accumulation, jellyfish plagues, oceanic posidonia extension, and whatever measurement that could be done by optic methods.**

- **#15: SEOSAT/Ingenio images can be used to measure and monitor the extension, the progress or the regression of different ecosystems on Earth, like woods, deserts, …**