

Current Developments in Space Instrumentation at RAL Space

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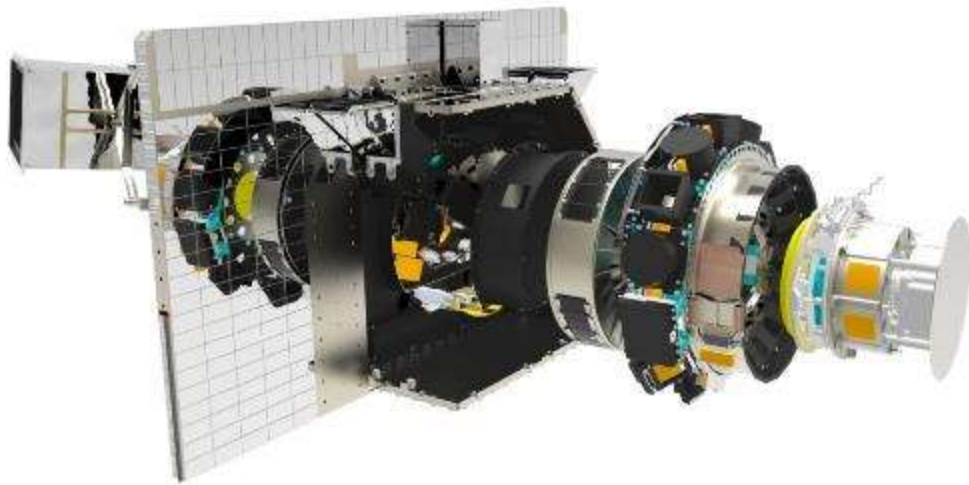
Solar Orbiter – SPICE



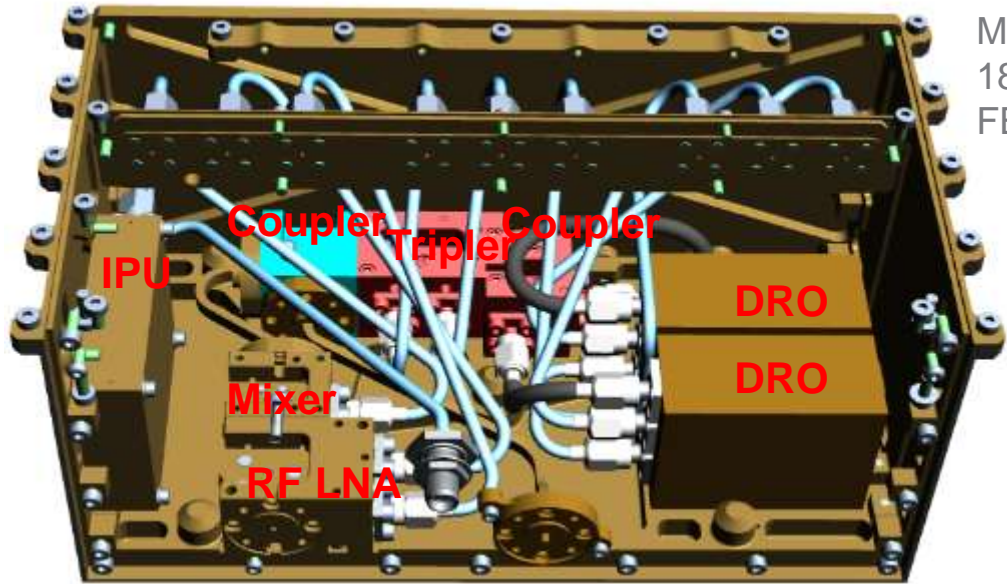
- Designed and built by RAL Space led international collaboration for ESA, as facility instrument for Solar Orbiter
- Extreme UV (50 – 100 nm wavelengths) Imaging Spectrometer with challenging thermal, radiation and straylight environments and state-of-the-art performance
- Flight Model integrated to spacecraft at Airbus Stevenage last week
- SPICE will take new spectral images of the sun, to help SoO explore the corona, and answer questions such as “what is the origin of the solar wind?” and “how does the Sun affect the heliosphere near the Earth?”

