



UK EO Technology Development

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Scope

- UK Space Agency EO
- EO Technology Strategy
- Centre for Earth Observation Instrumentation (CEOI)
- Current missions
- National Space Innovation Programme (NSIP)
- Summary
- Questions

UK Space Agency Earth Observation

New Era and New
Opportunities

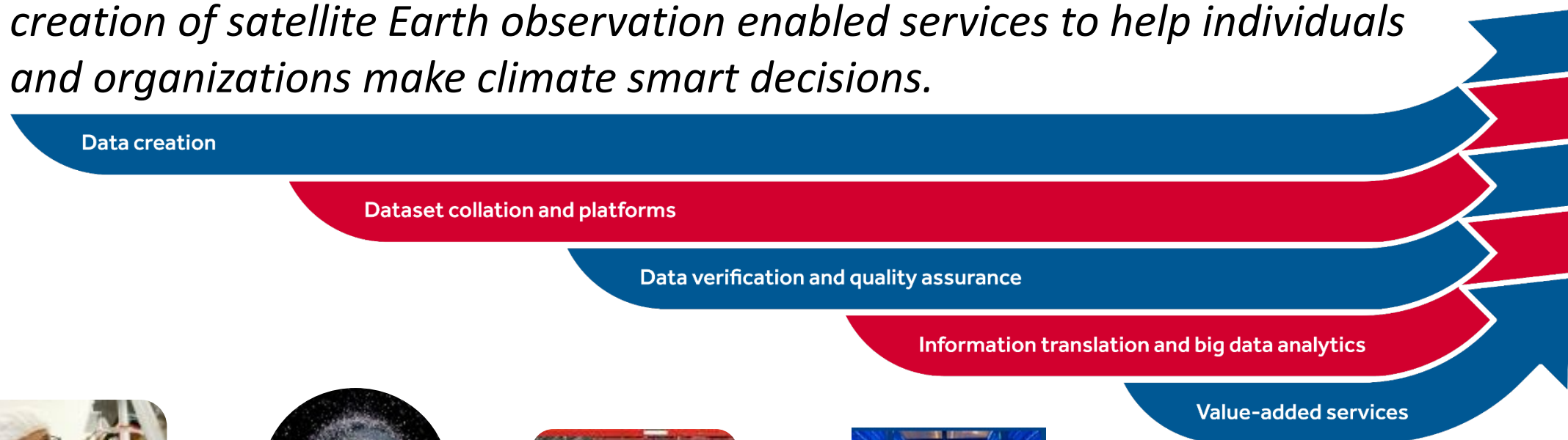
Space Data and Growth

National Space Strategy



Earth Observation

UK Space Agency (UKSA) supports the entire value chain underpinning the creation of satellite Earth observation enabled services to help individuals and organizations make climate smart decisions.



Research and Development



Operations



Data & Ground Segment



Data processing

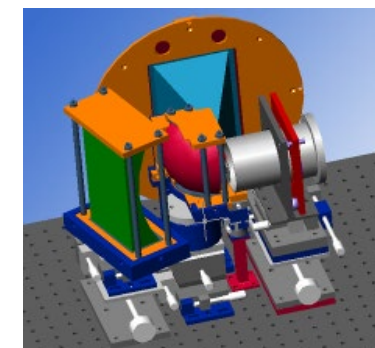
EO Technology Strategy

- Our 10-year vision is for the UK to become a world leader in new Earth Observation (EO) technologies
- The UK EO Technology Strategy will support the UK Space Agency in future investment decisions in EO technology
- The strategy helps to ensure that the UK targets its investment, where there is added value and market trends
- Technology themes:
 - RADAR/SAR
 - Passive microwave
 - Optical video/imaging
 - Optical Spectroscopy
 - IR Imaging
 - IR Radiometry
 - IR Spectroscopy
 - LIDAR
 - RADAR Altimetry
 - UV Spectroscopy
 - Quantum Technologies



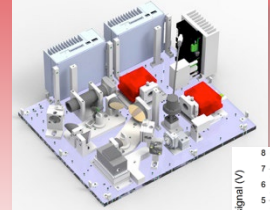
Centre for Earth Observation Instrumentation (CEOI)

