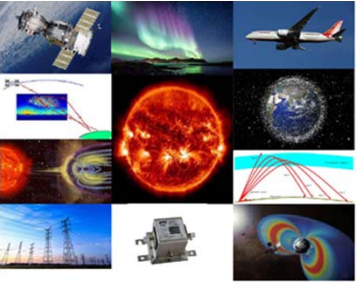


SWIMMR STFC Calls

Ian McCrea

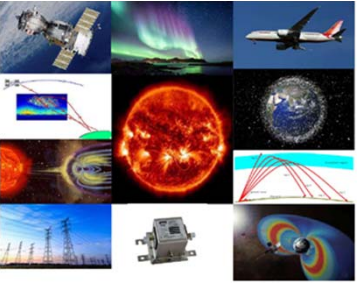
STFC Rutherford Appleton Laboratory



The SWIMMR Programme



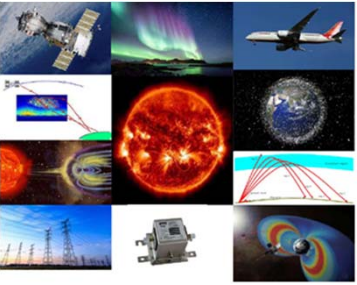
- Eleven projects, divided almost equally between STFC and NERC
- Delivered through STFC:
 - S1: In-situ radiation measurements for space and aviation (budget £5.7M)
 - S2: Support for technology testing and modelling (budget £600k)
 - S3: Support for the transition from research to operations (budget £900k)
 - S4: Forecasting from the Sun to L1 (budget £450k)
 - S5: Support for a ground radiation monitoring network (budget £1.4M)
 - S6: Production of an updated space weather impact study (budget £300K)



STFC Delivery Mechanisms (1)



- S1, S2, S3 will be mainly delivered through contracts with STFC
 - Budgets will be held at RAL Space
 - Some internal work will be done in STFC, using own staff and facilities
 - Reports, instrument builds etc. will be procured using ITTs
 - Met Office not funded directly, will get contracts from STFC
 - May be a grant-like element in S1 to facilitate academic involvement



STFC Delivery Mechanisms (2)



- Budgets for S4, S5 and S6 (and STFC OpEx) remain at STFC Programme Office (Swindon). Justin O'Byrne and Sarah Garlick taking care of this.
- Project funding will be disbursed by Announcements of Opportunity, like the NERC AO, the first of which will go out early next year.
- The probable order will be S4, S5 then S6
- Since projects have to end by 31/03/23, duration of grants will be less than three years
- These are smaller than the NERC projects, so grants can be a little shorter in duration

STFC Commissioned Projects:

S1: Improved in-situ radiation measurements

Context

- Relative paucity of real-time in-situ radiation data (both space and avionics) to inform radiation monitoring and models. Little indigenous UK capability in producing detectors.

Aims

- Produce and deploy spaceborne and airborne sensors capable of providing near real-time data for the civil sector.
 - 10 sensors for aerospace, based on trusted heritage
 - 2 sensors for space (pref MEO/GEO), based on trusted heritage
- Feed data streams from these sensors into models at MOSWOC
- Start development of new miniaturised sensors, for wider deployment

STFC Commissioned Projects:

