RAL Space

Science driven,
technology enabled

Highlights 2019–2020

UKRI Science and Technology Facilities Council

RAL Space R100 building: Credit: STFC RAL Space

Welcome

The motivating theme behind our work is 'science driven, technology enabled'. Our brilliant scientists drive our engineering teams to develop new technologies which in turn enable scientists in the UK and around the world to further our understanding of our planet and the universe.

From the specialists making critical components for a new carbon monitoring mission, to the leaps being made by our Quantum Space Laboratory, our technology will have a real impact on our environment and our society.

Our scientists have been leading the way on the next generation of technology in space and for ground based telescopes to help us answer key questions about space weather and the structure of the Milky Way.

Towards the end of the year we'll be celebrating Chief Scientist Richard Harrison's 25 years as a continuous PI for instruments on board SOHO and STEREO. Richard has shared his insights into the advances made in solar physics and along with the rest of RAL Space, looks forward to the launch of Solar Orbiter in 2020.

We continue to welcome new and old users from industry and academia to our facilities. JASMIN is the invaluable tool at the heart of many climate studies, while our environmental test facilities are as busy as ever. Construction of the National Satellite Test Facility continues apace, with work in full swing. Many of the crucial facilities are ready and waiting to be installed within the coming year.

As always, it is our brilliant people who put all of this work into action, whether as principal investigators, project managers, or international research fellows. Whether you are looking to embark on a career in space, or are looking to be re-inspired by the work our incredible community does, I encourage you to read the stories of our staff, within these pages.

A further highlight for me this year has been the publication of the RAL Space Strategy. This will shape how we support our communities and guide us as we continue to deliver scientific and technological excellence in years to come.

Professor Chris Mutlow,
Director STFC RAL Space

Environmental Test

In 2019 RAL Space provided satellite test facilities to small businesses, prime contractors and universities to make sure their technologies are space-ready. The first tests have taken place in the 5m x 6m thermal vacuum chambers. RAL Space clean rooms are being used for assembly and integration of projects including MicroCarb, and small space companies are putting their equipment to the test in the vibration facility. The construction of the National Satellite Test Facility (NSTF) is well underway. This will offer a co-located set of environmental test facilities for spacecraft up to 7 tonnes. As part of this, RAL Space has taken delivery of the shock test rig which will reproduce the mechanical shock environments that occur when pyrotechnic devices are fired during spacecraft launch, stage separation and deployment operations.

