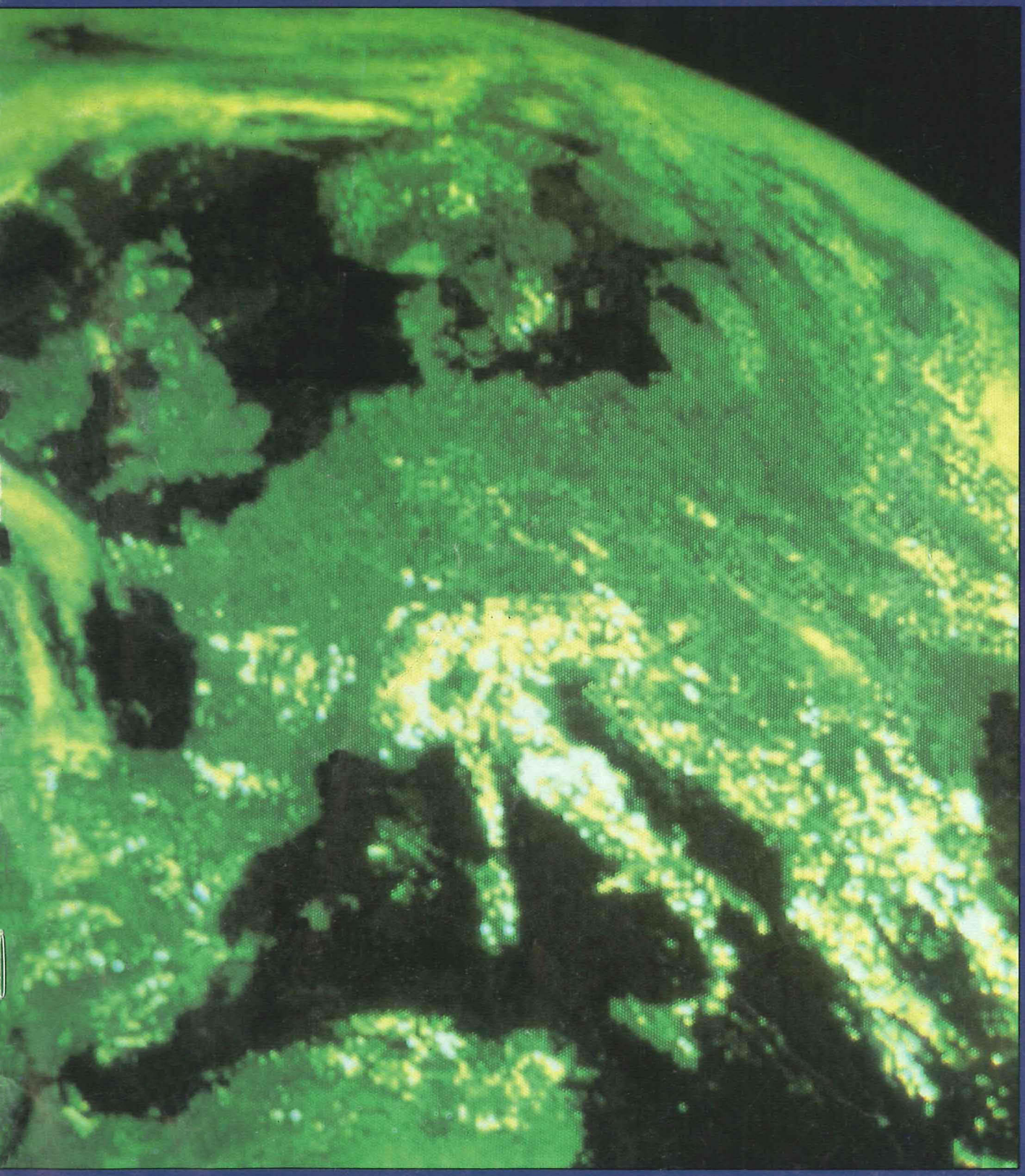
Britain in SPACE



Department of Trade and Industry

Britain in Space

We in Britain have been busy in space since the early 1960's, pioneering (with the highly successful Ariel scientific satellites) specialist techniques in such fields as X-ray astronomy, and playing a major role in both ESRO (the European Space Research Organisation) and ELDO (the European Launcher Development Organisation). We also developed our own research satellites and launch vehicle.