- CEOI is a UKSA-funded consortium of industrial and academic EO specialists
- CEOI oversees a Research and Development (R&D) grant programme which, with parallel investment from industry and academia, funds novel EO instrumentation projects to raise Technology Readiness Levels (TRL) to a level that allows contribution to major EO missions
- CEOI recently kicked off projects funded through the 14th Call
 - Technology development:
 - Detectors (IR, THz)
 - Multi-cell calibration source
 - UV-TIR Filters
 - Local Oscillators (THz)
 - Scintillator

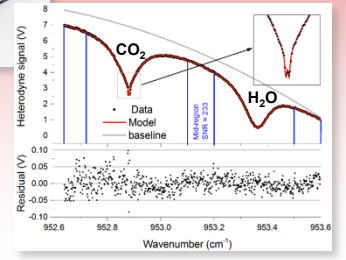


Recent CEOI developments (non-exhaustive)

LIDAR & Laser Heterodyne Radiometry (LHR)

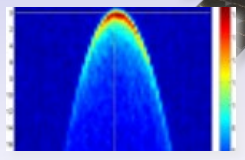
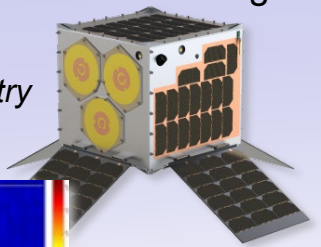


LHR Field Deployment
RAL Space

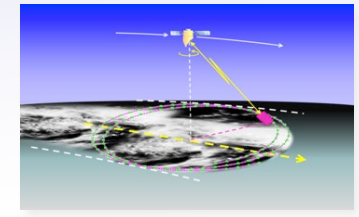


Microwave technologies

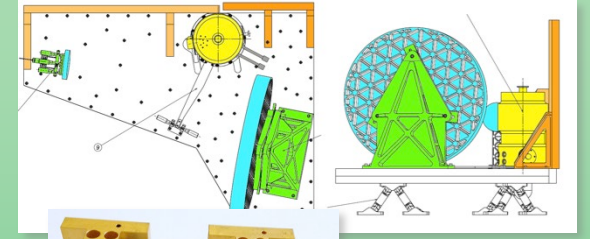
GNSS Reflectometry
SSTL



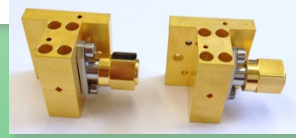
94GHz Wind/Rain Radar
Reading/RAL



Sub-millimetre & THz technology

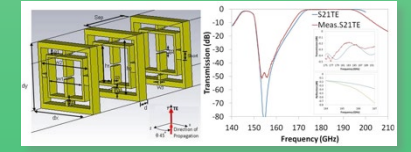
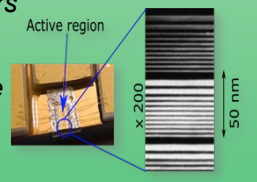