Thermal vacuum chambers

16 major test campaigns in 2019

Vibration testing

9 commercial and university customers

Project use of facilities

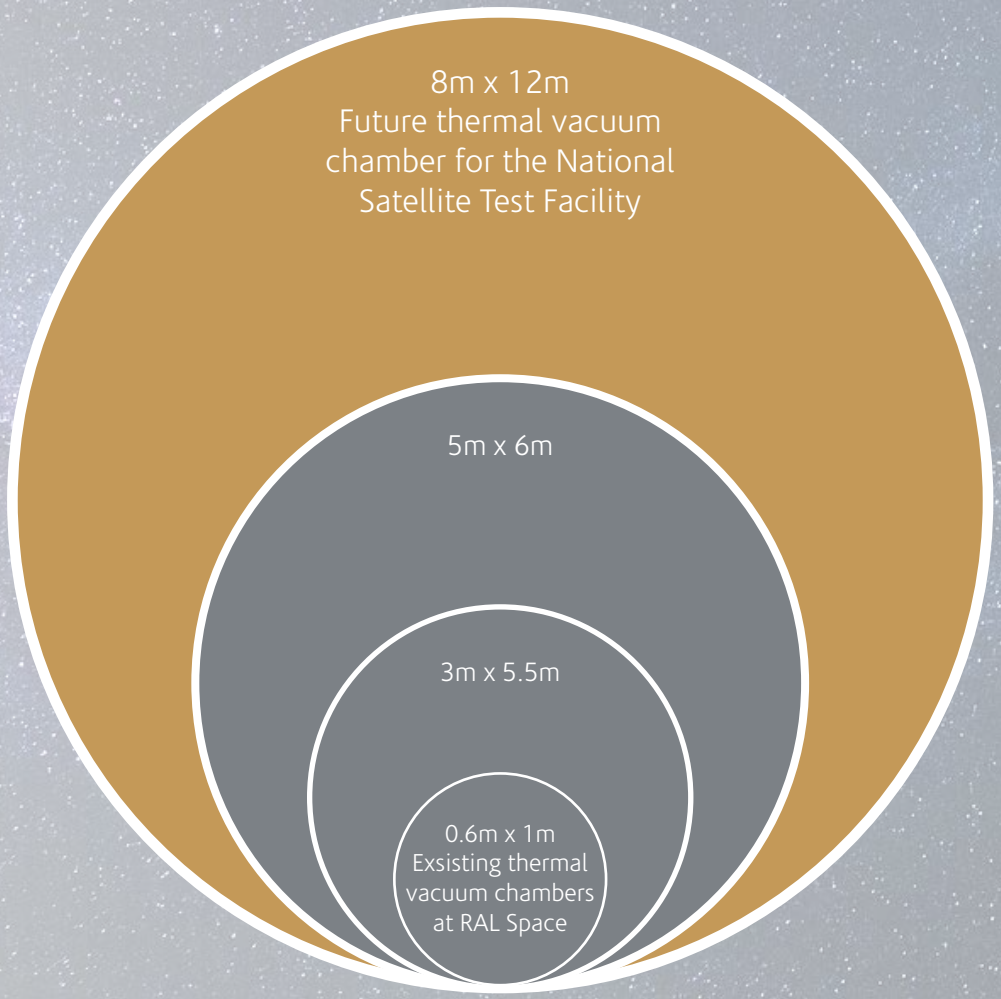
57% internal 42% external

Clean Room

8 projects in our 6 rentable rooms

Credit: Image by O12 from Pixabay

"Working with RAL Space we found a team that was as dedicated as we were to deliver an exemplary product to our customer." *– John Moth, Managing Director, NewSpace Systems*



Leading telescope enhancements to explore new horizons

A ten year project to give a new lease of life to the STFC's William Herschel Telescope will give astronomers new understanding of the sequence of events which brought the Milky Way into being.

The William Herschel Telescope (WHT) on La Palma in the Canary Islands was the third largest single optical telescope in the world when it was built in the 1980s. After supporting thousands of astronomers, the telescope was scheduled to close in 2012. A proposal from a RAL Space scientist to install a new instrument, measuring the velocity of several million stars in our galaxy, has given the telescope a renewed purpose.

The WHT Enhanced Area Velocity Explorer (WEAVE) instrument is a powerful new spectrograph, which will build on the work of ESA's Gaia spacecraft. Where Gaia created a 3D map of the position of a billion stars in the galaxy, WEAVE will measure the velocities of 10 million stars mapped by Gaia.

WEAVE will extend the telescope's field of view to two degrees on the sky in order to increase the rate of measurements to up to 1000 stars per hour. Light from 1000 individual stars and galaxies within this field will then be picked off by 1000 robotically-positioned optical fibres in the focal plane, and fed to a new spectrograph.

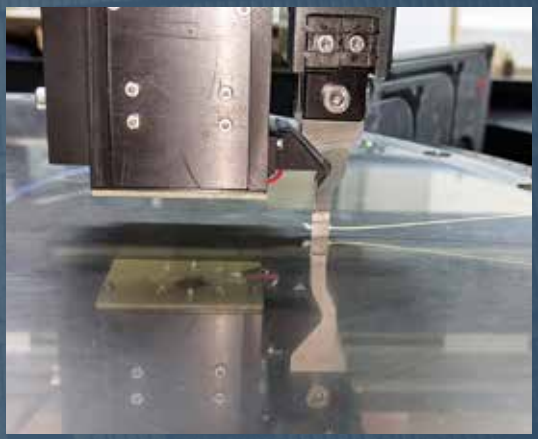
As well as initially proposing the idea, RAL Space led the detailed design work of the spectrograph. As Principal Investigator, RAL Space leads a team of more than 100 people from 6 partner countries to deliver the complex suite of instruments, fibres and data processing needed to upgrade the telescope.

More than 500 scientists around Europe have been developing a survey plan which will involve 1200 nights of telescope observations over 5 years, with all data processed and released to the community. This will provide scientists with ready processed data, which will help them shed light on the structure of the halo of dark matter around the galaxy and how its distribution may affect the evolution of the galaxy. The instrument will also map the chemical history of the galaxy by looking at the chemical structure of stars and identifying patterns which will help reveal the star formation events that shaped our galaxy.

By leading on the development of in-orbit and ground based telescopes like WEAVE for WHT, RAL Space is supporting our astronomy community in the UK, Europe and around the world.

The William Herschel Telescope and the Milky Way. Credit: Max Alexander

Ground based astronomy at RAL Space



One of the robots placing a single fibre in the field.
Credit: Gavin Dalton

With significant involvement in more than 220 instruments on board spacecraft, RAL Space is known for developing cutting edge space technology. However, RAL Space also has extensive involvement in ground based telescopes. The STFC leads UK investment in ground-based telescopes and as such RAL Space has played a leading role in some of the world's most significant terrestrial telescopes. This includes the European Southern Observatory, the Subaru Telescope, the Atacama Large Millimetre/ submillimetre Array (ALMA) and current work on the WHT and Square Kilometre Array. RAL Space has also contributed capabilities in millimetre wave technology, control software and data processing.

Ellis Elliott, at work in the Imaging Systems Laboratories. Credit: STFC RAL Space

Route to RAL Space: Ellis Elliott, Imaging Systems Project Manager

Undergraduate and Masters: Geology and Environmental Hazards, University of Derby

Experience: 2 years in the oil and gas industry, 4 years in RAL Space including completing the STFC Graduate Scheme

I am a project manager, mainly managing projects around camera electronics boxes on the US weather satellite GOES-R. I'm also working with the Open University on a really exciting project called ProSPA – it's a lunar lander mission looking at contaminants and volatiles on the surface of the moon and seeing if we can use them as resources for future space missions.

