

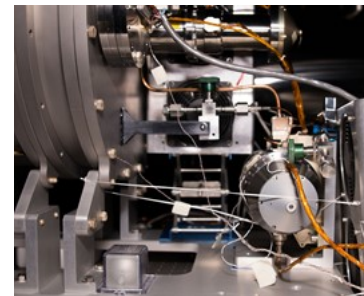
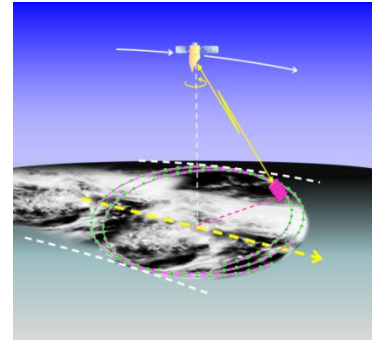


EO and Remote Sensing Next Generation Technologies

Mick Johnson
Director of CEOI

What is the CEOI?

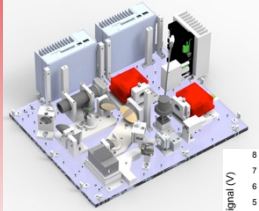
- UK Space Agency initiative to strengthen UK EO technology capability, with enhanced breadth and depth
 - Funds innovative technologies for global EO mission opportunities
 - Supports developments for commercial exploitation opportunities
 - Create new UK jobs and economic growth through leverage of investment in EO
 - Parallel industry investment, total approx £2-3M pa
- CEOI Programme focus on:
 - development of new EO instrumentation and technologies, taking EO technologies to higher TRL
 - horizon scanning and knowledge exchange
 - building highly capable academia/industry partnerships
 - Liaison with ESA
- Partnership led by Airbus with QinetiQ, STFC/RAL and University of Leicester



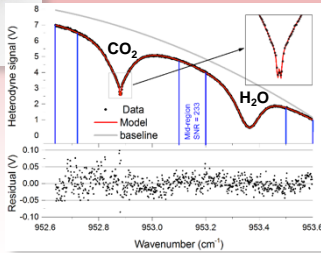
Recent CEOI developments (non-exhaustive)



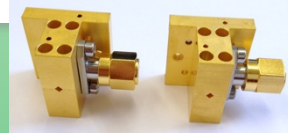
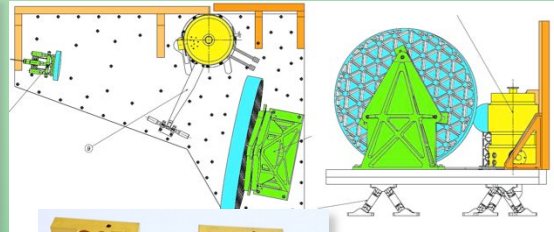
LIDAR & Laser Heterodyne Radiometry (LHR)



LHR Field Deployment
RAL Space

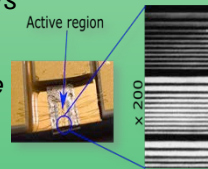


Sub-millimetre & THz technology



Supra-THz Mixers
RAL & Leeds

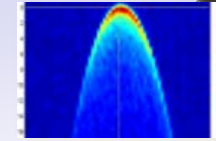
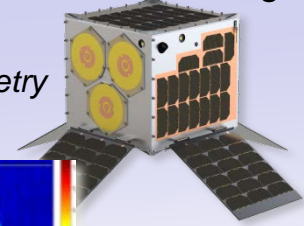
THz Quantum Cascade Lasers
Leeds



