Technology-testing Proba-2 opens new eye on the Sun

Packed with novel devices and science instruments, Proba-2 is demonstrating technologies for future ESA missions while providing new views of our Sun. At a press conference on Tuesday at the Royal Observatory of Belgium in Brussels, the team behind the small satellite declared themselves extremely happy with its first three months in orbit and unveiled Proba-2's first solar observations.

Since its launch on 2 November, Proba-2's numerous subsystems have been switched on one by one and their outputs checked. This commissioning process is essential before the mission's working life can begin.

Mission contributions have come from across Europe and Canada, with Belgium as a major participant. It was constructed for ESA by Belgian firm Verhaert Space, part of the QinetiQ group, and the mission is run from ESA's Redu ground station in Belgium.

Proba-2 is the latest in ESA's 'Project for Onboard Autonomy' series and its commissioning is proceeding with a comparatively modest level of ground personnel. "The satellite is sufficiently advanced to oversee itself on a day-to-day basis," said Frank Preud'homme of Verhaert Space.

Stepping stone to the future

The smooth operation of this small satellite – less than a cubic metre – is a stepping stone to ESA missions in the decade ahead. A total of 17 new technologies are being demonstrated aboard Proba-2 before being adopted by full-sized spacecraft, including a new startracker for the BepiColombo Mercury craft and a wide-angle camera for ExoMars and potentially the asteroid-explorer Marco Polo.

"The majority of technology demonstrators on Proba-2 have now been activated and I am happy to see that the first data we receive are very good," commented ESA's Director of Technical and Quality Management, Michel Courtois. "Proba-2 has shown that it can demonstrate technology in orbit."

The satellite runs itself using an advanced computer built by Verhaert Space and running on the ESA-designed LEON2-FT microprocessor. "Proba-2's computer is the most powerful computer for space applications developed in Europe," added Mr Preud'homme. "It has been selected for a number of new ESA missions."

Space weather station

The satellite will do double duty as a technology testbed and science platform. In addition to its experimental payloads, Proba-2 is hosting a quartet of new instruments focused on the Sun and space weather.

“In science terms, Proba-2 is a solar observatory,” said David Southwood, ESA Director of Science and Robotic Exploration. “Its instruments are evolved from those on SOHO, the ESA/NASA full-sized watchdog for solar storms, and are testing detector and software technology required for Solar Orbiter, envisaged as Europe’s next big solar mission.”

The Royal Observatory of Belgium (ROB) has the scientific responsibility for Proba-2’s two solar monitoring instruments. ROB’s David Berghmans described the Sun-imaging SWAP (Sun Watcher using APS detectors and imaging processing) instrument as an exercise in miniaturisation: “It is a full space telescope the size of a wide shoe box. Despite its size, SWAP is very ambitious, designed as a full ‘space weather’ instrument to detect all significant solar events such as solar flares or coronal mass ejections.”

Another ROB team led by Jean-Francois Hochedez oversees the LYRA (Lyman alpha radiometer) instrument which employs robust ultraviolet detectors – some made of diamond – to measure solar radiation.

“Proba-2 again proves the reliability of Belgian space technology and the Proba satellite platform,” said Belgian Science Minister Sabine Laruelle. “Together with the scientists of Brussels’ ‘Space Pole’, I eagerly await the first observations by the state-of-the-art instruments SWAP and LYRA, both made with substantial Belgian contributions.”

Opening a window on the ionosphere

Increasing Proba-2’s value in studying space weather – which can damage satellites, harm unprotected astronauts and affect ground-based electrical infrastructure – the satellite combines solar observation with plasma content monitoring of the space around it, revealing how the Sun’s activity can influence Earth’s ionosphere.

Proba-2 does so through two instruments developed by a consortium of Czech institutions led by the Czech Republic’s Academy of Sciences with an considerable support of Czech Space Research Centre.

Both the Dual Segmented Langmuir Probe (DSLP)and the Thermal Plasma Measurement Unit (TPMU) will probe in detail the satellite’s nearby surroundings. “Our aim is to identify observed ionospheric irregularities with possible solar-terrestrial connections due to sudden space weather events,” said Štepán Štverák of the Czech Institute of Atmospheric Physics, part of the DSLP team. “Preliminary results are very promising.”

Extending the Proba series

Proba-1, launched in October 2001, established the principle of small satellites for technology demonstrations. It included Earth-monitoring instruments which proved so successful that the still-operating mission was subsequently transferred to ESA's Earth Observation Directorate.

Providing frequent, low-cost flight testing opportunities for European industry as part of the Agency's General Support Technology Programme (GSTP), the Proba series is set to continue. Proba-3 will be a double spacecraft to study the solar corona while testing precision formation-flying techniques. Proba-V will house a miniaturised version of the Vegetation sensor currently flying on France's mainstream SPOT-5 satellite.

Note to editors:

LYRA was built by PMOD/WRC (CH) with Centre Spatial de Liège as lead institute and the Royal Observatory of Belgium as Principal Investigator, supported by an international team comprising PMOD (CH), IMOMEC (BE), The Max-Planck-Institut für Sonnensystemforschung (DE), and BISA (BE).

SWAP was developed by Centre Spatial de Liège with the support of the Royal Observatory of Belgium and with an industrial team comprising TAS-ETCA (BE), AMOS SA (BE), DELTATEC (BE), Fill Factory NV (BE) and OIP NV (BE).

TMPU was developed by a Czech consortium, led by the Institute of Atmospheric Physics, Academy of Sciences of the Czech Republic (CZ).

DSLP was developed by the consortium of Astronomical Institute and Institute of Atmospheric Physics, Academy of Sciences of the Czech Republic (CZ), RSSD ESA ESTEC (NL), Czech Space Research Centre (CSRC), Brno (CZ) and SPRINX Systems (CZ).

The technology demonstrations aboard Proba-2 are:

• a new type of lithium-ion battery, developed by SAFT (FR)
• an advanced data and power management system, containing many new component technologies, including the LEON processor developed by Verhaert Space (BE)
• combined carbon-fibre and aluminium structural panels, developed by Apco Technologies SA (CH)
• new models of reaction wheels from Dynacon (CA), startrackers from DTU (DK) and GPS receivers from DLR (DE)
• an upgraded telecommand system with a decoder largely implemented in software by STTSystemTechnik GmbH (DE)

• a digital Sun sensor, developed by TNO (NL)
• a dual-frequency GPS receiver, developed by Alcatel Espace (FR)
• a fibre-sensor system for monitoring temperatures and pressures around the satellite, developed by MPB Communications Inc. (CA)
• a new startracker development being test-flown before use on the BepiColombo mission, developed by Galileo Avionica (IT)
• a very high precision flux-gate magnetometer, developed by DTU (DK)
• a miniature magnetometer developed by Lusospace (PT)
a magnetotorquer for attitude control developed by ZARM Technik AG (DE)
• an experimental solar panel with a solar flux concentrator, developed by CSL (BE)
• a xenon gas propulsion system using resistojet thrusters and a solid-state nitrogen gas generator to pressurise the propellant tanks, developed by SSTL (GB) and Bradford (NL)
• an exploration micro-camera (X-CAM), developed by Micro-cameras & Space Exploration (CH)
• new GNC algorithms developed by NGC (CA)

More information: http://www.esa.int/proba