EXPLORER 43

NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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FOR RELEASE: WEDNESDAY, A.M.
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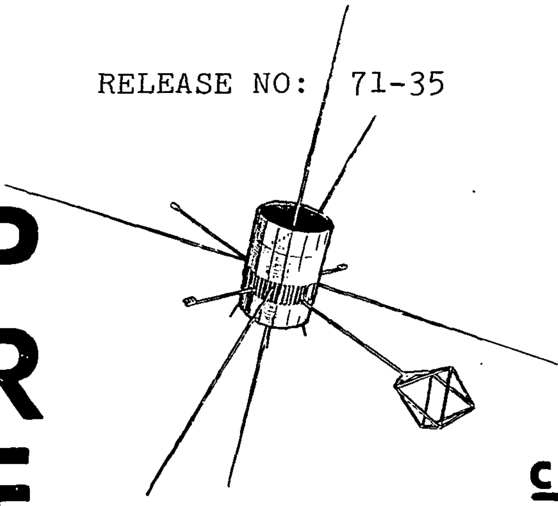

PRESS KIT

PROJECT: IMP-I

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NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (202) 962-4155
WASHINGTON, D.C. 20546 TELS: (202) 963-6925

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NASA TO LAUNCH EIGHTH IMP

The eighth spacecraft in the National Aeronautics and Space Administration's Interplanetary Monitoring Platform (IMP) program is scheduled to be launched March 12, 1971, by a three-stage Delta M-6 rocket from Cape Kennedy, Fla.

Called IMP-I the 635-pound automated space physics laboratory is the largest and most advanced spacecraft in the NASA Explorer series. Its major engineering innovations include the most advanced encoder-digital data processor system ever flown on an unmanned NASA satellite. It is also the largest and most complex spacecraft ever built at the NASA Goddard Space Flight Center, Greenbelt, Md.

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The IMP-I scientific mission is to continue the pioneering investigations of the seven earlier spacecraft in the series which began with the launching of Explorer 18, Nov. 18, 1963. Scientific results from the program to date include defining the nature and extent of the Earth's magnetosphere and vastly increasing man's knowledge of the turbulent interplanetary space environment. In addition, IMP spacecraft have provided warnings of possible solar flare radiation hazards to astronauts during Apollo flights to the Moon.

IMP-I, which will be called Explorer 43 after orbit is achieved, carries instrumentation for 12 scientific experiments and one engineering experiment. The scientific experiments, representing collaborative efforts of nine U.S. universities, the Atomic Energy Commission and NASA, are designed to study energetic particles, solar plasma, electric and magnetic fields and radio astronomy. The electric fields and radio astronomy experiments are "firsts" for the IMP program.

The engineering experiment, an on-board computer, will also be used to process data from some of the scientific instruments. It will be the first of its kind to assess its potential for future unmanned spacecraft missions.

The primary scientific objectives of the 12 scientific experiments are to investigate energetic particles, especially solar and galactic cosmic rays (six experiments), solar plasma (two experiments), magnetic and electric fields (three experiments) and radio astronomy (one experiment).

This will be the most demanding mission the Delta rocket has been given during its 11-year history.

It must be launched on a very precise trajectory so that the scientific instruments aboard the spacecraft can make measurements with the Sun at a specific angle to the IMP's orbit. This requires a launch window of only 10 minutes each 24 hours and to-the-second accuracies in the firing times of the three-stage rocket and six strap-on motors at various altitudes and locations around Earth.

It must hit a small, imaginary target in space with the accuracy of a skilled marksman, and at a speed near but not exceeding Earth escape velocity.

This will be the first launch from Cape Kennedy of this version of the Delta.

The orbit planned for IMP-I is highly elliptical, ranging initially from a high point (apogee) of 121,000 statute miles to a perigee of 145 miles wigh an inclination of about 29 degrees.

Projected orbital period is just under four days. Eventually the orbit will change because of the gravitational influences of the Earth, Moon and Sun to an apogee of about 113,000 miles and a perigee of 8,000 miles.

The spacecraft is expected to be fully operational about 30 days after launch.

Mission objectives are:

*Continue the detailed energetic particles studies begun with earlier IMPs.

