Science and Technology Facilities Council

STFC External Innovations CLASP Programme

Dr Wendy Carr
wendy.carr@stfc.ac.uk

28th September 2021

Challenge Led Applied Systems Programme CLASP

- Supports the application and commercialisation of core STFC research areas in four key global research challenge areas

- Energy
- Environment
- Healthcare
- Security

The call runs yearly focussing on 2 of the challenge areas which rotate.
Projects should aim to help address societal challenges currently facing these sectors that will benefit the UK

- Scope of the challenge areas are broad:
  - Specific challenges facing the Home Office and DEFRA
  - Government "Areas of Research Interest"
  - Other Security/Environment challenge areas

Home Office

Department for Environment Food & Rural Affairs

UKRI Science and Technology Facilities Council

More information available at: https://stfc.ukri.org/funding/stfc-knowledge-exchange/challenge-led-applied-systems-programme/

CLASP

- De-risking of R&D processes through industry development of technology demonstrators and industry read prototype systems TRL 3 upwards towards commercialisation
- Themes suggested but not dictated allowing flexibility when developing projects
- Project duration up to a maximum of 36 months
- Industry support is advised
- No limit on the amount of funding requested but the total budget is £2million and we aim to fund a number of projects through the scheme

Science and Technology Facilities Council

More information available at: https://stfc.ukri.org/funding/stfc-knowledge-exchange/challenge-led-applied-systems-programme/

CLASP - Eligibility

- Proposals must clearly demonstrate the underlying science/technology behind the project originated from the STFC core Science Programme (Nuclear Physics, Particle Physics, Astrophysics, Space Science, Accelerator Science, or computing in support of these), or at the STFC facilities, CERN, ESO or ESRF is also welcome.

- The lead applicant on any CLASP project should currently or previously be funded through the core STFC science programme (see above) or be a member of STFC staff. Applicants must also meet the UKRI eligibility criteria defined in the Research Grants Handbook.STFC employees working at the national laboratories are fully eligible to apply

- The lead Research Organisation (RO) must be eligible to hold UKRI grants; i.e. be an approved UK Higher Education Institution (HEI), Research Council Institute (RCI) or Independent Research Organisation (IRO) eligible for UKRI funding. Full details of approved RCIs and IROs can be found on the UKRI website.

- Organisations not eligible to hold UKRI grants, such as industry, research/training organisations and not-for-profit operations etc. must apply in collaboration with a lead academic partner and demonstrate that they possess the relevant technical capabilities and capacity to meet the scheme's objectives. These collaborators are expected to be **Project Partners** – donating funds or aid in-kind to a project.

UKRI Science and Technology Facilities Council

More information available at: https://stfc.ukri.org/funding/stfc-knowledge-exchange/challenge-led-applied-systems-programme/

CLASP - Capital

- Capital/Equipment
  - Funding is available please speak to us if you would like to apply for capital as we operate a first come first served policy.
  - Any equipment requested should follow standard STFC guidelines

Science and Technology Facilities Council

More information available at: https://stfc.ukri.org/funding/stfc-knowledge-exchange/challenge-led-applied-systems-programme/

CLASP – Application Process

- Stage 1 Outline Application
  - Assessed by our panel of experts on the following criteria –
    - Technical Excellence
    - Impact on the Challenge area
    - Relevance to the scheme

  - Successful applications move to the Full Stage. Help to work up proposal from the Panel who act as mentors

- Stage 2 Full Application
  - External Peer Review and PI response
  - Panel assessment
    - Scientific and technical merit
    - Societal impact
    - Economic impact
    - Added value

Science and Technology Facilities Council

More information available at: https://stfc.ukri.org/funding/stfc-knowledge-exchange/challenge-led-applied-systems-programme/

STFC Knowledge Exchange Showcase Event 2022

Talks include:

