



Update from the UK Space Agency

Royal Astronomy Society
8 February 2017

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Head of Space Science



UK Space Agency – Our “Domains”



Space Science

Planetary
Exploration

EO
& Meteorology

Space Situational
Awareness

Telecomm

Navigation

Applications &
Services

Human Spaceflight

Missions in Operation or Legacy phase

- Alsat Nano
- Cassini
- Cluster
- Gaia
- Herschel
- Hinode
- Lisa Pathfinder
- Rosetta
- Stereo
- Swift

AlSat Nano



Educational and technology demonstration mission launched from India in September 2016

UK Space Agency funded design, build and verification of spacecraft at Surrey Space Centre as part of programme to Algerian MSc and PhD students

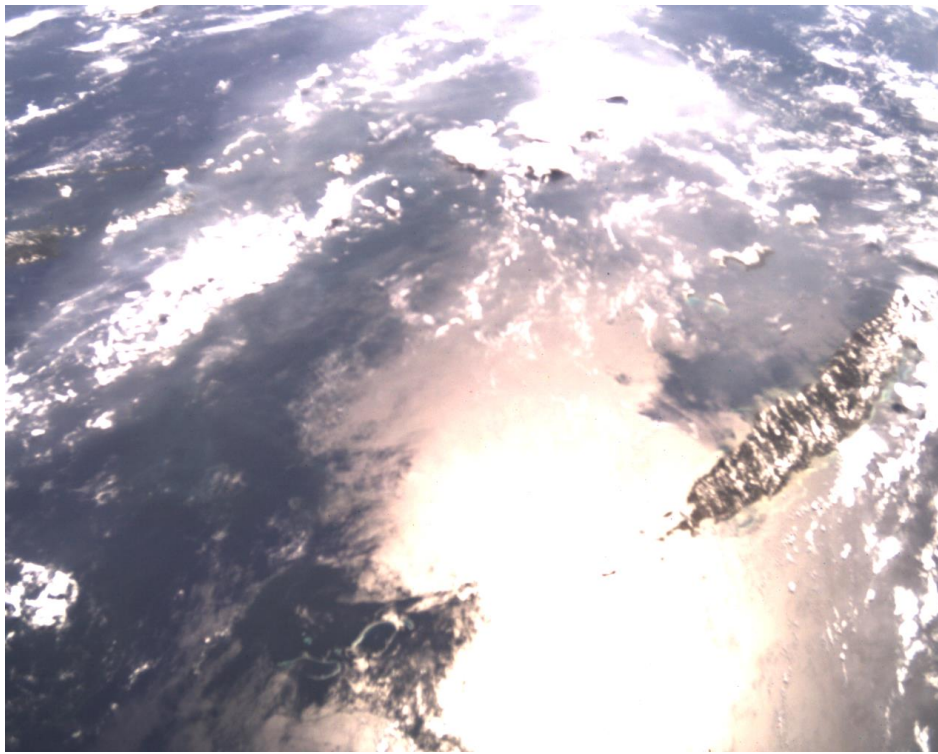


Algeria procured launch and is hosting mission operations in Oran

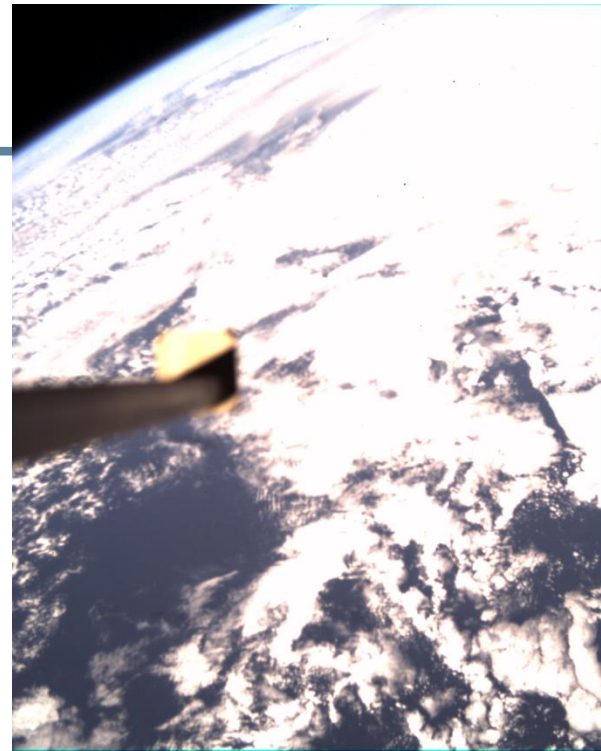
Spacecraft is performing well in orbit; platform is stable and healthy, all payloads are commissioned and functioning successfully