*Study the quiescent properties of the interplanetary magnetic field and its dynamic relationship with the flow of particles from the Sun.

*Continue the solar flare monitoring program.

*Improve our understanding of Sun-Earth relationships.

*Study low frequency radio waves from the Earth's magnetosphere, the solar corona and the Milky Way in order to determine their relationship to the magnetoionic properties of the solar system and the galaxy.

*Study the Earth's electric field from interplanetary space.

*Continue evolutionary development of relatively inexpensive, spin-stabilized satellites for interplanetary investigations.

Included in the overall IMP program are the two Anchored Interplanetary Monitoring Platform spacecraft, AIMP-D (Explorer 33) and AIMP-E (Explorer 35), also Goddard-built and managed. They were launched in 1966 and 1967. Both spacecraft were designed for lunar orbits and are still operational.

They made major contributions to scientific knowledge and understanding of the near lunar and interplanetary environment including the finding that positive ions from the solar wind impacted directly onto the Moon's surface and that a solar wind void exists directly behind the Moon. These findings aided in planning Apollo missions, particularly in providing the first detailed information on the electrical conductivity and internal temperatures of the Moon.

Results from the Earth-orbiting IMP spacecraft have greatly expanded our understanding of the Earth's magnetosphere and the transition region between the magnetosphere and interplanetary space.

The magnetosphere is a huge, teardrop-shaped envelope surrounding the Earth which contains the Van Allen radiation belts. It is formed by solar wind impinging on the Earth's magnetic field. The solar wind, traveling at supersonic speeds, tends to compress the Sun side of the magnetosphere, while the region behind the Earth, away from the Sun, is distended and trails off behind the Earth for several million miles much like the tail of a comet.

IMP findings have resulted in publication of more than 125 scientific papers. Key results reported to date include:

*First accurate measurements of the interplanetary magnetic field.

*Detailed mapping of the shock front boundary of the magnetosphere and the turbulent transition region--the magnetopause--behind the boundary.

*First detailed information on the magnetosphere tail region.

*Discovery of a magnetically neutral area in the magnetosphere tail-- called the neutral sheet--caused by magnetic lines of force moving in opposite directions.

*Discovery of energetic electrons in the neutral sheet which may be the source of radiation causing the aurora as well as replenishment of the Van Allen radiation belts.

The IMP series of scientific spacecraft is part of the space exploration program directed by NASA's Office of Space Science and Applications. NASA's Goddard Space Flight Center, where IMP spacecraft are built, is responsible for IMP project management. The EMR-Aerospace Sciences, College Park, Md., assisted in spacecraft systems integration and environmental testing. Prime contractor for the Delta launch rocket is McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)

THE IMP-I SPACECRAFT

As the largest and most complex spacecraft in the NASA Explorer series, the 635-pound IMP-I resembles a large drum with 16 sides. Its main structure is six feet high by four and one-half feet in diameter. The upper portion of the main structure contains an aluminum honeycomb shelf on which the science instrumentation and essential spacecraft electronic equipment are housed. The lower portion has an 18-inch thrust tube to accommodate the Delta third stage motor.

To avoid radio frequency interference and to maintain proper thermal control, the science section of IMP-I is insulated by protective metal covers and side panels. The experiment-to-spacecraft-weight ratio is one of the highest of NASA's unmanned satellites: 215 pounds versus overall weight of 635 pounds.

Power is obtained from 48 panels of solar cells arranged in three rings on the outside surface. These provide energy to operate the spacecraft and charge the 12-pound package of silver-cadmium batteries.

Four booms, folded during launch, are attached to the exterior of IMP-I. Two of these, about 12 feet long, carry sensors, and two, each five feet long, are used for the attitude control system. The attitude control system, using Freon-14, will help maintain the proper spin-stabilized orientation perpendicular to the ecliptic plane. This system, an improved version of a similar system flown on AIMP-E (Explorer 35), is operated by ground command.

Six antennas, four 150 feet long and two 20 feet long, will be deployed after orbit is attained to make electric field measurements and radio astronomy observations.