EarthCare – BBR

- Broad-Band Radiometer for EarthCare mission – in partnership with TAS UK and ESR Technologies
- Measurement of reflected solar flux and emitted IR from top of atmosphere to assist in characterisation of link between clouds and aerosols and thermal budget
- Three views and three channels between 0.25 and 50 mm plus on-board and solar calibrators
- Flight model in calibration following completion of environmental test

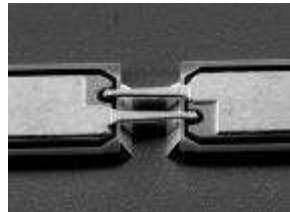
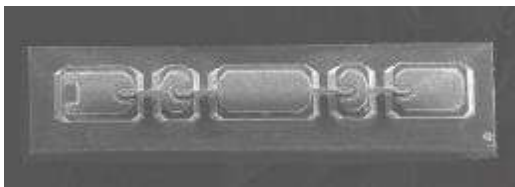
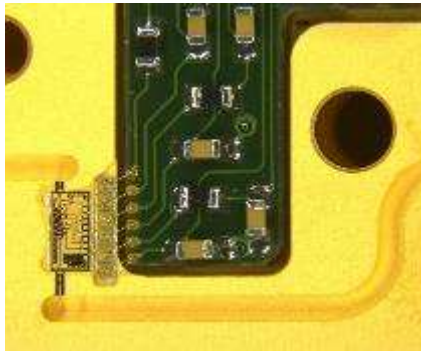


MetOp SG - Receivers



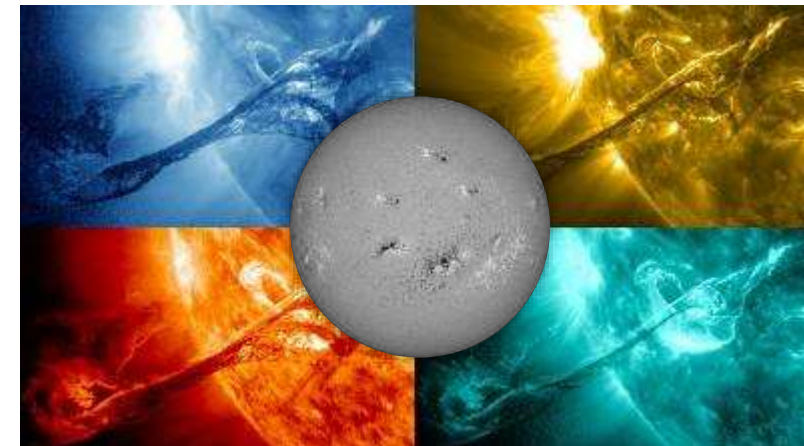
MWS
183GHz
FERX

- Next generation platform for Operational Meteorology
- Two-satellite configuration with first launches in 2021
- RAL leading a team to supply 55 sets of Front End Receiver (FERX) hardware to all three mm-wave instruments: MWS (Airbus UK), MWI (Airbus Fr), ICI (Radiometer Physics GmbH)
- State-of-the-art performance of components. Working from 114 – 325 GHz
- Flight qualification underway
- Components on display at exhibition stand