LOCUS
RAL/Leeds



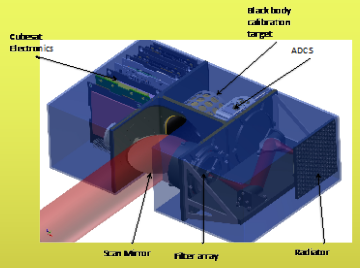
Supra-THz Mixers
RAL & Leeds

THz Quantum Cascade Lasers
Leeds



Frequency Selective Surfaces
QUB

Spectroscopy



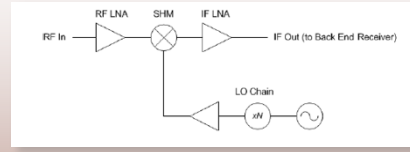
IR Radiometry (Cubesat)
U. Oxford

GHOST
U. Edinburgh
STFC ATC

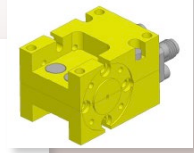


mm-Wave receivers

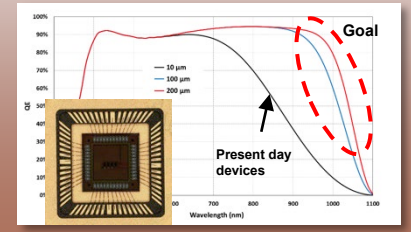
RAL Space



MWS-LNA229

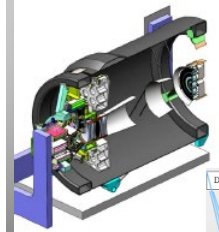


Detectors
Teledyne E2V

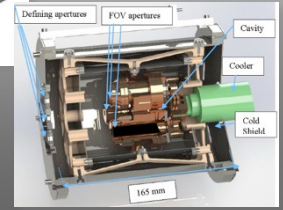


Optical instrumentation

Hi-Res Imaging & Video
SSTL



TRUTHS
National Physical Laboratory

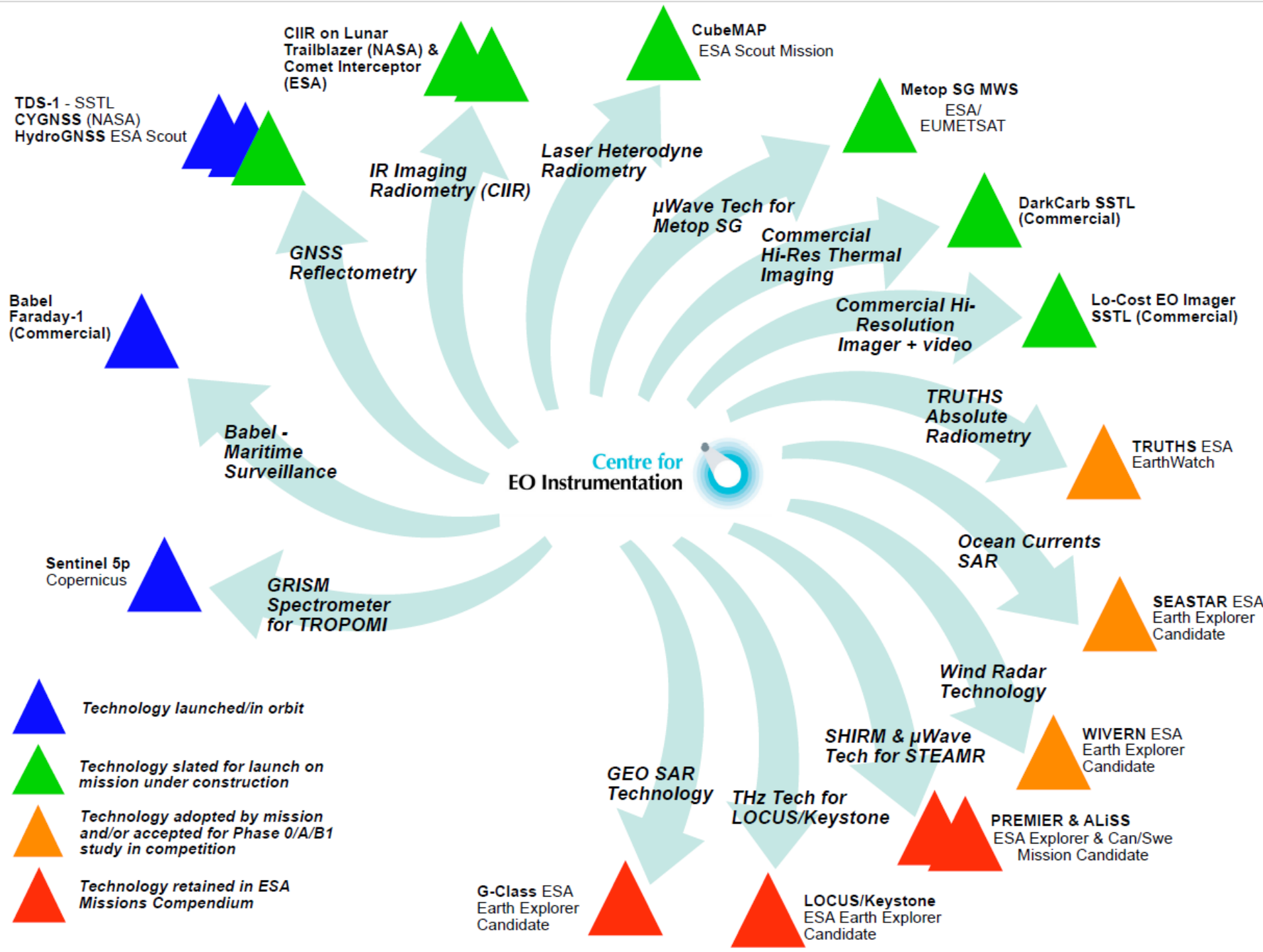


Centre for Earth Observation Instrumentation (CEOI)

