Towards the Continuity of SPOT/ Vegetation

PROBA V(egetation) Mission

Belgian Earth Observation Day 2010

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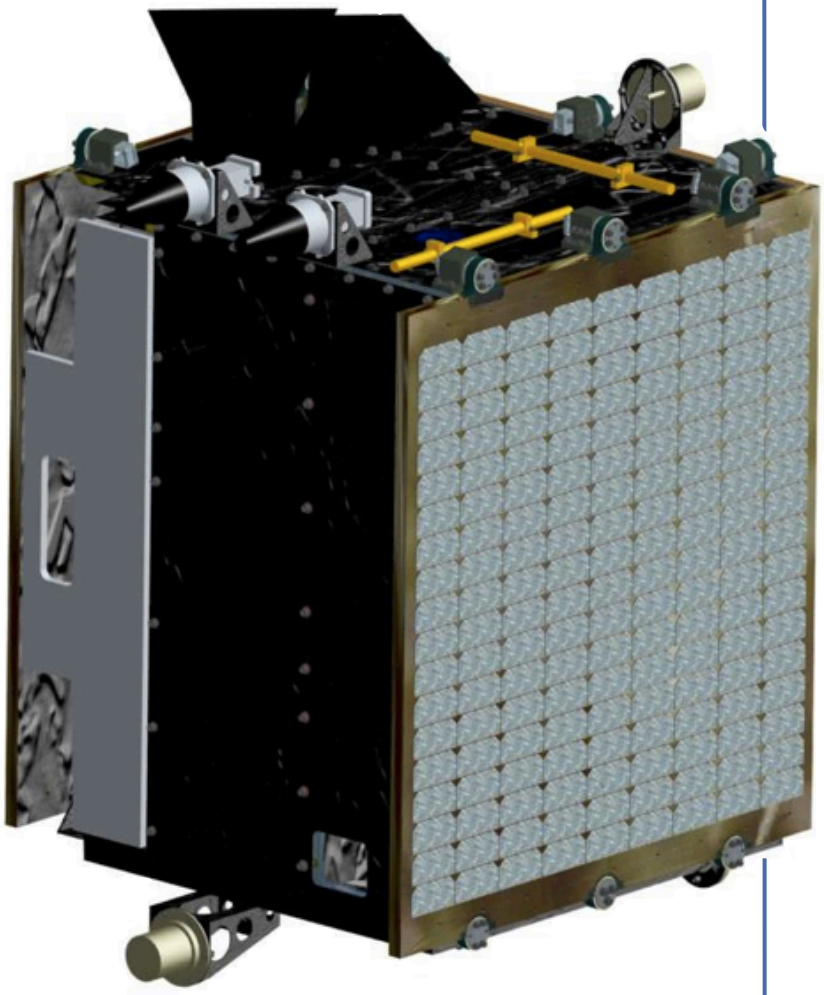


1. PROBA-V Mission

Introduction

Spot Vegetation

- Since 1998 SPOT 4 and since 2002 SPOT 5, CNES satellites, fly the VEGETATION instrument.
- Its provide since then daily images of the land vegetation to a large number of Users World Wide.
- Belgium has been since the beginning deeply involved in the Vegetation Program.
- The various products, the daily images and the 10 days synthesis, is processed and distributed from the VITO Institute located in Mol (B).
- The SPOT 4 and SPOT 5/Vegetation end of life is now planned end 2012.
- Continuity is needed to provide Users with similar data.

➡The Belgium Science Policy and ESA have started the PROBA-V Mission in 2008

PROBA-V Frame Work

➡The Primary objective of the PROBA-V mission is to **continue the generation of Vegetation products.**

➡The PROBA-V mission is developed in the frame of the ESA General Support Technology Program (GSTP) within the ESA In Orbit Demonstration Program under the Technology and Quality Directorate Management

➡The Contributors to PROBA-V mission are Belgium (>98%), Luxembourg and Canada.

➡PROBA-V will be the successor of PROBA-1 in orbit since Oct' 2001 operated no by the Earth Observation ESA Directorate and PROBA-2 in orbit since Nov'2009 that will be transfer soon to the Science ESA Directorate.

(Main) Mission Requirements

Objectives:

MR-001: Main mission objective

to perform remote sensing for the vegetation observation on the Earth surface

MR-002: Secondary mission objective

The PROBA-V mission shall include the possibility to fly two technology demonstration payloads.

MR-003: Service continuity

Operations shall start in the 2012 timeframe (SPOT Vegetation Continuity)

MR-005: Mission lifetime

A nominal operational mission life of 2.5 year with extension up to 5 years

Spatial requirements:

MR-012: Mandatory GSD VNIR and SWIR

GSD shall not be greater than **1 km**

(SPOT performances)

MR-013: Design Goal GSD VNIR

GSD should not be greater than **1/3 km** for VNIR

GSD should not be greater than **2/3 km** for SWIR

Coverage:

MR-006: Daily Coverage

A daily coverage shall be guaranteed for

1) Latitudes between 35 degrees and 75 degrees North
2) Latitudes between 35 degrees and 56 degrees South

MR-007 Coverage

Coverage every two days shall be guaranteed for latitudes between 35 degrees North to 35 degrees South

Mission Products

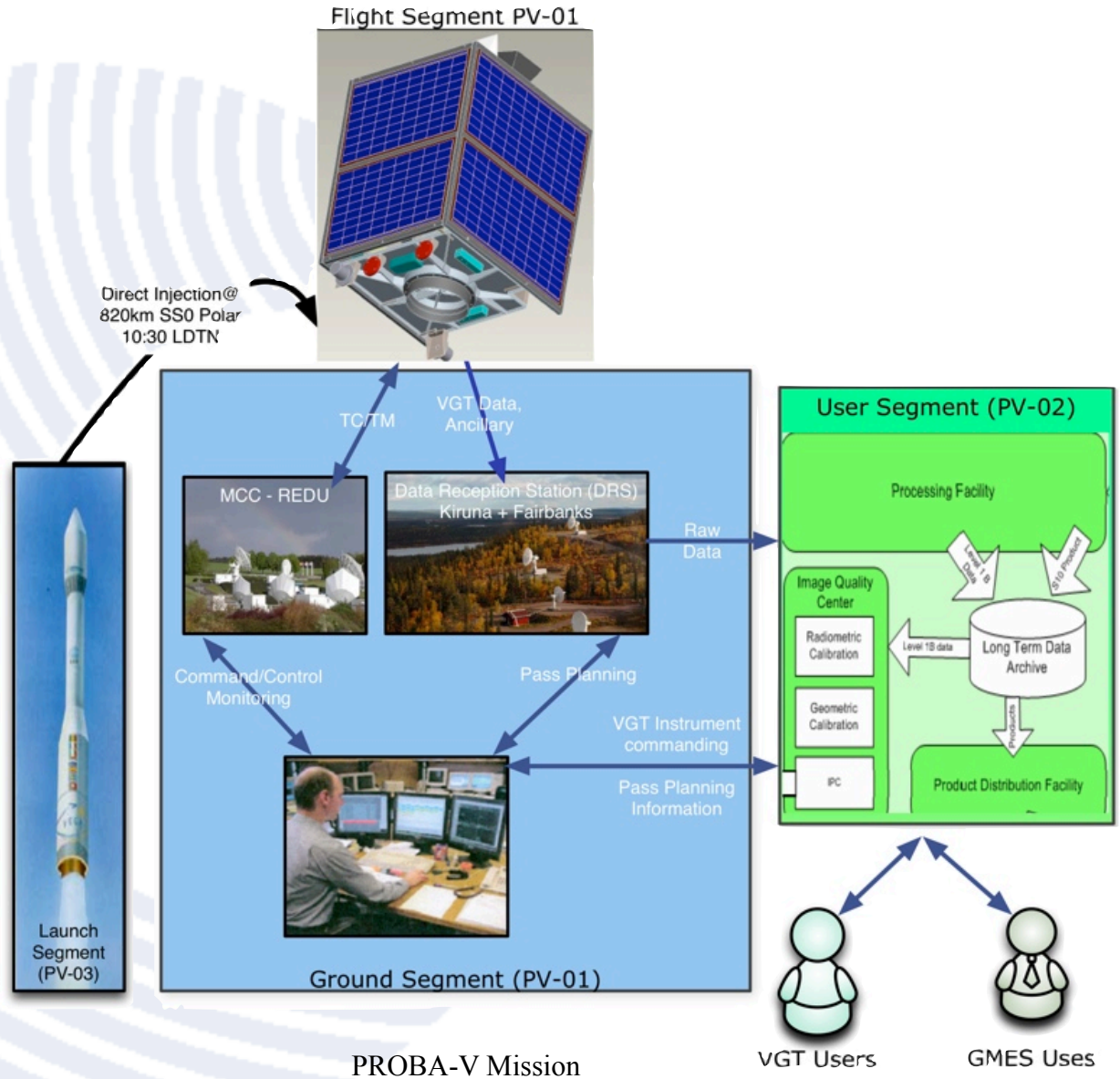
In continuation of SPOT, the PROBA-V mission will continue to offer two main products, primary products (P) and synthesis products (S).