In 1974 we developed and built the first operational European communications satellite, Skynet II, for military use.

When in 1975 ESRO and ELDO were succeeded by the European Space Agency, ESA, we again took a leading part. ESA now has eleven member states – Belgium, Denmark, France, Ireland, Italy, the Netherlands, Spain, Sweden, Switzerland, the UK and West Germany. Austria, Canada and Norway are now also associated with ESA for some of its programmes.

One of ESA's main aims has been to maximise the European space effort, and to that end it employs some 1350 staff, with headquarters in Paris and main technical base (ESTEC – the European Space Technology Centre) at Noordwijk in the Netherlands.

Today Britain is actively engaged in ESA's science and applications programmes. Our applications and industrial interests are sponsored by DTI, and our science interests by the Science and Engineering Research Council (SERC).

We have been developing new techniques and demonstrating the possibilities of new services through ESA, concentrating in the field of communications. This effort is bearing fruit, and British industry is now very involved in major civil and military satellite programmes for the UK, as well as those organised through ESA.

This leaflet describes some of the ways in which the Department of Trade and Industry has involved Britain in Space.

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London from space – Landsat 4

OTS – The Orbital Test Satellite

OTS, an experimental communications satellite, was launched by ESA in 1978 and taken out of service in 1983. Made by a British-led industrial team, it was used by Eutelsat (a group of European national telecommunications authorities) to transmit a wide variety of communications services; the fact that these could be received by small, transportable ground stations, direct at users' premises, vividly illustrated the potential advantages to commerce and industry.

Even today, OTS has its uses – its longevity has enabled many hazardous attitude and behavioural tests to be carried out; such tests are not permissible during the normal lifetime of a satellite because of the high risk involved. After being shut down for a year OTS will be subjected to further tests to assess long-term degradation, then boosted out of geostationary orbit to make way for its successors.

ECS – The European Communications Satellites

Derived from OTS, this series of satellites will provide a fully operational service for Eutelsat. The first, ECS-F1, was launched on 16 June 1983 and is now in service. It has been joined in orbit by ECS-F2, launched on 4 August this year. ECS-F3 will probably be launched early in 1985 and two others are on order, both to guarantee continuity of service in the event of failure and to replenish satellites at the natural end of their lives.

ECS satellites are used for a variety of trunk tele-communications traffic and for the first time provide businesses in Europe with the opportunity to use small dish ground stations at their own premises on an operational basis. ECS has put into operational service many of the activities pioneered by OTS.

MARECS – Maritime Communications Satellites

Another development of OTS now forms part of the first global maritime satellite communications system, and provides merchant shipping with a full range of telecoms services. The space segment of this activity is provided by the International Maritime Satellite Organisation (INMARSAT).

MARECS-A, launched in December 1981, is operated under lease from the European Space Agency and covers the Atlantic Ocean region where traffic demand is highest. MARECS-B1 was lost as the result of a launch failure but MARECS-B2 will be launched at the end of 1984 to serve the Pacific Ocean region.

MARECS vastly improves the quality and reliability of communications with ships at sea. British industry has been and remains the prime contractor for MARECS satellites and their communications payloads. Other work we have carried out includes the solar array drives, sun sensors, battery discharge regulators and auxiliary power units, and Britain is confidently expected to take a leading role in the second generation of MARECS satellites.

Olympus – The Large Telecommunications Satellite

In order to meet the world's exploding telecommunications requirement, ESA is developing Olympus, previously known as L-SAT. It will be the largest communications satellite in Europe, measuring some 26 metres across and 5.5 metres high with its solar arrays extended.