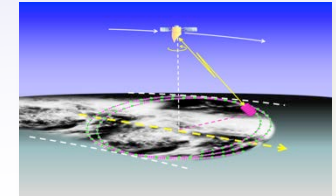
LOCUS
RAL/Leeds

Microwave technologies

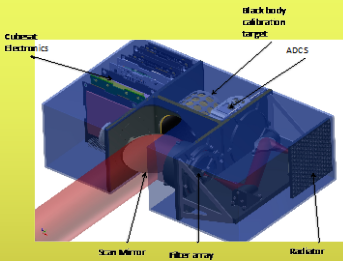
GNSS Reflectometry
SSTL



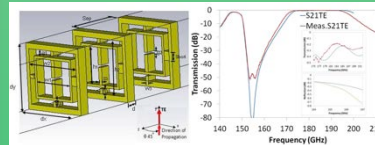
94GHz Wind/Rain Radar
Reading/RAL



Spectroscopy

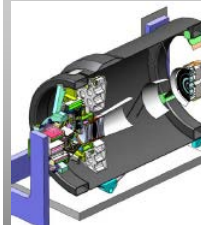


IR Radiometry (Cubesat)
U. Oxford

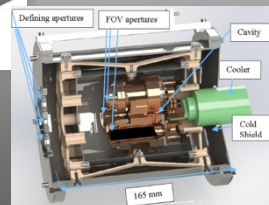


Frequency Selective Surfaces
QUB

Optical instrumentation

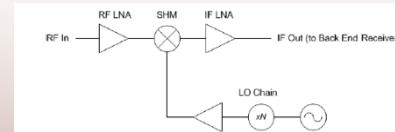


Hi-Res Imaging & Video
SSTL

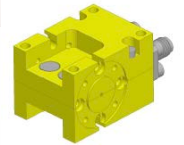


TRUTHS
National Physical Laboratory

mm-Wave receivers
RAL Space



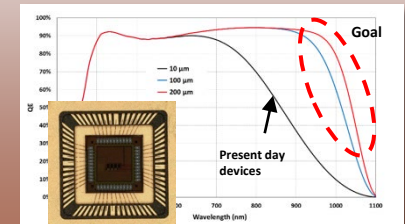
MWS-LNA229



GHOST
U. Edinburgh
STFC ATC



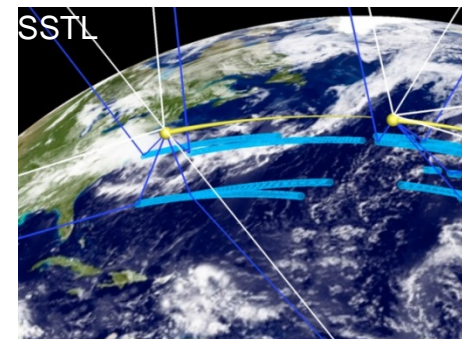
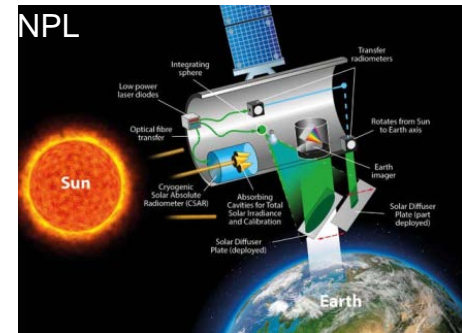
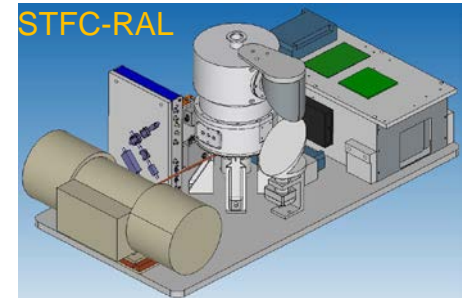
Detectors
Teledyne E2V



Developing technologies for future EO missions



- UV/visible high resolution spectrometer
 - CompAQS instrument for air quality
- Advanced millimetre wave and TeraHz technologies
 - Microwave Sounder (MWS) for MetOp-2G
 - Development of LOCUS mission and technologies
- Climate and GHG Monitoring
 - In-orbit SI-traceable calibration (TRUTHS)
 - Technologies for CNES bilateral (MicroCarb)
- Advanced Radar Systems and Missions
 - Ocean currents and global winds
- GNSS reflectometry for sea surface winds
- Low cost EO imaging systems



CEOI Technology Calls



Call No.	Call Value	UKSA Fin Year	Type	Call Timescale	No. of projects	Project Timescale
EO-10	£2.4M	2016/17	Open Call	Dec 16 - Feb 17	7 Fast Track, 9 Pathfinder 2 Airborne	KO Mar-May 17 Complete by Jul 18
EO-11a	£0.25M	2017/18	ESA EE10 Mission Concept development	Sep-Oct 2017	~5 Pathfinder	KO Dec 17 Complete by Mar 18
EO-11b	£3.3M	2017/18 and 2018/19	Technology Push to raise TRL	Nov-Dec 2017	~6 Flagship	KO Feb-Mar 18 Complete by Mar 20
EO-12	£2M	2019/20	Open Call	Oct-Dec 2019	8 Fast Track, 8 Pathfinder	KO Jan-Mar 20 Complete by Mar 21
EO-13	£2M	2020/21	Technology Push to raise TRL	Apr-Jun 2020	3 Flagship	KO Jul-Sep 20 Complete by Jun 22

