SPACE SCIENCE in the United Kingdom

SCIENCE AND ENGINEERING RESEARCH COUNCIL

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OBJECTIVES

The Science and Engineering Research Council's prime aim is to support research and postgraduate training in British Universities and Polytechnics in all basic areas of science and engineering. This includes space science involving astronomy, the solar system and the Earth's environment. University research in telecommunications and datalinks often also involves space techniques. SERC's four research establishments support these aims by providing and operating large-scale world-class central scientific facilities in the UK and arranging access to large ground-based observatories overseas, mostly in collaboration with other countries.

Space flight opportunities are provided by SERC to UK scientists directly, through subscription to the European Space Agency and through international collaboration with many countries including the USA, Germany and the Netherlands.

In all this, particular emphasis is placed on the use of the most modern image processing and data handling techniques. UK scientists have made major contributions to the developments of these techniques.

Developments in engineering research and postgraduate training directed to the needs of industry are major concerns of SERC. The Council is set up under Royal Charter and is funded by the UK Government through the Department of Education and Science.

Space is only one of the many areas in which SERC has strong international links.

Science and Engineering Research Council

SPACE SCIENCE

UK scientists have been involved in space research from the beginning and have remained amongst the world's leaders in this exciting area. Part of the strength has come from SERC's complementary support of ground-based astronomy.

The first of the UK/Ariel series of scientific satellites, launched in 1962 with the strong support of NASA, included the first instrument to observe solar X-rays. X-ray astronomy has been a particularly strong theme in the UK subsequently. Ariel V, launched in 1974, was the world's second satellite to be dedicated to X-ray astronomy and carried five instruments built by UK University teams and one from the USA. This satellite returned extremely valuable scientific data for over 5½ years of operation. Ariel VI, launched in 1979, also studied X-ray sources and the origin of cosmic rays. Recently satellites have been controlled directly by SERC's Rutherford Appleton Laboratory.

Apart from the use of the Ariel series of satellites and of sounding rockets, UK scientists have won places for their experiments and instruments on a wide range of satellite missions, particularly of ESA and NASA. In addition, the UK is currently involved in many joint astronomical missions with other countries, including IUE, IRAS and ROSAT.

Throughout, the emphasis has been on science making use of the most advanced technology – scientists in many ways acting as the vanguard to subsequent applications programmes. The breadth of the scientific base in the United Kingdom involved in the space science area can be seen from the fact that SERC supports over 40 groups in British Universities and Polytechnics.

SERC believes in a broad approach to astronomy both from space and ground-based facilities using the most advanced techniques and data facilities available, or developing them if necessary. Listed below are some of the programmes in which UK scientists are strongly involved.

X-ray Astronomy

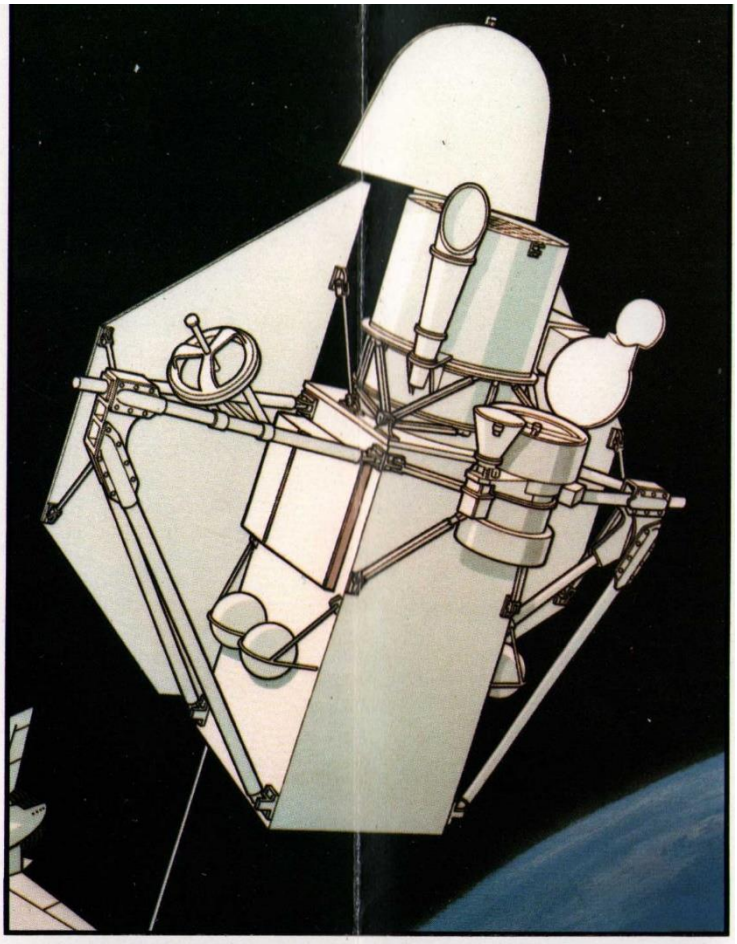
EXOSAT The European Space Agency's EXOSAT, to be launched by Ariane during 1983, will locate and measure the temporal and spatial characteristics of cosmic X-ray sources. Using expertise obtained on the Ariel series of satellites, UK groups at the University of Leicester and the Mullard Space Science Laboratory of University College London are participating in each of the three payload experiments including two imaging telescopes, medium-energy proportional counters and a gas scintillation spectrometer.