Unique engineering features of the IMP-I include:

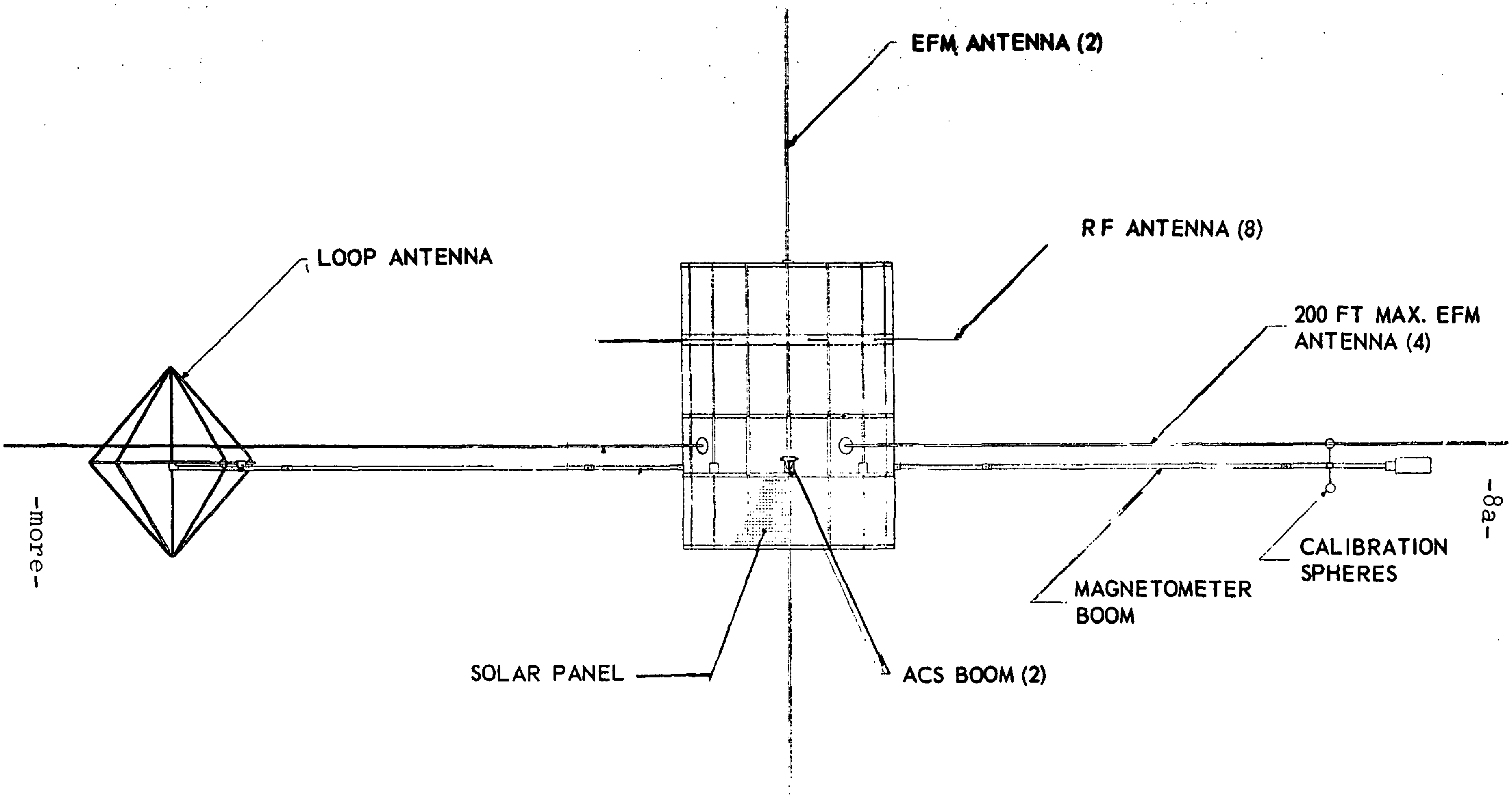
*An encoder and digital data processor, the most advanced and most powerful device of its type ever flown on an unmanned NASA spacecraft. This device using only four watts of power, is fitted into a ten-inch volume area of the spacecraft. It contains 328,000 MOSFET devices (metal oxide silicon field effect transistors) and 500 separate data counters.

*An optical-aspect system consisting of sensors designed to give the spin axis orientation of the spacecraft with respect to Earth.