S1: Improved in-situ radiation measurements

Methodology

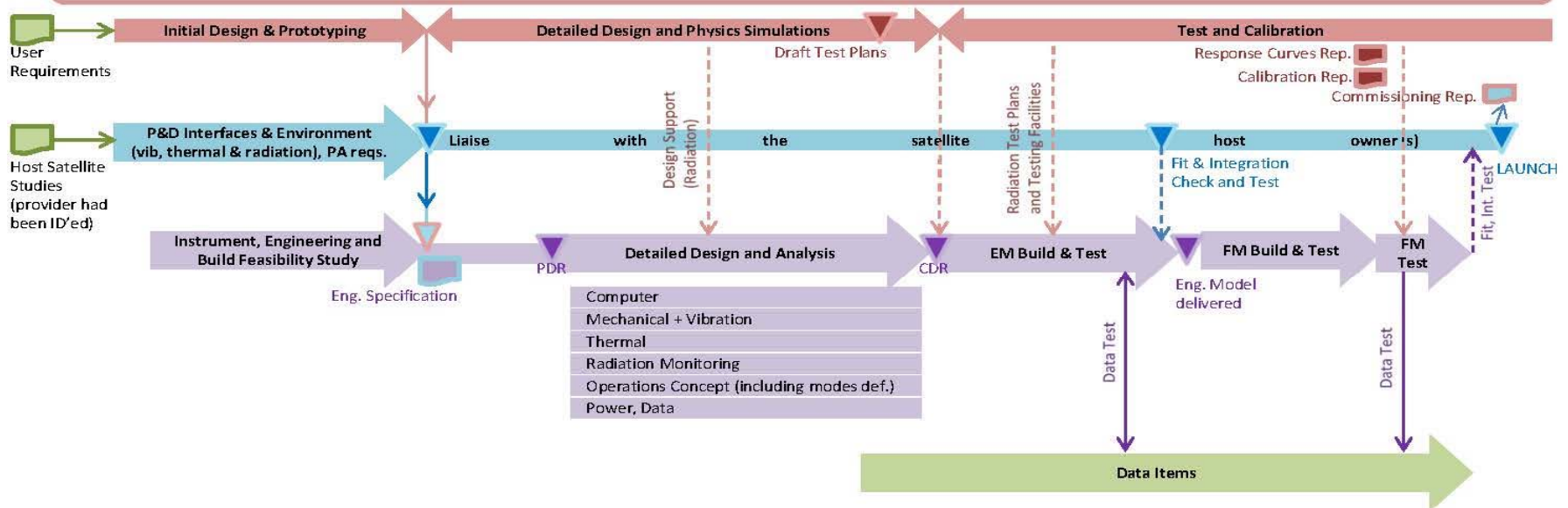
- First requirement is a clear statement of user requirements (e.g. from MOSWOC, with community assistance)
- Close working with industry is essential (flight opportunities, help with production)
- Academic involvement also essential (design, simulations, understanding of test results)
- Synergy with project S2 regarding testing of developed detectors.

Year 2 (01/04/20-31/03/21)

Year 3 (01/04/21-31/03/22)

Year 4 (01/04/22-31/03/23)

Trusted Detector Physics, Design and Support



STFC Commissioned Projects

S2: Technology testing and modelling

Context

- Developers of hardware (especially for avionics) make use of UK (and overseas) facilities for testing their devices and instruments
- Relevant to GCSA avionics forum aim to promote testing possibilities in this sector

Aim

- Support STFC's ChipIR facility, providing funding for upgrades, offset of user fees for space weather projects and testing access for sensors developed in project S1
- Retain some funding to support testing at other facilities (e.g. CERN) especially for space sensors from project S1
- Potentially investigate new technologies for testing (e.g. with laser technology)

STFC Commissioned Projects

S2: Technology testing and modelling

Methodology

- ChipIR is currently investing in a hardware upgrade (DT source) to make it more independent of ISIS main beam. We will contribute to that upgrade (precise amount tbd, but probably >£100k)
- User fees at ChipIR are of order ~£9k/day (same as CERN). We are planning an assessment scheme to reduce user fees for space weather related projects, based on existing ChipIR access rules
- Some testing funds will be retained to allow S1 testing at other facilities
- If funding permits (later in the project) we will fund a small study of new testing methodologies with other types of facility.

