OVERVIEW
Mission setup and Industry teams
Launch and Orbit
Satellite key figures
Main and techno demo payload
Ground segment (MOC)
Mission setup

• ESA General Support Technology Program
• PRoject for On Board Autonomy
• 2nd small mission for in orbit demonstration of platform and payload technologies
• Accommodation of guest payload providing user data (Solar/Plasma physics)
• LEO SSO with minimised eclipse time
• 2 years operational lifetime specification
• High degree of spacecraft autonomy and ground support automation
• PROBA 2 expands on PROBA1 experience (currently for 8.5 years in orbit)

Project Industry teams

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<th>Qinetiq Space (B)</th>
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<td>System definition, integration and validation</td>
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<td>AOCS IF development</td>
<td>Operations during LEOP and Commissioning</td>
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| Spacebel (B) | • On board software |
| DUTU (DK) | • Star Tracker |
| STT (D) | • RF electronics |
| Billingsley | • Magnetometers |
| Metravib (F) | • Hinges |
| Dutch Space (NL) | • Hold-down and release mechanism |
| NGC Aerospace (CA) | • AOCS algorithms |
| Dynasty (CA) | • Reaction Wheels |
| Salle Giakko (D) | • Photo-Voltaic Assembly |
| APCO (CH) | • Structure |
| DLR (D) | • GPS |
| Zurn (D) | • RF antennas |
| SAFT (F) | • Battery |
PROBA-2 Science Working Team

Company | Solar Observation payload | Technology Demonstrators
---|---|---
CSL (B) | SWAP | Propulsion subsystem
CSL/PMOD/MPS, ROB (B, CH, D) | LYRA | Cool Gas Generator Experiment
Institute of Atmospheric Physics (CZ) | DSLP, TPMU | Bepi Colombo star tracker

Company | Plasma environment payload
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Company | Launch / Orbit
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• Launched on 2nd of November 2009 on Rockot from Pletsetsk as a co-passenger with ESA SMOS spacecraft
• Orbit:
  • LEO SSO orbit dawn-dusk 06:00-18:00
  • Visual light eclipses from mid-November to end of January
  • Altitude of 730 km
• Orbit suitable for more than 10 years
• 3 months of commissioning until end of January
• Routine operations phase since February 2010
• Operated by ESA with the MOC located at the ESA Redu ground station (B)
• 2 ground stations: Redu (B) and Svalbard (N) to support 9 satellite passes per day.
Key Figures

- Sun pointing with automatic manoeuvring
- 120 kgs, 60 x 70 x 85 cm, 60 W
- Mixed Honeycomb structure Alu/CFRP
- 2 deployable solar panels + 1 body mounted
- Single box miniature avionics (ADPMS)
- 18 Ah Lithium-Ion battery
- S-band RF system (1 Mbps downlink, 64 kbps uplink)
- 3-axis stabilized with full redundancy
Sun observation mode general concept

- Four 90 deg manoeuvres per orbit in order to avoid blinding of the star tracker
- High pointing accuracy and stability
- Payload operation mode
- Pointing offset capability
Platform technologies

Data&Power Management System
ADPMS (QinetiQ Space)

3-Junction GaAs Cells
Integrated diode
(Selex Galileo)

Miniature Phoenix GPS receiver (DLR)

Reaction Wheel
RW-1000 (Dynacon)

Li-Ion Battery
(SAFT)

Micro Miniature Star Tracker Electronics (DTU)

Sun Payload

SWAP (CSL, ROB):
- Extreme UV imager of the solar corona
- mass: 10 kg
- nominal cadence: 1 image per minute
- image processing done on-board

LYRA (CSL, ROB, PMODWRC):
- Solar UV radiometer
- 3 detectors with closeable covers
- mass: 3.5 kg
- cadence: up to 100 Hz
- Data processing done on board
Plasma physics payload

TPMU (Czech republic):
- Total ion density.
- Ion composition and temperature
- Potential of satellite body

DSLX (Czech republic):
- Two probes located on a deployable panel
- Space plasma and variations
- Electron density
- Satellite potential

Technology demonstrators

TOPSTAR Dual Band GPS (ALCATEL)
Bepi Colombo Star Tracker (SG)
Fiber Optic Sensor Demonstrator (MPB, CA)
Laser Retro Reflector (RU)
CCM (Lusospace, P)
Science Grade Vector Magnetometer (DTU)
Cold Gas Propulsion (SSTL & Bradford)
Digital Sun Sensor (TNO)
ZMM (ZARM)
Experimental Solar Panel (CSL)
eXploration Camera (Space-X)
CCM (Lusospace, P)
TDM (G5)
Ground segment interactions and responsibilities

- Uplink / downlink
  - G/S Redu (B)
  - G/S Svalbard (N)
  - PI's

- Mission operation centre
  - Flight dynamics
  - Operations planning (incl. Tech demos)
  - S/C operations
  - MOC (Redu, B)

- Science operations centre
  - LYRA/SWAP planning and
  - LYRA/SWAP data processing
  - SOC (ROB, Brussels)

Ground segment: operations automation

- All the nominal spacecraft operations are automated:
  - Satellite/ground station pass prediction and planning
  - Ground and spacecraft pass activities, e.g.:
    - Spacecraft status check
    - Telecommands uplink for the on board scheduler
    - SOC Science request processing (Instrument Operation Sheet)
    - Data extraction and transfer
    - Email generation
- Operator intervention only needed for special requests:
  - e.g. to plan specific test for any demonstration unit
- Based on the use of an automated pass flow (Mission Pass Scheduler)
- All satellite telemetry accessible on-line for display and reporting.
- Internet connection for Svalbard connection, data request and distribution.
Multi-pass prediction system & management

EGSE & Mission Control System (EMCS)
Ground segment: satellite contact activities

Phase 1 – Ground Segment preparation
- Updates files
- BBE configuration

Phase 2 – Ground Segment preparation
- Redu antennas set-up
- Redu-EGSE, TMTC, SCOS
- MDS IOS preparation and pass check

Phase 3 – Contact with satellite
- Acquisition of signal check (AOS)
- RF stability test
- TM stores dump
- OBET check and scheduling activities
- SWAP images download
- Plasma and Techno demo activities

Phase 4 – Loss of contact
- S/C health check
- On board scheduler readback
- Disable RT PKTs
- Switch off uplink

Phase 5 – Data processing
- HK TM playback
- Reports TM and events printouts, graphics, Ops logs
- Payload data extraction
- Data transfer to MDS, Redu and ROB server
- Daily reports
Small S-band terminals: REDU-3 & 4

Base Band Equipment

COTS based BBE (ENERTEC unit from ZODIAC (F))
Thank you for your attention!