J. Watson

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

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FOR RELEASE: THURSDAY A.M.
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PROJECT: UK-E

(To be launch no earlier than May 5, 1967)

CONTENTS

NEWS

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THIRD UK
SATELLITE
LAUNCH SET

The United Kingdom satellite, UK-E, third of a series of US-UK cooperative projects, will be launched for the UK Science Research Council (SRC) by the National Aeronautics and Space Administration from the Western Test Range, Lompoc, Cal., no earlier than May 5.

UK-E is scheduled to be placed in an approximately 342-mile, circular polar orbit by a four-stage Scout rocket. The orbit will be inclined 80 degrees to the Equator and will have a period of 95 minutes. Design lifetime of the 198-pound spacecraft is about one year.

On attaining orbit UK-E will be called Ariel III.

Objectives of the UK-E project are to supplement and extend investigations in the atmosphere and the ionosphere conducted by Ariel I and Ariel II, which were launched in April 1962 and March 1964, respectively. The spacecraft will carry instrumentation for five experiments:

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1. Molecular oxygen -- To measure the vertical distribution of molecular oxygen in the Earth's atmosphere at levels at which it is being destroyed by solar radiation. Results of the experiment are expected to provide information on the amount of solar heat absorbed and reflected by the Earth.

2. Electron density and temperature -- To measure electron density and temperature in the ionosphere along the orbital path of the satellite. This experiment will furnish information on the distribution and movement of ionozation in the ionosphere.

3. Terrestrial radio noise -- To measure the radio noise from natural terrestrial sources (primarily lightning discharges) and the geographical distribution of the sources during different times of the day and seasons. Such information will be useful in weather studies and in the design of radio-communications systems.

4. Very Low Frequency (VLF) Radiation experiment -- To measure the intensity of VLF radiation in several selected regions, its space and time variation, and its spectrum. It is planned to measure both naturally occurring signals, and signals transmitted by Radio Station, GBR, the Post Office Main VLF transmitter at Rugby, England.

5. Galactic Radio Noise -- To record galactic radio noise in the 2.0 Mc/s to 5.0 Mc/s region at frequencies too low to be observed on the ground. This experiment is expected to provide new knowledge in the field of radio astronomy.

Design and fabrication of the spacecraft, as well as its five experiments, was accomplished in the United Kingdom, based on experience derived from Ariel I and II. SRC will be responsible for reduction and analysis of experiment data.

NASA will furnish the Scout rocket, conduct the launch, track the satellite and acquire data from it with its Satellite Tracking and Data Acquisition Network (STADAN). NASA also designed and fabricated the system for holding the spacecraft's appendages in place during launch.

The authority to conduct a program of international cooperation with other nations in aeronautical and space science activities was set forth in the National Aeronautics and Space Act of 1958. UK-E is one of fifteen international cooperative satellite projects developed under this provision of the Act.

The agreement between NASA and the UK for the UK-E mission was formalized in an exchange of letters between NASA and the British National Committee on Space Research in mid-1964.

Management of the experiments and the spacecraft is the responsibility of the Space Research Management Unit (SRMU) of the UK Science Research Council. The Royal Aircraft Establishment, Farnborough, England, was assigned technical direction of the design, fabrication and integration of the spacecraft system.

The Office of Space Science and Applications, NASA Headquarters, directs NASA's participation in the UK project, in cooperation with the Office of International Affairs. The Goddard Space Flight Center, Greenbelt, Md., is assigned overall project management responsibility, including systems management, and the spacecraft's tiedown and release system, and tracking and data acquisition.

NASA's Langley Research Center, Hampton, Va., is responsible for the four-stage Soout rocket. Western Test Range, Lompoc, Cal., will provide prelaunch and launch operations support. Ling-Temco-Vought, Inc., Dallas, Tex., makes the Scout rocket.

(END OF GENERAL RELEASE;
BACKGROUND INFORMATION FOLLOWS)

SCIENTIFIC EXPERIMENTS

Molecular-Oxygen Experiments

Air Ministry, Meteorological Office
Dr. R. Frith
Dr. K. H. Stewart

Sounding rocket probes have investigated the composition of the Earth's ionosphere. However, because of their rapid ascent and descent and limited area of sampling, sounding rockets cannot provide sustained quantitative measurements.

