SPACE EXPLORATION SYMPOSIUM (A3)
Solar System Exploration (5)

Author: Ms. Salma Fahmy
European Space Agency (ESA), The Netherlands

Mr. Giorgio Bagnasco
European Space Agency (ESA), The Netherlands
Dr. Kristin Wirth
European Space Agency (ESA), The Netherlands
Ms. Anne Pacros
European Space Agency (ESA), The Netherlands

SOLAR ORBITER PAYLOAD SUITE: A HOTBED OF INNOVATION

Abstract

Solar Orbiter is ESA's next flagship solar science mission, planned for launch in 2017. It will carry a suite of ten instruments closer to the Sun than any spacecraft has ever been. The payload complement consists of six remote sensing instruments operating at wavelength ranges from visible to X-ray, as well as four in-situ instruments covering all attributes of the interplanetary medium. It will acquire simultaneous spectra and images of the photosphere and corona; images of the photospheric magnetic field and gas velocity as well as measurements of the magnetic field and in-situ plasma properties at the location of the spacecraft.

The challenging nature of the Solar Orbiter mission, along with tough constraints in the area of volume, mass and data rates, have led to a range of innovative design solutions for the payload, involving new technologies never previously used in space. In the thermal and optical domains, heat rejecting windows, limiting the bulk of the solar flux while allowing the wavelength(s) of interest to pass through, are being developed for two instruments. Several multi-layer coatings are also being designed for internal lenses and mirrors. For externally mounted sensors , including three deployable antennas, the harsh thermal environment has also required innovation in the area of thermal design.

For the purpose of polarisation measurements, newly developed Liquid Crystal Variable Retarder technology is being applied and several instruments are also making advances in detector design, including newly designed CdTe X-ray detectors and back-illuminated Extreme UV CMOS detectors. In the data handling domain, a considerable amount of data processing and compression will be performed onboard. To enable this, several new technologies for data handling are being pursued, including the use of dynamically reconfigurable FPGAs.

With the spacecraft and payload development currently approaching Critical Design Review, these design concepts are becoming reality and the qualification of these technologies is underway to demonstrate that they will retain their function throughout the 10 year lifetime of the mission. This paper begins by describing the latest Solar Orbiter payload design, before focussing on each of the major new technologies being employed. These will be described in detail, along with the development and qualification activities being undertaken. Many of our science and exploration missions push the boundary of technology and Solar Orbiter is no exception. The experience and progress made on this mission will be a valuable stepping stone for future solar system exploration missions.