



## The Earth Clouds, Aerosol and Radiation Explorer (EarthCARE)

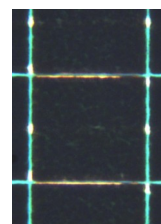
EarthCARE is a major combined European Space Agency (ESA) and Japan Aerospace Exploration Agency (JAXA) satellite programme, and with a mission cost in excess of £500M it is one of the world's most significant space programmes.

### SEA

The science instruments on board EarthCARE are a Broadband Radiometer (BBR) that will provide images of the Earth from space with multiple viewing angles and unprecedented precision from the ultra-violet through the visible spectrum and out to the mid-infrared, an Atmospheric Lidar (ATLID), a multi-spectral imager (MSI) and a Cloud Profiling Radar (CPR). SEA is Prime Contractor for the BBR and associated instrument Control Unit (ICU). SEA is also supplying the MSI ICU, the ATLID Control & Data Management Unit (ACDM) and the CPR flip mirror .



EarthCARE satellite



Detector Surface

### Detectors

With the requirement to image the Earth from 0.2 $\mu$ m to 50 $\mu$ m wavelengths the detectors are a key item in the development programme. The custom MEMS-based bolometer array incorporates a specially developed 'gold black' coating which ensures a uniform response over the complete spectral range. MEMS technology has enabled the miniaturisation of bolometric detectors in order to achieve the custom area array format required for the measurements. Performance of the detector array and the special coating processes have been demonstrated and the qualification model programme is nearing completion.



BBR life-test rig

### Long-life mechanisms

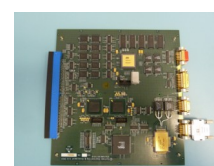
Detector performance is further improved by a well known 'chopping' technique which exposes the detector alternately to the scene and to a controlled temperature background. This requires a mechanism that will run in the vacuum of Space for more than 600 million revolutions without stopping and this requires a special 'dry lubricated' bearing technology that has to be demonstrated through an accelerated life test. The life test replicates all aspects of ground handling, launch and in orbit operations using identical electronics and control laws to those that will actually fly. Having completed the initial stages including vibration testing the life test is in its final phase.



BBR Telescope Interior

### BBR Telescope

Other key elements of the BBR instrument include the Telescope Assembly and Structure and the Instrument Control Unit (ICU) which provides the interface to the satellite, controls the mechanisms and interfaces with the detector and focal plane electronics. Following board-level testing and hardware/software integration, the BBR Engineering Model integration has been fully assembled for the start of unit level testing with the platform interface simulators.



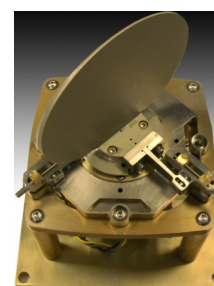
ICU Processor Board

### BBR instrument Control Unit (ICU)

The BBR ICU incorporates the radiation hardened LEON 2 processor together with several bespoke FPGA developments, designed and developed in compliance with the new ECSS-Q-60 standard.

### Atmospheric Lidar and Multi Spectral Imager

SEA's specialism in high integrity electronics has enabled it to also become the supplier for instrument electronics for both the ATLID and MSI instruments. Each of these instruments has very specific requirements to ensure that maximum performance is achieved and SEA is able to provide a custom solution for each instrument whilst leveraging the benefits of a common processing architecture, power conversion and conditioning. The MSI ICU and ATLID ACDM have completed PDR with preparations underway for the build of the Engineering Models.



CPR flip mirror assembly

### Cloud Profiling Radar

The Cloud Profiling Radar CPR itself is being developed by JAXA. SEA is providing the flip mirror mechanism and Quasi Optic Front End (QOFE) electronics. Following completion of the functional model testing the Qualification Model testing programme has commenced.