It's important to have a customer facing person on our projects – one person who is there to interact with both the internal and external stakeholders. It's also great to have the opportunity to get out and meet customers to put faces to names, see their excitement about space and how they might apply the tech.

One of my projects is due to launch in 2023 and at the outset it can feel quite daunting because the timescales involved in space missions are so long. So working to schedules, pulling people together and seeing things come to fruition is really satisfying. When you reach the end of a project phase and see the finished box it's really exciting and there's a real sense of achievement in knowing that you helped them to build it – it makes all the time and effort worthwhile.

If you want to work in the space industry, do your research! Space is quite different, so if space is your interest, then take the time to understand the industry a bit so that you can demonstrate a general awareness of space missions and projects. Don't be overwhelmed – within the industry there's an appreciation that the learning curve is steep for new starters.

Qualifying new quantum technologies for space

New quantum technologies have the potential to revolutionise a range of industries – from construction and finance to cyber security and healthcare.

The emergence of new quantum technologies poses a major opportunity for the UK's research and innovation sector, which boasts world-leading excellence in quantum science and related fields. The emerging quantum technology market is estimated to be worth up to £1 billion to the UK economy.[1]

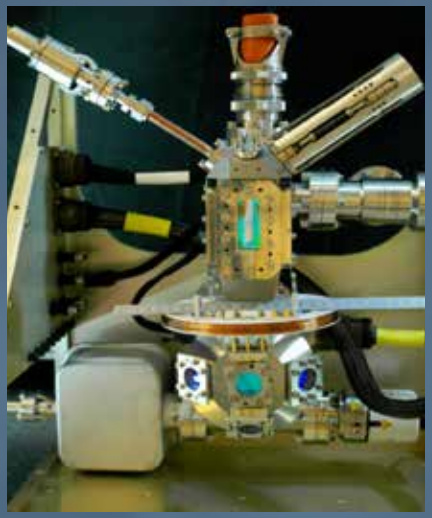
Terrestrial quantum technologies are becoming more established but research into using these technologies in space is still at an early stage. RAL Space has been working at the forefront of this field with a number of projects to qualify quantum technologies for space.

The Miniaturised Cold Atom GRavimEter for Space ApplicatioNs (MCLAREN) project has successfully developed space-ready laser control electronics, which will control a compact cold atom gravimeter. This extremely challenging project, from both a programmatic and technical perspective, involved the design, assembly, integration and test of six key modules. A route towards a space-deployable system for this entirely new technology has been identified and the design maximises potential opportunities for future exploitation and commercialisation.

Once deployed in space, the instrument will be able to take highly accurate measurements of gravity, which can be used to survey much larger areas than can be easily completed on the surface of the Earth. This can be used by a wide range of sectors for applications including underground surveys of mineral deposits, monitoring ground water levels, oceanic currents and ice sheet thickness. A more sophisticated version of the system would allow tests of general relativity and may also serve as a starting point for a next generation gravitational wave detector.

Currently, most quantum devices are based on commercial-off-the-shelf subsystems, which are too large and heavy and cannot be used in space. RAL Space's experience in space engineering and long space heritage informs work to provide customers with the required subsystems needed for successful deployment of quantum technologies into space. Through the Quantum Space Laboratory the team works with industry to raise the technology readiness level of critical components for quantum technologies.