- UKRI Commercialisation Tony Soteriou/Alex Chaix (UKRI)
- STFC's Knowledge Exchange Opportunities Wendy Carr (STFC) Isabella Panovic (STFC)
- CLASP Challenges Areas facing the Security and Environment sectors (Home Office and DEFRA)
- "Accelerated Contraband Identification by Diffraction (ACID)" Matthew Wilson, (STFC, RAL Tech)
- "Novel Gyro-TWA Amplifier for High Power mm-wave Radar Remote Sensing" Adrian Cross (University of Strathclyde)
- KEC Fellowships Theresa Harrison and Don Pollacco (University of Warwick)
- Q&A with speakers and Panel Chairs

- **Event will be held at Royal College of Physicians on 16th November**
- **Whilst the event will be "in-person" it will also be live-streamed for anyone unable to attend**
- **To register please visit:**

  https://www.eventbrite.co.uk/e/stfc-knowledge-exchange-2022-tickets-159403049813

UKRI Science and Technology Facilities Council

Innovations club is a network of people from Industry, Academia, and Government etc. interested in Knowledge exchange and Innovation from STFC.

- **Aims to celebrate Innovation and Commercialisation from STFC research, and connecting the community together**
- Provides a platform for networking between the STFC community, industry, wider academia and other third-sector organisations
- Regular updates on current and upcoming funding opportunities from STFC and wider partners
- Invitation to STFC's Annual Networking and Showcase Event
- Events, workshops, and symposia focused around knowledge exchange
- Bi-monthly newsletter featuring new projects, case studies, and upcoming engagement activities/events
- Series of monthly webinars (free to attend) with different themes

Science and Technology Facilities Council

Please visit https://stfc.ukri.org/innovation/events-and-innovations-club/ for more information or Google "STFC innovations club"

UKRI Science and Technology Facilities Council

Thank you

Science and Technology Facilities Council @STFC_matters Science and Technology Facilities Council