- ➡Primary products (P): extracts of a segment along a single orbit
- ➡Synthesis products (S): merged segments (mosaic of P products).
- ➡Two types: a daily (S1) and a 10-daily product (S10).

The products will be delivered to the Users on:

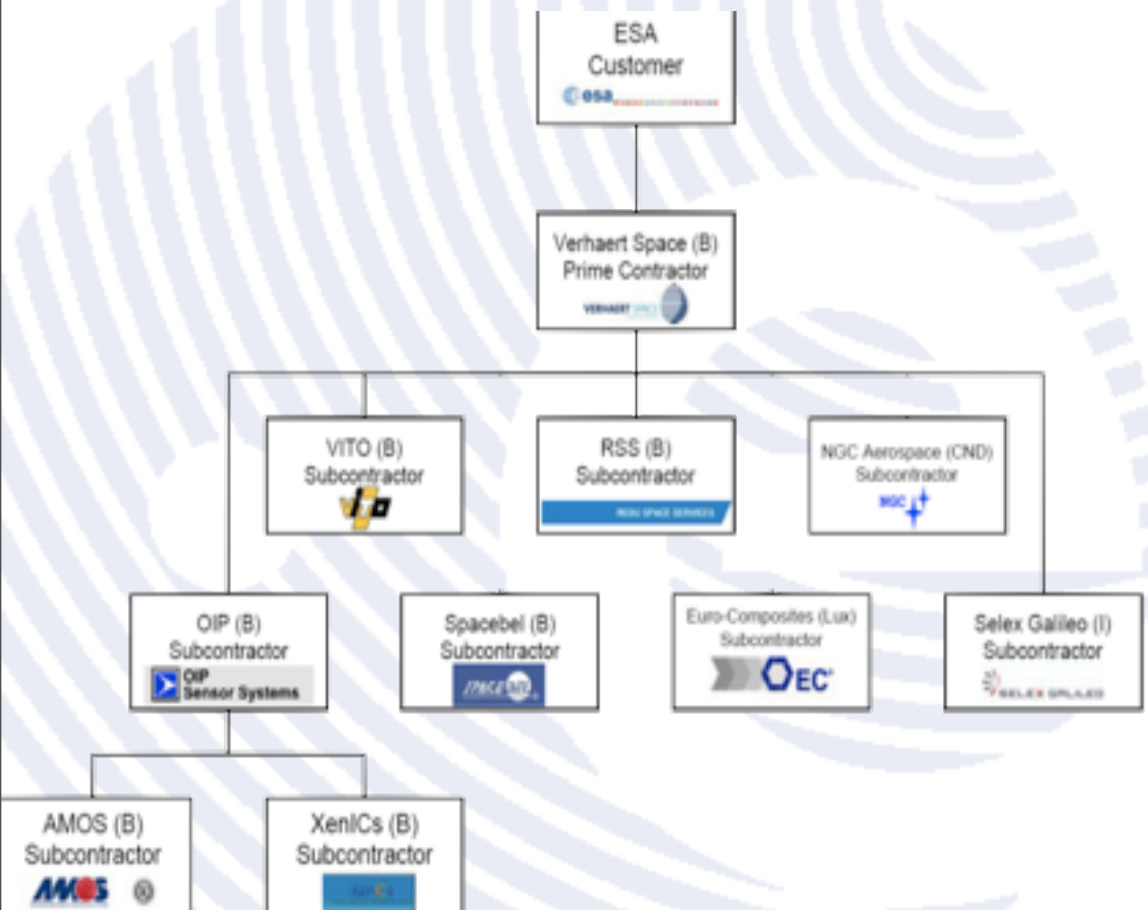
- ➡ a **1km** grid (like SPOT/Vegetation) and
- ➡a **1/3 km** grid (improved Vegetation data)

Mission Elements

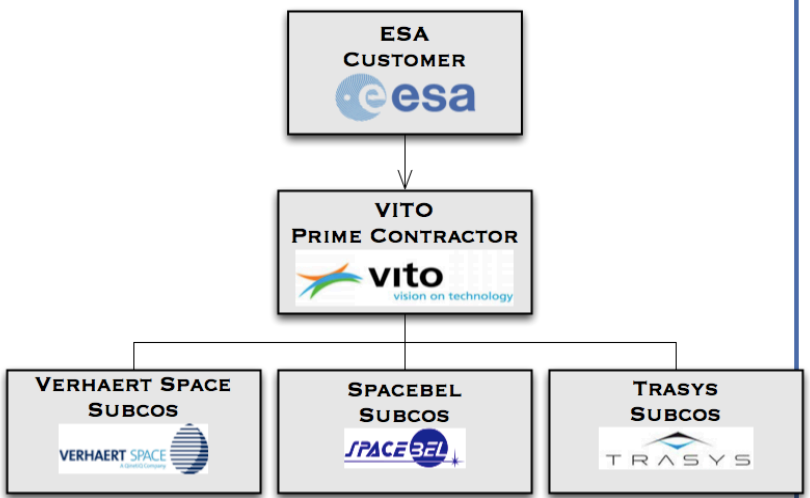


Industrial Organization

Flight Segment and Ground Segment



User Segment



Project Status

Flight Segment and Ground Segment

Phase B :

✓Kick-off January 2009

✓System Requirements May 2009

✓Preliminary Design Review September 2009

Phase C/D:

✓Kick-off December 2009

➡Subsystems CDR March to June 2010

➡System CDR September 2010

➡Integration Readiness Review December 2010

➡Payload Delivery July 2011

➡Flight Acceptance Review January 2012

User Segment

Phase B:

