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Press Kit

Project Atmosphere Explorer-E

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For Release:
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SATELLITE TO MEASURE EQUATORIAL OZONE LAYER

The third in a series of maneuverable, unmanned spacecraft will be launched by NASA this month to study the upper atmosphere, including Earth's protective ozone layer above the Equator.

Atmosphere Explorer E will be launched aboard a Delta rocket from Cape Canaveral, Fla., about Nov. 18.

Linked through a sophisticated ground computer with scientists in widely scattered parts of the country, AE-E carries 12 scientific instruments designed to return information on the Earth's heat balance and energy conversion mechanisms, as well as the flow of heat or energy from one hemisphere to the other.

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The AE-E satellite (Explorer 55 in orbit) also carries an instrument to measure Earth's ozone layer between 20 degrees north and south. Called a backscatter ultraviolet spectrometer (BUV), it was added to the spacecraft's payload last spring as part of NASA's continuing program to measure the atmospheric distribution of ozone on a global basis.

Information returned by this instrument in conjunction with the others could represent a major step in understanding the interaction of upper atmosphere constituents with solar ultraviolet light and the resulting impact on the ozone layer.

Originally carried on Nimbus-4, a NASA weather research satellite launched into polar orbit from the Western Test Range in 1970, the BUV instrumentation has been measuring the global ozone distribution ever since. As a result, the world's largest data base on atmospheric ozone has been gathered by Nimbus, and detailed analysis of the data is currently underway.

NASA's Goddard Space Flight Center, Greenbelt, Md., has management responsibility for the Nimbus and AE series of spacecraft, as well as the Delta launch vehicle that places them in orbit. RCA Corp., Princeton, N.J., is AE spacecraft prime contractor and McDonnell Douglas Corp., Huntington Beach, Calif., builds the Delta.

Goddard's Dr. Donald Heath, Principal Investigator on the BUV instrument, says: "This is a typical example of space technology developed in the past being put to use to solve problems of today. In 1970 we knew ozone measurement was necessary, but until scientists began to become alarmed about the possible depletion of the ozone layer some 22-25 kilometers (13-15 miles) above us, we were not aware of the critical necessity to understand what is happening there.

The only way you can get at the problem, that is, measure ozone on a global, seasonal and solar-cycle basis, is by satellite. Satellite data gathering has been going on for 5-1/2 years and should continue through several 11-year solar cycles and beyond, to get an idea of the magnitude of the problem or determine if indeed there is a problem."

Dr. Heath says we will probably have an understanding of important trends on which we can base some decisions here on Earth, such as whether to ban the widespread use of aerosol cans using chlorofluoromethanes (CFM), commonly known by the trade name "Freon." CFMs expelled from aerosol cans slowly, over a period of about 10 years, work their way up to the ozone layer where sunlight and resulting chemical reactions are believed to cause it to destroy ozone.

AE-E will look at the ozone content in the equatorial region in conjunction with its sister satellite, AE-D, which is dipping into the atmosphere to sample nitric oxide, one of the controlling agents of ozone production and depletion. AE-D was launched in early October 1975.

The new spacecraft will measure changes in ozone distribution and provide new information on the horizontal scale of the structure in the ozone fields at different altitudes in the stratosphere over the equator. It also will provide an opportunity to evaluate the long-term accuracy of the Nimbus-4 BUV instrument by comparing newly-calibrated equipment with that launched in 1970. In addition, it will fill the gap between Nimbus-4 and Nimbus-G, scheduled for launch in 1978. Nimbus-4, with a design lifetime of only one year, cannot be counted on to operate until 1978.

AE's low perigee, dipping into the atmosphere at times to an altitude of some 130 km (80 mi.), will return valuable information on changes in the total ozone field. This includes the vertical ozone distribution between 22 km (13 mi.) and 50 km (31 mi.) as well as changes in relation to composition, structure and dynamics of the entire upper atmosphere.

The spacecraft's initial apogee will be 3000 km (1875 mi.) with a period of 118 minutes and an inclination of 20 degrees.

The main energy input to the atmosphere is known to come from the absorption of solar ultraviolet radiation, but a substantial portion also comes from the solar wind (a mass of ionized gas flowing out of the Sun) interacting with the atmosphere in the polar regions. An immediate consequence of this interaction can be seen in the aurorae, whose bands of light consume more energy than is used by the entire United States.