STFC Commissioned Projects

S3: Research to Operations Development

Context

- Migrating models and data from the research community into MOSWOC is a key aim of this programme
- For this to happen there have to be commonly understood modes of operation
- Inputs/outputs have to be specified in a way enabling them to be used by both parties

Aims

- Met Office is planning to extend its system for running models and assimilating data, built on Amazon Web Services into the space weather sector
- Effort and funding will be front-loaded to get something in place which can be used by the modelling community by the mid-point of the SWIMMR programme
- Plan is to develop a beta version by mid 2021, which can be used for the testing of models as they develop in the other (mainly NERC) projects

STFC Commissioned Projects

S3: Research to Operations Development

Methodology

- This project will mainly be carried out by the Met Office, working with its own contractors, but needs engagement from the community
- First step will be a requirements gathering phase based on Met Office experience (with community input on requirements)
- High-level design and costing to be done by summer 2020
- Prototype system to be available by spring 2021, to provide something for modelling packages to plug into
- Testing phase will work with modellers to deliver a robust version of the R2O environment, by spring 2022
- Last year of the project will be devoted to widening the scope of models and services and to minor modification and support activities

STFC Grant Call Projects

S4: Forecasting from the Sun to L1

Context

- Understanding travel time of solar wind structures is a key requirement for space weather prediction
- MOSWOC already uses ENLIL, but these multi-point MHD models are slow and computationally expensive
- Limited scope for ensemble modelling if models are very compute heavy, hence difficult to establish errors
- Need a diversity of modelling techniques, not just one globally-used model

Aim

- Look at improved solutions, based on work already being carried out in the community
- Optimisation of existing models or development of computationally lightweight models would be in scope

STFC Grant Call Projects

S4: Forecasting from the Sun to L1

Methodology

- Grant-funded activity, so onus is on the applicant(s) to tell us what the best approach is
- Has more in common with the NERC projects than any other STFC projects
- Is in the STFC domain because solar and heliospheric physics traditionally belong to STFC
- Model developers will need to work inside the S3 modelling framework just described

STFC Grant Call Projects

S5: Ground radiation monitoring network

Context

- Driven by the avionics agenda and the need to monitor conditions on air routes, especially at high latitude
- Fixed ground-based neutron monitor networks are useful complement to aircraft-based monitoring, worldwide network exists
- However, no detectors in UK, and locations not well optimised to use for avionics
- Detectors are large (building sized) and comparatively expensive

Aims

- Ideas exist for smaller and more affordable detectors, potentially using non-standard techniques (being developed in other UKRI-funded studies)
- If this has potential, aim is to develop a prototype network as proof of concept, driving new technology development
- Also to provide test data feeding into avionics models

Neutron Monitoring Facility at Dourbes

Building



Detector



STFC Grant Call Projects

S5: Ground radiation monitoring network

Methodology

- Again, as a grant the onus will be on the proposers to describe and justify the best approach and candidate technology
- In this case, however, there will need to be a set of requirements to work against, to ensure that data generated by a novel instrument will be relevant and applicable
- Requirement study will be done earlier via a stand-alone call/ITT
- Work with Met Office will be needed to demonstrate data flow from prototype sensors
- Ideally developed technology should be suitable for deployment and remote operation, including in high-latitude locations.

STFC Grant Call Projects

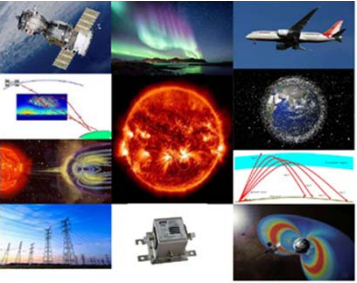
S6: Updated space weather impact study

Context

- Royal Academy of Engineering report: ““Extreme space weather: impacts on engineered systems and infrastructure”, published in 2013, is one of the definitive studies on worst case scenario impact
- By the end of SWIMMR, it will have been ten years since publication
- Ideally this kind of study should be updated every few years as technology, science and operation/mitigation strategies evolve

Aim

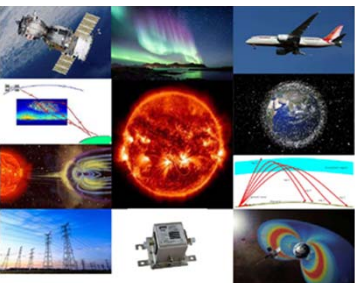
- Provide the opportunity for a consortium of authors to update the report and fund the time required for them to do this
- Back-load funding toward the end of the SWIMMR study in order to capture some of the SWIMMR impacts within the scope of the report



