



Joint NCEO-CEOI Science Conference

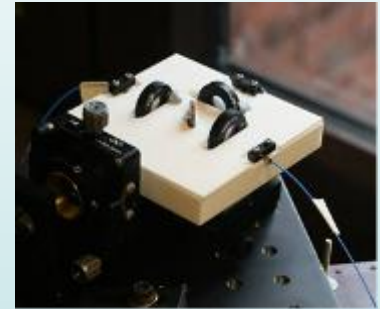
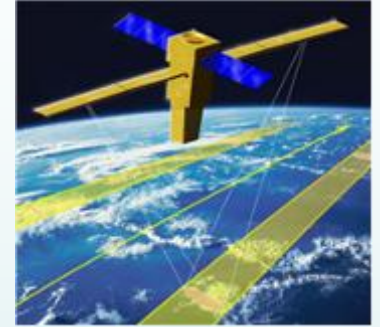
**Observing the Earth:
Technology, Industry and Growth**

Mick Johnson, CEOI Director

The Future for EO

A challenge and an opportunity:

- Increased demands on the mission, spacecraft and sensors
- Payload complexity is increasing
- Costs are being driven down
- Commercial EO services are growing fast
- Launch cost is a major driver



What capability does the UK have?

- EO science strongly supported through NCEO
- National/industry led EO programme:
 - SSTL DMC missions, TechDemoSat, NovaSAR
- On-going UK support to ESA EO programmes
 - Earth Observation Envelope Programme (EOEP)
 - MetOp Second Generation
 - GMES – Sentinel 1, 3 and 5PC
- Development of advanced instrument through Centre for EO Instrumentation (CEOI)

What is the CEOI?

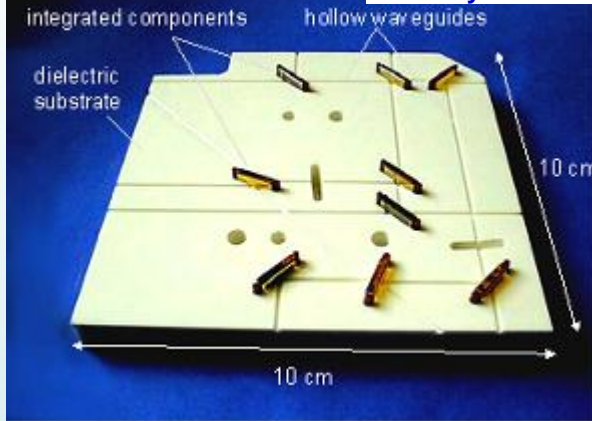
- UK Space Agency initiative ‘to boost UK capability and remain at the forefront of EO technology for space’.
- Launched in 2007, long term programme
 - Parallel investment from Government and industry
- Programme focus on:
 - development of new EO instrumentation and technologies
 - horizon scanning and knowledge exchange
 - building highly capable academia/industry partnerships
 - training for next generation scientists and technologists
- CEOI is a partnership led by Astrium with QinetiQ, STFC/RAL and University of Leicester



CEOI Technology developments

LIDAR technologies in 1.5-2.5 μm range for CO₂ measurement

Courtesy QinetiQ



Integrated Optics
Hollow Waveguide

QinetiQ with Uni. of
Leicester and CTCD

Courtesy SSTL



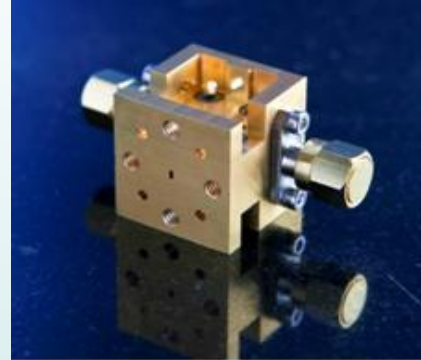
Spectrometers and detectors
in UV/Vis/NIR for atmospheric
composition measurement

Univ. of
Leicester
with SSTL
and Astrum

STFC/RAL
with Astrum

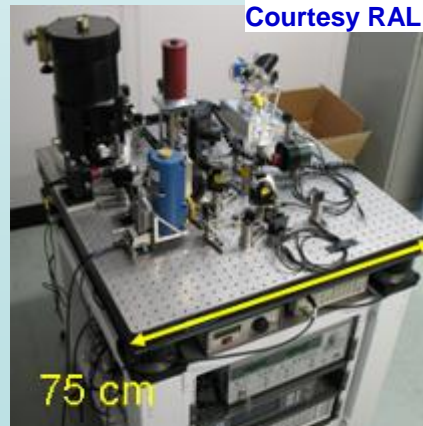
Millimetre wave radiometric
sounding of the atmosphere

STFC/RAL with Astrum and QUB



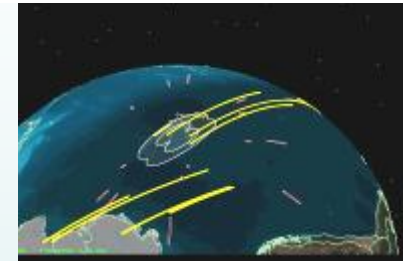
SHIRM 360 GHz image
separator mixer using Schottky
diode technology