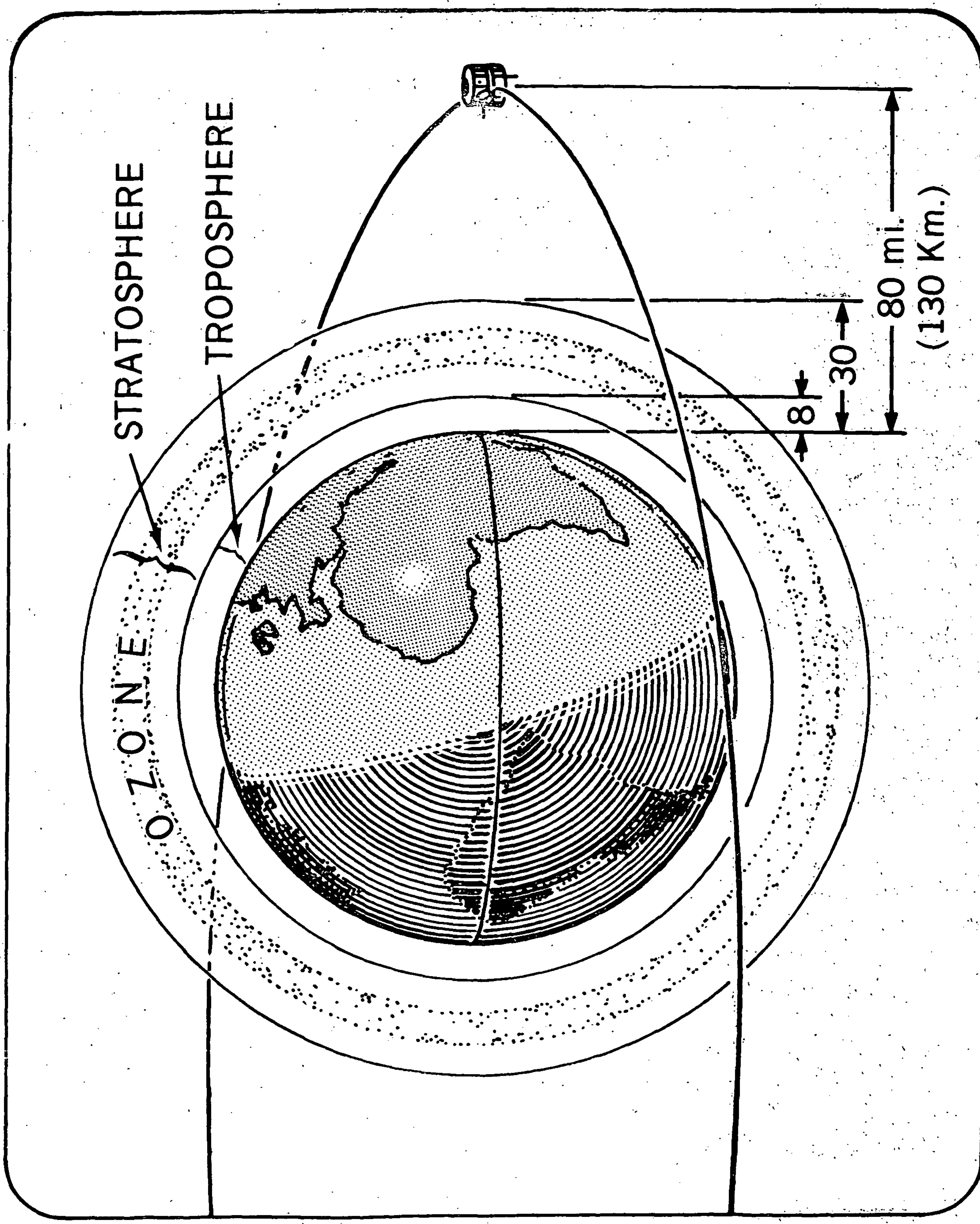
The magnitude and variability of this high latitude heat source which causes worldwide radio blackouts during geomagnetic storms is poorly understood. An important objective of this mission is to investigate these processes and mechanisms. The 12 instruments aboard AE-E will measure particle fluxes, airglow intensities, plasma densities and temperatures, and neutral densities, temperatures and compositions at the low altitudes where energy dissipation occurs as well as solar ultraviolet radiation.

The spacecraft design, making use of existing technology, is relatively inexpensive. Prime contract costs for all three spacecraft are expected to total about $24 million.

The AE satellite is a 16-sided polyhedron, 135 centimeters (53.2 inches) in diameter and 115 cm (45 in.) high. It weighs 720 kilograms (1587 pounds), including 107 kg (237 lbs.) of instrumentation.