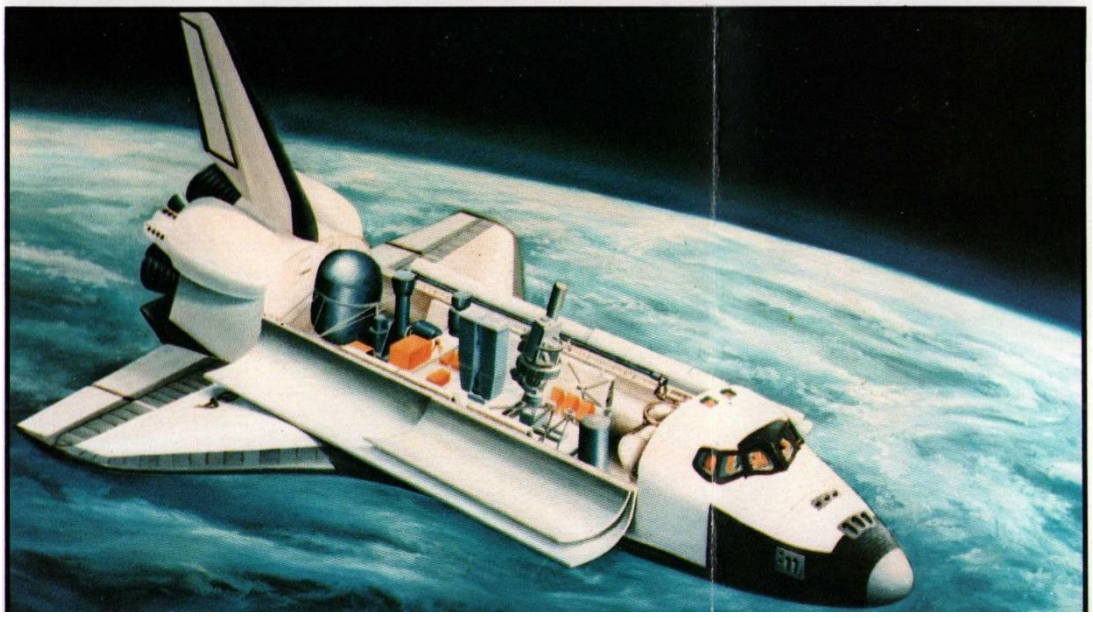
SPACELAB The UK is involved in a number of experiments to be flown on SPACELAB. The joint NASA/ ESA SPACELAB 1 mission will carry a gas scintillation counter for X-ray spectroscopy, developed by the Mullard Space Science Laboratory. There are also UK experiments in the field of life-sciences. NASA's SPACELAB 2 mission (scheduled for 1984) will include a solar XUV experiment, developed by the Mullard Space Science Laboratory and SERC's Rutherford Appleton Laboratory, to determine solar helium abundance. A large X-ray telescope, being developed at Birmingham University, will measure cosmic X-rays in the 2.5 to 25 keV energy range.