*A spin synchronous clock which is essentially "timed" with the rotation rate of the spacecraft.

*The range and range-rate tracking system which permits pinpoint tracking by ground stations.

IMP-I, designed, built and environmentally tested at the Goddard Space Flight Center, is planned for an operating lifetime of at least one year.



IMP I
SIDE VIEW
ORBITAL CONFIGURATION

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THE SCIENTIFIC OBJECTIVES

IMP-I, with its vastly increased size and weight, data handling capability and new and advanced sensors, represents a significant step forward in the NASA program of exploring space.

Earlier and less sophisticated IMPs mapped in broad terms the interplanetary region, the magnetosphere, and studied solar and galactic cosmic rays and other aspects of the complex solar-terrestrial relationship over a significant portion of the most recent 11-year solar cycle. IMP-I will, if successful, make contributions beyond this basic exploration role.

Its 12 scientific experiments are designed to investigate the complex mechanisms and processes in the interplanetary environment which should lead to understanding how the various phenomena relate to each other. For example, the number and type of energetic particles trapped in the magnetosphere are fairly well known from early investigations. How they got there, what the acceleration mechanisms are and how they are "lost" remains a mystery.

Two additional spacecraft remain to be flown in the IMP program. These are IMPs H and J, currently scheduled for launching in 1972 and 1973, respectively. These spacecraft will be configured like IMP-I, although they will carry somewhat different instruments and will be placed in very high circular orbits about half the distance to the Moon.

Energetic Particles-Cosmic Rays

The six energetic particles-solar and galactic cosmic ray experiments comprise the major complement of IMP-I experiments and are viewed as potentially the most significant in terms of expanding our knowledge of these forces. They represent the most comprehensive and intensive effort of its type ever flown on a single spacecraft.

Before man can function in interplanetary space, he must first learn more about effects of cosmic rays and where in space these lethal particles may dominate the environment.

Cosmic rays are actually high energy particles, some of which carry energies ranging from a million to a billion-billion electron volts. They consist primarily of protons (high energy hydrogen nuclei) alpha particles (helium nuclei) and heavier nuclei. Some are so powerful they can ram through a three-foot lead wall.

Cosmic rays that come from deep space are called galactic cosmic rays, while cosmic rays from the Sun are called solar cosmic rays.

Galactic Cosmic Rays. What produces galactic cosmic rays is not clearly understood. Cosmic radiation from galactic sources is present at all times in the solar system. The Earth's magnetic field is not strong enough to deflect them.

Only during times of intense solar activity does the rate at which they are found near Earth decrease. This is called the Forbush decrease and is observed when a large solar flare event occurs on the Sun. It is believed the intense magnetic field lines in the tongue of plasma that streams out from the Sun envelops the Earth and is strong enough to deflect galactic cosmic rays. Detectors flown on earlier IMP spacecraft have shown that during periods of minimum solar activity in the 11-year solar cycle, the arrival of galactic cosmic radiation tends to increase.

The intensity of cosmic radiation varies with the latitude of Earth. It is more intense at the poles. Since cosmic ray particles have tremendous energies, they penetrate deeply into the Earth's atmosphere. When these fast-moving particles collide with particles in the atmosphere they produce many kinds of lower-energy radiation.

Solar Cosmic Rays. Although their composition is similar, solar cosmic rays have less energy than those of galactic origin. Solar cosmic rays stream from the Sun during periods of solar events. They result in "clouds" of highly charged particles being ejected into the solar system. Those that reach the Earth, particularly the protons, interact with the Earth's atmosphere and cause magnetic storms, radio blackouts, auroral displays and other phenomena.

The six charged particle experiments carried by IMP-I are designed to study both galactic and solar cosmic rays. These experiments, essentially, will measure particle intensity, composition and direction. They include:

*Goddard Cosmic Ray Experiment. Provided by the Goddard Space Flight Center, this package consists of three telescopes to measure very low energy, low energy and medium energy solar and galactic cosmic rays. Of particular interest will be investigations of the flow patterns and isotropic composition of the particles. The detectors weigh almost 27 pounds and will use an average of four watts of power. The Principal Investigator is Dr. Frank B. McDonald of Goddard.