Atom Chip for Atom Interferometer. Credit: STFC RAL Space/IQO Hannover



Atom Chip for Atom Interferometer.
Credit: STFC RAL Space/IQO Hannover

The RAL Quantum Space Laboratory

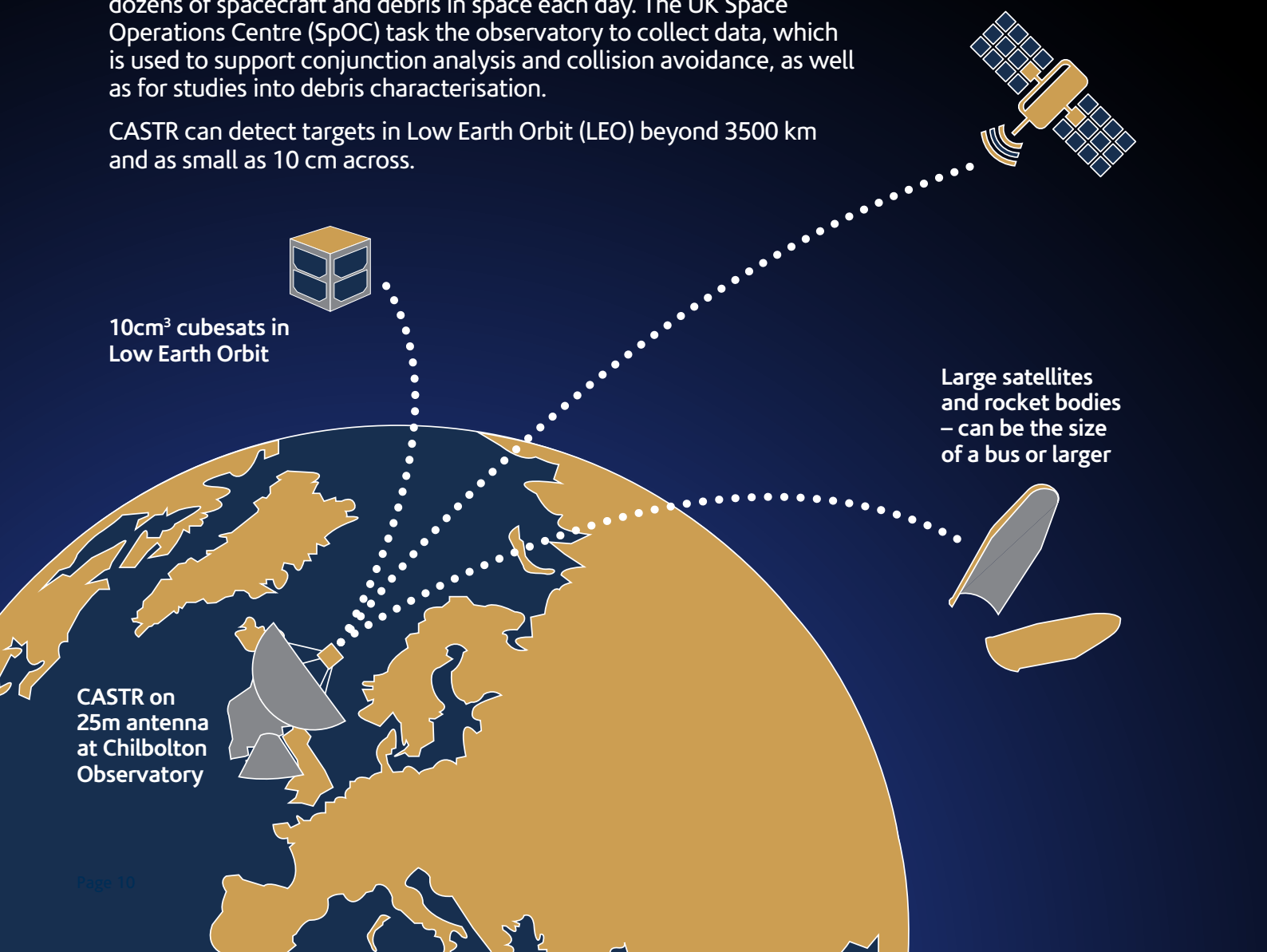
RAL Space has established a laboratory to help reduce the barriers to space qualifying quantum technologies. The laboratory aims to reduce the risk, time and cost of making existing technologies ready for space by providing a place for industry, SMEs, research institutes and academia to collaborate on next generation technologies. The Quantum Space Laboratory houses the accurate lasers, cooling systems and photon-counting detectors common to the development of all quantum systems. It also provides users with access to RAL Space engineering teams and support, access to business support and incubation facilities as well as opportunities for ground, airborne and on orbit demonstrators.

1. A Roadmap for Quantum Technologies in the UK – UK Quantum Technologies Programme. EPSRC UKRI

Space Surveillance and Tracking (SST)

The Chilbolton Advanced Satellite Tracking Radar (CASTR) has been developed by the Chilbolton Observatory Space Monitoring Facility on the iconic 25m antenna. This radar has the ability to track and detect dozens of spacecraft and debris in space each day. The UK Space Operations Centre (SpOC) task the observatory to collect data, which is used to support conjunction analysis and collision avoidance, as well as for studies into debris characterisation.

CASTR can detect targets in Low Earth Orbit (LEO) beyond 3500 km and as small as 10 cm across.



2010/2011

As part of ESA's CO VI Space Situational Awareness preparatory programme, the radar tracked and detected over 40 satellites over several weeks to demonstrate the radar's capability to support Europe's requirement.

2014

Chilbolton collaborated with Defence Science and Technology Laboratory (DSTL) and DSTO (Australian Defence Science and Technology Organisation) to conduct a radar / EO sensor data-fusion experiment.

2015

CASTR participated in an observation campaign to characterise the re-entry of ESA's ATV-5 (Autonomous Transfer Vehicle) after it departed from the International Space Station in February.

2016

STFC joined the UK Space Agency, the Ministry of Defence, Natural Environment Research Council's Satellite Geodesy Facility, Space Insight Ltd, and the DSTL as the UK's membership to a five country EU consortium for SST.

2017

CASTR was tasked by UK SpOC to track objects to support EU SST requirements.

2018

CASTR was used to track over 2000 items under tasking for UK SpOC. In February, CASTR participated in a LEO satellite mini catalogue maintenance experiment with UK and Australian optical sensors.

2019

CASTR supported tasking by UK SpOC. In June, TDS-1 was tracked around the time of the deployment of its de-orbit sail.