Science and Technology Facilities Council

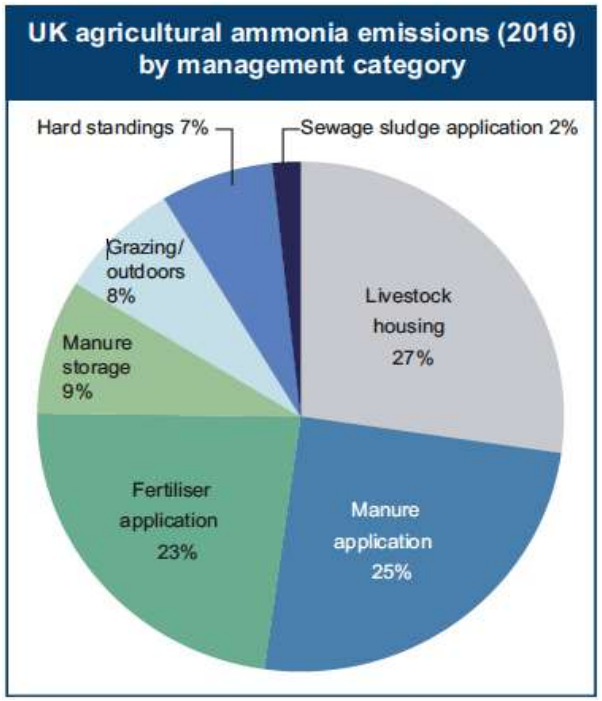
RAL Space

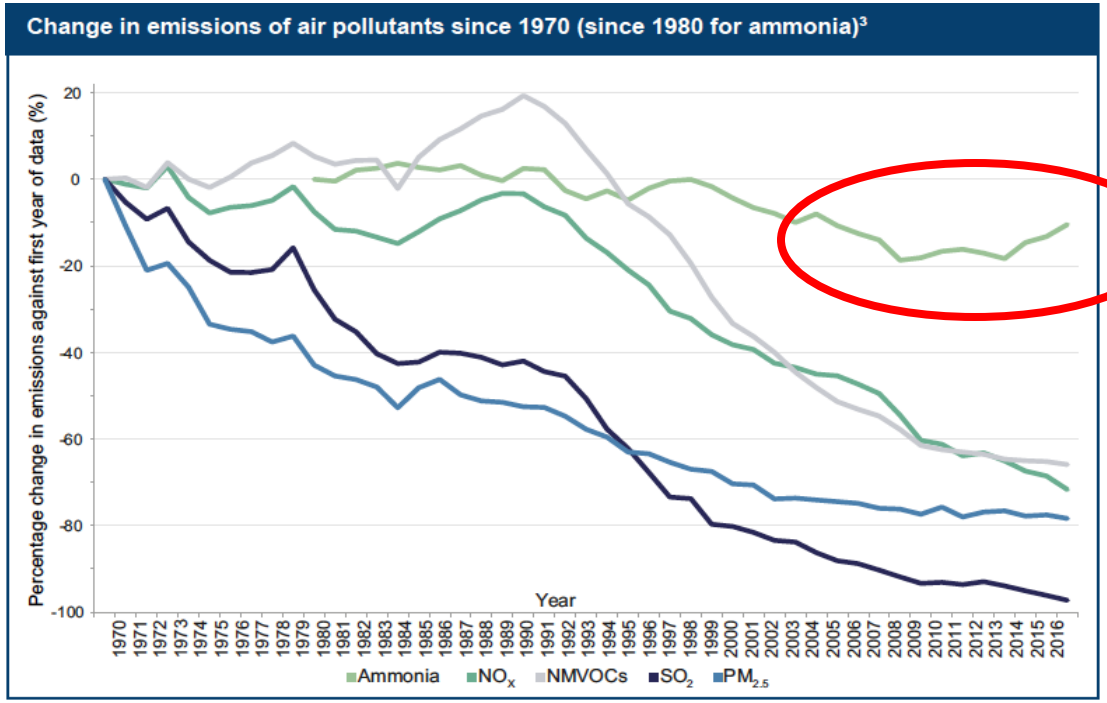
Example CLASP Project

Prototype Radiometer for Ammonia Monitoring – PRAM

Motivation

- Ammonia (NH_3) is a major air pollutant
- 90% of the emission comes from agriculture
- It's the only pollutant we haven't managed to mitigate since the 70ies
- **→ It's now a core target in the government's new air quality strategy**





Science and Technology Facilities Council
RAL Space

Target Market and Opportunity

Ammonia production in poultry houses can affect health of humans, birds, and the environment[1]

880 million birds produced in UK per year for chicken meat

1,534 industrial-sized farms operate ca. 36 day growing rotations

220g

Bird growth performance & profits impacted at levels > 25 ppm.

Farms under pressure from regulators to reduce emissions.

Each farm has multiple houses and PRAM can impact every house in monitoring NH_3 levels for protection of humans, birds and environment.

UKRI Science and Technology Facilities Council

RAL Space

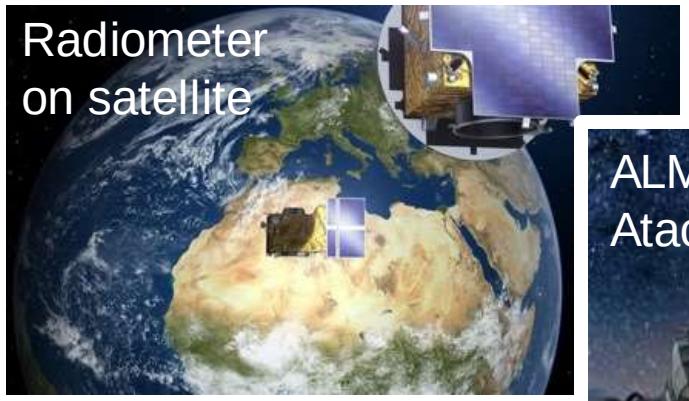
[1] Naseem, Sadia & King, Annie. (2018). Ammonia production in poultry houses can affect health of humans, birds, and the environment—techniques for its reduction during poultry production. Environmental Science and Pollution Research. 25. 10.1007/s11356-018-2018-y.