Requirements for STFC studies

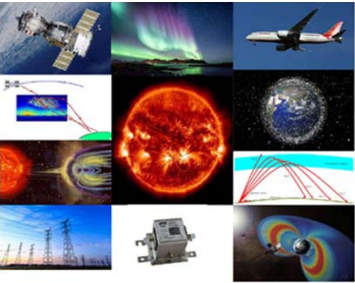


- All STFC (and NERC) studies in SWIMMR must report progress regularly
- The whole SWIMMR programme has to report monthly to UKRI
- There will be a dedicated UKRI Monitoring and Evaluation Team who will be liaising with PIs and gathering evidence of progress and impact for a demonstration of “benefit realisation”.
- This will supplement normal procedures such as Research Fish
- Budget and scope must stay on track, as we will be required to demonstrate this to UKRI
- We will organise an annual SWIMMR workshop for progress reports from PIs of all projects, with stakeholders in attendance

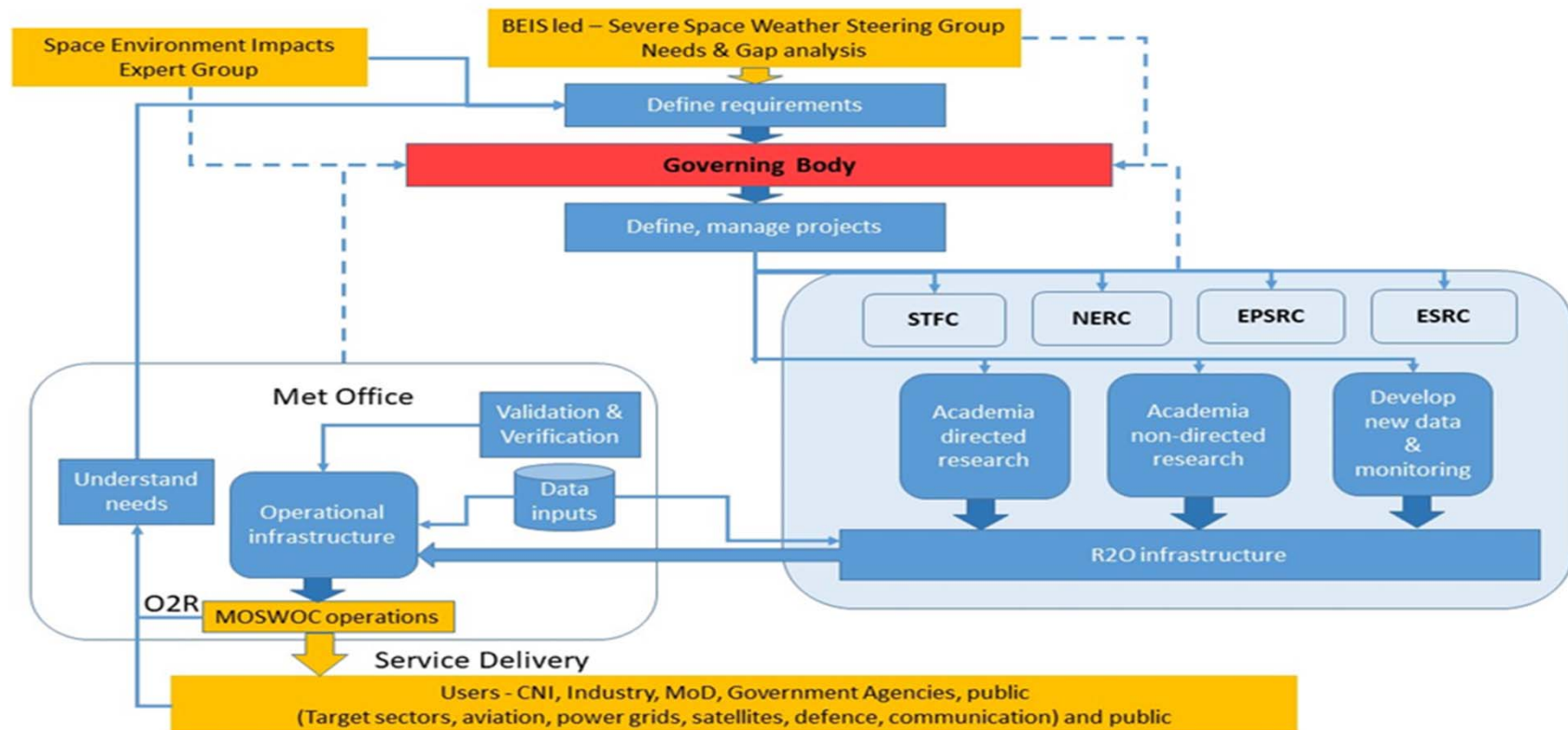


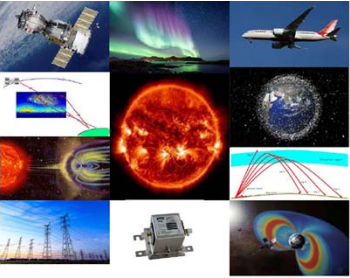
Budget by STFC project

Project Number and Name	Lead Council	FY 19/20	FY 20/21	FY 21/22	FY 22/23	TOTAL £M
S1: Improved in-situ radiation measurements for space and aviation	STFC	0.20	1.80	1.83	1.87	5.70
S2: Technology testing and modelling	STFC	0.10	0.19	0.20	0.11	0.60