✓Kick-off August 2009

✓System Requirements Review October 2009

✓Preliminary Design Review April 2010

Phase C/D:

➡Kick-off May 2010

➡System CDR December 2010

➡System Deployment July 2011

➡Operational Readiness Review January 2012

Launcher

Target Launch date in **Q1 2012**

Main Launcher :

Vega (dedicated launch TBC)

Backup Launchers (in negotiation) :

Soyouz from Kourou (piggy back on Pleyade 1B)

Falcon 1E (dedicated launch)

Russian Launcher (TBD)

2. PROBA-V Satellite

Driver Requirements

The Main driver for the satellite design are :

- ✓ Recurrent from PROBA-2 (small platform of about 120kg)
- ✓ Allocation for
  - ➡Vegetation instrument
  - ➡Two technology demonstrators
- ✓Design lifetime of 2.5 years with appropriate margin philosophy
- ✓Single failure tolerant at spacecraft level
- ✓System availability goal of 95%
- ✓VEGA as primary launcher + back-up launcher (TBD)
- ✓Late integration of payload

Orbital Parameters

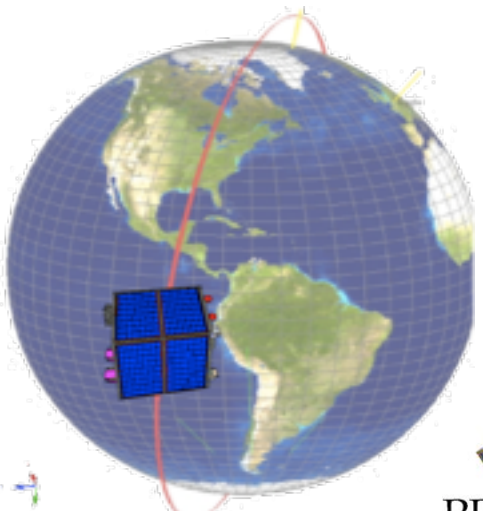
Orbit selection based on SPOT/Vegetation:

Mission Requirements:

- ➡ 100 % daily coverage above 35° and below -35°
- ➡ 100% two-daily coverage
- ➡ 90% daily coverage of equatorial zones
- ➡ Minimum swath width of 2250 km
- ➡ LTDN between 10:30-11:30 AM

From These requirements the following orbital parameters have beens chosen:

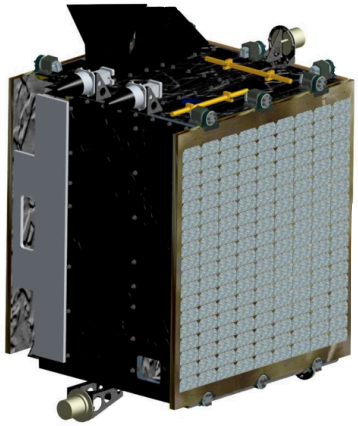
- ➡ Orbit parameters:
- ➡ Altitude: 820 ± 10 km (launcher dispersion)
- ➡ Eccentricity: 0
- ➡ Inclination: SSO + 0.1° (TBC with Launcher Authority)



Spacecraft Main Characteristics

PROBA-V Platform Characteristics

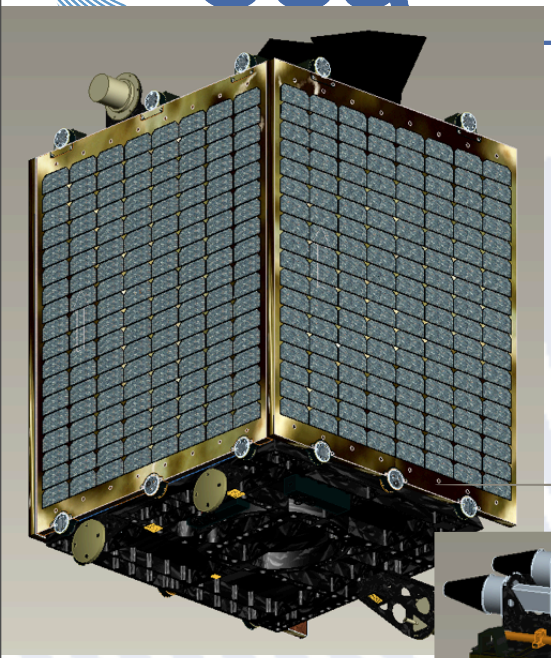
- Mass: 160 kg
- Dimensions: 765x730x840 mm³
- Three axis-stabilised
- Body mounted Solar Array
- Platform H-structure
- Vegetation Instrument 35kg

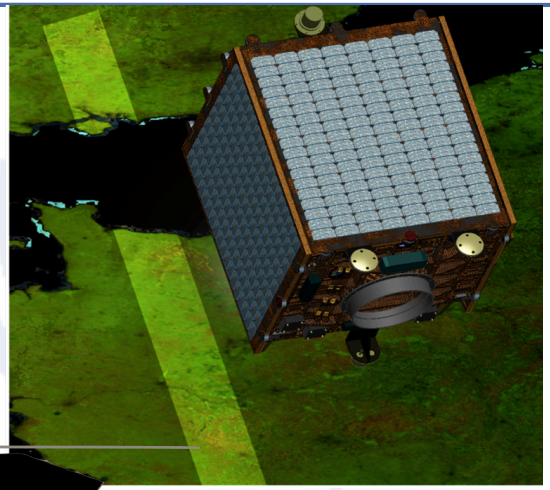


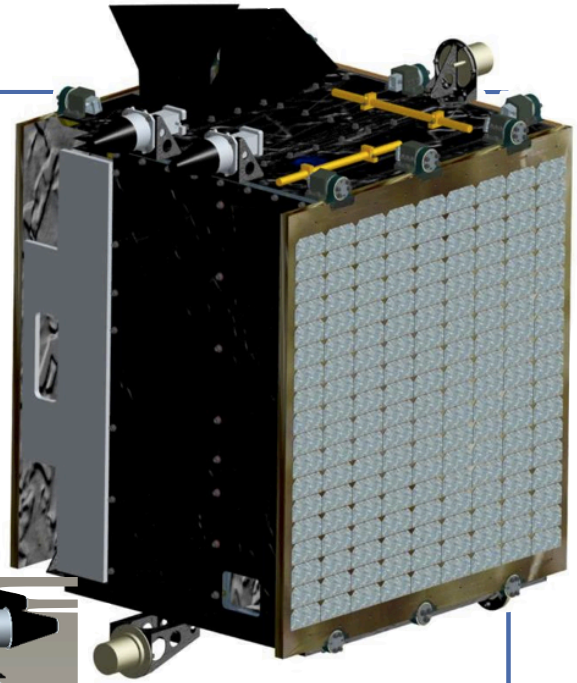
SPOT-5 Platform Characteristics

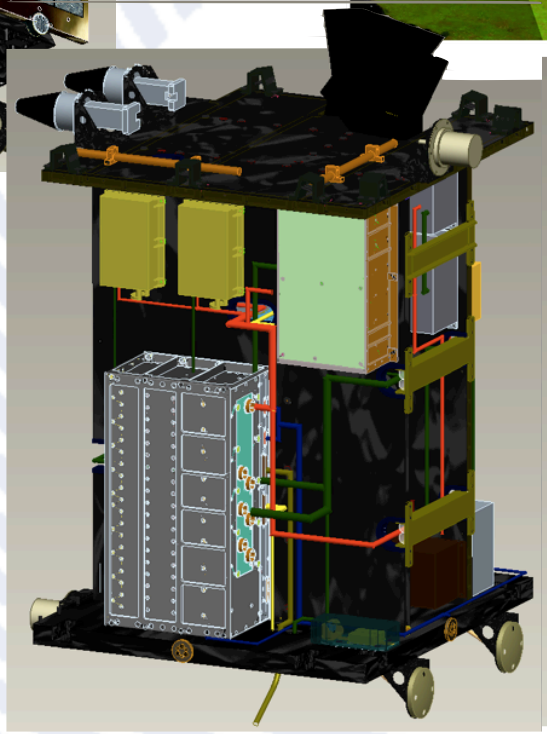
- Mass: 3000 kg with
- Vegetation Instrument 120kg