The UK-E molecular-oxygen experiment will be capable of measuring, frequently and in many different areas, the vertical distribution of molecular oxygen. The particular areas of interest are at altitudes of 100 kilometers and above, where molecular oxygen is being destroyed by solar radiation. This destruction is observed by measuring the attenuation of the solar ultra-violet radiation in the oxygen absorption band at each satellite sunrise and sunset twilight period when the solar rays are seen as they pass tangentially through the Earth's atmosphere. Since the effect of solar radiation on molecular oxygen in the upper atmosphere is believed to be an important contributor to the Earth's heat balance, this experiment may contribute new knowledge of use in meteorology.

Galactic Radio Noise Experiment

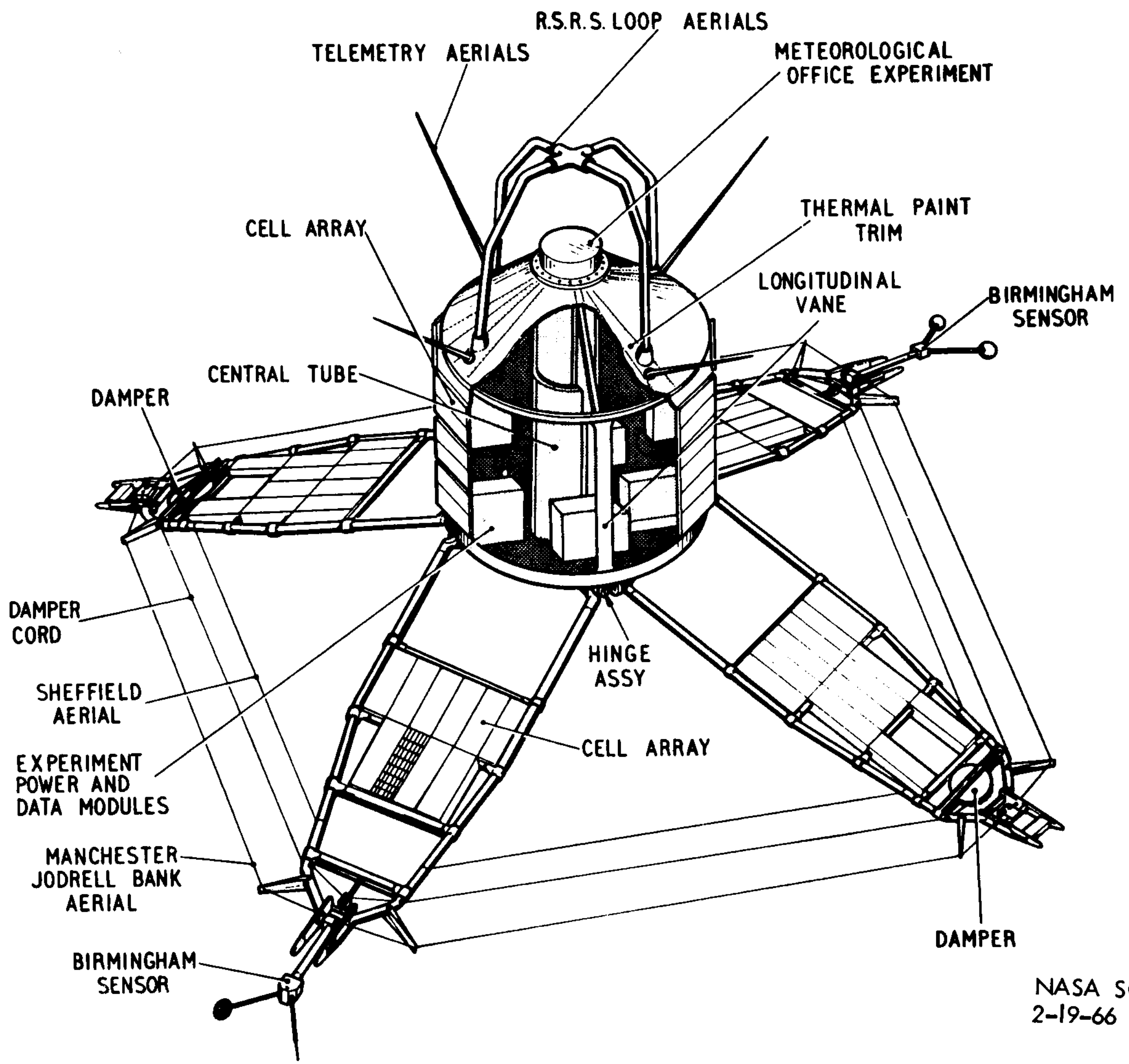
University of Manchester (Jodrell Bank)
Dr. F. G. Smith