S3: Research to Operations support	STFC	0.05	0.29	0.30	0.26	0.90
S4: Forecasting from Sun to L1	STFC		0.15	0.15	0.15	0.45
S5: Ground radiation monitor network	STFC		0.55	0.45	0.40	1.40
S6: Space weather impact study	STFC		0.10	0.10	0.10	0.30
TOTAL STFC Programme Budget by Year		0.35	3.08	3.03	2.89	9.35



UK Space Weather Relationships



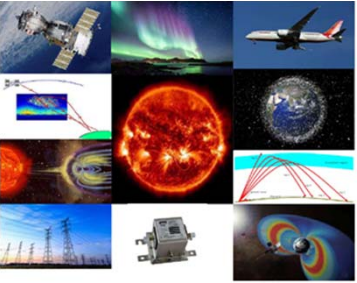


Key Individuals and Roles

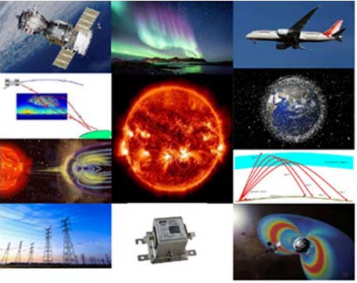


- Prof Chris Mutlow – Senior Responsible Owner
- Jacky Wood – NERC Programme Office Lead
- Justin O’Byrne - STFC Programme Office Lead
- Simon Machin and Mark Gibbs – UKMO members of PB and SAG
- Dr Ian McCrea – Senior Programme Manager
- Mila de Vere, Toni Cullum (+others) – Project Managers in STFC and NERC

- Olivia Greenall, Dr Gemma Attrill, Asher Lawrence-Cole – representatives of BEIS, MoD and DfT respectively

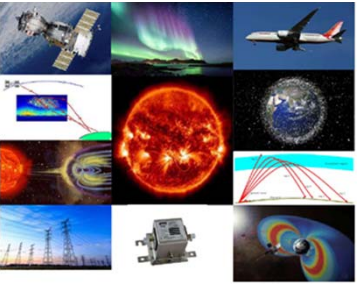


For more details of the individual projects, see Mark Gibbs's presentation coming next!