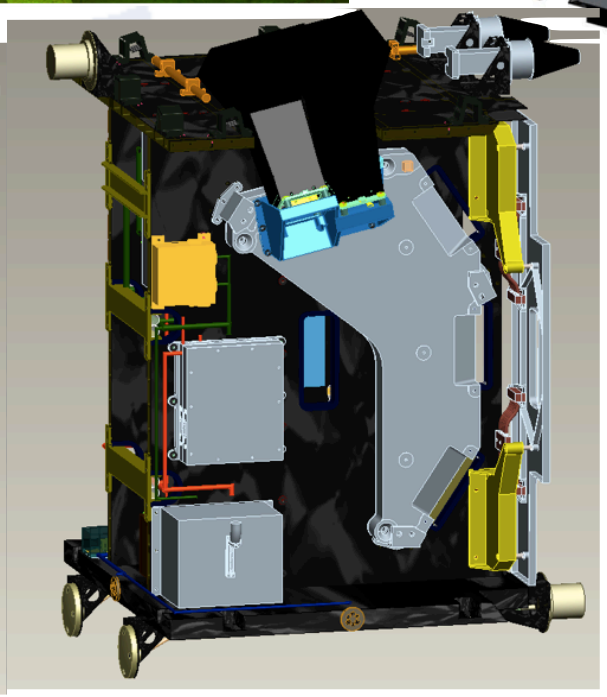
Spacecraft 3D Views



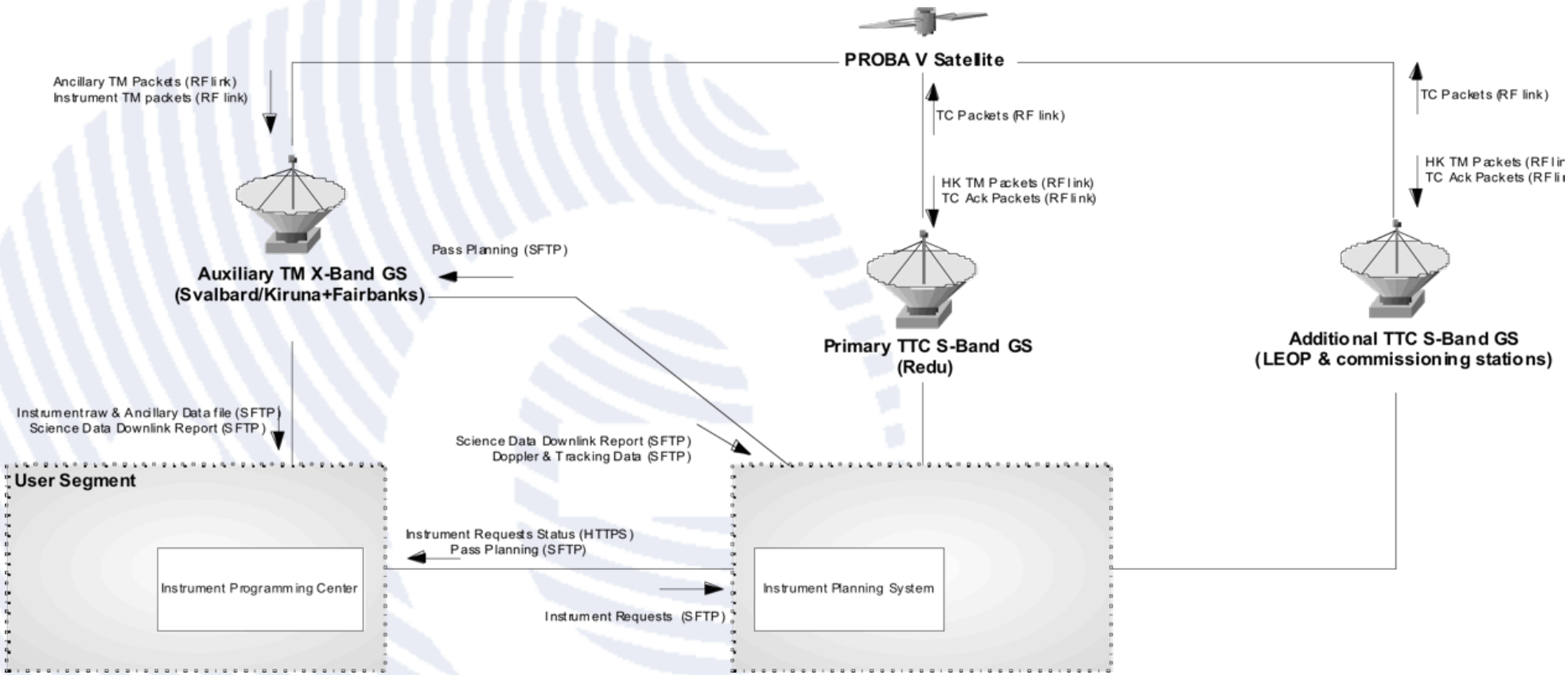




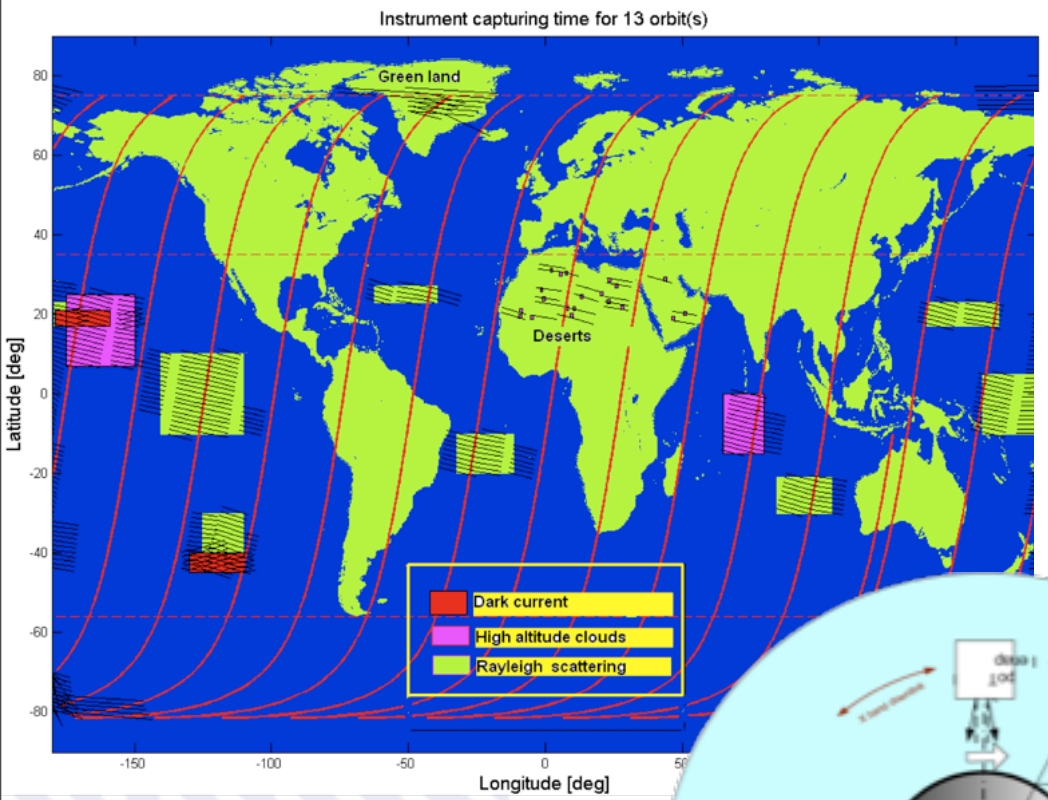


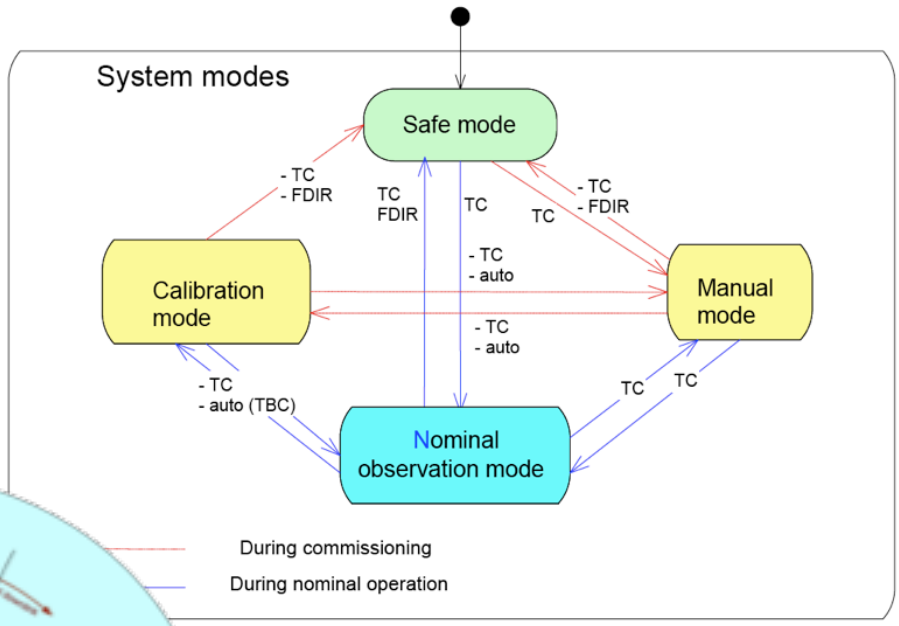


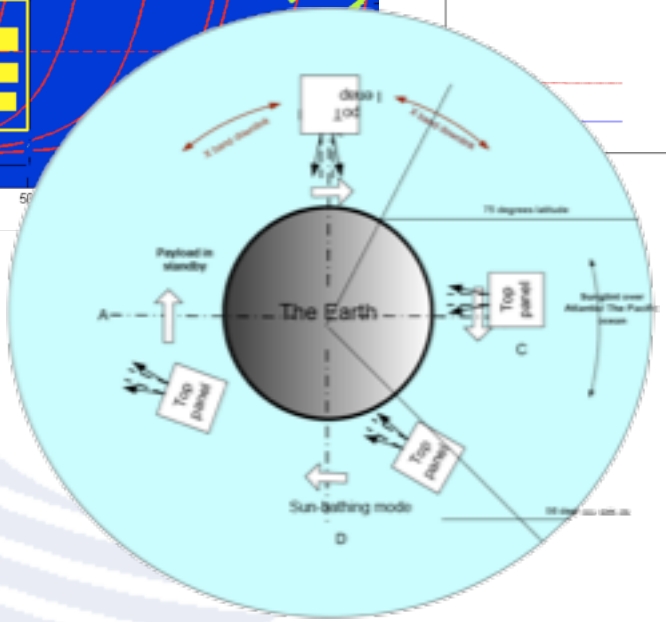