*Galactic and Solar Particle Composition and Spectra Experiment. Provided by the University of Chicago, this instrument will measure high energy spectra, nuclear composition and electrons of various energies. It consists primarily of two telescope detectors, including a low energy telescope which is the prototype of one scheduled to fly on the Pioneer F and G Jupiter missions in the mid-1970s. The package weighs 18 pounds and uses four watts of power. The Principal Investigator is Dr. J. A. Simpson of the University of Chicago.

*Low Energy Particle Detector Experiment. Provided by the University of Iowa, this is a spectrometer consisting of three cylindrical curved plates and related electronic equipment. It will study the differential energy spectrum, angular and spatial distribution and temporal variation of electrons and protons. Weighing about five pounds, the package requires four watts of power. Principal Investigator is Dr. L. A. Frank, University of Iowa.

*Energetic Partical Experiment. Designed to study the acceleration of electrons at the Sun and their injection into interplanetary space. Provided by the University of California, it consists of four detector telescopes weighing about seven pounds, requiring 1.5 watts of power. The Principal Investigator is Dr. Kinsey A. Anderson of the University of California at Berkeley.

*Solar Proton Monitoring Experiment. Provided by the Applied Physics Laboratory of the Johns Hopkins University, it was first flown on IMP-F (Explorer 34) and IMP-G to provide continuous and systematic measurements of solar protons coming from the Sun. During Apollo missions 8 through 14 this information was used to insure astronaut safety from potential radiation hazards. Data from this experiment will be released to the scientific community when solar proton events occur. It will employ five detectors using about 1.3 watts of power and weighs eight pounds. Dr. C. Bostrom of APL is the Principal Investigator.

*Solar and Distant Magnetosphere Electron Experiment. This complex device will determine the characteristics of cosmic ray electrons and positrons of various energies using a collimated electron detector, a background detector and a gamma-ray spectrometer. It was provided by Dr. T. L. Cline of the Goddard Space Flight Center. Its weight is eight and one-half pounds, with two watts of power required for operation.

Solar Plasma

The solar plasma or solar wind is a stream of charged particles speeding constantly into the solar system from the Sun at supersonic speeds. The electrons and protons which make up the solar wind arrive at the bow of the Earth's magnetosphere in about equal numbers.

The Sun exhibits a cyclic change of activity with a duration of about 11 years. During periods of maximum activity, the stream solar plasma increases greatly and has disruptive effects upon the magnetosphere, frequently causing disruption of short-wave radio transmissions and communications undersea cables.

There is also a cycle of about 27 days corresponding to the rotation of the middle portion of the Sun's surface. Charged particles and a lesser number of heavy atomic nuclei are expelled at tremendous speeds. Scientists believe the solar wind is an extension of the Sun's atmosphere or corona. During solar events, solar wind particles attain speeds approaching the velocity of light.

One of the effects of the solar wind on the magnetosphere is that it compresses the magnetic field closer to Earth on the sunside and distends the tail, or anti-solar side to a distance of millions of miles, forming a comet-like aerodynamic shape.

The two IMP-I solar plasma experiments are:

*Goddard Plasma Experiment. Provided by the Goddard Space Flight Center, it consists of a complex 12-pound device to measure the bulk, velocity, density and parallel and perpendicular temperatures of hydrogen and helium ions in the solar wind at various energy ranges. It will use almost five watts of power. The Principal Investigator is Dr. K. W. Ogilvie of Goddard.

*Los Alamos-Sandia Plasma Experiment. Provided by the University of California (Los Angeles) and supported by the Atomic Energy Commission, it consists of an electron multiplier device and a door viewing port in the side of the spacecraft which permits the study of electron and positive ion populations in the solar wind, the magnetosheath and the magnetotail. This information is expected to help delineate the plasma populations of these three areas. The device weighs almost 11 pounds and requires two and one-half watts of power. Principal Investigator is Dr. S. J. Bame of UCLA.

Magnetic and Electric Fields

The distance between the atoms that make up particles in space is many times greater than, for example, the air around us. Unlike air in the Earth's atmosphere, particles in space move at tremendous speeds. This movement is controlled throughout the universe by magnetic fields.

