UK SPACE AGENCY

Space Science at UK Space Agency - Challenge and Opportunity

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UK "Science & Space"

- First and foremost to carry out world class frontier science
- Exploit mandatory GDP funding through ESA
- Deliver strategic benefits forcing-house for new technology and skills – drives innovation
- Showcase UK capabilities (academia and industry) on world stage
- Develop new international partnerships
- Public understanding of science and inspiration



We acknowledge many reasons for investing in UK space – economics, technology, social interest etc but a clear role for SCIENCE has always been a key requirement for our involvement. This has historically been through our contribution to the European Space Agency Programmes in Space and Earth Sciences.

We focus on world class science that usually require projects involving several nations – in many ways similar to ground based observatories

We seek ways to maximise our ESA investment in support of this science – through industrial and academic contracts for the construction of infrastructure to deliver the science, supplemented in some cases with national investments.

We seek to promote UK capability through this science "shop window" and garner wider UK public support for investment in space.

"Science" at UKSA - Approx 40% of our budget UK Research nd Innovation Gesa £40M p.a. National - science instruments data exploitation sustainable devt £150M p.a. ESA - technology - satellite & ops science instruments @esa applied research GOSMIG VISION (Few) bilateral missions @esa

Science at UK Space Agency is not an insignificant investment in the eyes of Treasury and accounts for approx. 40% of its annual budget (around £450M) – it covers

- Astronomy
- Solar System
- Earth
- Materials and Life Sciences

And (more loosely...)

- Applications that embrace research into use of space data in support of sustainable devt (via a Govt Research Grant)
- The majority of this investment is through ESA we have very little (and increasingly no) headroom for bilaterals outside this arrangement (see later)



Today we have an extensive portfolio of ESA space science missions and more on the blocks... many will be familiar and all are peer review choices across European science.

However the **cadence** of these missions is declining as the core missions become ever more expensive per mission while the projected operational life for "past missions" continues to demand rolling investment in data operations. This places pressures on our national space science budget...



Looking Forward... "Solar Science" will see Solar Orbiter and SMILE over next few years....

	(F-Mission	ESA Missions of Opportunity		
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		Acres 1	Microscope	Fundamental physics	France
TERMS PARSON	1.		Hinode	Solar physics	Japan
			Proba-2	Plasma physics	TEC/Belgium
M4 Ariel			Hitomi	X-ray astronomy	Japan
		NAME OF A DESCRIPTION OF A	ExoMars	Planetary science	HRE/Russia
			IRIS	Solar physics	NASA
			Proba-3	Solar physics	TEC/Belgium
M5 😯 🗡		EnVision	XRISM	X-ray astronomy	Japan
		Understanding why our most Earth-like	Einstein Probe	X-ray astronomy	China
() 🦄 ,		heighbour is so allferent	MMX	Planetary science	Japan
			eXTP	X-ray Astronomy	China
	Creseus	A Company	LiteBIRD	Cosmic Microwave	Japan
SPICA	early universe surveyor		WFIRST	NIR Astronomy	NASA
obscured Universe	Land Property Learner Starts (2007-2007 Bologue, Indy)	C. Stern State	Taiji	Gravitational Waves	China
Desi ulara		V 3265	HERA	Asteroid deflection	OPS/Safety
		NASA	L5	Space Weather	OPS/Safety
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Looking to the future ...

M missions continue with **M4** and **M5** which feature UK capabilities... and which will require funding...

And then there is the new **F-mission**.... New one-off ESA "Fast mission" offering quick science for 160M€

(6 candidates chosen from community proposals; 4 include strong UK instrument teams)

And additional **Mission of Opportunities** are emerging in ESA – programmes that limit ESA investment to <23M€ per mission but which offer routes for additional national investment...

Today these place ever more pressure on the UK Space Agency investment process – essentially not all these missions can be supported... a strategic choice will be needed...

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What then of "Bilaterals" outside ESA?

Currently UKSA has bilaterals in Earth Science through the intervention of a past Space Minister and some reallocated BEIS budget. This route is closed for the future.

UKSA also has a small bilateral with USA for Exploration and a past commitment in Solar Science

Today the national space science instrument investment is approx. £15M-£20M p.a. and this is increasingly the entry ticket for any ESA Mission. With M4, M5, ESA MoO and F-missions set to continue this trend then the UK National budget is not increasing at a sufficient rate – this leads to fewer opportunities for non ESA partnerships going forward... and **Solar Physics** may be most impacted in the future?



How to address this?

- a) ESA CMIN 2019 offers a chance to restructure the ESA Science budget and ESA basically asks for a significant funding uplift after 10 years or so of "flat cash" at ESA Science. (see next)
- b) UK Govt sees BREXIT as placing constraints on the space industrial sector and may offer a funding line to reach out to new international markets could science partnerships play a part in this?



ESA state: "The most important decisions facing Member States at Space19+ will be: to restore ESA's (space) science programme as the world leader in the physics of the Universe by reversing the long-standing decline in buying power of the Level of Resources ..."

ESA want 20% to address 4 new opportunities – bring LISA and Athena L missions together; introduce regular F mission series; add a new M mission for Neptune/Uranus and bring about a better engagement between ESA and Member States for investment in payload technologies.

This is very ambitious and probably will fail to win unanimous support. UK is very keen on the last option as a way to build a better balance between National and ESA funds for instruments.



The Space Sector Deal is the second line – could HMG offer the Space Community a new national space programme to readdress long standing imbalance between national and ESA budgets (vs Fr, D, I etc etc)??

We wait to see (by April??) but if this happens what role and what voice will SCIENCE have?

Summary

- UK is investing in "world-class" Space Science
- The complexity of "world class" Space Science is increasing (costs etc) and cadence is decreasing...
- UKSA budget for Space Science embrace (small) national (mainly academic) and (large) ESA (mainly industrial) contributions
- ESA missions will consume UK budget what role for bilaterals?
- UK space ambitions focus on new markets for economic growth what role for Science?
- UK must make strategic science case into new programme lines through a concerted voice – SPAN



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