Overall program direction is the responsibility of NASA's Office of Space Science, Washington, D.C., with Goddard providing the spacecraft and rocket management. Launch operations have been assigned to Kennedy Space Center Unmanned Launch Operations Directorate. RCA Corporation, Princeton, N.J., is the spacecraft prime contractor, and McDonnell-Douglas Corp., Huntington Beach, Calif., builds the launch vehicle.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)



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ATMOSPHERE EXPLORER SCIENCE INSTRUMENTS

Cylindrical Electrostatic Probes (L. H. Brace and R. F. Theis, GSFC and A. Dalgarno, Harvard College Observatory)	Measure electron temperature and ion and electron concentrations in the orbital path of the spacecraft.
Atmospheric Density Accelerometer (K. S. W. Champion and F. A. Marcos Air Force Cambridge Research Labs)	Determine density of the neutral atmosphere by measurement of satellite deceleration due to aerodynamic drag.
Photoelectron Spectrometer (J. P. Doering, Johns Hopkins University, and C. O. Bostrom and J. C. Armstrong, APL)	Measure the low energy flux and energy distribution in the thermosphere by means of two electrostatic deflection-type electron spectrometers.
Positive Ion Mass Spectrometer (BIMS) (H. C. Briton, GSFC)	Measure the concentrations of thermal positive ions and identify major and minor species.
Airglow Photometer (P. B. Hays and G. Carignan, University of Michigan; G. G. Shepherd, York University, Canada, and J. C. G. Walker, Yale University)	Measure the airglow emissions for dayglow, nightglow and aurora borealis
Solar Extreme Ultraviolet Spectrophotometer (H. E. Hinteregger, D. E. Bedo and J. E. Manson, Air Force Cambridge Research Labs)	Measure the solar extreme ultraviolet radiation and and the monochromatic optical depths of the Earth's atmosphere.
Open Source Neutral Mass Spectrometer (A. O. Nier, W. E. Potter, D. R. Hickman and K. Mauersberger, University of Minnesota)	Measure the densities of various neutral atmospheric gases, particularly atomic oxygen.
Neutral Atmosphere Composition (D. T. Pelz and C. A. Reber, GSFC, and G. R. Carignan, University of Michigan)	Measure concentrations and distributions of neutral gas constituents of the thermosphere.

Neutral Temperature (N W. Spencer and H. Niemann, GSFC and G. R. Carignan, University of Michigan)	Measure atmospheric kinetic temperature by determining the response of a mass spectrometer and baffle tuned to neutral nitrogen (N_2) in a spherical chamber.
Backscatter Ultraviolet Spectrometer (Donald F. Heath, GSFC)	Measure atmospheric distribution of ozone.
Planar Ion Trap (RPA) (W. B. Hanson, and D. R. Zuccaro, University of Texas, Dallas)	Measure ion-temperature and concentration: Determine velocity of plasma flow.
Solar Extreme Ultraviolet Photometer (ESUM) (D. F. Heath and J. Osantowski, GSFC)	Broad-band photometric measurements of the solar extreme ultraviolet irradiance. Emphasis on high spectroradiometric accuracy and long term variability of the Sun in EUV.

AE-E MISSION FACTS AT A GLANCE

Launch:	From Cape Canaveral, Fla.
Launch Vehicle:	Two stage Delta with nine solid fuel strap-on motors.
Orbit:	Apogee: 3000 kilometers (1875 miles) Perigee: 157 kilometers (97 miles) Period: 118 minutes Inclination: 20 degrees
Operating Lifetime:	At least one year
Spacecraft Weight:	720 kilograms (1587 pounds)
Structure:	Drum-shaped (16-sided polyhedron), 135 centimeters (53.2 inches) in diameter and 115 centimeters (45 inches) high. Consists of two shills, inner and outer, with solar cells, telemetry antennas and viewing ports on outer shell. Inner shell holds 12 scientific instruments. 107 kilograms, (237 pounds), electronic packages, attitude control system, hydrazine thruster subsystem.
Power System:	Solar cells on exterior of spacecraft, redundant nickel cadmium batteries. Provides 120 watts of power during normal operation.
Communications and Data Handling:	Telemetry, tracking and command and control and the antennas.
Telemetry:	Pulse-coded Modulation (PCM)
Tracking and Data Acquisition:	Stations of the Space Tracking and Data Network (STDN) operated by GSFC.

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LAUNCH VEHICLE

The two-stage Delta 2910 launch vehicle will be used for this 117th Delta payload. The vehicle has an overall length of approximately 35 meters (116 feet) and a maximum body diameter of 2.48 m (8 ft.). The nominal launch weight is about 130,000 kilograms (290,000 pounds), including the nine booster thrust-augmentation solid motors.

The first stage is a McDonnell Douglas Astronautics Co. modified Thor booster incorporating nine strap-on Thiokol solid fuel rocket motors. The booster is powered by an RS-27 engine using liquid oxygen and liquid hydro-carbon propellants. The main engine is gimbal-mounted to provide pitch and yaw control from liftoff to main engine cutoff (MECO). Two liquid propellant vernier engines provide roll control throughout first stage operation and pitch and yaw control from MECO to first stage separation.

The second stage is powered by a TRW-TR 201 liquid fuel pressure fed engine which is also gimbal-mounted to provide pitch and yaw control through second stage burn. A nitrogen gas system using eight fixed nozzles provides roll control during powered and coast flight as well as pitch and yaw control after second stage cutoff. Two fixed nozzles, fed by the propellant tank helium pressurization system, provide retro-thrust after spacecraft separation.