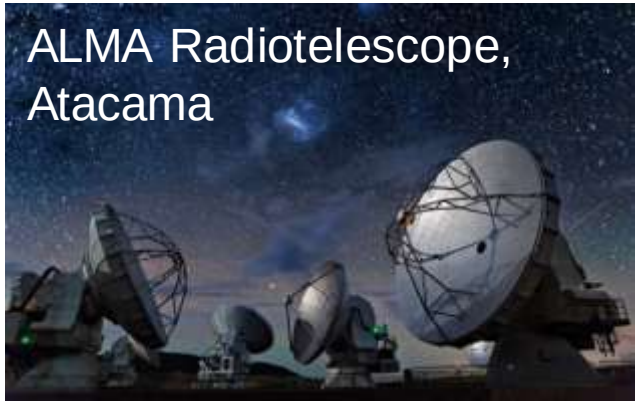
The Problem at Hand

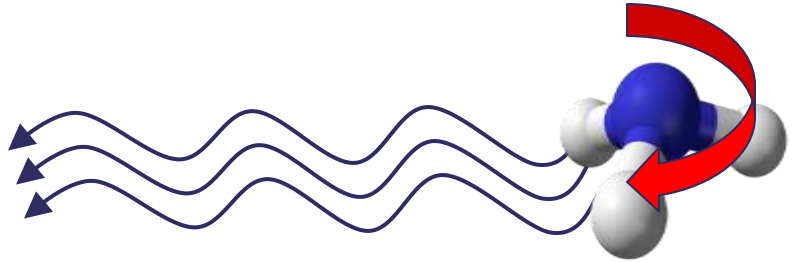
- There is no cost-effective, accurate, real-time, measurement method for ammonia at farm level:
  - Chemical methods (e.g., wind tunnels are accurate, but not real time
  - Handheld detectors are inexpensive but unreliable
  - Infrared spectrometers and laser systems are expensive and complex to operate

A Possible Solution

- Ammonia has been measured in astronomy by detecting faint radio waves emitted by the NH_3 molecule
- Although never tried on Earth, this technique could provide a promising alternative:
  - It's sensitive (thanks to technological progress in the last decades)
  - It's continuous and real-time
  - It's now comparatively inexpensive at low frequencies







UKRI Science and Technology Facilities Council

RAL Space

Project Roadmap

- **STFC Food Network+**
  - 2018: Scoping study (asses theoretical viability of method)
  - 2019: SFN+ study extension (refine simulations)
- **STFC Proof-of-Concept** (PoC)
  - 2019: Instrument design concept study
  - 2020: PoC extension: Market Analysis (Fresh Perspectiv)
- **CLASP** application
  - January 2020: Expression of Interest (EoI)
  - June 2020: Full JeS proposal & Reviewer Comments
  - August 2020: CLASP panel interview
  - December 2020: CLASP kick off (~2 years running)

Roadmap for Commercialisation

Demo opportunities

Collaborating

To be contacted

In conversation

Industry – NH_3 monitor for leak detection

Poultry – NH_3 monitor for improved bird performance

Agriculture – NH_3 monitor for improved air quality

2021

Prototype demo(s) at ADAS site to benchmark against competition

2022

Industry showcase to system integrators at RAL to secure licence or generate NewCo pre-sales

2023

Spin-out/Licensee support for completion of product development & integration into poultry sector

2024+

Expansion into diary and ammonia production sectors

UKRI Facilities Council

RAL Space

(Our) Case for CLASP Funding

- **User Need** – Endorsed by the targets set out in the Air Quality Strategy
- **Innovation / Novelty** – Interdisciplinary aspect is feeding into STFC/UKRI knowledge transfer objectives (and it makes for a good story)
- **Commercial Potential** – Need to convince the panel that there is a viable road for commercial update:
  - Best to get industry partner on board early, e.g. as part of consortium
  - We have commissioned a market analysis by an external consultant
- **Technology Readiness** – The technology has to be mature enough for a quick road to market:
  - OK, this is our weakest point, but the CLASP project is quite long so there is time to catch up

CLASP Proposal Tips, Tricks & Caveats

- **Schedule** – The evaluation procedure is quite convoluted and lengthy:
  - Not necessarily a fast road to market
  - Might block out alternative funding opportunities for ~1 year
- **Mentors** – Get feedback and strategic advice
- **Use Case** – Need to demonstrate user need and socio-economic impact
- **Industry Partners** – Need credible industry partners for commercialisation
- **JeS Form** – JeS application is fiddly; register early and read tutorials
- **Spending Profile** – Projected spending profile is pretty much set in stone
  - Funds are allocated internally and can't be transferred between F/Ys
  - With a start in Q4, the first F/Y is short. Problematic for procurements!
- **Financial** – STFC funding is overhead-free, which is brilliant