CEOI 10th Call – Flagship Projects

Raising TRL through airborne demonstrations



Project No.	Project Title	Lead
EO10-FSA-001	SPIDER Proof-of-Concept Campaign	Airbus Defence and Space Limited
<p>SPIDER (Ship Position and Detection Radar) is an innovative radar payload based on COTS components, with significantly reduced power consumption, downlink data-rates and antenna size, resulting in a lightweight highly efficient instrument. The project will complete with an airborne proof-of-concept demonstration.</p>		
EO10-FSA-005	Demonstrating Multi-View Spectroscopy for Greenhouse Gas Remote Sensing	University of Leicester
<p>The project will use airborne demonstrations of technologies for the proposed Tropical Carbon Mission to firmly establish the GHOST instrument technology at TRL 6 and raise to SRL 5 the multi-view spectroscopy CO₂ measurement technique, in preparation for a future ESA EE-10 competition.</p>		
<p>Project Partners: UK ATC, RAL Space, University of Edinburgh</p>		

CEOI 10th Call - Fast Track Projects



	Project Title	Lead
EO10-FT-001	A New Generation of Deployable Optical Systems to Increase Small Satellite Capability	Surrey Space Centre, Univ. Surrey
EO10-FT-002	SEASTAR+: enhancing the mission concept	National Oceanography Centre
EO10-FT-003	Stabilisation of 3.5 THz quantum-cascade laser local oscillators	University of Leeds
EO10-FT-005	HYMS (HYper-spectral Microwave Sounder): Novel and Critical Component Development and System Bread-boarding	STFC RAL Space
EO10-FT-010	SuperRes-EO: Super-resolution for high resolution EO imaging for targeted and global applications	MSSL
EO10-FT-019	Proton radiation testing of Leonardo large format MCT arrays	Leonardo MW Ltd
EO10-FT-021	HYMAS – Filterbank spectrometers for HYperspectral Microwave Atmospheric Sounding	Cardiff University

CEOI 10th Call – Pathfinder Projects



	Project Title	Lead
EO10-PF-003	MEMS-based spectrometers for ultra-miniature space-borne hyperspectral remote sounders	STFC RAL Space
EO10-PF-006	Freeform Gratings for Ultra-compact Spectrograph Designs	Durham University
EO10-PF-008	Calibration and pointing capabilities of a CubeSat based radiometer	University of Oxford
EO10-PF-010	Onboard Data Autonomy for Next Generation of EO Nanosatellites	Craft Prospect Ltd
EO10-PF-012	New Electronic Switching Arrangement for mm-wave Radiometer Calibration	Queen's University Belfast
EO10-PF-013	Hyperspectral High Resolution Thermal Imager	STFC RAL Space
EO10-PF-014	High Performance Pyroelectric Detectors for Space-Based Instruments	Leonardo MW Ltd
EO10-PF-019	Smart optics for Satellite Applications	University of Oxford
EO10-PF-021	Feasibility of Passive Bistatic Geosynchronous Radar using Comsats	Cranfield University

CEOI-11th Call



Instrument technology development for future commercial, export or operational missions

- Proposals for flagship projects to advance world-leading UK EO technologies for future operational or commercial missions, with a particular interest in technologies for export.
- Must identify viable flight opportunity in the short to medium-term,
- Total Grant awards of up to £3.3M total
- ITT release in early Nov 17; Closing date ~19 Dec 17;
- Selection Jan 18, projects start from March 2018
- Project Duration 18-24m (March 2020 latest completion)

- Proposals will need to be aligned to the EO Technology Strategy, to be issued in early November.

EO Technology Strategy - Aims

- To develop innovative new technologies for Earth observation
- To ensure that UK entities are prepared and competitive in global commercial, institutional and science markets
- To assist EO space sector to contribute substantially to economic growth, job creation and societal benefit.

EO Technology Strategy – Objectives

- **Economic Impact:** Develop EO technologies which lead to increased exports, jobs and economic growth
- **Innovation:** Support new and innovative ideas that offer tangible benefit to future missions
- **Capability:** Strengthen capability where the UK already leads, can build a lead in a new area or can overtake existing capability elsewhere
- **Return on ESA Investment:** Maximise the benefit from the UK funding to ESA and other institutional bodies

@CEOI_Space



Centre for EO Instrumentation



CEOI
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CEOI, a UKSA programme, funds development of innovative Earth Observation satellite instrumentation technologies, supporting the UK's world-leading position.

United Kingdom ceoi.ac.uk

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ESA EarthObservation

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SatApps Catapult @SatAppsCatapult



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CEOI @CEOI_Space · 13 Sep

CEOI workshop article about wide range of future applications for Autonomous #RemoteSensing systems. #SPIENewsroom spie.org/newsroom/ceoi...