Photo: NASA

ROSAT SERC will participate in the German X-ray astronomy satellite, ROSAT, due for launch by the American Space Shuttle in 1987. An XUV telescope, complementing the main X-ray telescope, will be provided by a UK consortium comprising Leicester and Birmingham Universities, the Mullard Space Science Laboratory, Imperial College of Science and Technology and SERC's Rutherford Appleton Laboratory. UK astronomy groups will be invited to participate in the observing programme.

Photo: ESA





Ultra-Violet Astronomy

IUE The International Ultra-violet Explorer (IUE) satellite is a joint venture between NASA, SERC and ESA. Since the launch in 1978, the mission has been providing observing groups world-wide with data on a range of astronomical objects from planets to the stars, on quasars, and on interstellar material of our galaxy and neighbouring galaxies.

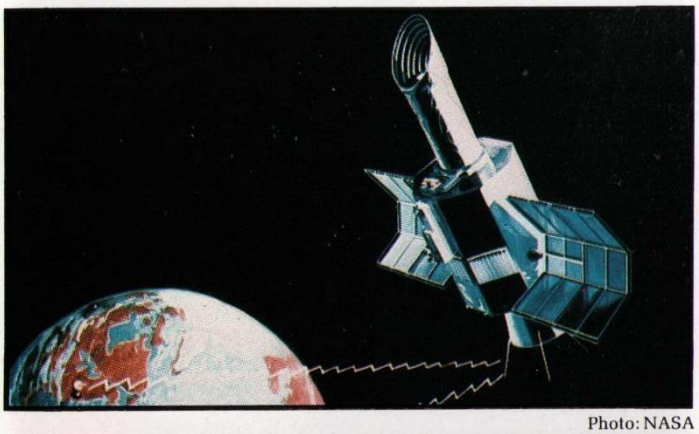


Photo: NASA

Photo: ESA

SPACE TELESCOPE
NASA's Space Telescope, with ESA participation, has been conceived as a long-term programme in space astronomy at ultra-violet, optical and infra-red wavelengths that will provide an astronomical capability unattainable by any ground-based telescope. A high-resolution 2.4 m telescope will be placed by the Space Shuttle in a circular orbit around the Earth in 1985. The intended lifetime of the telescope is 15 years. The Rutherford Appleton Laboratory will provide image processing software.

Infra-Red Astronomy

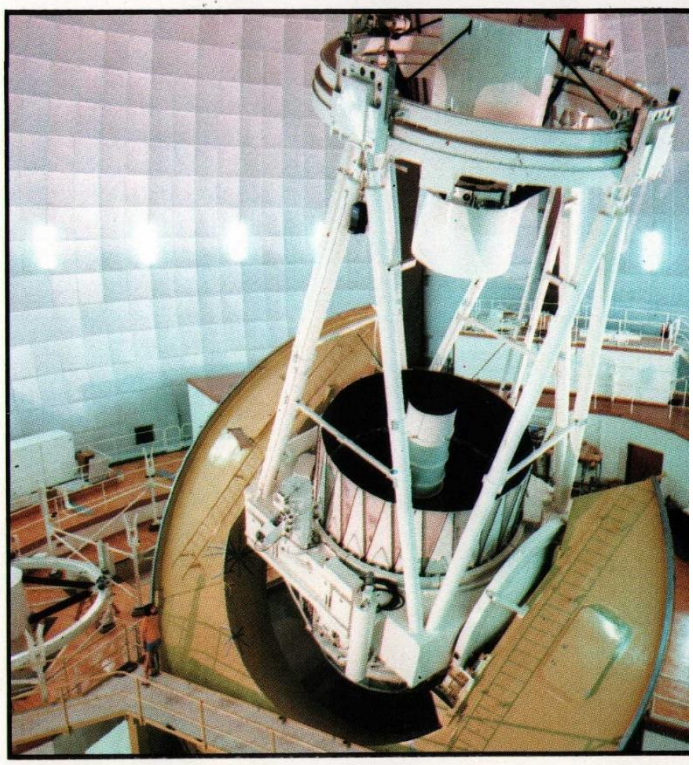
IRAS The Infra-Red Astronomical Satellite (IRAS) is a joint Netherlands/USA/UK mission to be launched at the end of 1982 and will enable astronomers to study cool objects such as very young and very old stars. SERC will provide the satellite control centre and data retrieval from a ground station at Rutherford Appleton Laboratory.