Science and Technology Facilities Council

RAL Space

Thank you

ralspace.stfc.ac.uk @RAL_Space_STFC RAL Space RAL Space

Science and Technology Facilities Council

Scientific Computing Department

Data, Compute, and Software divisions

jens.jensen@stfc.ac.uk, Mad Scientist, Scientific Computing

Software

- “Computational mathematics”
  - Research in parallelisation and performance of algorithms
  - Maintains the HSL: https://www.hsl.rl.ac.uk/
- Machine learning
  - Applications of machine learning in scientific computing
  - Collaborations with Alan Turing Institute
- Data and Software engineering, Dynamic Infrastructure
  - RSE roles in department
  - Developing and maintaining tools to support STFC facilities

Data

- Open Science group
  - Includes libraries
  - Open Access publishing, publications include reports, articles, data
- Data Science and Technology
  - Which includes yours truly
  - Supporting STFC Food Networks (prev. also Soil Security)
  - Data as research, data for research
  - PSDS – physical sciences data service (www.psds.ac.uk)
- Data Analysis Facility for National Infrastructure (DAFNI)
  - Supporting data, simulations and models for national infrastructure
  - Sometimes sensitive research

Science and Technology Facilities Council

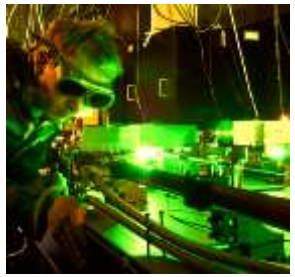
Systems

- Research Infrastructure
  - Includes the JASMIN (climate modelling) and SCARF (everything else) HPC facilities
- Data Services
  - Includes the main tape storage facilities
  - Hosting data from STFC facilities, Large Hadron Collider, climate and satellite data
- Distributed Computing and Cloud Operations
  - Provides STFC's private cloud compute resource
  - Supports STFC-funded research across the UK through IRIS (www.iris.ac.uk)

Science and Technology Facilities Council

CLF Facilities and Functions

GEMINI



High power, ultra-short pulse dual beams of 15 J, 30 fs pulses

Pulse every 20s

VULCAN

Ultra high-power laser

Up to 1 PW peak power

Focused intensity > 10^{21} Wcm^{-2}

High-power, ultra-intense lasers for extreme conditions science & applications

ARTEMIS

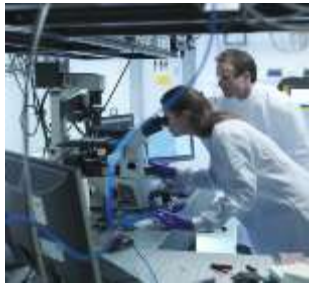
fs and as ultrafast spectroscopy

IR to soft x-ray

ULTRA

Ultrafast vibrational spectroscopy

OCTOPUS



Imaging, laser tweezers and microscopy

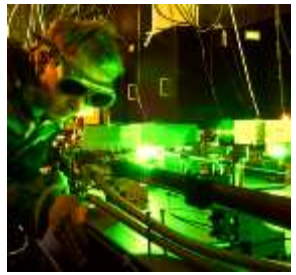
Research Complex at Harwell

Laser applications in the physical and life sciences (materials, chemistry, biology)

UKRI Science and Technology Facilities Council

Application to Air Quality

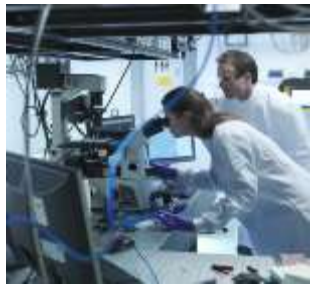
GEMINI



VULCAN

ULTRA

OCTOPUS



CLEAN AIR TECNHOLOGY

AEROSOL STUDIES

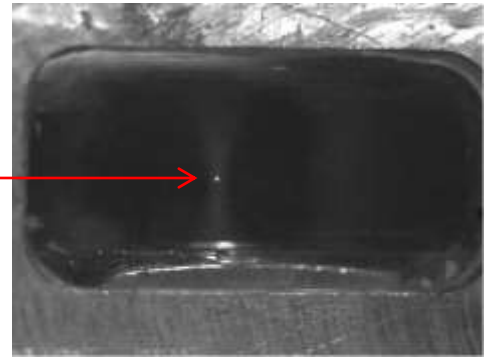
?