Olympus is due to be launched in 1986, and will carry

* two experimental TV broadcasting channels (for use mainly by Italy and the European Broadcasting Union)
* an advanced business communications payload (for use with small dish terminals and propagation)
* communications payloads using the 20/30 GHz frequency band (predicted to be of major importance in future telecommunications).

The 20/30 GHz payload will also be used as an experimental communications link between a satellite in low earth orbit and a ground terminal. Olympus' platform is designed to be suitable for all the large telecommunications missions planned for the 1990's.

Eight countries are participating in this programme – Austria, Belgium, Canada, Denmark, Italy, the Netherlands, Spain and the UK; British industry is leading the team as prime contractor and manufacturing the payload.

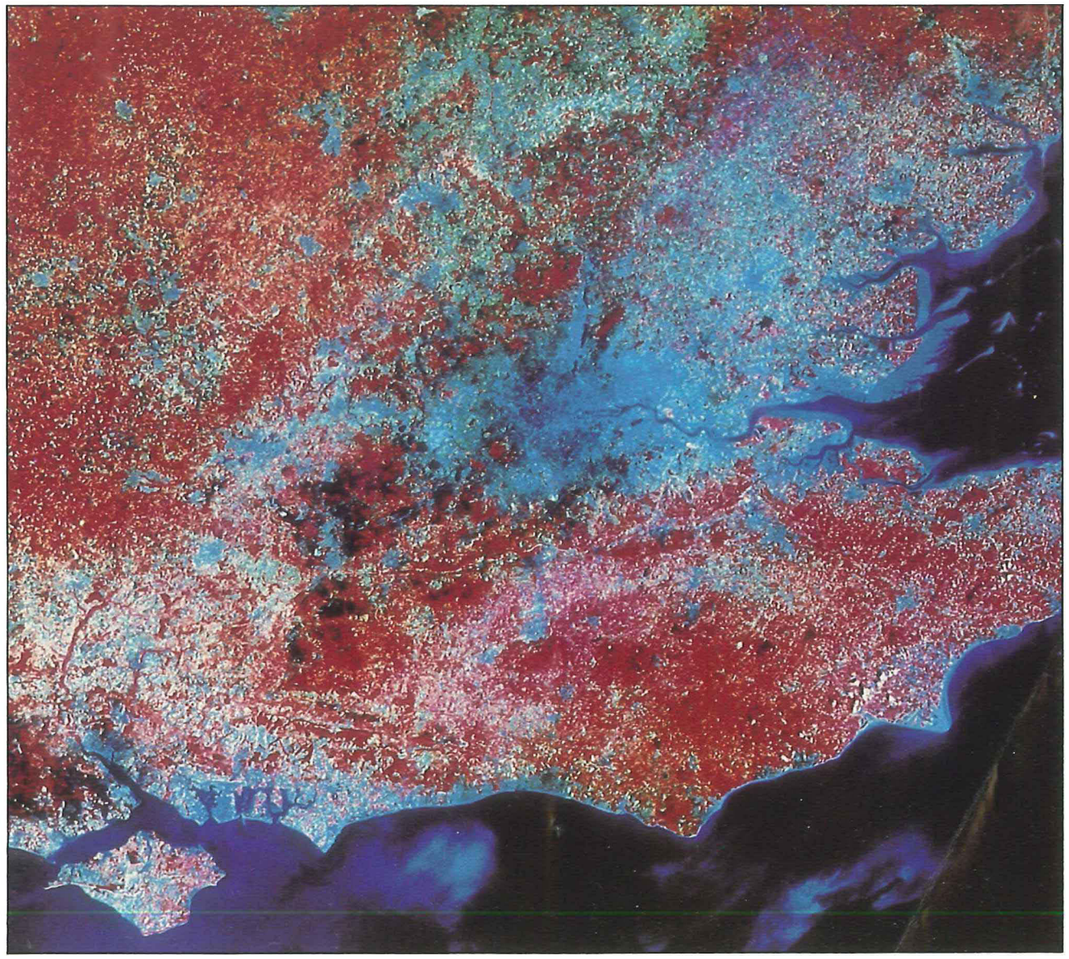
Remote Sensing

The USA's Landsat series of satellites have been 'observing' the Earth and supplying information as data and images since 1972. The imagery received from these and other remote sensing satellites is of great use in a number of ways for it provides data about (for example) crop production, timber and water resources and the location of minerals.