Ground-Based Astronomy

OPTICAL ASTRONOMY: Three optical telescopes are being erected within the international Spanish observatory on La Palma in the Canary Islands, including one of 4.2m diameter. Two of these telescopes will be operational in 1983. The Netherlands is a partner in this programme. These telescopes will complement the 3.9m Anglo-Australian telescope (shown in the photograph).

INFRA-RED ASTRONOMY: Since 1978, SERC has operated the world's largest infra-red telescope (UKIRT) on Mauna Kea, Hawaii.

RADIO ASTRONOMY: A millimetre wave telescope, operating down to 300 microns, will be constructed on Mauna Kea, alongside the infra-red telescope. Major facilities in radio astronomy are also supported at Jodrell Bank and at Cambridge University.



SOLAR SYSTEM SCIENCE

A wide range of solar system studies involving planetary and plasma geophysics programmes and neutral upper atmosphere physics, initially using Skylark rockets, has been undertaken in the UK since the late 1950s. More recently, the potential of spacecraft, together with supporting rocket, balloon and ground-based programmes, has widened the scope of solar system science. In addition, participation in the European Incoherent Scatter facility (EISCAT) in Scandinavia which is a high-powered, ground-based radar facility will, in conjunction with satellite data, extend our understanding of upper atmosphere processes.

AMPTE The Mullard Space Science Laboratory and Rutherford Appleton Laboratory are involved in the construction of a satellite to be carried in a three-spacecraft joint German/USA/UK Magnetospheric mission, AMPTE (Active Magnetospheric Particle Tracer Explorers). The UK spacecraft will measure magnetic fields, positive ions, electrons, plasma waves and wave-particle interactions. The satellite is scheduled for launch in 1984.

ISEE A UK team from Imperial College of Science and Technology is participating in the ESA/NASA International Sun Earth Explorer, launched in 1977, through the provision of detectors to measure the directional distribution and energy spectra of solar flares.

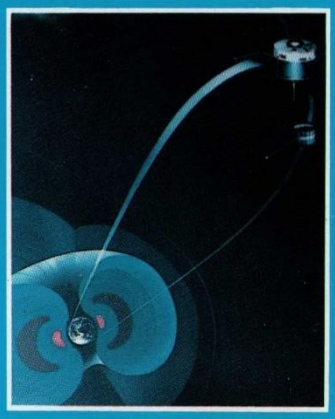
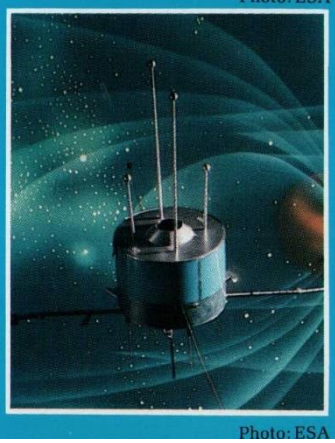


Photo: ESA

GEOS-2 This ESA satellite, launched in 1978 to study the interaction of the Earth's magnetic field and the solar wind, carries electrostatic analysers provided by the Mullard Space Science Laboratory for the study of thermal plasma. Plasma wave pulsations detected high in the magnetosphere have been found concurrent with modulated electron precipitation measured in the auroral zone by the Rutherford Appleton Laboratory's Skylark rocket experiments.