Science and Technology Facilities Council

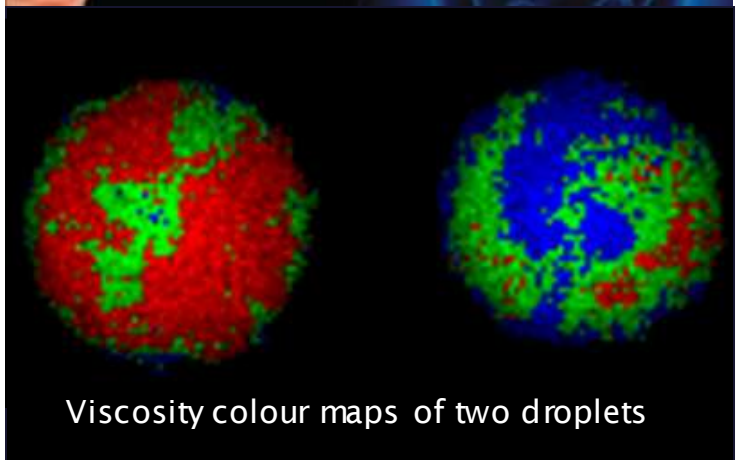
SAQN STFC AIR QUALITY NETWORK

Spectroscopic studies of laser levitated micro-particles

A micron-sized aerosol droplet (white dot) levitated using lasers at the CLF Octopus Facility.



- Studying the chemistry and optical properties of cloud droplets and pollution
- Simulating the respiratory environment of pharmaceuticals in the lung
- Understanding the viscosity behaviour of airborne droplets using FLIM



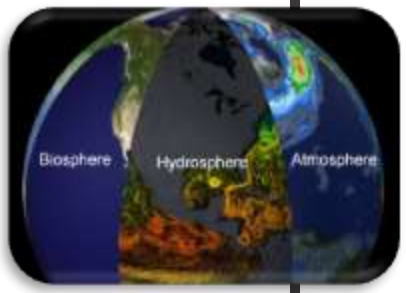
Viscosity colour maps of two droplets

Science and Technology Facilities Council

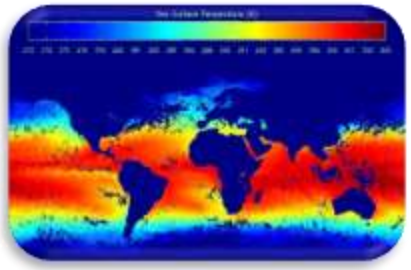
RAL Space
The Rutherford Appleton Laboratory

Daniel.Peters@stfc.ac.uk

The UK's National Laboratory of Space Science.
Using Earth Observation and Remote Sensing for Environmental Research



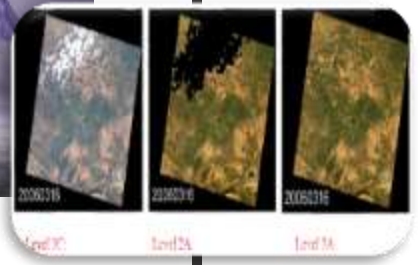
Research the different spheres of the planet



Fundamental Environmental Research.