Ground Segment Concept



Operational Scenario







3. Vegetation Instrument

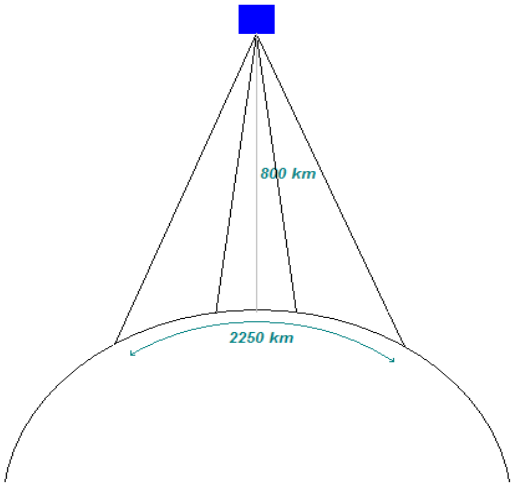
Driver Requirements

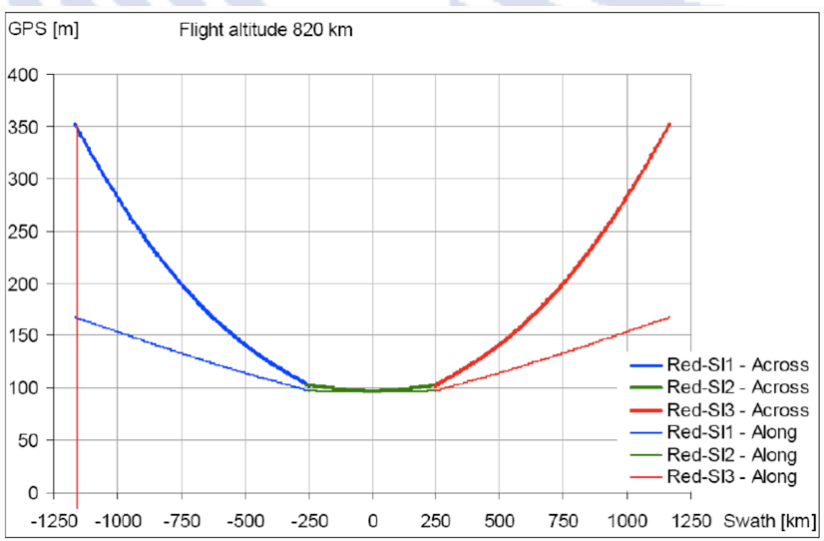
- Field of View 102.6°
- Swath width: 2250 km at 800 km altitude