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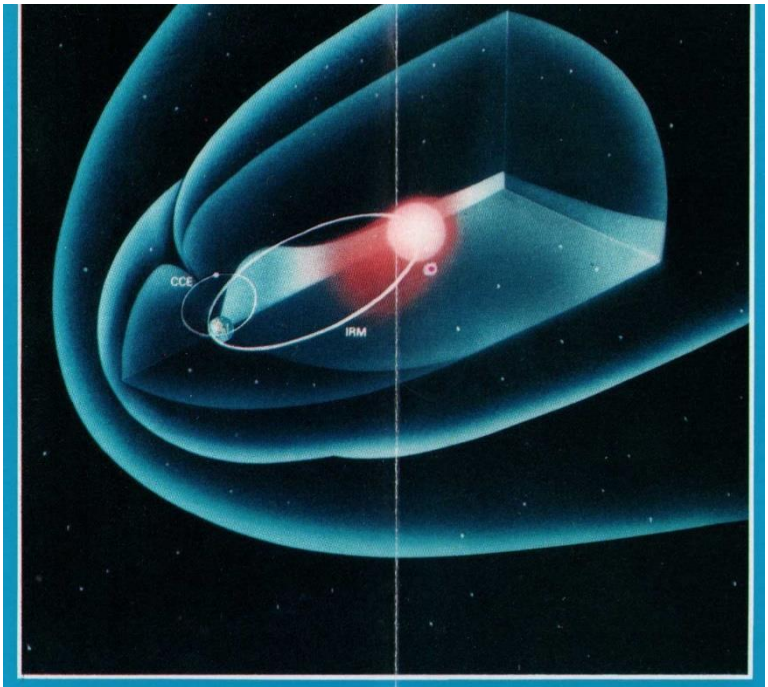


GIOTTO ESA's cometary mission, designed to intercept comet Halley during its post-perihelion phase in 1986, will carry UK instrumentation to measure cometary dust particles and study the interaction of cometary plasma with the solar wind.

ISPM The International Solar Polar Mission (ISPM) is a joint ESA/NASA project which will be launched in 1986 to provide the first three-dimensional investigation of interplanetary space, exploration of the heliosphere and view of the Sun over the full range of latitudes. SERC supports an experiment on magnetic field measurements and participation in four other research programmes on this mission.

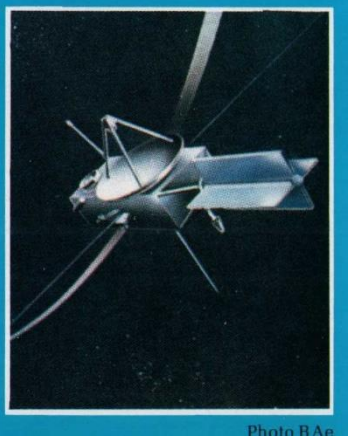


Photo BAe

EARTH-ORIENTATED RESEARCH

The UK is a world leader in the development of satellite instrumentation for remote sounding of the Earth's atmosphere, having provided sensors for the American series of Nimbus atmospheric satellites. UK groups developed a Selective Chopper Radiometer for Nimbus 5 (launched in 1972) and a Pressure Modulated Radiometer for Nimbus 6 (launched in 1975), both of which have provided valuable measurements of the mesospheric and stratospheric temperature. The Stratospheric and Mesospheric Sounder (SAMS) on Nimbus 7 (launched in 1978) observes infra-red emission from the limb of the Earth's atmosphere to provide data on temperature, atmospheric structure and minor constituents. An improved instrument, ISAMS which will be cryogenically cooled by a Stirling refrigerator also developed by a UK research team, has been selected by NASA for flight on the Upper Atmosphere Research Satellite (UARS) due for launch in 1988. UK University groups have also provided, in co-operation with the Jet Propulsion Laboratory, Pasadena, an infra-red radiometer for the Pioneer Venus Orbiter which arrived at the planet in 1978. NASA's Dynamics Explorer, part of the upper atmosphere research programme , carries an experiment developed by a UK University group for the detection of atmospheric winds.

ERS-1 The European Space Agency's Remote Sensing satellite (ERS-1) for global ocean and coast monitoring will carry a nadir-looking infra-red radiometer (the Along Track Scanning Radiometer) which will be developed by a UK team to provide absolute measurements of sea-surface temperature, to accuracies not previously achieved. This instrument will provide valuable monitoring of the air-sea interface which is crucial in the understanding of the global climate.