A variety of magnetic fields exist in the universe. In the solar system the Sun's magnetic field affects the movement of particles in space. This field is altered dramatically by the periodic disturbances occurring on the Sun. Near Earth, of course, is the terrestrial magnetic field, enclosed in the magnetosphere. The existence of galactic magnetic fields is also theorized. The magnetometer is the primary instrument used on board spacecraft to study magnetic fields.

A little known electric current system flowing within the molten, metallic core of the Earth is responsible for the Earth's main magnetic field. The configuration of these currents forms a positive-negative field. Many variations occur in this field. These effects can be detected for thousands of miles into space. The fact that the variations move slowly westward indicates that the crust and core of the Earth rotate at slightly different rates.

Detailed knowledge of the main electric field of the Earth is still scarce. It is expected that IMP-I will shed new light on the subject.

The three magnetic electric field instruments carried by IMP-I are:

*Direct Current Electric Fields Experiment. Provided by Goddard, this 50-pound device is the heaviest on board the spacecraft. It consists of four 150-foot-long and two 20-foot antennas which will be deployed after IMP-I attains orbit. The objective is to make measurements of the electric field to obtain detailed direct current and low frequency alternating electric field information. A similar electric field meter, with shorter and fewer antennas, was carried on OGO 5. Principal Investigator is Dr. Theodore L. Aggson of Goddard.

*Alternating Current Electric and Magnetic Field Experiment. This collaborative University of Iowa-University of Minnesota-Goddard Space Flight Center experiment, weighing 30 and one-half pounds, will study the origin and characteristics of naturally-occurring radio noises in the Earth's magnetosphere, in the magnetosphere transition region and the solar wind. It will also permit low and high frequency range studies to be made of magnetic and electric fields. Special devices will collate radio intensity data with measurements of electron and proton energy distribution data obtained from the University of Iowa's Low Energy Particles Experiment. Coupled with this is a device provided by the University of Minnesota, capable of measuring electric fields in a variety of low and high frequency ranges. Total power required will be nine and one-half watts. Principal Investigator is Dr. Donald Gurnett, University of Iowa.

*Magnetic Field Experiment. The third and final instrument in this category is a Goddard three-orthogonal component fluxgate magnetometer. Its purpose is to make precise measurements of the interplanetary field, the magnetosphere transition regions, the magnetosphere proper and the tail. The magnetometer weighs almost eight pounds and requires two and one-half watts of power. Principal Investigator is Dr. Norman F. Ness of Goddard.

Radio Astronomy Investigations

For the first time since the inception of the IMP series, a radio astronomy experiment has been selected for IMP-I.

Although radio astronomy investigations date back to the pioneering efforts in 1932 of Karl G. Jansky, a Bell Telephone scientist , radio astronomy as a specialized branch of science did not receive any great impetus until after World War II when large ground-based observatories were built.

The first intensive efforts to study extra terrestrial radio emissions from a spacecraft occurred with Explorer 38 (Radio Astronomy Explorer-A) launched July 4, 1968. This spacecraft continues to transmit excellent data in low frequency ranges which cannot penetrate the Earth's atmosphere.

The IMP-I radio astronomy receiver will continue pioneering studies being carried out by Explorer 38.

*Radio Astronomy Experiment. Provided by the University of Maryland (impedance probe and radiometer) and the University of Michigan and Goddard (radiometer), the 17 and one-half pound instrument has as its objective the study of the radio spectra of various celestial objects, including our galaxy, the Sun and the planet Jupiter in low frequency ranges not receivable by Earth-based instruments. It consists of two independent, but complementary systems and requires seven watts of power for operation. Principal Investigator is Dr. W.C. Erickson of the University of Maryland.

Computer Engineering Experiment

The 13th experiment carried by IMP-I is an engineering test of a spacecraft computer called the SDP-3. In addition to evaluating its potential for future unmanned spacecraft missions, the SDP-3 computer will be used to enhance the data return of the University of Minnesota Electric and Magnetic Field Experiment, the Goddard Plasma Experiment, the University of Chicago Cosmic Ray Experiment and the University of California Medium Energy Particles Experiment.

The computer, weighing 12 and one-half pounds, is a general-purpose, stored-program device with a one-level indirect addressing capability and one hardware index register. Its memory core can store four thousand bits of information in a program consisting of 16 pages of 256 words each. It has a five-watt power requirement.