- Alongside grant distribution and project support, CEOI also delivers a community building '**Added Value**' programme, which promotes close working relationships and knowledge transfer between academia and industry
 - This includes holding events such as:
 - an annual national EO conference; providing advice and guidance to projects teams on technology development and commercialisation;
 - supporting UK companies to make the best case possible when pursuing a role in EO missions

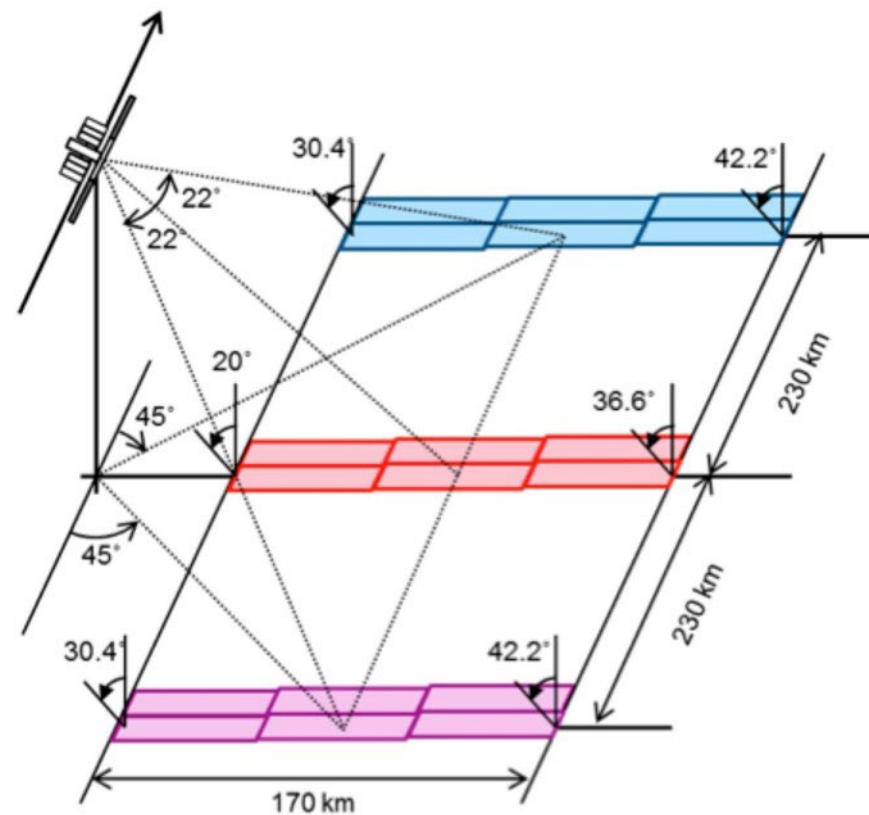


Technology project impact



Ocean Currents, Wind & Waves: SEASTAR

- With support from CEOI and UKSA, the National Oceanography Centre (NOC) is developing a mission named SEASTAR to measure currents and winds from space with unprecedented accuracy and resolution
- The SEASTAR instrument is a new type of radar imager that senses the motion of the ocean surface in three directions from Doppler frequency shifts
- This unique design developed in partnership with Airbus makes it possible to measure current speed, current direction, wind speed and wind direction simultaneously, from space, for the first time
- SEASTAR has been selected by the European Space Agency as one of four mission candidates for Preliminary (Phase 0) study for Earth Explorer 11