Credit: Image by O12 from Pixabay

Dr Oyuki Chang at the Arecibo Observatory dish, in Puerto Rico. Credit: Phil Perillat/ Arecibo Observatory

Route to RAL Space: Dr Oyuki Chang, Space Weather Rutherford Fellow

The Rutherford International Fellowship Programme supports post-doctoral researchers to work within the STFC. It sets out to develop the next generation of leading researchers and enable them to participate in world-class STFC facilities and departments.

While I was doing my PhD at the National Autonomous University of Mexico, I had an opportunity to work with some Rutherford Fellows from RAL Space. I decided to apply for a postdoc fellowship and was successful. I started a two year fellowship at RAL Space in June 2018 as part of the Space Weather team as a Rutherford International Fellow. My project is very specific. I'm analysing datasets from the LOFAR radio telescope to monitor solar activity. LOFAR is an integrated European telescope, with its UK station at the Chilbolton Observatory.

My work is really challenging because we actually don't know many things about solar activity, so we're constantly learning. There are many mysteries, so it's a process of testing and trying to explain. We have to formulate the questions and then try to find the answers using theories, models and observations. The physics of solar activity is not very well known because it's hard to have a complete vision of the Sun and we can't get very close using spacecraft. My work involves analysing signals from radio telescopes on Earth, which are used as complementary information alongside telescope images and spacecraft data to provide a bigger picture of what is going on between the Sun and the Earth.

I'm working on science here, as part of a very strong space weather team. Here at RAL, as a young scientist, I have had the opportunity to create collaborations and to strengthen my knowledge in many ways. I also have an opportunity to access data from the LOFAR radio telescope and to work with its amazing community.

Influencing space weather mitigation activities through science research and technology development

Our existing forecasting capability and further investments in projects like SWIMMR, Lagrange and LOFAR for Space Weather, could save the UK a loss of £15 billion caused by a major space weather event.[2]

Space weather arises when disturbances in the terrestrial and near-space environments, driven by solar activity, disrupt vital technological systems such as electric power, positioning and communications services, and spacecraft operations. For a large, 1-in-100 year event with no space weather forecasting capability, the gross domestic product loss to the UK could be as high as £15.9 billion. With our existing capability and new projects RAL Space is involved in, this figure could be reduced to just £0.9 billion.

RAL Space advises the government on the risks posed by adverse impacts of space weather, leading the work of the Space Environment Impacts Expert Group, which brings together key UK experts. Our globally influential research programme shapes the conversation on space weather with our world renowned scientists occupying positions on the United Nations Committee on the Peaceful Uses of Outer Space Expert Group on Space Weather and Committee on Space Research Panel on Space Weather.

This research is driving the development of technologies for space weather monitoring and forecasting. RAL Space is leading an international consortium to develop the remote sensing instrument package for ESA's proposed Lagrange mission, and lead on two of the instruments.

From its unique vantage point at Lagrange point 5, the mission will monitor events developing on the Sun before they become visible to Earth while also providing a prime view of Earth-directed events once launched. RAL Space is also developing techniques and models that will help to fully utilise the unique measurements from Lagrange. This will improve the accuracy of operational space weather forecasting.

RAL Space is a key member of an international team to upgrade the Low Frequency Array (LOFAR) radio telescopes to enable space weather science and future monitoring capabilities. RAL Space leads the system design work package and is involved heavily in the science definition and software and operations specifications. The LOFAR for Space Weather (LOFAR4SW) study leverages the existing infrastructure and technology of around 50 LOFAR stations across Europe, including the UK station at RAL Space's Chilbolton Observatory. A fully-upgraded LOFAR4SW facility will provide a missing link in forecasting the severity of geomagnetic storms by measuring the interplanetary magnetic field and enabling better prediction of space-weather events.

Thanks to rigorous scientific advice, the risks of space weather are being taken seriously. The UK Government's Strategic Priorities Fund is investing £20 million in space weather monitoring and mitigation activities. The Space Weather Instrumentation, Measurement, Modelling and Risk (SWIMMR) programme is administered by RAL Space and the Natural Environment Research Council to support governmental and commercial sectors with the highest potential for impact such as spacecraft operators, the aviation industry and power grids.

Aurora over northern Canada captured by ESA astronaut Tim Peake. Credit: ESA/NASA

Heliospheric Weather Expert Service Centre

Artist's impression of the Lagrange mission. Credit: ESA/A. Baker, CC BY-SA 3.0 IGO

RAL Space coordinate an international team that provides the Heliospheric Weather Expert Service Centre, one of the pillars of the ESA space weather system. As part of this, RAL Space is actively involved in the development and provisioning of the critical end-user space weather forecasting and nowcasting services. This provides inputs not only for terrestrial space weather forecasting but also for solar system exploration missions. These services will also significantly benefit from the unique observations provided by new spacecraft such as ESA's Lagrange mission.