Features three self-funded UK payloads:

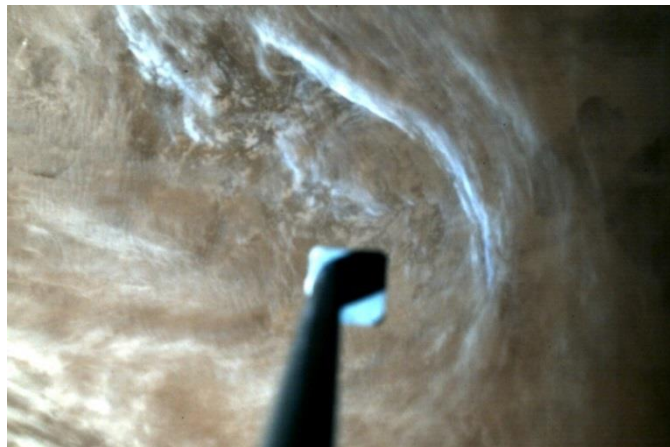
- C3D2 – Open University, e2v Ltd, XCAM Ltd – CMOS imager with three fields of view
- AstroTube Boom - Oxford Space Systems Ltd, Bartington Instruments Ltd, STFC RAL Space -Flexible carbon fibre fully retractable boom extends up to 1.5m. Includes sub-payload incorporating magnetometer and RadFET radiation monitoring devices
- Thin Film Solar Cell - Swansea University Centre for Solar Energy Research, University of Surrey, Qioptiq Ltd and Surrey Satellite Technology Ltd): Experiment to demonstrate new ultra-thin solar cell technology



This image was captured after successful stowing of the AstroTube Boom payload on 12th January 2017 over New Caledonia in the South Pacific. The main island is to the right of the image with low level cloud cutting across the island. Atoll lagoons can be seen at the bottom right of the image and the Vanuatu island chain to the upper left.



This image was captured over the Atlantic Ocean, off the East Coast of the United States on 12th December 2016. The object in the foreground is the deployed Oxford Space Systems Ltd AstroTube Boom payload.



The image was taken by the Open University C3D2 instrument's wide field camera on 3rd December, 2016, over the Arkhangelsk Oblast region, on the North West coast of Russia. It was captured under twilight conditions at dawn, showing the coastline to the right, and a brief winter sunrise over the arctic region with a deep red-brown hue. Through the cloud cover there is evidence of hills and snow

All photos credit
Open University,
Alsats Nano mission

Cassini Huygens

- NASA/ESA mission to Saturn with Huygens probe to Titan
- Launched 1997, planned end 15th September 2017 when Cassini enters Saturn's atmosphere
- New science potential from April-September as Cassini enters "proximal" orbits i.e. highly inclined orbits with close periapses
- Prof Michele Dougherty, PI of Cassini MAG received the Royal Astronomical Society Gold medal; a lifetime achievement award for her work in understanding the evolution of our solar system.