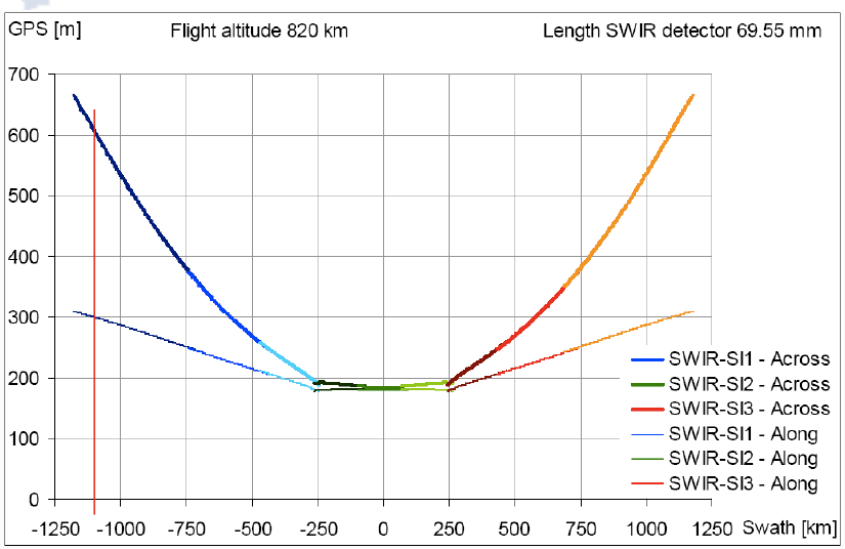
- Ground Sample Distance: 1km and 300m

- VNIR Ground Sampling Distance is 100 m in centre, 350 m at edge

- SWIR Ground Sampling Distance is 200 m in centre, 700 m at edge







Detectors

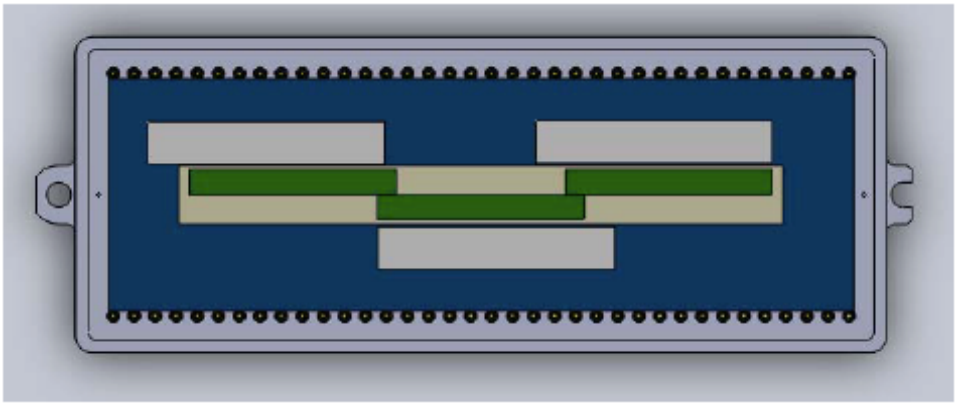
VNIR DETECTOR: quadrilinear fro E2V

- 4 VNIR bands 6000pix/band – 13µ x 13µ
- 3 bands used

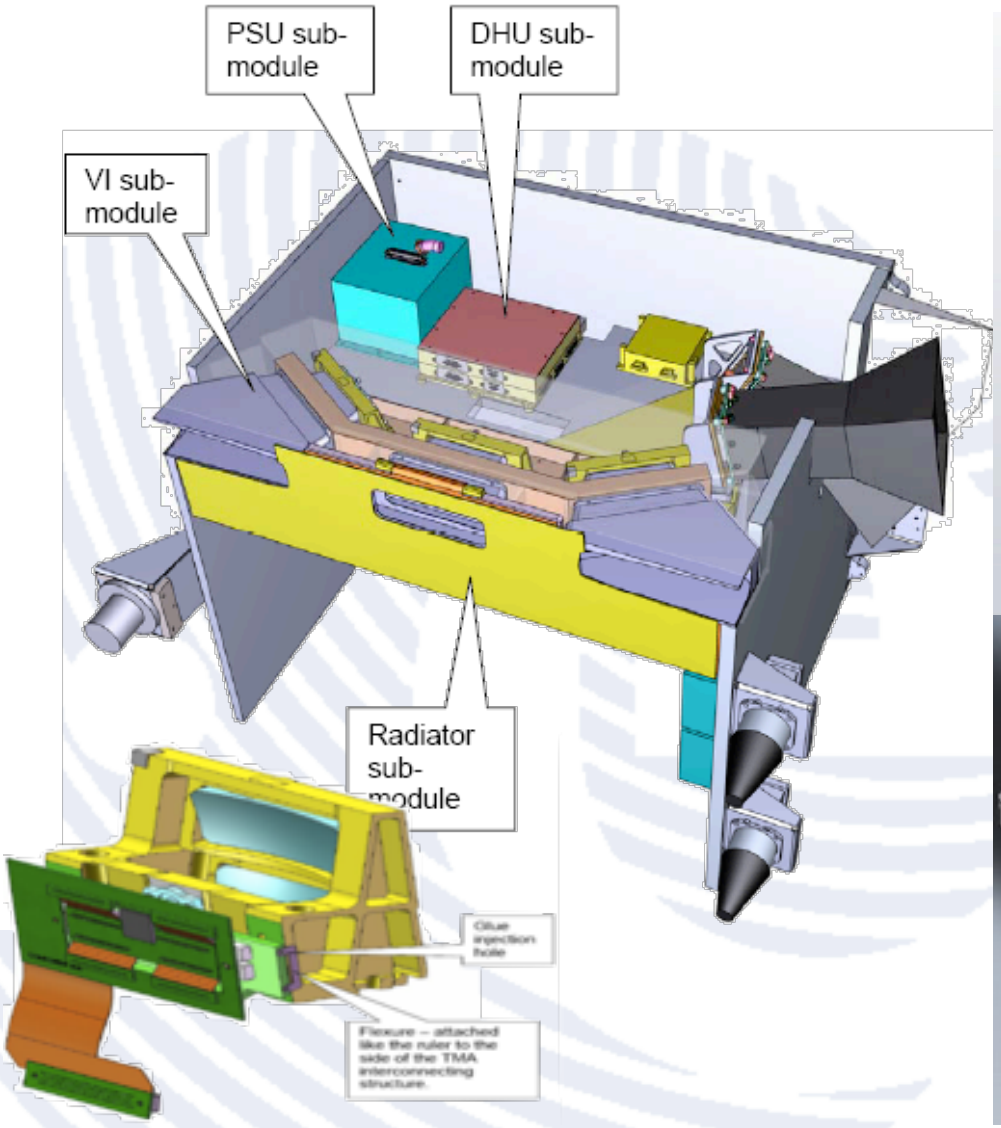
Filters : Blue 447 – 493 nm
Red 610 – 690 nm
NIR 777 – 893 nm