2. Oughton, E.J., Hapgood, M. et al. (2018) A Risk Assessment Framework for the Socioeconomic Impacts of Electricity Transmission Infrastructure Failure Due to Space Weather: An Application to the United Kingdom. Risk Analysis. Vol.39. Issue 5. p1022-1043. https://doi.org/10.1111/risa.13229

Professor Richard Harrison reflects on solar science

In the early 1960's the first space-borne instruments from one of the pioneering groups that ultimately became RAL Space, were launched aboard suborbital rockets. These were instruments sent into space to study the nature of the Sun using unique ultraviolet techniques. Some 57 years later, we are poised to launch Solar Orbiter – an ESA mission carrying a novel RAL Space-led spectrometer called SPICE, whose heritage can be traced directly back to those original rocket flight instruments.

I came to RAL Space in 1986 and find it incredible to believe that my 33 years here (so far) spans well over half of the time back to those original flights. When I joined, we were heavily involved in the leadership of an instrument aboard the first major truly international mission to study the Sun, the NASA Solar Maximum Mission (launched 1980).

In the subsequent 30 years there were 11 major solar missions. Four of these carried instruments led by RAL Space; nine carried instruments that included RAL Space hardware. Our record became second to none and this strength played a huge role in putting the UK solar research community in a world leading position.

One of my highlights was the launch of the ESA/NASA Solar and Heliospheric Observatory (SOHO) in 1995, carrying the RAL Space-led Coronal Diagnostic Spectrometer (CDS) – a solar extreme-UV spectrometer designed to provide detailed diagnostics of the Sun's super-hot atmosphere. CDS was a remarkable success and a credit to the engineering and operations teams. In its 20 years of operation almost 1000 professional research papers were published around the world from this mission. The scientific impact of SOHO has provided a wonderful benchmark in our understanding of the Sun.

Nevertheless, there are gaps in our knowledge. Since the beginning of the human race, our view of the Sun has always been from on, or near the Earth. With the launch of the NASA twin STEREO spacecraft in 2006, carrying the RAL Space-led Heliospheric Imagers, we had two spacecraft orbiting the Sun, rather than the Earth. These Imagers look back at the Sun and Earth and actually image the coronal mass ejections as they travel through the solar system.

So, to bring us up to date, Solar Orbiter is about to fill two other outstanding gaps in our knowledge. First, it will fly closer to the Sun than Mercury - just close enough to enable a carefully shielded spacecraft to take close-up views of the Sun and study the environment around the spacecraft so close to a star. Second, it will climb out of the so-called ecliptic plane, enabling unprecedented views of the polar regions of the Sun. Imagine the potential for new science by taking a first glance at the solar poles. The mission was first conceived in the late 1990s with RAL Space playing a leading role in the proposal and early development. It is extremely satisfying to see the mission come to fruition. The RAL Space-led SPICE instrument takes the concepts of the earlier SOHO instrumentation to new levels.

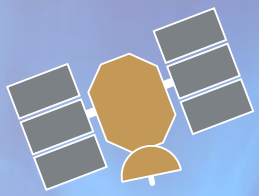
I have only mentioned some of the exciting missions that we have been involved with. Through an active programme of mission conception, acquisition, development and operation, RAL Space has been at the forefront of studies of the Sun for decades including, now, the emerging field of space weather, and has provided space-based facilities for the UK's world-leading research community.

Professor Richard A Harrison
MBE RAL Space Chief Scientist

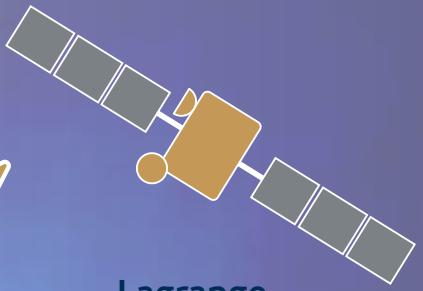
Principal Investigator –
ESA/NASA Solar and Heliospheric Observatory
(CDS instrument – 1992 to 2004)

Principal Investigator –
NASA STEREO (HI instruments – 2002 to date)

A selection of solar, heliosphere and space weather missions with RAL Space involvement

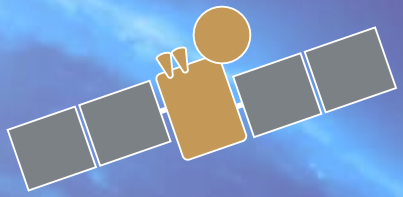


Solar Maximum Mission
Launched: 1980

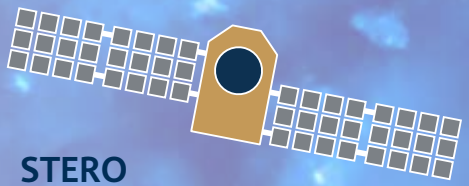


Lagrange
Launch: 2025

SOHO
Launched: 1995



Solar Orbiter
Launch: 2020



STERO
Launched: 2006

Loops of plasma contained by magnetic fields on the Sun taken by STEREO's (Ahead) spacecraft in extreme UV light. Credit: STEREO/NASA

Machining space components with novel complex geometries to help monitor greenhouse gas emissions

The in-house precision development team at RAL Space have produced one-of-a-kind machined components for the next generation carbon monitoring satellite.

This work has been a vital part of the instrument pointing and calibration mechanism on board MicroCarb, a UK-France Earth monitoring mission. MicroCarb will measure sources and sinks of carbon, the principal greenhouse gas driving climate change.