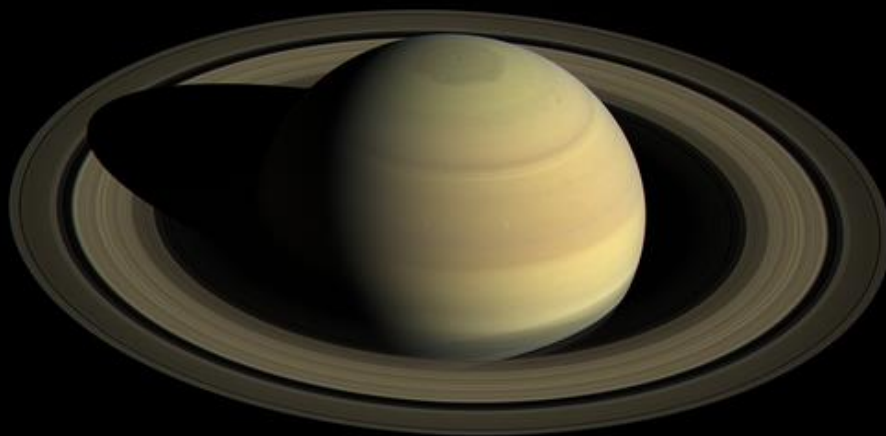


Photo credit NASA/ESA

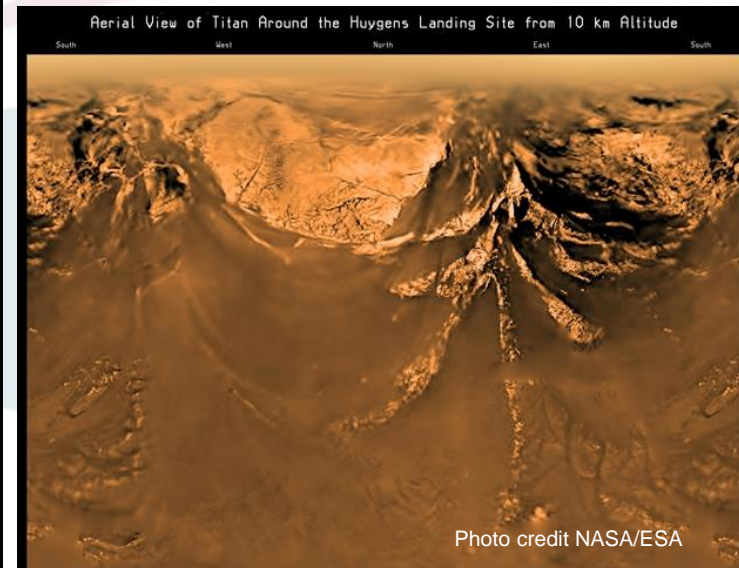


Photo credit NASA/ESA

Gaia

- Accurate mapping of 1 billion stars
- UK data centre & DPAC lead of photometry, participate in spectroscopy and produce science alerts
- 1st data catalogue released 14th September 2016
 - 3 UK workshops were run in preparation
- 2nd catalogue release anticipated April 2018