The Atmosphere Explorer spacecraft will be attached to the Delta second stage by means of a standard fitting which incorporates the separation system.

The Delta fairing which is attached to the forward face of the second stage is 560 centimeters (224 inches) long and 162.5 cm (65 in.) in diameter. This fairing, which protects the spacecraft from aerodynamic heating during the boost flight, is jettisoned as soon as the vehicle leaves the atmosphere shortly after second stage ignition.

An all-inertial guidance system consisting of an inertial sensor package and digital guidance computer controls the vehicle and sequence of operations from liftoff to spacecraft separation. The sensor package provides vehicle attitude and acceleration information to the guidance computer. The guidance computer generates vehicle steering commands to each stage to correct trajectory deviations by comparing computed position and velocity against prestored values.

In addition, the guidance computations perform the functions of timing and staging as well as issuing pre-programmed command attitude rates during the open loop and coast guidance phases.

After second stage burnout, the vehicle will be re-oriented so that the spacecraft spin axis is normal to the orbit plane. The desired orbital spin rate will be achieved by rolling the vehicle prior to spacecraft separation.

LAUNCH OPERATIONS

The Kennedy Space Center's Unmanned Launch Operations Directorate plays a key role in the preparation and launch of the two-stage, thrust-augmented Delta rocket carrying Atmosphere Explorer-E.

Delta 117 will be launched from Pad B at Complex 17, Cape Canaveral.

The Delta 117 booster was erected on Pad B and four of the nine strap-on solid motors were mated Oct. 22. The remaining five solid rocket motors were mated with the booster Oct. 23. The second stage was erected Oct. 24.

The AE-E spacecraft arrived at Cape Canaveral Oct. 28 and was placed in Hangar S for checkout and prelaunch preparations. The spacecraft was mated with Delta 117 Nov. 7 and the payload fairing which will protect AE-E during its flight through the atmosphere was placed atop the rocket and spacecraft several days prior to launch.

MAJOR AE-E/DELTA FLIGHT EVENTS

EVENT	TIME Min./Sec.	ALTITUDE Kilometers	ALTITUDE Miles	VELOCITY Ft./Sec.
Liftoff	0:00	0	0	0
Six Solid Motors Burnout	0:38	6.0	3.7	2,209
Three Solid Motors Ignite	0:39	6.4	4	2,210
Three Solid Motors Burnout	1:18	22	14	3,783
Jettison Nine Motor Casings	1:27	26	16	4,074
Main Engine Cutoff (MECO)	3:48	100	62	18,234
Stage I/II Separation	3:56	105	65	18,271
Stage II Ignition	4:01	108	67	18,254
Jettison Fairing	4:36	126	78	18,948
Stage II First Cutoff (SECO)	7:49	158	98	25,628
Second Stage Restart	23:50	157	97.5	25,621
Second Stage Cutoff	25:12	158	98.2	27,828
Stage II/Spacecraft Separation	33:20	432	268	27,051

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AE-E/DELTA TEAM

NASA Headquarters

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Frank W. Gaetano	AE Program Manager
Dr. E. R. Schmerling	AE Program Scientist
Joseph B. Mahon	Director, Launch Vehicle and Propulsion Program
I. T. Gillam IV	Small Launch Vehicles and International Programs Manager
P. T. Eaton	Delta Program Manager
Robert R. Stephens	Tracking and Data Analysis Program Manager

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Dr. Robert S. Cooper	Deputy Director
Robert N. Lindley	Director of Projects
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Robert C. Weaver	Deputy Project Manager, Technical
John A. Underwood	Deputy Project Manager, Resources
Nelson W. Spencer	Project Scientist
Richard E. Donnelly	Experiment Manager

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David J. Haykin	Mission Operations Director
Robert Baumann	Associate Director of Projects for Delta
Robert Goss	Chief, Mission Integration and Analysis
George D. Baker	Chief, Mission Integration
Francis J. Lawrence	Mission Integration Engineer
Tecwyn Roberts	Director of Networks
Albert Ferris	Director of Mission and Data Operations
Ed Lowe	Network Support Manager
Roger V. Tetrick	Mission Support Manager
Seaton B. Norman	Communications Engineer

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John J. Neilon	Director, Unmanned Launch Operations
Hugh A. Weston, Jr.	Manager, Delta Launch Operations
Wayne McCall	Chief Engineer, Delta Operations
John J. Bunn	Spacecraft Coordinator

Contractors

RCA Corp., Astro-Electronics Division Hightstown, N.J.	AE-E Spacecraft
McDonnell Douglas Astronautics Huntington Beach, Calif.	Delta Launch Vehicle

November 6, 1975