The Rutherford Appleton Laboratory

Satellite Development



Data processing

Development of key technologies

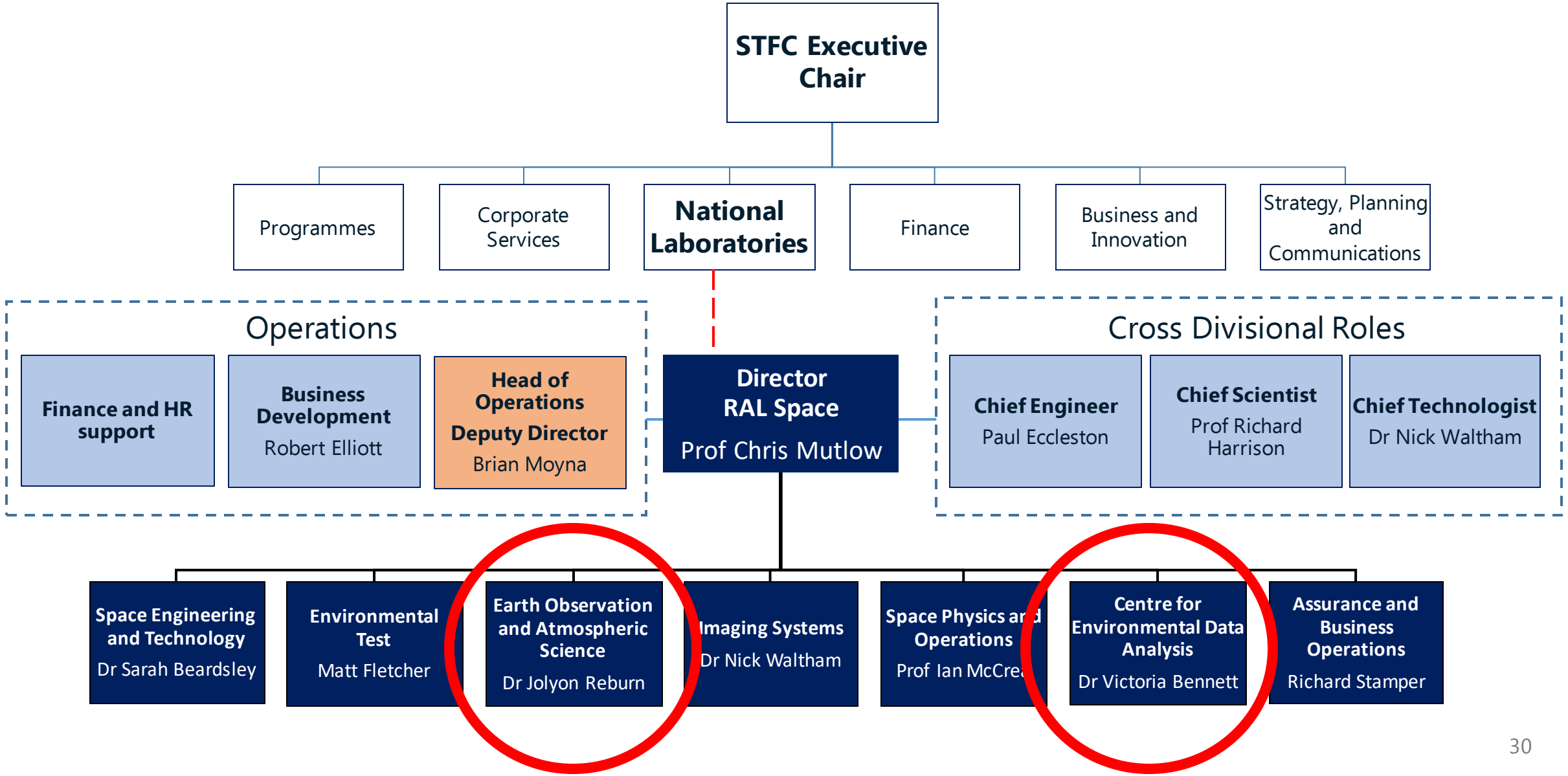
Environnmental Data, algorithms super computing

Application of Technology

Access to environmental data


HM Government
Home Office
Department for Business, Energy & Industrial Strategy
Department for Environment Food & Rural Affairs
UK SPACE AGENCY
Met Office
NPL
UK Research and Innovation
Science and Technology Facilities Council
RAL Space
Science and Technology Facilities Council
Arts and Humanities Research Council
Engineering and Physical Sciences Research Council
Biotechnology and Biological Sciences Research Council
Economic and Social Research Council
Research England
Natural Environment Research Council
Innovate UK
Medical Research Council