Britain's National Remote Sensing Centre, based at the Royal Aircraft Establishment, Farnborough, helps users obtain and interpret remotely-sensed data. Its work is overseen by the Remote Sensing Programme Board, which is developing a national strategy for remote sensing. The Board, consisting of industry and public-sector representatives, is chaired by DTI and aided by industrial consultants who act as coordinators of the national programme.

In 1989, ESA plans to launch a remote-sensing satellite (ERS-1) to complement the range of information received from the USA. ERS-1, on which detailed definition studies have been completed, will concentrate on monitoring the oceans. British industry will supply the Active Microwave Instrument which will produce radar images of the sea's surface and measure winds and waves.

We also plan to establish a facility for converting the satellite data into information for meteorologists, oceanographers, and marine engineers among others, as well as participating with the USA in Canada's Radarsat programme, which is designed to give all-weather coverage of land, ice and ocean. We will be supplying a major part of the satellite, based on the Olympus platform.



South East England seen from space – Landsat 4

Ariane Launcher

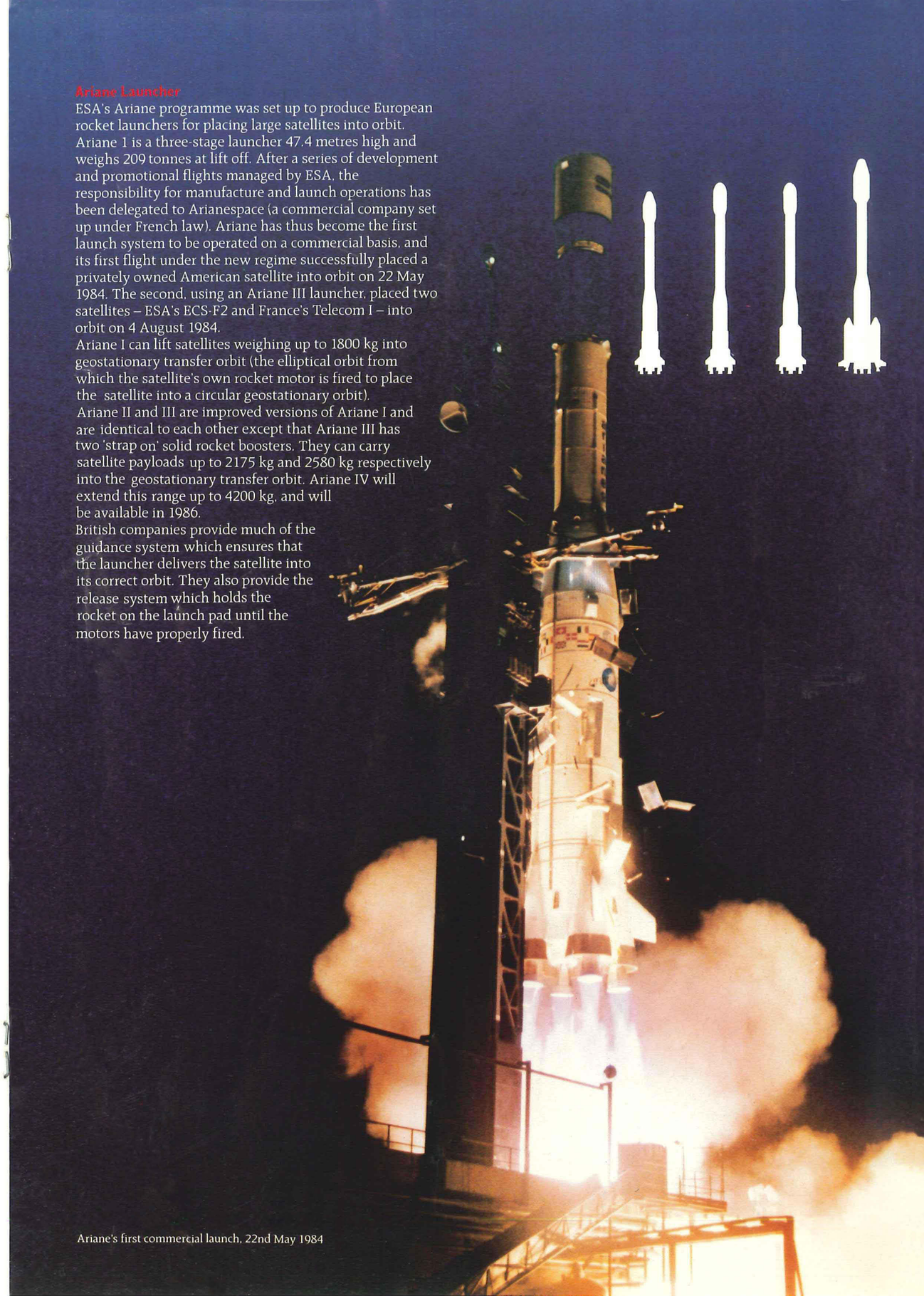
ESA's Ariane programme was set up to produce European rocket launchers for placing large satellites into orbit.