This experiment is designed to measure the emission of radio noise from sources in the galaxy in the 2.0-Mc/s to 5.0-Mc/s band, a spectrum which is of too low a frequency to be measured reliably from the ground due to the interaction of the ionosphere.

The ionospheric focusing effect at the position of the satellite is expected to provide improved angular resolution sufficient to distinguish galactic-plane and galactic-halo sources from the isotropic flux.

The galactic radio noise experiment is expected to contribute new knowledge in the field of radio astronomy and to supplement previous investigations by other satellites such as Ariel II and Aloutte.

UNITED KINGDOM (UK) - E SPACECRAFT



NASA SG66-15066
2-19-66

T + EVENTS

a) Liftoff	
b) 1st stage burnout	79.75 sec.
c) 2nd stage ignition	82.00 sec.
d) 2nd stage burnout	121.02 sec.
e) 3rd stage ignition	134.77 sec.
f) 3rd stage burnout	169.67 sec.
g) Spin-up	561.56 sec.
h) 3rd /4th stage separation	563.06 sec.
i) 4th stage ignition	567.56 sec.
j) 4th stage burnout and orbital injection	590.56 sec.
k) Yo-yo release	657.56 sec.
l) Boom release	687.56 sec.
M) S/C/4th stage separation	897.56 sec.

VLF Radiation Experiment

This experiment will measure the level of intensity of VLF radiation, its spatial and temporal variation, and its spectrum. The VLF noise intensity will be measured at three fixed frequencies at a number of points during each orbit. The frequencies to be monitored, 3.2, 9.6, and 16 KH_2, are harmonically related to facilitate receiver calibration during orbital flight. It is intended to map the radiation-field pattern of the UK radio transmitter GBR (16 KH_2) as well as natural VLF emissions. An additional feature will be the correlation of natural VLF signals with those received by the terrestrial radio-noise experiment to investigate the possibility of determining whether the incidence of "whistlers" is dependent mainly on the locations of lightning flashes or on particular local ionospheric characteristics.

Electron Density and Temperature

University of Birmingham
Prof. J. Sayers

The objective of this experiment is to conduct a world-wide survey of the ionosphere by measuring the electron density and temperature at frequent points along the orbital path of the satellite. Measurement will be made with the RF plasma probe developed for the measurement of electron density in Ariel I.

The version used in UK-E&F will be a revised design working at a higher frequency (29 MH) and, by a small addition, permitting the recording of electron temperature. The combination of the survey with similar measurements of magnetic fields, particle streams and solar radiations expected to be obtained by NASA geophysical satellites may give valuable new information on the production, distribution, and movement of ionization phenomena.

Terrestrial Radio Noise

Radio and Space Research Station, Slough
Dr. J. A. Saxton

This experiment is designed to determine, at the altitude of the satellite's orbit, the flux of radio-wave energy from natural terrestrial sources (primarily lightning) at certain slected radio frequencies, and the geographical distribution of the sources as related to the time of day and the season. This information may aid in the design of radio-communication systems, especially those in which highly directional antennas are used.

It will also demonstrate the extent to which radio noise is a potential source of interference to satellite receivers. The experiment is a desirable preliminary to future investigations of electrical discharges and natural noise sources from Earth and other planets.

Information from this experiment combined with the VLF radiation experiment should provide information on whistlers by showing whether their incidence is dependent on the location of lightning flashes or on local ionospheric conditions.

SPACECRAFT AND SUBSYSTEMS

Structure

UK-E uses a center tube of aluminum as the basic structural member. Four honeycomb vanes are attached to the center tube, parallel tothe spin axis, forming four radial vanes. These vanes are"peg-boarded" with holes to provide mounting for the various subsystems and points to which interconnecting wiring is secured.