RAL Space - Organisation



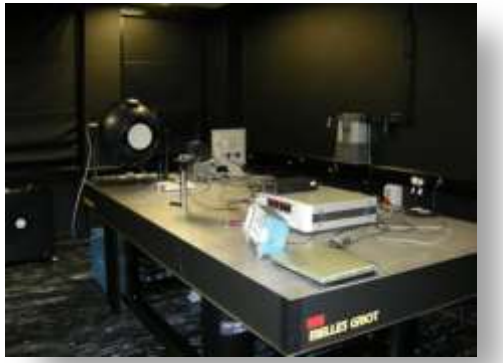
Current Activities

Science & Technology Facilities Council

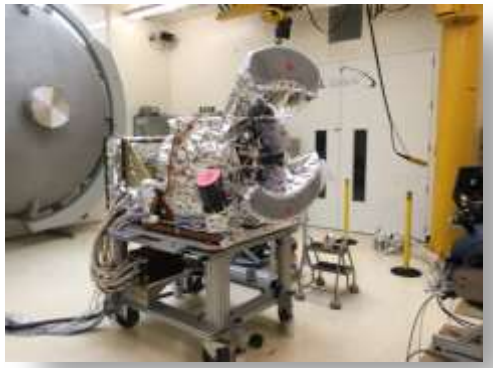
RAL Space

Radiometer Group

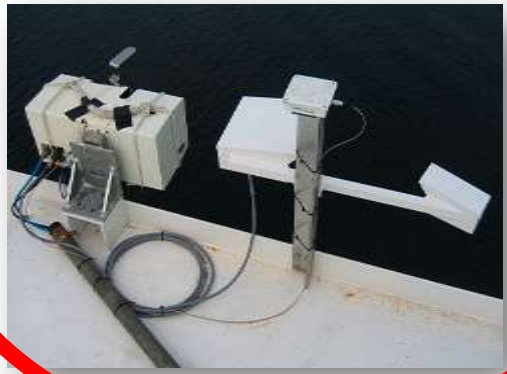
Calibration Facilities



Instrument Calibration

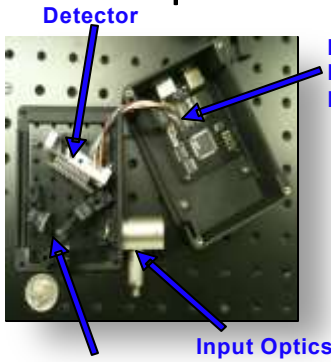


Post Launch Activities

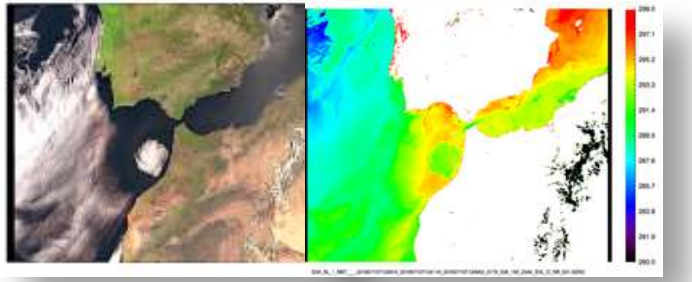


Calibration Source Development

Instrument Development



Data Processing



Application of Technology

UAV-based sampler

- A small, lightweight instrument designed to be mounted on a fixed-wing UAV
- **USP Isokinetic aerosol sampling**
- Collaboration:
  - **Oxford University.** Application lead, Volcanic plume sampling - Jean-Francois Smekens
  - **STFC** RALspace: **Earth Observation and Atmospheric Science Division.** Aerosol sampling expertise UAVs, Dan Peters (PI) and Connor McGurk
  - **STFC** – **Scientific computing Division**. CFD modelling support Stefano Rolfo
  - **Loughborough University**. In-situ UAV sample consultant Cunjia Liu
  - **SAQN mentor** - Gas sampling consultant - Jim Mills

Isokinetic Sensor package

- Optical particle counter – PM1, PM2.5 and PM10
- NDIR CO_2 – 0-5000ppm, 15ppm resolution
- SO_2 – 0-50ppm, ~15ppb resolution
- H_2S – 0-50ppm, ~5ppb resolution