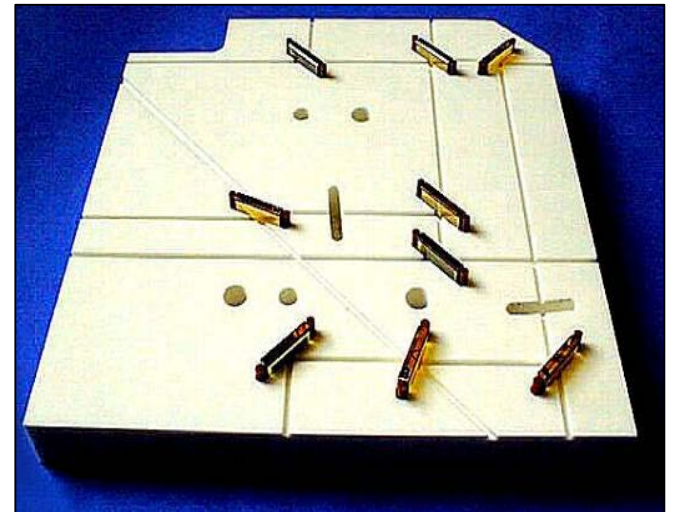
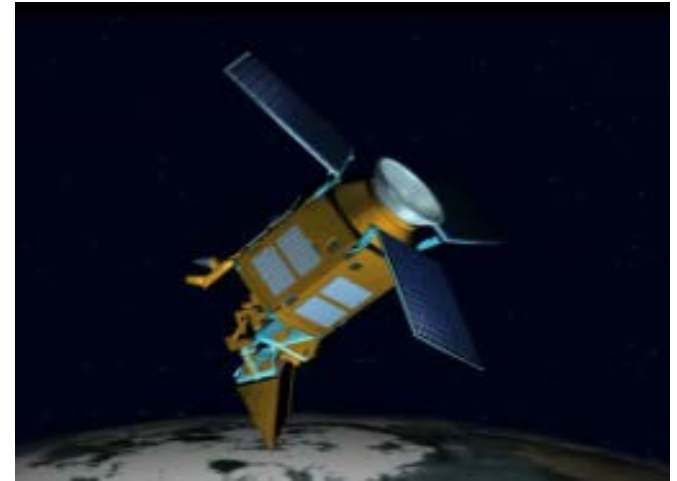


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Conclusion



- CEOI projects developing advanced, lower-cost, compact EO payloads.
- Great opportunities to exploit UK upstream and downstream capability
- CEOI and our programme is there to support UK EO instrument teams
- Next funding call released soon!
- Contact
 - mick.johnson@airbus.com
 - ceoi.ac.uk
 - [@CEOI_Space](https://twitter.com/CEOI_Space)



EO Technology Posters



Presenter	Organisation	PosterTitle
Daniel Gerber/ Brian Moyna	STFC RAL Space	THz Earth Observation (The LOCUS Mission)
Konstantin Stefanov	The Open University	Novel CMOS image sensor with high quantum efficiency
Manju Henry	STFC RAL SPACE	HYper-Spectral Microwave Sounder (HYMS): Novel & Critical Component Development & System Breadboarding
Martin Crook	STFC RAL Space	Low Cost Active Cooling for Space Applications
Raymond Dickie	Queen's University Belfast	Advances in Frequency Selective Surface Technology for Remote Sensing Radiometers
Alexander Valavanis	University of Leeds	Stabilisation of 3.5 THz quantum-cascade laser local oscillators using Schottky diode technology
Yvonne Munro	Airbus DS Ltd	A Maritime Radar for Zephyr S
Neil Bowles	University of Oxford	The Compact Infrared Imager and Radiometer - CubeSat based

EO Technology Elevator Pitches



Presenter	Organisation	Pitch Title
Prof Martin Booth	University of Oxford	Smart optics for satellite based telescopes
Berend Winters	MSSL-UCL	Advanced Manufacturing Techniques for Lightweight Optical Components
Steve Greenland	Craft Prospect Ltd	Increasing mission return through onboard data autonomy in EO nanosatellites
Kyle Palmer	Airbus DS Ltd	Near real-time processing system: handling SAR images
Yu Tao	MSSL-UCL	Super-resolution for high resolution EO imaging for targeted and global applications
Charles Cranstoun	SSTL	Low Cost EO Imaging
Yvonne Munro	Airbus DS Ltd	SPIDER (Ship Position and Detection Radar)
Neil Humpage	University of Leicester	Demonstrating Multi-View Spectroscopy for Greenhouse Gas Remote Sensing
Damien Weidmann	STFC RAL space	Augmenting the nadir atmospheric observing infrastructure with microsatellite-based high-performance miniaturized spectrometers
Martin Townend	TAS UK Ltd	OmniSat-HAPI project for air quality monitoring