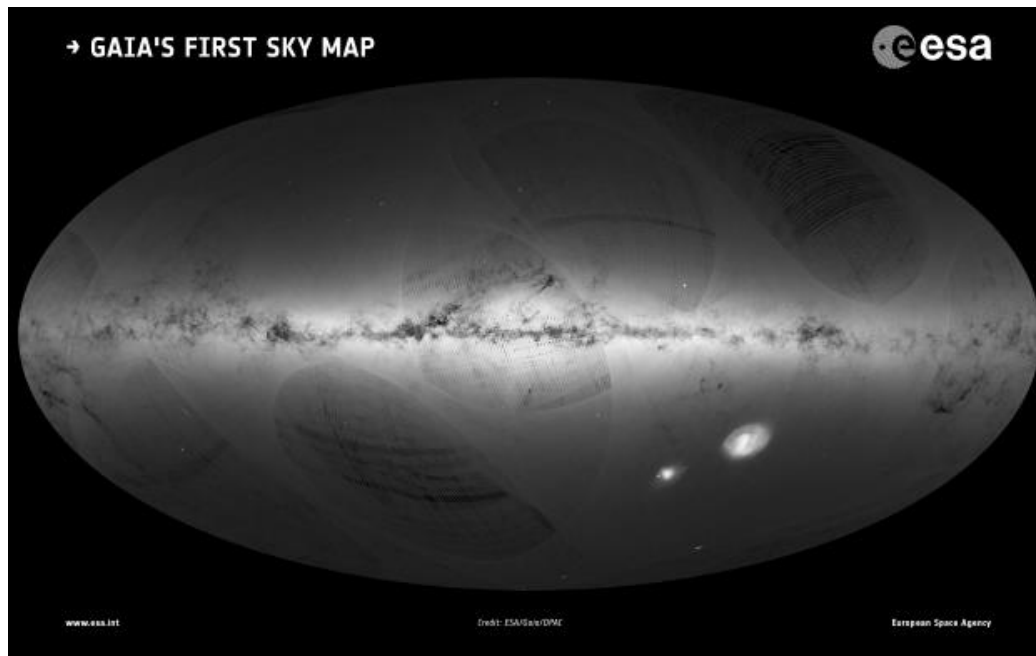
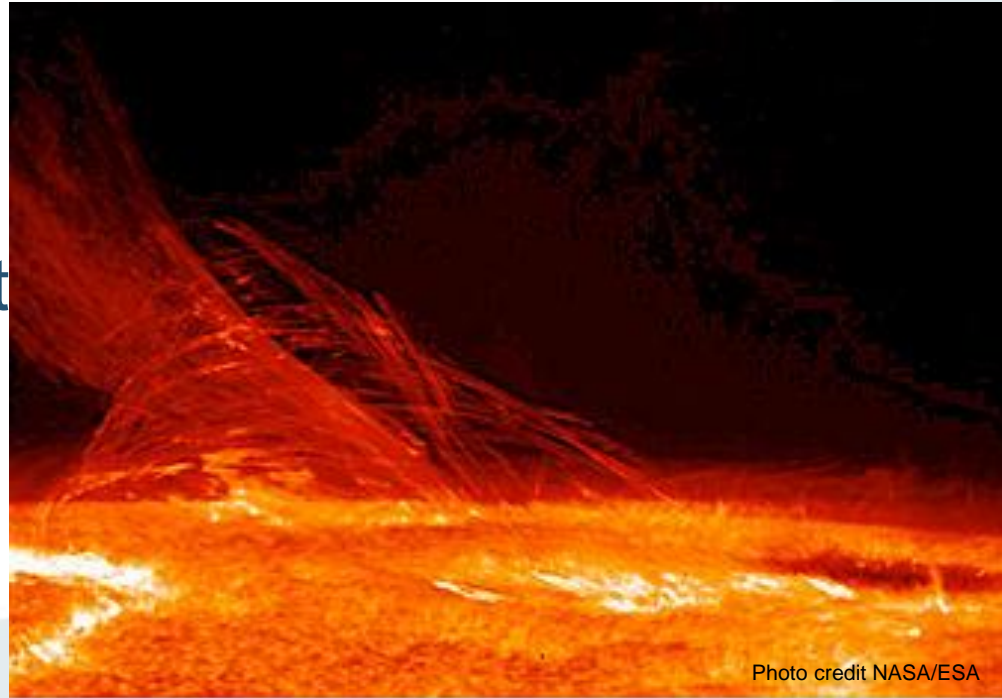


Image of Gaia's first sky map

Hinode

- 10 years in space celebrated on 22nd September 2016
- UK built and operating the Extreme Ultraviolet Imager (EIS)
- Mission collaborators in Japan, US & Norway