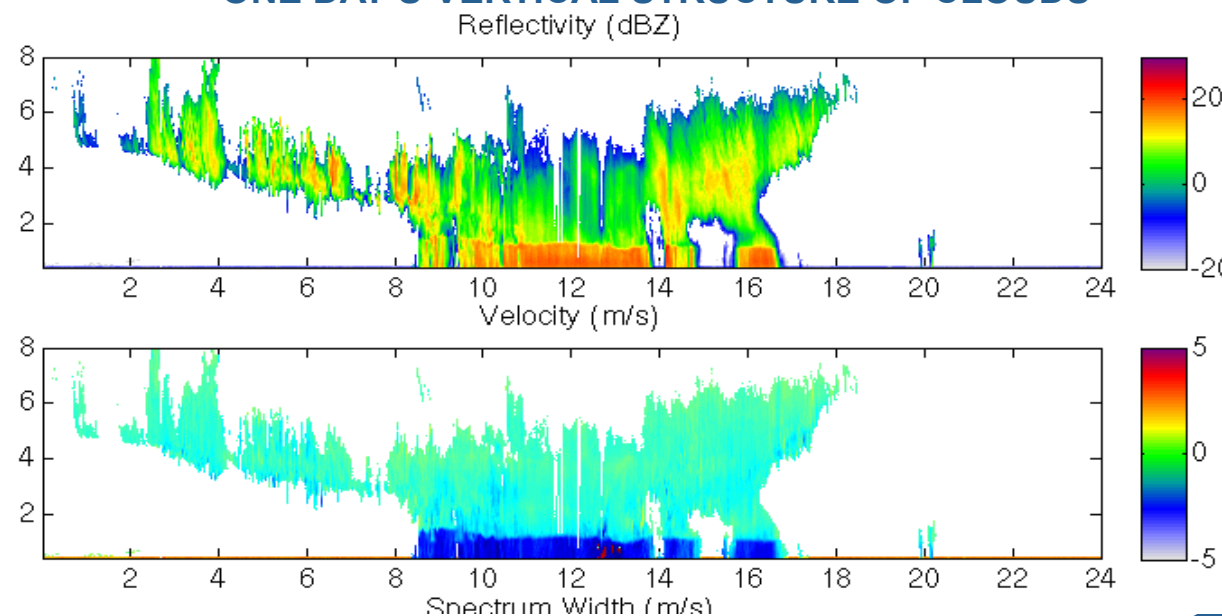


Measuring Wind & Rain in the Atmosphere: WIVERN

- The CEOI and UKSA have been supporting the University of Reading's wind and rain project, which has developed a narrow beam 94GHz radar which will measure wind speeds within clouds and rainfall
- This radar is operating at the Science and Technology Facilities Council (STFC) Chilbolton observatory in Hampshire looking upwards and gathering data on passing weather systems
- It is proposed to deploy a version of this radar on a spacecraft using a large conically scanning antenna. This concept is known as WIVERN
- The WIVERN mission has been selected by ESA for Preliminary (Phase 0) study, which means that the concept will be developed further with a view to a future spaceflight but will be competing with other missions also under study