The pointing and calibration mechanism is crucial for ensuring that the spacecraft is measuring accurately and reliably. The flight models of critical mechanical components integral to the assembly were machined from solid titanium in the Precision Development Facility (PDF) after an initial prototyping phase supported by STFC's Technology Department. RAL Space engineers worked closely with the PDF to optimise the design for manufacturing. The team has in depth knowledge of machining complex geometries for space and taking designs and turning them into reality. By playing an active part in the design process, the PDF can save time and money on complex projects like MicroCarb.

The components produced, with some features machined to exacting sizes to within a few micrometres by the PDF for MicroCarb, affect the performance of the mission and stability of the instrument. The high level of accuracy achieved in these components ensures that vital parts of the instrument can align precisely, ensuring that the data we receive is accurate.

This quality of workmanship has a direct impact on the performance of missions like MicroCarb and therefore our society and environment. MicroCarb will be an important part of international efforts to measure how much carbon dioxide is being emitted by natural processes and human activities. It will even enable mapping of emissions from cities in order to monitor local sources of the greenhouse gas.

MicroCarb is a collaboration between the French space agency (CNES) and the UK Space Agency. RAL Space has been working with Airbus Defence and Space to design, qualify and deliver the pointing and calibration system. RAL Space is also providing multi-layer insulation for MicroCarb and Thales Alenia Space will assemble, integrate and test the satellite in RAL Space's dedicated suite of facilities for the UK space community.

In 2019 the UK government committed to a target of net zero greenhouse gas emissions by 2050. Understanding the sources and sinks of carbon dioxide can help us better understand our impact on the carbon cycle and how to regulate it. RAL Space's attention to detail and craftsmanship ensures that we can be confident in the spacecraft monitoring our planet.

Artist's impression of MicroCarb. Credit: CNES/ill./SATTLER Oliver, 2017

Precision Development Facility (PDF)

MicroCarb vessel machined by the PDF. Credit: STFC RAL Space

A comprehensive and well-equipped facility providing expertise in precision machining and novel component prototyping associated with the manufacture of miniature detectors. It was set up to provide the very high accuracy machining required in the development of sub-millimetre wavelength receiver technology. As well as providing close project support at RAL Space, the facility undertakes development work for industry and a variety of government institutions. It offers some of the very latest Computer Numerical Control machine tools for precision machining.

Facilitating essential climate science research

The UK's top 10 warmest years have all occurred since 2002, and July 2019 saw its hottest ever recorded temperature (38.7 °C).

Extreme weather events, such as heatwaves and flash flooding, are expected to increase in severity and frequency as the climate continues to change. Extreme weather can adversely affect the way we live our lives. Damaged wildlife habitats, decline in food production, and endangered human life are just a few impacts associated with climate change. Predicting global climate change is complex and requires the analysis of vast amounts of data.

JASMIN, a Natural Environment Research Council funded computing facility for data-intensive environmental science, provides this capability to the UK and European environmental science community. It is jointly managed by STFC's Scientific Computing Department and the Centre for Environmental Data Analysis (CEDA), part of RAL Space.

In order to better predict climate change and thus mitigate against its effects, scientists used JASMIN to analyse data from a new generation of high-resolution global climate models. The PRIMAVERA project, funded by the European Commission's Horizon 2020 programme, allows over 100 scientists from 19 European partners to work together to process 172 unique climate simulations.

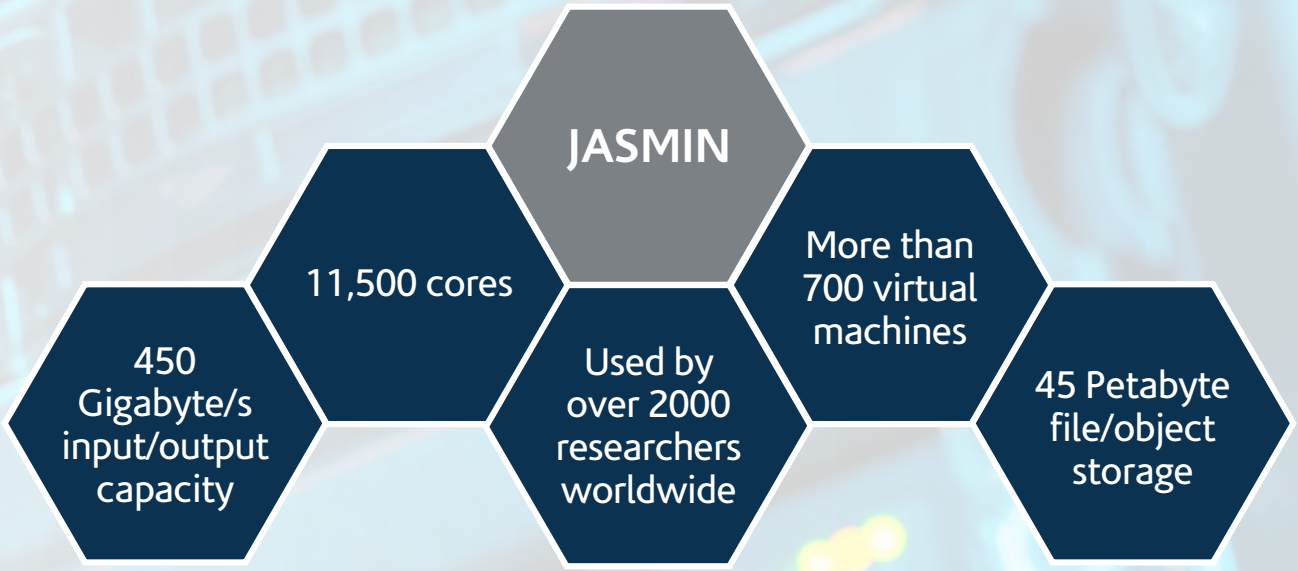
Two Petabytes of climate simulations were produced by seven different climate models on high performance computers across Europe for use by the project. Transferring large volumes of data between computing facilities can be a time consuming and laborious process. JASMIN's fast connections to the UK and European research networks meant that the data could be efficiently collated into a shared workspace on JASMIN where PRIMAVERA research scientists could work together to analyse it.