Attachment points for the structural cover panels are located at the outer edge of each vane. The top dome and the lower cover panel are attached at the upper and lower edges of vanes as appropriate.

Part of the solar cell power source is attached to the structure by means of cell trays mounted on the structure cover panels. There are four booms equally spaced around the lower end of the spacecraft structure. Additional solar cell trays are mounted on the booms. They also support the Manchester loop antenna and the Sheffield loop antenna. Two opposing booms have extensions to support the Birmingham ionization density and temperature probes.

The booms are folded against the last-stage rocket motor case during launch and are extended by centrifugal force upon release of the tie-down system in flight. They will be weighted as required to provide a favorable moment of inertia about the spin axis.

Power

The prime power source for UK-E consists of N/P silicon solar cells mounted on trays which are in turn attached to the booms and to the structure cover panels. The solar power source will have 8,000 solar cells capable of supplying 15 watts after degradation from radiation at the end of one year.

The spacecraft will require five watts of power during shadow periods of the orbit and five watts during daylight plus seven watts for recharging the battery.

One nickel cadmium storage battery supplies spacecraft power during shadow portions of the orbit.

Stabilization and Control

The spacecraft will be stabilized by spinning up the final launch vehicle stage to approximately 160 rpm. Any tendency of the spacecraft to cone or tumble will be minimized by balancing the spacecraft and maximizing the moment of inertia about the spin axis.

The spacecraft spin rate will be decreased from the initial spin rate, prior to erection of booms, by means of a yo-yo despin mechanism. A final spin rate of 20 rpm has been selected to provide a suitable scanning rate for the attitude sensor and to maintain inertial stability about the spin axis for the life of the spacecraft.

Separation of the spacecraft from the Scout fourth stage is designed to establish sufficient velocity differential to ensure that no collision occurs between the two. This is accomplished by delaying separation for a time after last-stage burnout to eliminate the hazard of the empty motor case overtaking the spacecraft if late burning of residual propellant should occur.

Attitude Control

Attitude control is achieved by choice of launch injection parameters. There is no active attitude-control system on board the spacecraft. An 80-degree inclination is planned for UK-E.

Telemetric Control

UK-E has on board a command receiver with sequential address-execute decoder to inhibit spurious commands.

The command function is used to initiate tape recorder playback and to turn the experiments on and off as required, should power conservation become necessary.

Telemetry

UK-E will use the PFM/PM telemetry system. In this system the analog or digital information from the various data sensors is used to frequency modulate an associated subcarrier oscillater. The subcarrier oscillators, in turn, are gated to the modulator where the transmitter-carrier frequency is phase-modulated. The subcarrier oscillators operate at from 5 to 15 kc in accordance with their analog or digital voltage input levels.

High-Speed Encoder

The high-speed encoder will provide a 96-word data sequence arranged in a 16-channel-by-six-frame format. The data rate is 55 cycles or words per second. Each data word has a duration of 18.18 msec, beginning with a 9.9-msec blank followed by a 9.9-msec subcarrier-oscillator data burst. There are 16 data words in each frame for a frame duration of 290.88 msec. The entire six-frame format is repeated every 1.745 seconds. The high-speed format is telemetered continuously in real time except during brief periods when a tape recorder playback cycle is commanded by a ground station.

Low-Speed Encoder

The low-speed encoder transforms the output of selected sensors into a format suitable for storage in the on-board tape recorder. The analog and digital oscillator frequency bursts are divided by 48 prior to being recorded by the spacecraft tape recorder. This, in effect, narrow-bands the data bursts so that over two hours of real-time information can be stored in less than 150 feet of magnetic tape in the data storage.

Data Storage

The data storage tape recorder, using an endless-loop magnetic tape, records throughout the entire orbit until the record function is interrupted by a playback command.

Upon receipt of a playback command, a 320.83-cps burst is recorded and simultaneously telemetered in real time for two seconds. This provides the ground station with a command-received acknowledgement and places a last-recorded-data mark on the tape. The tape recorder then ceases to record and goes into its playback function.