ONE DAY'S VERTICAL STRUCTURE OF CLOUDS

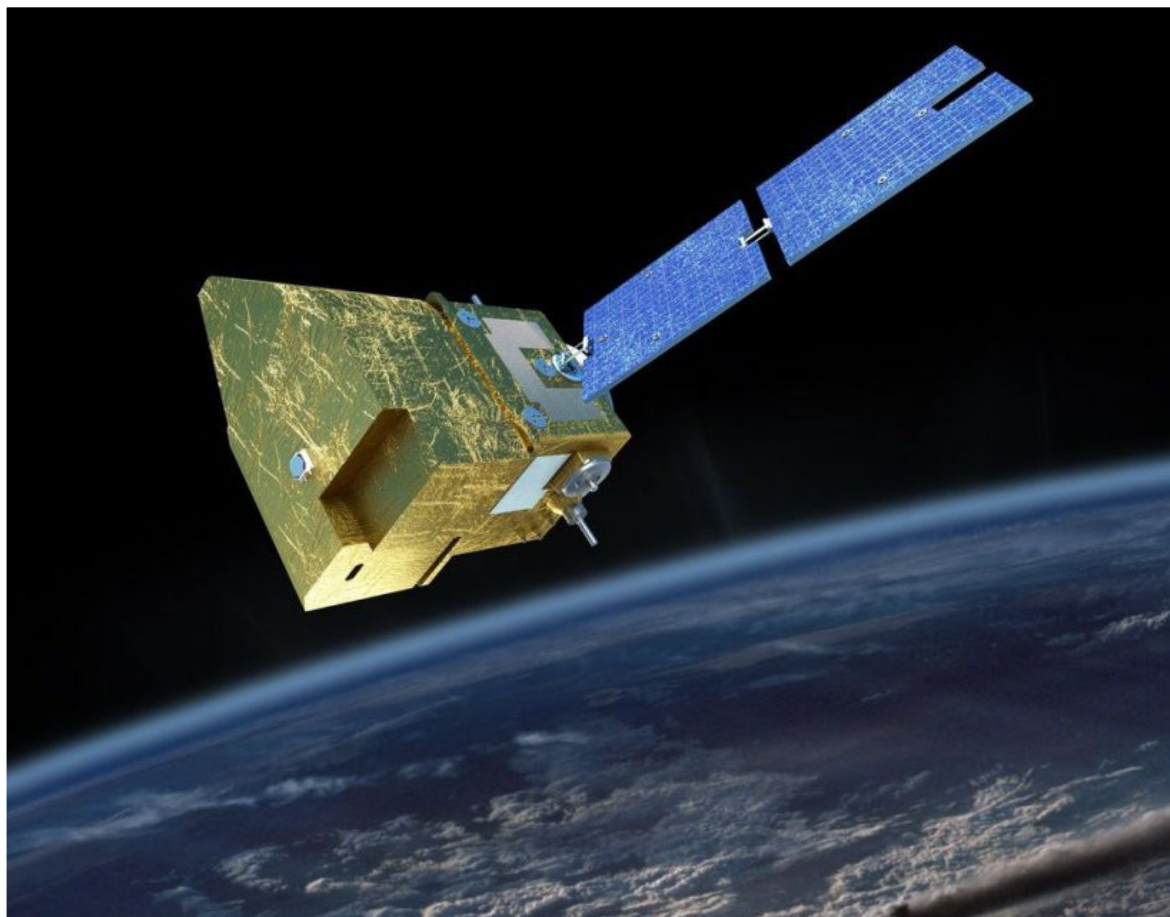


TRUTHS (Traceable Radiometry Underpinning Terrestrial- and Helio-Studies)



- UK led ESA mission
- Monitoring Climate Change
- ‘climate and calibration observatory in space’ which will reduce uncertainty in the Earth observing data
- Confidence in data and reducing uncertainties
- Now in detailed design phase

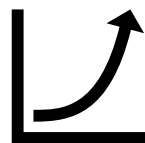
MicroCarb



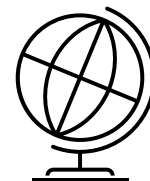
- New implementation arrangement signed at COP26
- Monitor for climate action
- First European satellite measuring CO₂
- Synergies exploiting EO data
- Will translate atmospheric CO₂ observation into maps

National Space Innovation Programme (NSIP)

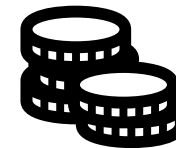
- Created in 2020 to support the development of innovative space projects
 - Novel
 - Solve meaningful problems
 - Create value
- It supports projects that may be high risk but have the potential for high returns and a clear target market
- EO Projects include:
 - Development of Novel High Resolution Infrared Sensor (Global Satellite Vu)
 - TreeView: Precision Forestry to Tackle Climate Change (The Open University)
 - High resolution thermal infrared space telescopes for globally monitoring the energy efficiency of buildings (University of Cambridge)
 - **Global Lidar Altimetry MISsion: GLAMIS (University of Edinburgh)**
 - Hyperspectral Microwave Sounder Constellation of Nanosatellites for Climate change And Mitigation (STFC RAL Space)
 - GHGWatch (Geospatial Insight)



Supporting growth in UK space sector



Global competition



Dedicated funding

Summary

- EO is a priority and a growth area for the UK
- Highlights some of the UK's EO technology development programmes ensuring the long-term resilient supply of data and skills needed for economic growth, science discovery and addressing climate change
- CEOI demonstrates how small scale investments over time have developed and are now visible in a number of missions presented across LPS 2022

Questions