Ariane 1 is a three-stage launcher 47.4 metres high and weighs 209 tonnes at lift off. After a series of development and promotional flights managed by ESA, the responsibility for manufacture and launch operations has been delegated to Arianespace (a commercial company set up under French law). Ariane has thus become the first launch system to be operated on a commercial basis, and its first flight under the new regime successfully placed a privately owned American satellite into orbit on 22 May 1984. The second, using an Ariane III launcher, placed two satellites – ESA's ECS-F2 and France's Telecom I – into orbit on 4 August 1984.

Ariane I can lift satellites weighing up to 1800 kg into geostationary transfer orbit (the elliptical orbit from which the satellite's own rocket motor is fired to place the satellite into a circular geostationary orbit).

Ariane II and III are improved versions of Ariane I and are identical to each other except that Ariane III has two 'strap on' solid rocket boosters. They can carry satellite payloads up to 2175 kg and 2580 kg respectively into the geostationary transfer orbit. Ariane IV will extend this range up to 4200 kg, and will be available in 1986.

British companies provide much of the guidance system which ensures that the launcher delivers the satellite into its correct orbit. They also provide the release system which holds the rocket on the launch pad until the motors have properly fired.



Ariane's first commercial launch, 22nd May 1984

Britain's Space Technology Programme

This centres on a long-term research programme of spacecraft technology at the Royal Aircraft Establishment, Farnborough, and on a communications technology programme at the Royal Signals Research Establishment at Defford, near Malvern. Grant assistance is also given to industry through DTI's Support for Innovation scheme.
The programmes cover a number of advanced technological fields including

* a new thruster system for spacecraft attitude control
* advanced designs for satellite antennas
* the development of new power sources
* the experimental distribution of data to low cost receive–only ground stations.