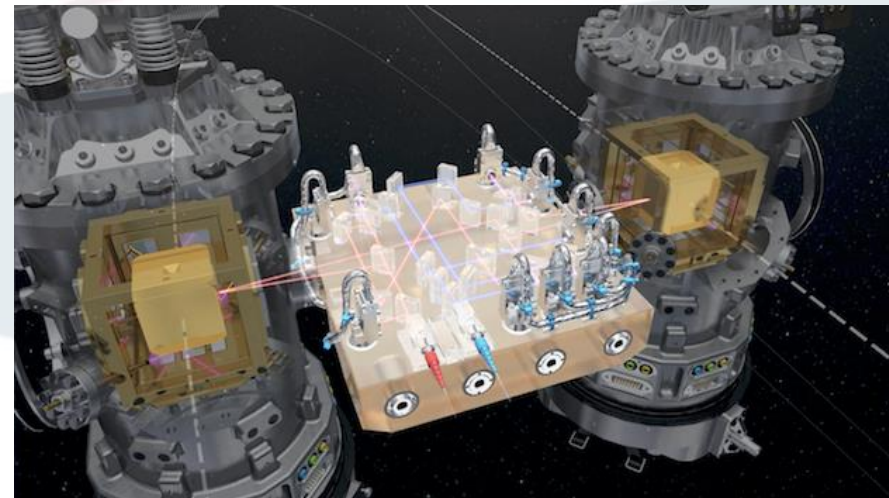


LISA Pathfinder

Technology demonstrator for gravitational wave experiment



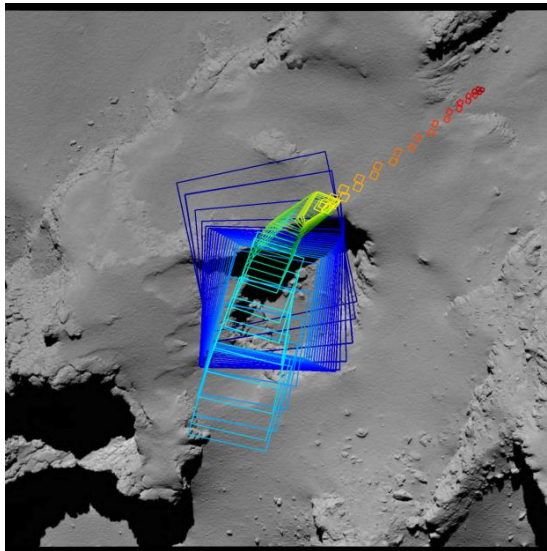
- Since launch in December 2015, LPF has successfully demonstrated technology for LISA/L3
- Two test masses in free fall influenced by gravity alone
- Five times greater precision than originally required
- UK built the optical bench (Glasgow), phasemeter (Birmingham) and charge management system (ICL)



(Copyright ESA images)

Rosetta - Farewell

- Mission ended 30th September 2016 with the spacecraft landing on the comet
- Follows Philae's dramatic landing on 12th November 2014,
- Marks the end of a long & successful mission with unexpected science discoveries & unprecedented media interest



OSIRIS imaging footprints during Rosetta's final descent (left)