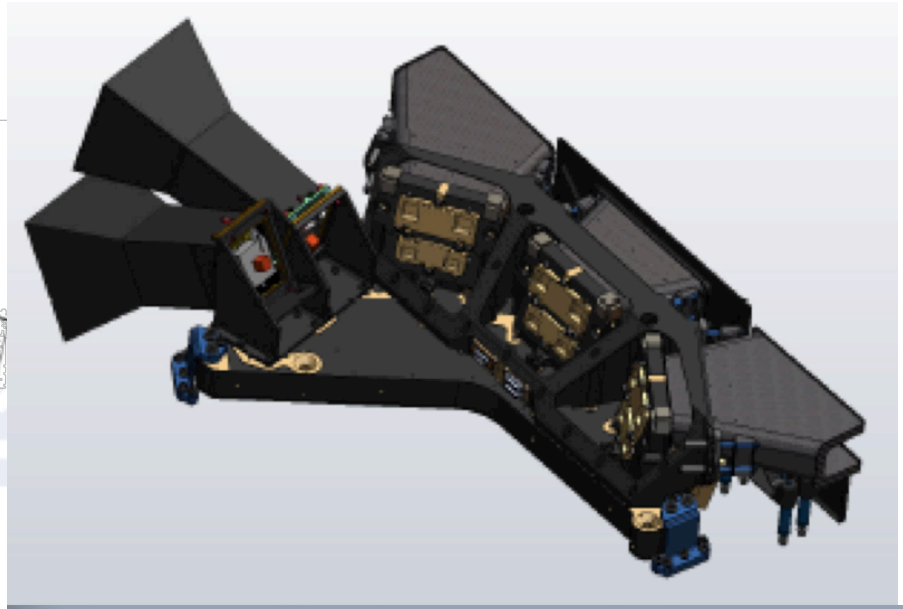
SWIR DETECTOR (ESA GSTP development)

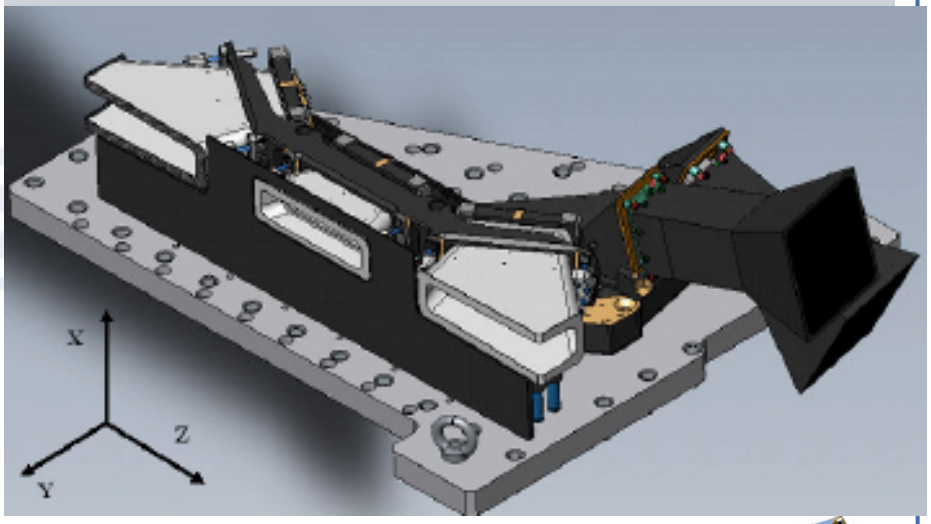
- 1570 – 1650 nm
- Supplier XenICs
- 3 x 1024 newly developed; 25µ x 25µ
- mechanically butted