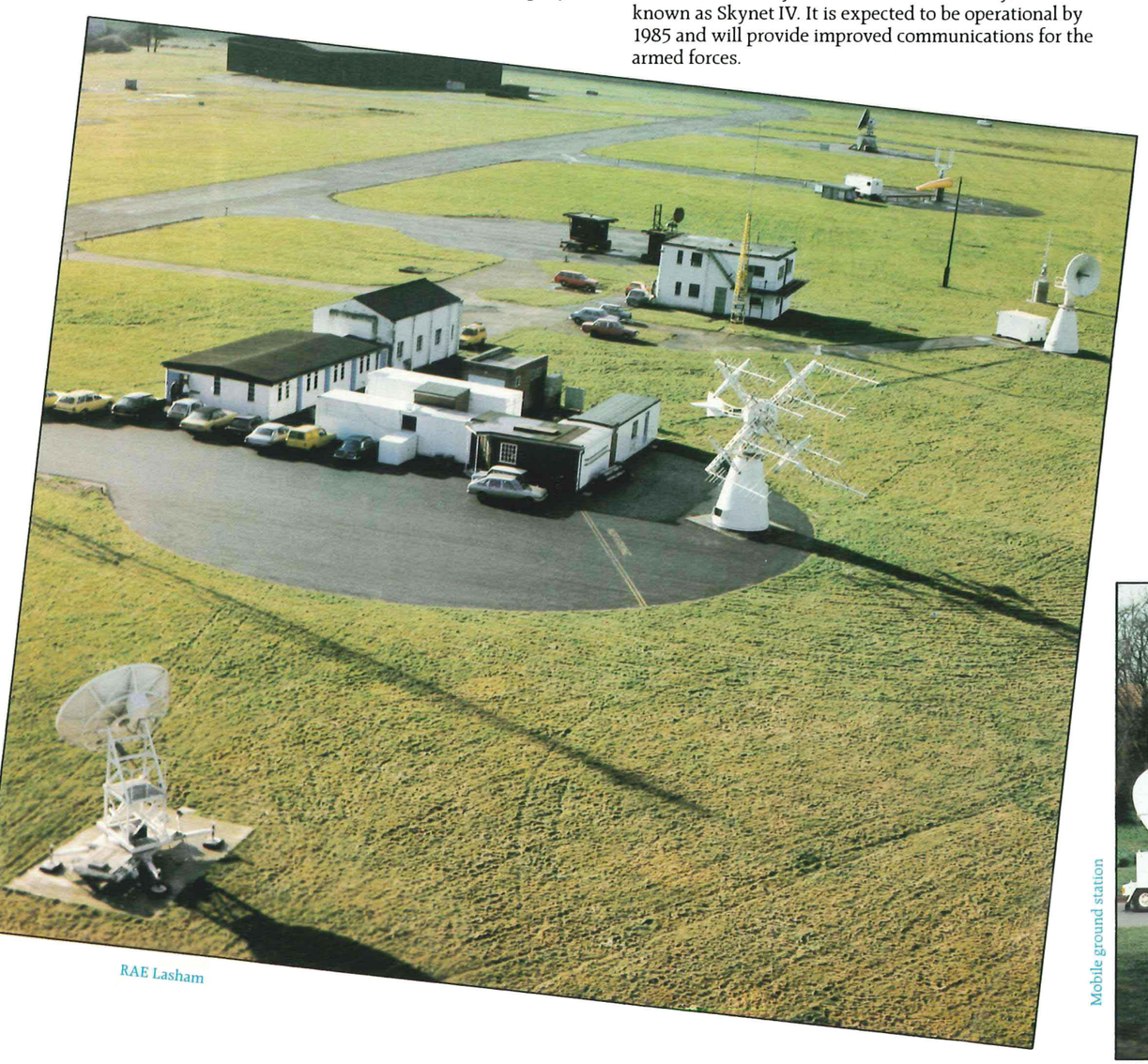
These (and other) developments are intended to help maintain British industry as the leading manufacturer of satellites outside America.

Direct Broadcasting by Satellite (DBS)

Following the Government's decision to authorise an operational satellite TV broadcasting service, an industrial consortium established the United Satellites Company to supply and operate the space component. Carrying two channels of high-powered DBS and devoting one third of their capacity to telecommunications, both for business systems and TV distribution, the satellites were to be leased by the BBC and British Telecom.
These arrangements have recently been re-negotiated to allow three DBS channels and participation by independent broadcasters. This will be the first satellite venture in Europe to be funded from the private sector. Viewers will need small dish antennas (up to 0.9 metres diameter) pointing directly at the satellite, and adaptors attached to their existing receivers to convert the new signals. Due to the use of the new MAC system improved image quality is possible.
British companies will build the satellites and lease channels to the broadcasters.