In orbit, the computer will provide experiment sequencing operations, select sensor ranges and perform some experiment calibration. It will also store data, perform data handling and processing tasks. Principal Investigator is R. A. Cliff of Goddard.

TRACKING GROUND SUPPORT

The IMP-I spacecraft will be support from ground stations of the Space Tracking and Data Acquisition Network (STADAN). The Range and Range Rate systems at Fairbanks, Alaska; Rosman, N.C.; Santiago, Chile; Tananarive, Madagascar; and Carnarvon, Australia will provide precise tracking of the spacecraft in its elliptical orbit. At its farthest point from Earth (some 120,000 miles), the position of the spacecraft will be known within 30 miles.

The telemetry systems at these sites and at Ft. Myers, Fla.; Quito, Ecuador; and Ororral Valley, Australia, will receive spacecraft signals and relay them almost immediately via wide band communication circuits to the control center at Goddard.

At the control center the data will be analysed and appropriate commands will be generated and issued to the spacecraft via the STADAN remote sites. These STADAN sites also support the Computer Engineering Experiment by issuing the proper instructions to the computer's memory.

In addition to this real time support, the information processing division will process the scientific data being acquired and forward it to the principal investigator.

All these ground facilities are managed for NASA's Office of Tracking and Data Acquisition by the Tracking and Data Systems Directorate at Goddard.

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DELTA LAUNCH VEHICLE

The most precise and demanding flight trajectory in 11 years of orbital flight for the Delta rocket faces Delta #83 when it lifts off Cape Kennedy with the IMP-I.

It must be launched within a 10-minute period, it requires a second stage re-start over Australia some 53 minutes after lift-off and, finally, when the third stage fires 56 minutes after launching, its trajectory must be as accurate as a skilled marksman's.

All of this is necessary because the satellite's rendezvous point is a keyhole in space from where experiments aboard IMP can make scientific observations when the Sun is at a specific angle to the spacecraft orbit.

The cigar-shaped orbit scientists are shooting for ranges between 145 statute miles (perigee) and 121,000 statute miles (apogee). Because of this elongated orbit, it will take the spacecraft about 93 hours for one Earth orbit. The inclination to the Equator will be 29 degrees.

As IMP-I nears apogee (farthest most point from Earth) the satellite's speeds slows down to 865 mph. As it heads back toward Earth the speed gradually increases. When it swings through perigee (closest point to Earth) the speed accelerates to 24,175 mph and the satellite streaks back out into space like an astronomical roller coaster.

For a flight between March 12 and 14, the launch window opens at 11:15 a.m. and closes at 11:25 a.m. The window after March 14 is as follows:

	Opens	Closes
March 15	11:10 am EST	11:20 am EST
March 16	11:05 am EST	11:15 am EST
March 17	10:30 am EST	10:40 am EST

If the flight should slip beyond March 17, the window reopens in about one week for about a five day period.

There are several "firsts" for Delta #83.

. It will be the first rocket with six solid boosters to be launched from Cape Kennedy. (Three will ignite on the pad and three when the booster is about 7,500 feet above the Launch Complex 17.)

. It will be the first three-stage configuration to have six strap-on boosters.

. It will be the first three-stage configuration with restart capability.

If the flight is successful, it will mark the 77th successful orbit for Delta in 83 attempts.

Delta is managed for NASA's Office of Space Science and Applications by the Goddard Space Flight Center, Greenbelt, Md. Launch operations are conducted by the Kennedy Space Center's Unmanned Launch Operations. The McDonnell-Douglas Corp., Huntington Beach, Calif., is Delta prime contractor.