The magnetic tape is speeded up to 48 times the record rate. In this manner 100 minutes of stored data can be read out in little more than two minutes. Since the data-burst frequencies are divided by 48 prior to recording and are played back at 48 times the record rate, the data bursts modulating the transmitter carrier appear as real-time telemetry to the ground receiving station.

Telemetry Transmitter, Command Receiver, and Decoder

The telemetry transmitter is a single-frequency solid-state device with a power output of 250 milliwatts. The sub-carrier oscillators phase-modulate the RF carrier to provide plus or minus 57 degrees of deviation. The transmitter operates in the 136-Mc/s telemetry band.

The command reciever and its associated decoder are also solid-state devices. Sequential address-execute tones are transmitted by ground stations in the 148-Mc band whenever a command function, such as tape-recorder playback, is desired. Upon receipt of a tape-recorder playback command, the tele-metery transmits a two-second acknowledgement tone prior to switching to the commanded function. After a playback sequence of approximately two minutes, the telemetry is automatically switched back to transmitting real time data.

Use of the coded address-execute command system provides assurance against spurious or unauthorized interrogation of the spacecraft system.

Telemetry Antenna

The telemetry antenna is a canted turnstile identical to that used on Ariel I and Ariel II, and designed to produce cir-cular emission as viewed coincident with the spacecraft spin axis. The polarization will vary from linear to elliptical to circular, depending on satellite aspect as viewed from the ground stations.

TRACKING AND DATA ACQUISITION

The Goddard Space Flight Center STADAN network will have tracking and telemetry data-acquisition responsibility. In the United Kingdom, Singapore, and South Atlantic British stations will participate in the acquisition of data. Arrangements have been made whereby the United Kingdom will defray the costs for station magnetic tapes used for data acquisition by STADAN stations.

The Science Research Council will be responsible for data reduction and analysis, and publication of reports and findings.

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LAUNCH VEHICLE

The UK-E spacecraft will be launched by the Scout, four-stage solid fuel rocket system.

Scout S-155 and the UK-E spacecraft will be set on an initial launch azimuth of 169.922 degrees to obtain a prograde orbit. The orbit will be circular at an altitude of approximately 570 km.

Managed by the National Aeronautics And Space Administration's Langley Research Center, Hampton, Va., the Scout is the only operational solid-propellant launch vehicle with orbital experience. The launch vehicle is used by many governments in the conduct of a variety of exploratory programs to advance the space sciences.

The four Scout motors, Algol, Castor, Antares, and Altair, are interlocked with transition sections that contain guidance, control, ignition, instrumentation systems, separation mechanics, and the spin motors needed to stabilize the fourth stage.

Guidance for Scout is provided by an autopilot and control is achieved by a combination of aerodynamic surfaces, jet vanes, and hydrogen peroxide jets. The launch vehicle is approximately 73 feet long and weighs about 40,000 pounds at liftoff.

Roland D. English heads the Scout Project Office at Langley. Robert A Schmitz will serve as Scout Payload Coordinator for the UK-E project; James D. Church as Scout Field Operations director; Thomas C. Moore, Scout Quality and Reliability engineer; Leo C. Forrest, Scout Systems engineer; Angelo Guastaferro, Langley Vehicle Test Director at Western Test Range; Lt. Col. Carl Hale, Jr., USAF - 6596th Aerospace Test Wing, Launch Control Officer; and Milton Green, Ling-Temco-Vought Vehicle Contractor Program Manager.

UK-E PROGRAM PARTICIPANTS

UNITED KINGDOM

Sir Harrie Massey, National Committee on Space Research; Dr. B. G. Pressey, Space Research Council; Alan C. Ladd, Program Manager; Arthur P. MacLaren, Project Manager; and J. F. Smith, Experiment Systems Coordinator.

NASA

John R. Holtz, Program Manager; Raymond Miller, Associate Program Manager; Dr. Erwin R. Schmerling, Program Scientist; Dr. Russell K. Sherburne, Scout Program Manager, all of NASA Headquarters, Washington, D.C.

R. C. Baumann, Project Manager; John Flynn, Project Coordinator; Dr. S. Bauer, Project Scientist, all of Goddard Space Flight Center, Greenbelt, Md.

R. H. Schmitz, Scout Project Manager, Langley Research Center, Hampton, Va.

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