Military Communications by Satellite

As already mentioned, we developed and manufactured Europe's first operational communications satellite, Skynet II. In 1981 the Ministry of Defence ordered a new satellite communications system from British industry, to be known as Skynet IV. It is expected to be operational by 1985 and will provide improved communications for the armed forces.



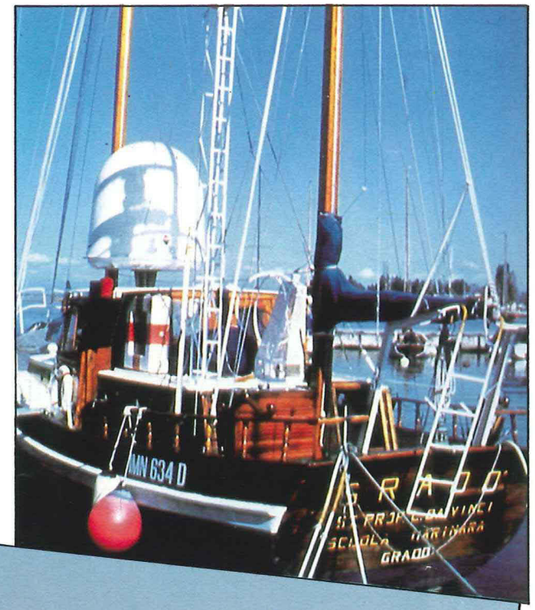
RAE Lasham

The Ground Sector

Ground Stations are becoming increasingly important in the space industry. We in Britain have been supplying ground stations for use with the Intelsat and other satellite communications systems since 1962. The market for these large stations is still expanding – as in the new London Docklands site where 5 large dishes are already in place and operational. However, it is the increasingly common small dish systems which are likely to provide the major expansion of business, as the latest generation of satellites comes into service. Such systems are small enough to be installed on road trailers for rapid and easy deployment on almost any site; they are rapidly being installed on the world's major ships, and more compact terminals are being developed so that they will bring good communications to smaller ships such as sea-going trawlers. Experiments are planned to bring a similar service to aircraft.
Ground terminals have been developed which can be carried by one person and brought rapidly into operation, making them ideal for military purposes, or for use after natural disasters such as floods and earthquakes.

Search & Rescue

The COSPAS-SARSAT programme was begun in 1980 by Canada, France, the USA and the USSR to provide a global system for the location of distress incidents using satellites. More recently Norway and the UK entered the programme as participants in the ground segment, joined in 1984 by Finland and Bulgaria. British industry has developed and tested several types of emergency beacon to transmit signals to the satellite system, and has built a prototype receiver system to convert the signals from the satellites into position information which is passed on to the search and rescue services. Although still only in its Demonstration and Evaluation phase, the system has already proved of great benefit in assisting in real emergencies.



Typical maritime satellite installation

London Dockland receivers (BTI)

Mobile ground station

Spacelab

Developed by ESA in co-operation with the United States National Aeronautics and Space Administration (NASA), Spacelab is a re-usable manned laboratory (the module) with unpressurised U-section platforms (pallets) measuring three by four metres. The module and pallets are designed to fly together or separately in the cargo bay of the American Space Shuttle. Without the module, up to five pallets can be flown. Instruments or experiments requiring exposure to space are mounted on the pallets.

Pre-production pallets, designed and built by British industry first flew on the Shuttle's second and third flights (November 1981, December 1982). The production flight units were delivered to NASA in 1982, and when Spacelab made its maiden flight (28 November to 8 December 1983) marked Europe's entry into manned space flight. NASA now plans a series of Spacelab/Pallet flights in the next 10 years which will increasingly enable scientists and technologists to take advantage of a near-zero gravity environment both for research and processing of high value materials in space.