Photo credit ESA

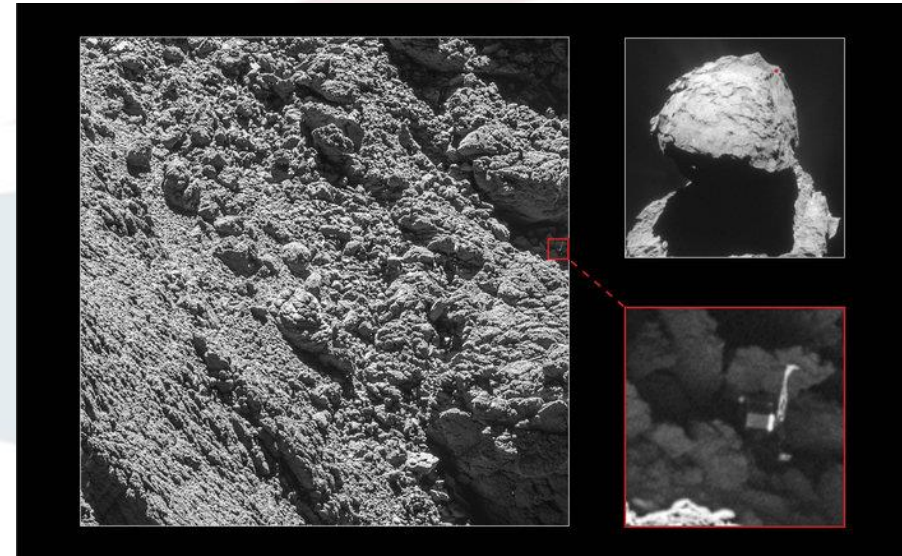


Photo credit ESA

Missions in build/integration phase

- JWST
- JUICE
- Bepi Colombo
- Solar Orbiter
- Euclid

James Webb Space Telescope

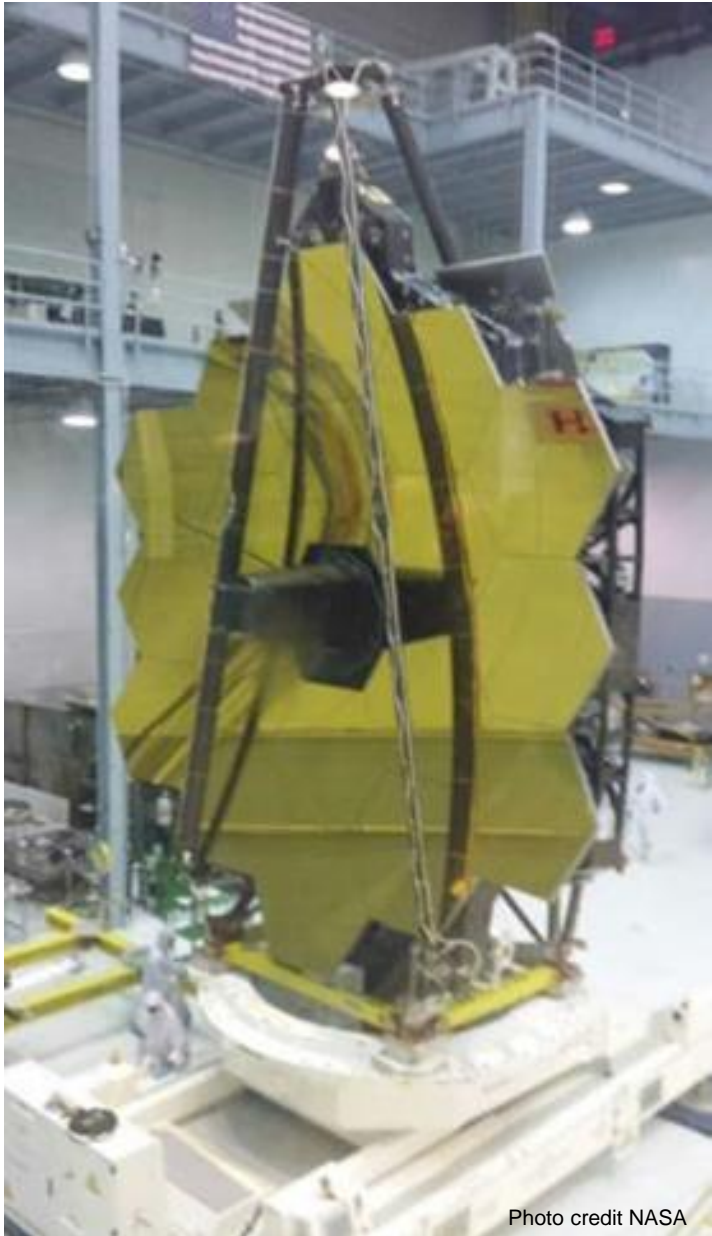


Photo credit NASA

JWST - Optical Telescope
Assembly (Oct 2018 launch)

UK is leading the magnetometer (JMAG) and contributing to the JANUS camera and the Particle Environment Package