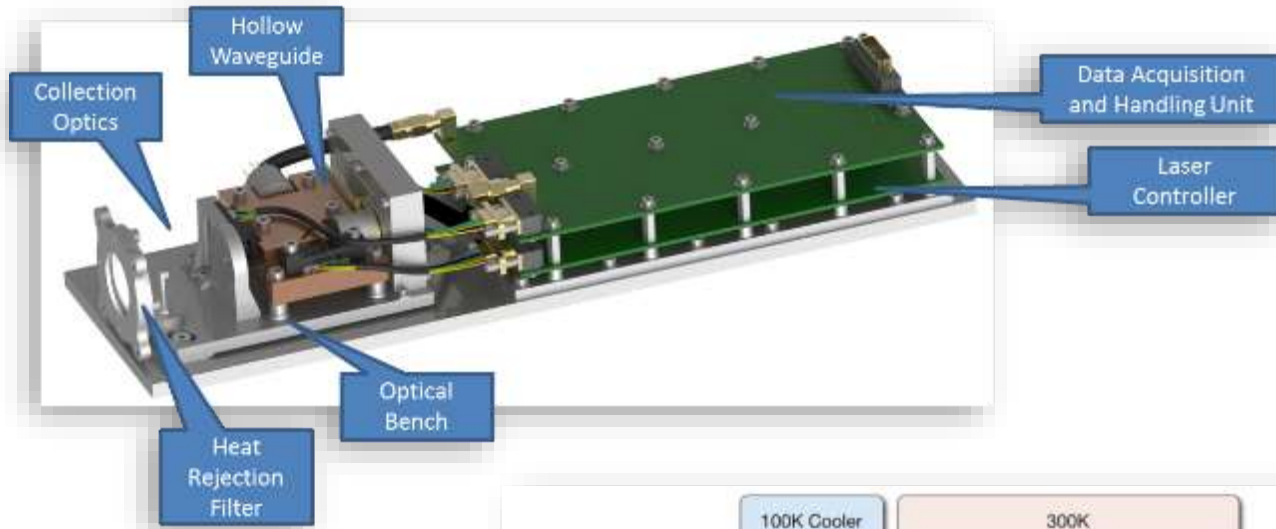


Space Weather Instrumentation

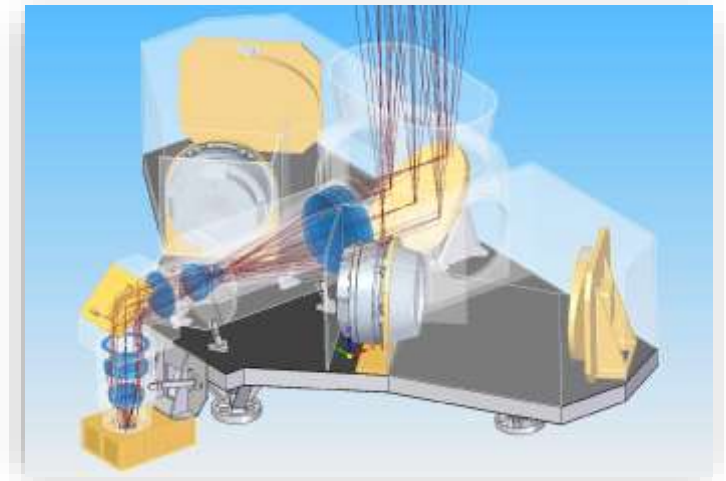
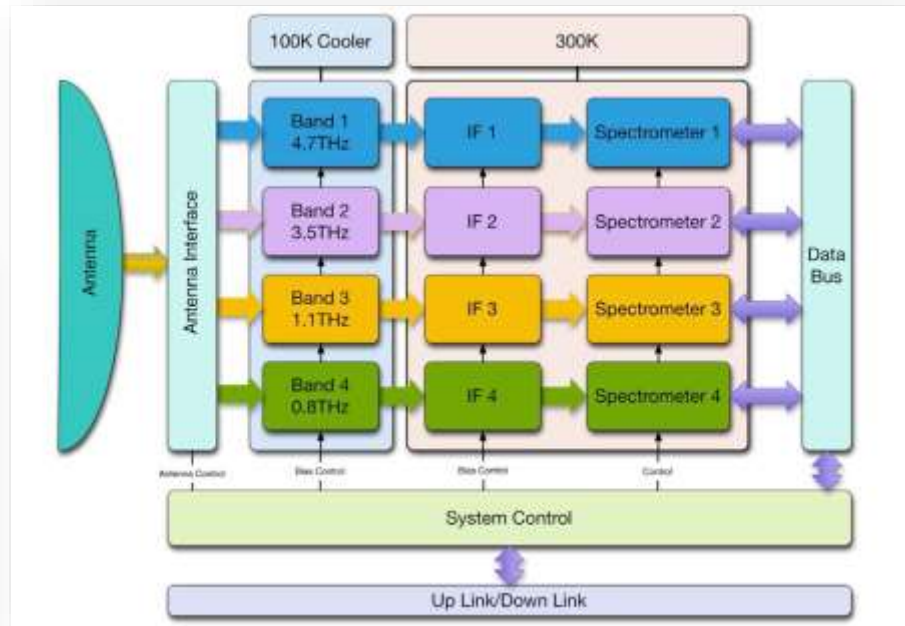
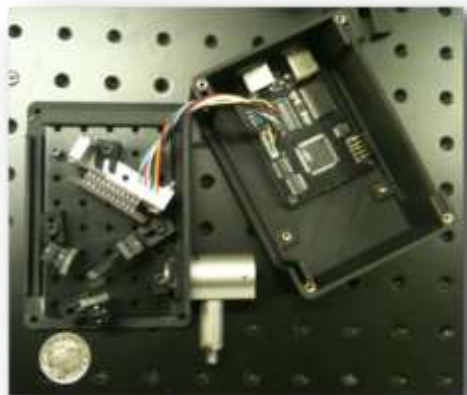
- Leading the European consortium that is designing the SCOPE (Solar Coronagraph for OPERations) instrument.
- Developing follow-on Heliospheric Imager from STEREO-HI heritage.
- Detector systems for the STEREO/EUV imagers, SDO/AIA and HMI, and for the SUVI instrument on the new GOES-16 satellite.