Courtesy RAL



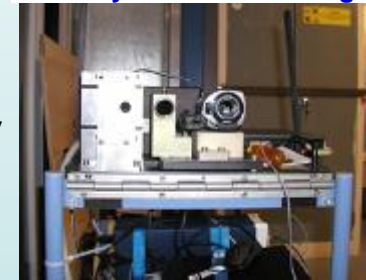
Laser heterodyne sounding
in 4-150 μm range

GNSS Reflectometry



SSTL with NOCS, Univ. of
Surrey & Univ. of Bath

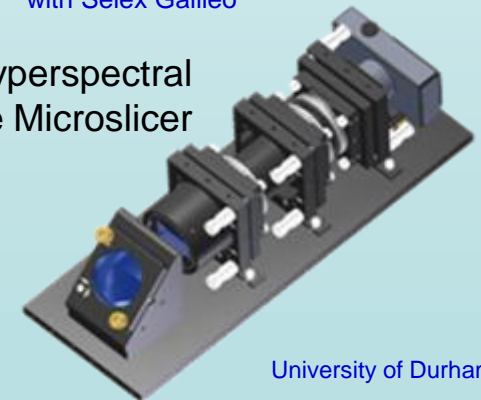
Courtesy Univ. of Edinburgh



Multispectral
Canopy
LiDAR

Univ. of Edinburgh
with Selex Galileo

Hyperspectral
Image Microslicer



University of Durham



ANNUAL REPORT 2011/12

Version 1.0

CEOI Leadership Team
September 2012



Version 1.0



Developing New Technologies to Observe the Earth from Space

With a vision to develop and strengthen UK expertise and capabilities in EO instruments, the Centre for EO Instrumentation is helping to position the UK to win leading roles in future international space programmes. The CEOI was created in 2007 as a result of joint support from the Natural Environment Research Council (NERC), the Technology Strategy Board (TSB) and industry, with the aim to develop key capabilities through the teaming of scientists and industrialists. The CEOI is set-up as a partnership led by Astrium together with the University of Leicester, STFC/Rutherford Appleton Laboratory and QinetiQ. From April 2011 CEOI is funded by the UK Space Agency.



There is significant evidence that man's industrial and other activities are modifying our environment by changing the composition of the atmosphere through emissions of carbon dioxide and other greenhouse gases and through changing land use. Satellite instruments are essential tools to improve our understanding of the processes driving the climate, to provide a health check and to monitor the changes to the environment in which we live. The Centre supports projects to design and build new instruments used in observing the Earth from space.

Technology Programme

The main activity is the development of new EO instruments and technologies, which includes projects carried out by the CEOI partners and those selected through a series of Open Calls. These are held around once per year, resulting in participation of many industrial and academic groups throughout the UK. In all the CEOI has funded development of more than 30 projects, through a series of major developments and through smaller 'seedcorn' projects, described in the centre pages. The CEOI provides support to project teams through the knowledge exchange programme to identify potential spin-out into non-space applications. In the 5 years since its inception the CEOI has made great progress in technology developments and in improving the cohesion of the UK EO community.

Horizon Scanning

The Centre has held a series of Challenge Workshops to bring together technologists and scientists to identify future priorities for Earth observation instrumentation. The CEOI has developed a close relationship with the National Centre for Earth Observation (NCEO), whose scientists play a key role in the success of the Challenge Workshops, resulting in a list of indicative high priority UK EO missions. In total the CEOI has held 17 Challenge Workshops and more than 250 scientists and technologists have attended.

Leveraged Funding

In addition to and often as a direct result of the CEOI funded projects, teams have won funding from a variety of sources, increasing the overall investment by a factor of two. In total around £5M in additional funding has been secured over the period April 2007 to March 2012 i.e. around £1M pa.

In addition SSTL has secured a 10 M€ project from ESA, following a CEOI funded technology project, to develop the short wave IR instrument for the Sentinel 5 Pre-cursor mission.

The picture right shows the Minister for Universities and Science, David Willetts at the University of Leicester with the CityScan project, which uses CEOI developed optical technology in a ground based instrument to monitor air quality over an extended volume.



ESA's EOEP is Europe's flagship programme in EO

- Primary objectives:
 - Pursuit of scientific knowledge
 - Enhancement of quality of life
 - Development of an independent capability for Europe
 - Promotion of a European industry of innovation and value added services
- Main components of EOEP:
 - Earth Explorer missions
 - Development and Exploitation
 - Ground segment and mission operation
 - Mission exploitation

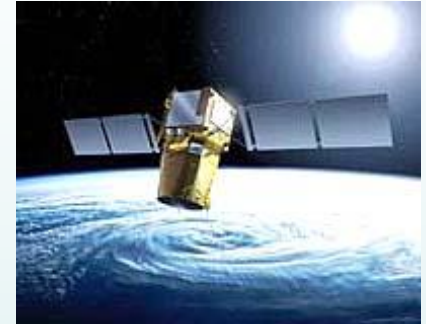
Industrial benefits of EOEP

EO science mission industrial activities:

- Aeolus prime contractor (Astrium)
- Ion engine on GOCE (QinetiQ)
- Platforms (3) for SWARM & EarthCare (Astrium)
- Instruments on EarthCare (SSTL & SEA)
- And many other sub-systems and equipments

Preparation for future missions:

- EE7: BIOMASS, PREMIER and CoReH2O
- EE8: CarbonSat and FLEX
- Operational: MetOp-SG and Sentinels



- EOEP will ‘contribute directly to maintaining and utilising a strong EO base at the forefront of global Earth observation science, engineering and technology’