Photo credit Imperial College London

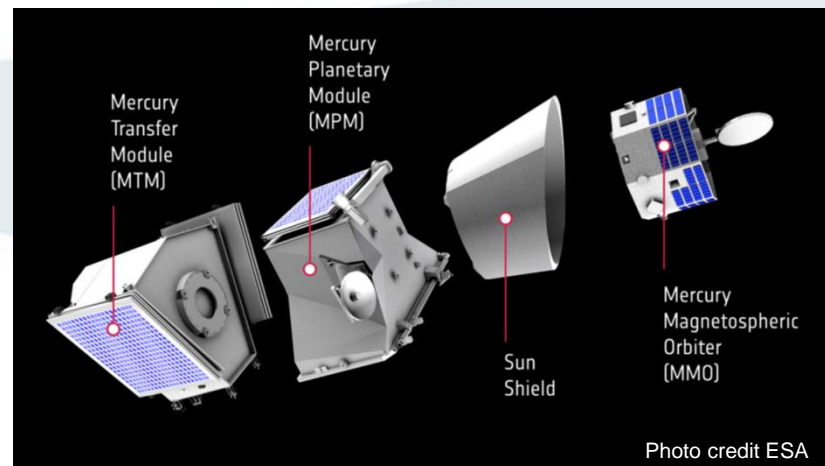
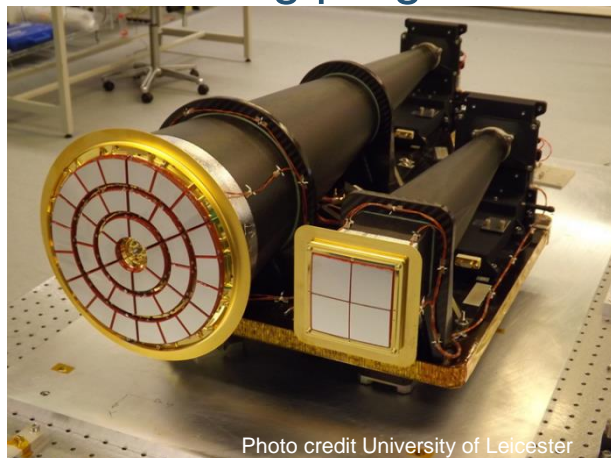
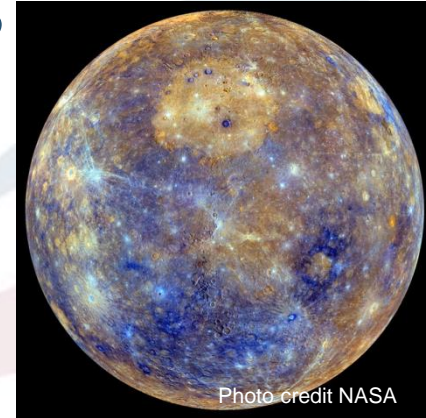
JMAG Lab Model working at ICL since mid 2016 as primary test bench for instrument development

Outboard Sensor electronics already demonstrate science grade performance

Team now moving into Engineering Model design phase. Flight Model schedule on track (delivery February 2019, launch in 2022)

BepiColombo

- 2 spacecraft
 - Mercury Planetary Orbiter (MPO) European led
 - Mercury Magnetospheric Orbiter (MMO) Japanese led
- Launch October 2018, arrival at Mercury December 2025
- Leicester University PI MIXS: Mercury Imaging X-ray Spectrometer
- RAL Space CoI SIXS: Solar Intensity X-ray & particle spectrometer
- Hardware delivered & Leicester continuing support for ESA flight testing programme.



Solar Orbiter

- Launch October 2018, but may be delayed
- UK PI for Solar Wind Analyser suite, Magnetometer & SPICE & Col on Extreme Ultraviolet Imager
- Flight model deliveries currently taking place & up to Q2 this year; intense payload development being completed

The structural and thermal model (STM) of the Solar Orbiter spacecraft, pictured in March 2015 at the Stevenage premises of prime contractor Airbus Defence and Space. Copyright: Airbus Defence and Space 2015



- UK leading on VISible instrument (MSSL, UCL)
- All VIS subsystem Critical Design Reviews complete
- Instrument-level CDR kicked off in January
- First Flight Model detectors (CCDs) delivered to ESA on schedule (February 2017)
- Launch December 2020

Missions in development

- Athena
 - PLATO
 - L3
 - M4
 - M5
- 

Outcome of the Ministerial Council

€million	2017	2018	2019	2020	2021	TOTAL
Scientific Programme	508	508	508	508	508	2540
Basic Activities	232	232	232	232	232	1160
Annual adjustment	7.5	15	22.5	30	38	113

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Wider developments

- *Building our Industrial Strategy*
 - Green Paper published 23 Jan
 - Responses due by 17 April

- *The United Kingdom's exit from and new partnership with the European Union*
 - White Paper published 2 Feb

Space Growth Strategy



HM Government

National Space Policy



Space Growth Strategy

- Space is of strategic value to the UK
- We need to protect the space operating environment
- We need to sustain and grow our space capability
- Space is an international endeavour