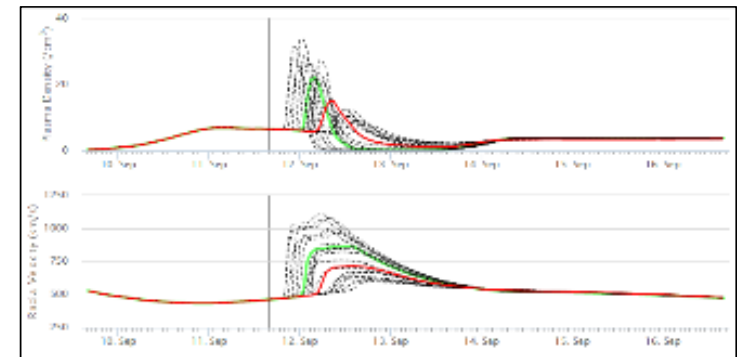
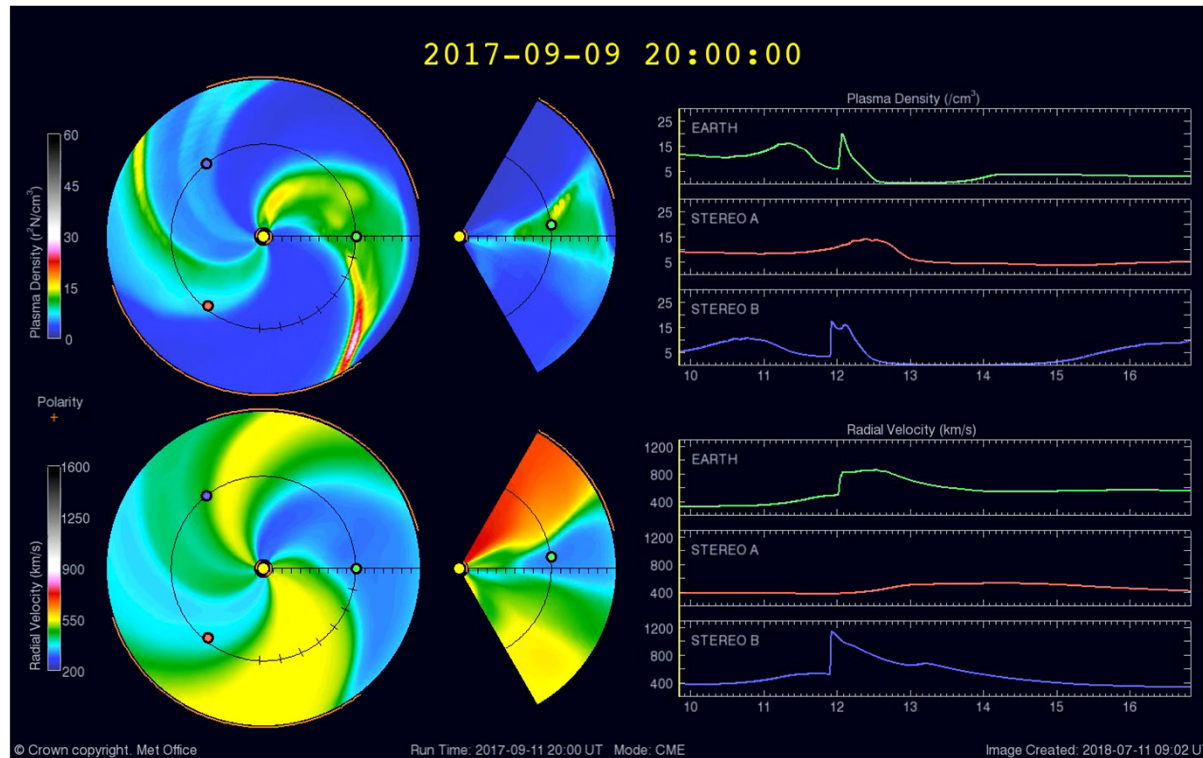


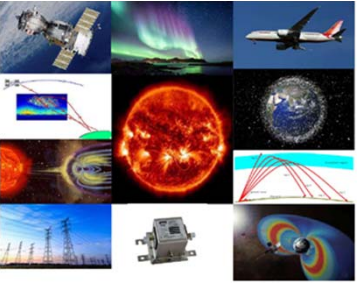
Motivation

- MOSWOC created by importing SWPC capability
- No UK space weather research programme results in continued dependence on US
- Lack of diversity in models
- Cost if transitioning research into operations is expensive