Novel EO Instrumentation

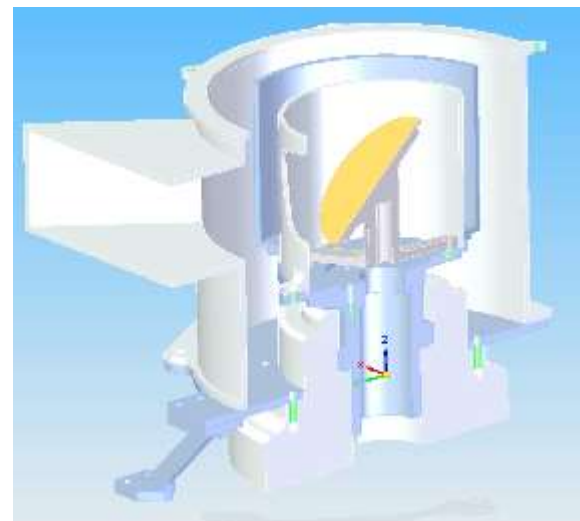


- Through CEOI and other routes are developing various novel EO instrumentation concepts:
 - MISO
 - LOCUS
 - Micro-FTS
 - Thermal IR Instruments



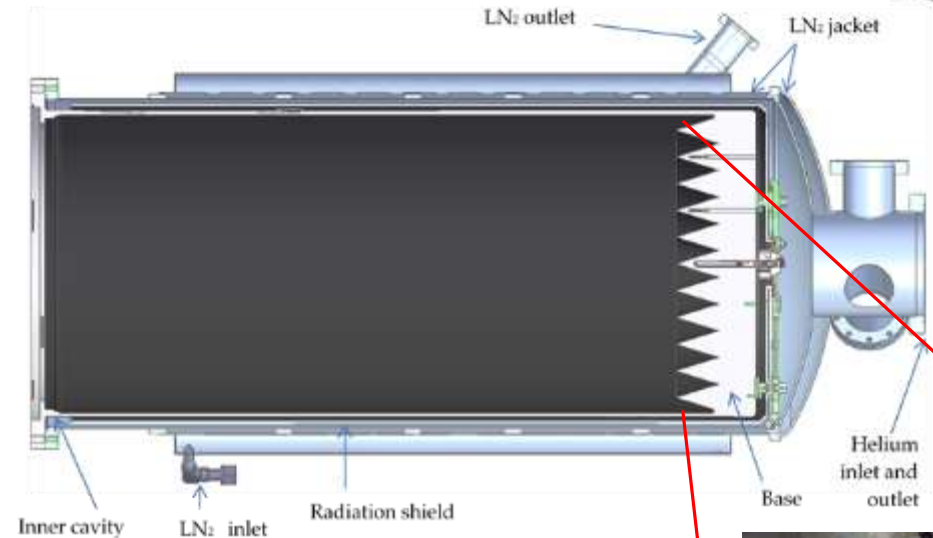
In-flight Calibration Targets

- Building flight calibration systems for Sentinel-3 SLSTR
- Developments:
 - Advanced next generation integrated thermometry solutions for flight blackbody monitoring and control
 - Demonstrate application of Vantablack® on large area flight black body and measurements of performance enhancement
 - Development of high uniformity and stability White Light Sources for future carbon monitoring missions



Ground Calibration Systems

- In addition to building ground calibration systems for own instrumentation also partner with industry to support their programs
- MTG: 5 targets for two instruments (FCI and IRS) for continuous meteorological data from 2021 onwards.
- MetOp: OGSE and calibration targets for MWS and MWI instruments
- All require accurate thermal control via electronic systems, heaters, harnesses, and cryogenic supply systems.



Temp range	100 K – 370 K
Operational environment	294 K \pm 5 K
Temperature gradients	20 mK between channels 10 mK within channels
Temporal stability	10 mK over 10s 25 mK over 24 hours
Heating & Cooling rates	100 – 390 K in 2 hours 390 – 100 K in 7.5 hours
Cavity Dimensions	Length: 1000 mm Diameter: 432.85 mm Aperture: 386.75 mm



Current and Future Facilities



- To be supplied on Tues 30th after checking for Purdue restrictions...