The space weather element of ESA's SSA programme was established to address the increasing risks of solar effects on human technological systems and health. Within its current Period 3, the SSA programme has been extended to include the additional Lagrange (LGR) element, targeted towards the development of an operational space weather mission to the L5 Lagrange point. Under the auspices of LGR, a number of Phase A/B1 studies are well underway; these studies cover the remote-sensing payload, the in-situ payload, and the overall system. Here, we review the status of the Phase A/B1 study of the remote-sensing instrument package, which includes a Photospheric Magnetic Field Imager (PMI), EUV Imager (EUVI), Coronagraph (COR) and Heliospheric Imagery (HI). We will present the instrument designs at Preliminary Requirements Review (PRR), including the instrument control and processing philosophy (in terms of a shared Instrument Processing and Control Unit, IPCU, albeit in conjunction with a dedicated PMI processor); we will also present the progress towards defining the baseline architecture for the End-to-End simulator for the whole instrument package.

Building on Extensive European Heritage in Scientific Instrumentation.

- A European consortium with extensive scientific and technical expertise, and heritage, in solar and heliospheric instrumentation...
- ...on ESA, joint ESA/NASA and NASA missions such as SOHO, Proba-2, STEREO, SDO and Solar Orbiter.
- A suite of instruments that, combined, will image the photosphere, chromosphere/inner corona, outer corona and heliosphere to 1 AU.

**Consortium members**
- RAL: STFC-RAL Space, UK (J. Davies/R. Torabi/M. Caldwell) : Consortium Prime
- ADS: Airbus Defence and Space, Germany (B. Oexl)
- CSL: Centre Spatial de Liège, Belgium (C. Kintziger)
- DMU: Deimos Space UK Ltd, UK (R. Wright)
- DMAR: Deimos Space S.R.L., Romania (I. Groza)
- PMOD: Physikalisch-Meteorologisches Observatorium/World Radiation Center, Switzerland (M. Gyo)
- MPS: Max-Planck-Institut für Sonnensystemforschung, Germany (J. Staub)
- OHB: OHB System AG, Germany (E. Gubbini)
- RDA: Research & Development in Aerospace, Switzerland (J. Barbosa)
- ROB: Royal Observatory of Belgium, Belgium (M. West)
- UGOE: Georg-August-Universität Göttingen Stiftung Öffentlichen Rechts, Germany (G. Kuchner)
- UKMO: Met Office, UK (M. Gibbs) - requirements oversight

**IPCU : Instrument Processing and Control Unit**

To provide control, commanding and telemetry, power interface from IC and distribution to instruments, digital processing, mechanism control, thermal control.

- IPU lead : ADS
- Concept: single IPU for package additional processing unit for PMI)

**G&F: Ground and Flight Operations**

Support definition of operations concept/flight operations ground segment requirements/high-level architecture/protoype architecture for E2E Mission Performance Simulator : interaction with instrument definition/design tasks.

- G&F lead : DMU, G&F partners : DMR, RDA
- Concept : Standard approach built on Space Science E2E Mission Simulator Performance Reference.
- Status : Standard tailored to required high-level architecture and modules defined. Working on the specifics for each instrument.

**PMI : Photospheric Magnetic Field Imager**

Monitoring (in visible light) magnetic activity on the Sun; provides input to the background solar wind to model CME arrival at Earth. L5 view enables such monitoring of that part of the solar disk yet to rotate towards Earth.

- PMI lead : MPS, PMI partner : OHB
- Heritage : PHI on Solar Orbiter
- Concept : optically-modified version of HRT of PHI on Solar Orbiter.
- Products : vector magnetograms (B, v, γ), line-of-sight velocities (vLOS) and continuum mapping (Ic)
- FoV : full disk + alignment margin (depends on pointing)
- Spatial resolution : 2.2 arcsec
- Cadence : 30 min

**EUVI : Extreme Ultraviolet Imager**

Monitoring evolving activity of the chromosphere/low corona including filaments/prominences and coronal holes. L5 view enables such monitoring of that part of the solar disk yet to rotate towards Earth.

- EUVI leads : CSL/RoB, EUVI partner : PMOD
- Heritage : SWAP on Proba-2, ESIO study
- Concept : combines SWAP optical layout/ESIO thermo-mechanical concept
- Products : three bands centred on Fe XIII 193Å, He II 304Å, Fe VIII 131Å
- FoV : 4.2 x 6.1 arcmin (extended towards Earth)
- Spatial resolution : 3.2 arcsec
- Cadence : <5 min (wavelength dependent)

**HI : Heliospheric Imager**

EARliest definitive confirmation of CME launch, and tracking of early CME trajectory (in visible light); basis of CME parameterisation for most CME arrival predictions

- HI lead : RAL, HI partner : UGOE
- Heritage : HI on STEREO
- Concept : optically-modified STEREO HI instrument
- FoV (elliptical extent) : 4 – 70° elongation
- HI-1 : 30° FoV, boresite 19°
- HI-2 : 50° FoV, boresite 25°
- Spatial resolution : 1.5 arcmin (HI-1), 0.6 arcmin (HI-2)
- Cadence : 30 min (both cameras)

**COR : Coronagraph**

Earliest definitive confirmation of CME launch, and tracking of early CME trajectory (in visible light); basis of CME parameterisation for most CME arrival predictions.

- COR lead : RAL, COR partner : UGOE
- Heritage : HI on STEREO, SCOPE study
- Concept : SCOPE instrument
- FoV (radial) : 2.5 – 25 Rsun
- FoV (azimuthal) : 360°
- Spatial resolution : <2 arcmin
- Cadence : <5 min

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