University teams are supported by SERC's Remote Sounding Group at Rutherford Appleton Laboratory and good international relations are developed through collaborations with American and European teams. SERC is also working with the Natural Environment Research Council on climate research programmes involving remote sensing techniques and as part of the National Remote Sensing Programme associated with ERS-1.

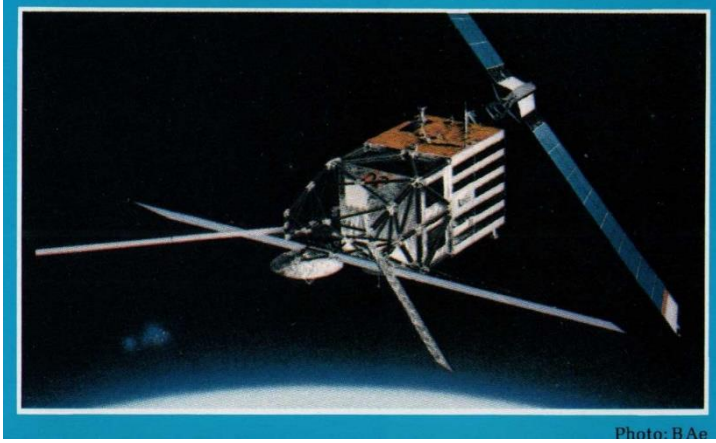
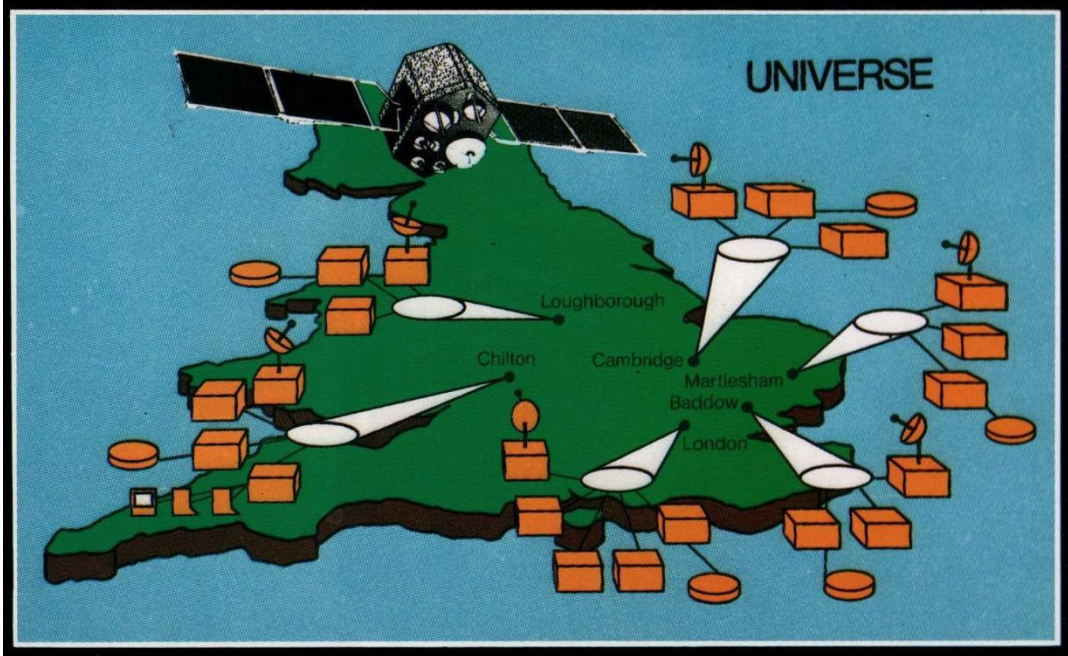


Photo: BAe

GROUND SUPPORT & COMMUNICATIONS

SERC provides ground support for the IRAS and supports a major programme in information technology including space-related communications research. An important project in this area is UNIVERSE, a joint experiment, proposed by SERC, with DOI and British Industry, aimed at linking together a number of university-based local area computer networks via ESA's OTS communications satellite.

Another network, STELLA, links the Rutherford Appleton Laboratory with European laboratories, for the transfer of high-energy physics data via OTS.



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