CME / Geomagnetic focus

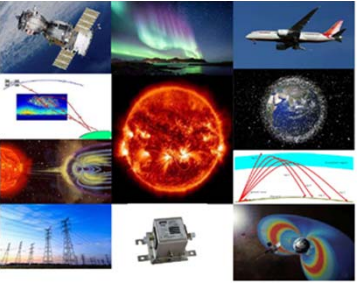




Origins of the Programme (1)



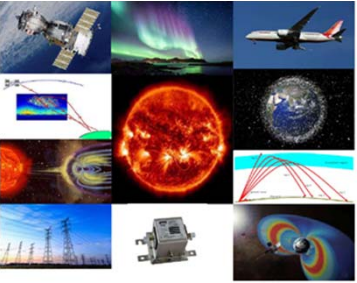
- STFC conducted a “Priority projects” exercise in July 2018
- Submitted three applications, for different combinations of space weather and space surveillance ideas
 - Space weather ideas based on previous discussions with Mark Gibbs
- STFC Director of Strategy asked for the space weather proposal to be turned into a bid to Strategic Priorities Fund Wave 2 (October 2018)
 - Suggested amount £5M



Origins of the Programme (2)



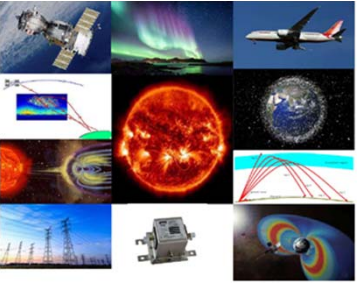
- STFC Executive Board approved SWIMMR as an STFC-led SPF proposal (November 2018)
- Contacts with Wave 1 projects revealed the need for cross-Council and ministerial support
- Initial description, budget and ministerial support letter
 - Submitted to UKRI December 2018
 - Support letter signed by three ministerial CSAs



Origins of the Programme (3)



- UKRI asked us to prepare full business and economic case
 - Submitted March 4th 2019
- UKRI gave outline approval of business case
 - May 2019
- Treasury approval secured on July 5th
 - Conditional on final approval by BEIS
- Signed off by BEIS Project Investment Committee on August 15th
- Announced (by the Prime Minister) on September 23rd

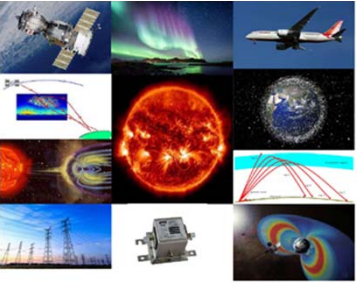


The SWIMMR Planning Group



- Met as an informal group to pilot the proposal to where it is now.
- Had its last meeting last week, as programme is handed over for kick-off
- We owe them huge thanks for steering SWIMMR through the various hurdles.

- Mark Gibbs and Simon Machin (UKMO)
- Richard Horne (BAS)
- Keith Ryden (Univ. of Surrey)
- Paul Cannon (Univ. of Birmingham)
- Jacky Wood, Gemma Truelove and Stephen Elsby (NERC)
- Jason Green and Justin O'Byrne (STFC)
- Mike Hapgood, Mila de Vere, Toni Cullum (RAL)



Top-level SWIMMR budget



- The programme is budgeted “in year”, in terms of funds transferred by BEIS to UKRI
- This annularity will not be visible in multi-year grant awards!
- Note the slow start in year 1, because we anticipated delayed approval

	FY19/20	FY20/21	FY21/22	FY22/23	Totals £M
STFC Programme	0.35	3.08	3.03	2.89	9.35
STFC Management	0.13	0.13	0.13	0.13	0.52
STFC OpEx	0.06	0.08	0.08	0.07	0.29
NERC Programme		2.92	2.97	3.38	9.27
NERC Management	0.03	0.09	0.08	0.08	0.28
NERC OpEx	0.06	0.07	0.07	0.08	0.28
TOTAL	0.63	6.37	6.36	6.63	19.99