Instrument 3D View

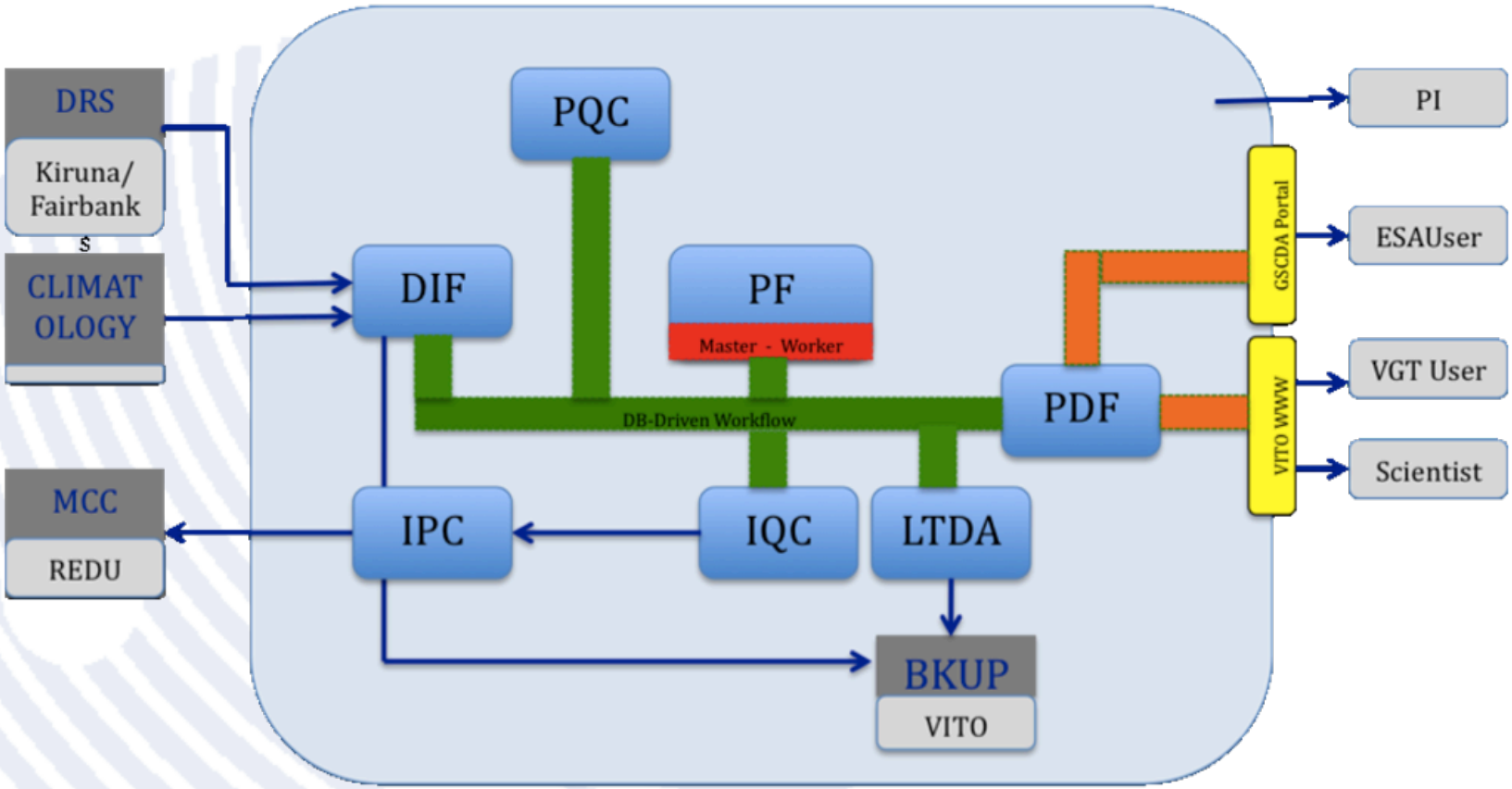




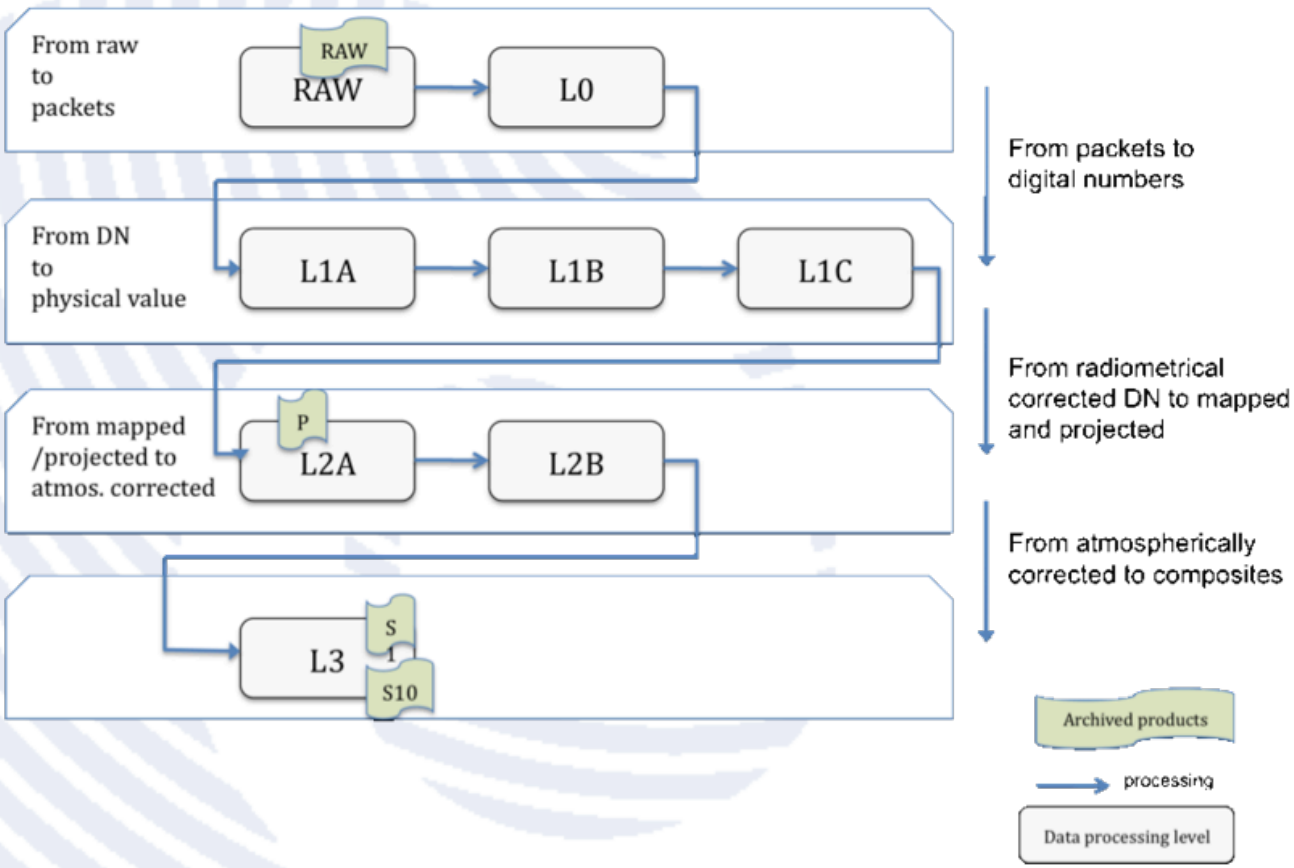


4. User Segment

User Segment Overview



Processing Flow

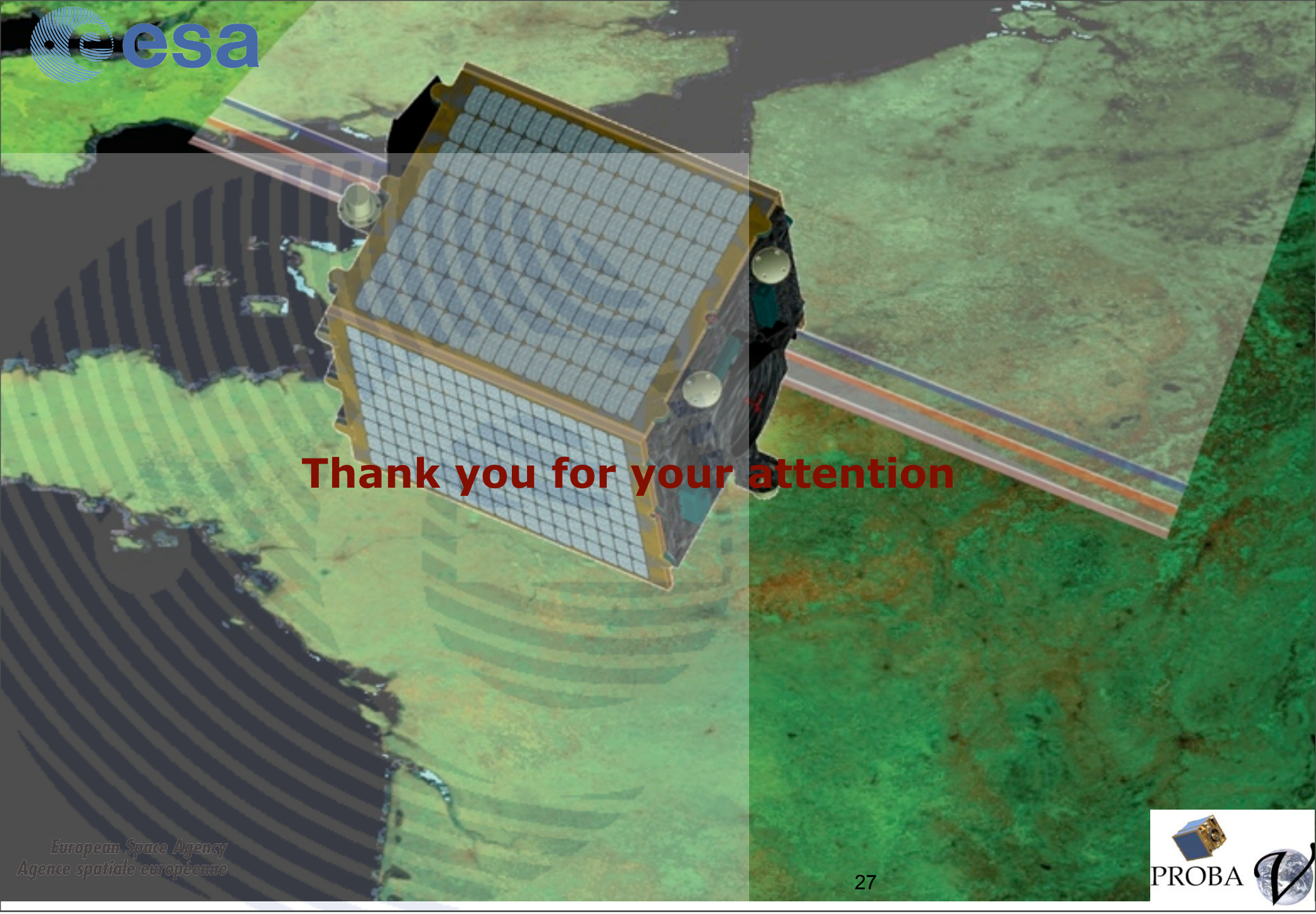


5. Conclusion

Conclusion

- By end 2012 SPOT/Vegetation data production will be discontinued
- PROBA-V is under development to provide continuity of the Vegetation data equivalent to SPOT/Vegetation data (1km and spectral bands)
- Thanks to new technologies, improved data spatial resolution up to 1/3 km will be distributed to Users.
- PROBA-V needs to be in orbit by early 2012 to be fully commissioned by end 2012.
- PROBA-V new developments cover the Flight Segment, the Vegetation Instrument and the User Segment

➡ The project is on track to meet these challenging objectives.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