JASMIN not only made transferring and sharing the data easy, it also made processing huge amounts of data possible. Running analyses in parallel can dramatically reduce processing time from weeks or months into just days. Once the analyses are complete, the reprocessed datasets are curated in the CEDA archive, for long term reuse by other scientists.

Datasets continue to grow and researchers need to analyse much higher resolution climate simulations. Greater resolution datasets add detail to how climate change may affect society and also enable researchers to make more localised predictions of the future climate. The scale and complexity of the PRIMAVERA project means that it would not have been possible without JASMIN.

The JASMIN computing facility for data-intensive environmental science. Credit: UKRI/STFC

"JASMIN is probably the only facility in Europe (and the world) that would allow PRIMAVERA to do its research. This is because of the large storage capability and the ability for users from multiple institutes across Europe to collaborate where the data is stored. Other projects without access to JASMIN require a member of staff to store the data on a 10 TB disk and fly with it - not ideal when we are trying to help solve climate change, not contribute to it!" *– Dr Jon Seddon, a Senior Scientific Software Engineer at the UK Met Office*



Dr Caroline Cox with a model of Sentinel-3. Credit: STFC RAL Space

Route to RAL Space: Dr Caroline Cox, Research Scientist

Undergraduate: Physics and Space Science and Technology, University of Leicester

Doctorate: Research into cirrus clouds, Imperial College London

Experience: 9 years working at RAL Space

I provide expert support for the Sea and Land Surface Temperature Radiometer (SLSTR) instrument for Sentinel-3 and I'm also working on various independent research projects including one looking at the properties of cirrus clouds and another focused on the retrieval of sea surface temperatures from SLSTR. Part of the work we're doing on the SLSTR involves validating the data. Clouds can really affect our view of the surface and must be identified in the images before any surface temperature retrievals are performed as they affect the accuracy of these.

Earlier this year, as part of a RAL Space team I won an STFC Spark Award to fund a new project on the Zooniverse App called CloudCatcher. CloudCatcher will allow us to employ 'citizen science' to help us identify which satellite images do and don't have cloud. We can't look at every single image ourselves, but CloudCatcher will provide us with a valuable source of additional validation of the cloud masking algorithms and could help us identify where our algorithms need improvement. In the future it could also provide a data source for our machine learning algorithms.

I like that we're able to work as part of a team, but we also have the independence to do our own research. In academia I would write papers on my research, but here I'm working directly on the space mission and so I see the impact of what I'm doing far more quickly. The hours here are really flexible, so it works well around my family, and the people are really nice!

Olympus Rover Competition participants putting their rover to the test in the vibration facility. Credit: STFC RAL Space

Providing graduates with the skills and experience they need to succeed

University equips graduates with the theoretical knowledge they need to work in the space sector, but gaining the experience of managing a project from start to finish, working with others and time and budget management are often the skills employers are looking for.

RAL Space has been working with the UK Students for the Exploration and Development of Space (UK SEDS) to address this shortfall by hosting the finals of their annual rover engineering competition.

For the past 3 years student teams have been putting their rovers to the test on the Robotics Test Yard and vibration facility. In total 20 teams made up of more than 130 students from universities across the country have gained first-hand experience of using the RAL Space test facilities.

The students have had the opportunity to work with some of the space test experts behind the NSTF and understand the unique rigours of designing and building for the space sector.

Participants have developed a greater knowledge of technical project work and enhanced the skills required to become active participants in the space sector.

"As a former participant in 2018 and now a member of RAL Space and volunteer at the 2019 competition, I have had the chance to experience both sides of this event. Through participation I developed a lot of the skills that I use in my job today, whether it be communicating to other members of my team or prioritising tasks to be carried out. Volunteering this year meant that I could share and demonstrate how my job directly related to the skills required for the competition." *– George Kersey, Systems Engineer at RAL Space*

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