Following are the general characteristics of the three stage vehicle for the IMP-I mission:

Total Height:	106 feet
Total Weight:	225,000 pounds
Maximum Diameter (first stage)	8 feet
First Stage Thrust (average)	325,000 pounds (includes solids)

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DELTA #83 NOMINAL FLIGHT EVENTS

EVENT	TIME	ALTITUDE (STATUTE MILES)	SURFACE RANGE (STATUTE MILES)	VELOCITY (MILES PER HOUR)
Castor I Burnout	43 sec.	3 miles	4,164 ft.	1,281
Castor II Ignition	31 sec.	4 miles	1,204 ft.	1,090
Castor II Burnout	1 min 10 sec.	9 miles	5 miles	2,100
Solid Motor Separation	1 min 20 sec.	12 miles	8 miles	2,265
Main Engine Cutoff (MECO)	3 min 41 sec.	63 miles	173 miles	10,652
First Second-Stage Ignition	3 min 47 sec.	68 miles	188 miles	10,655
Shroud Separation	4 min 11 sec.	82 miles	251 miles	10,961
1st Second-Engine Cutoff (SECO)	10 min 3 sec.	153 miles	1,434 miles	17,349
Re-Start Second Stage	53 min 4 sec.	149 miles	12,081 miles	17,378
Final SECO	53 min 9 sec.	149 miles	12,058 miles	17,552
Third-Stage Ignition	53 min 55 sec.	149 miles	11,861 miles	17,553
Third-Stage Burnout	54 min 39 sec.	148 miles	11,634 miles (more than half-way around the world)	24,169
IMP-I Separation	56 min 20 sec.	174 miles	11,015 miles	24,088

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Launch: From Complex 17, Cape Kennedy, Fla., Eastern Test Range.

Launch Rocket: Three-stage Delta M-6, with six thrust-augmenters and the TE-364-3 third-stage motor.

Orbit: Apogee: 121,000 statute miles
Perigee: 145 statute miles
Period: About four days
Inclination: 29 degrees

Operating Lifetime: At least one year.

Spacecraft Weight: 635 pounds, including 215 pounds of experiments.

Main Structure: Drum-shaped with 16 sides, six feet tall, four and one-half feet in diameter.

Appendages: Two experiment booms, 12 feet long (one with loop antenna, one with magnetometer)

Two Attitude Control System Booms, five feet long.

Six antennas for electric field and radio astronomy measurements (deployed after orbit is achieved, four of which are 150 feet long and two 20 feet long)

Eight radio frequency antennas

Power System: Power Supply - 48 panels of solar cells arranged in 16 panel rings on outer surface of spacecraft to power the spacecraft and charge a 12-pound package of silver-cadmium batteries. Power requirement: 110 watts.

Communications and Data-Handling System:

Telemetry: Pulsed-Code Modulation (PCM) operating at 137.170 MHz.

Analog transmitter operating at 136.170 MHg

Encoder and Digital Data Processor: Pulsed-code modulation with digital data storage capability of 500 separate data counters.

Tracking and Data Acquisition Station: Stations of the world-wide Space Tracking and Data Acquisition Network (STADAN) operated by Goddard Space Flight Center.

IMP-I PROJECT OFFICIALS AND CONTRACTORS

NASA Headquarters

Mr. Frank Gaetano - Program Manager

Dr. E. Schmerling - Program Scientist

Mr. I. T. Gillam IV - Delta Program Manager

Robert Stephens - Network Engineering, OTDA

James C. Bavely - Network Operations, OTDA

Goddard Space Flight Center

Mr. Paul Butler - Project Manager

Dr. Frank B. McDonald - Project Scientist

Mr. Jeremiah J. Madden - Assistant Project Manager

Mr. Curtis M. Stout - Tracking Scientist

Mr. John J. Braham - Spacecraft Manager

Mr. William W. Conant - Experiment Manager

Mr. Stephen J. Paddack - Project Operations Director

Mr. Theodore C. Goldsmith - Electronic Systems Manager

Mr. William S. Logan, Jr. - Mechanical Systems Manager

Mr. Thomas C. Moore - Tracking and Data Systems Manager

Mr. William R. Schindler - Delta Project Manager

Mr. George D. Baker - Delta/IMP-I Coordinator

Kennedy Space Center

Dr. Kurt H. Debus - Director

Mr. John J. Neilon - Director, Unmanned Launch Operation (ULO)

Contractors

McDonnell-Douglas Astronautics Co., Huntington Beach, Calif., Delta Rocket EMR - Aerospace Sciences, College Park, Md., assisted in S/C systems integration and environmental testing.

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IMP-I EXPERIMENTS AND INVESTIGATORS

1. Cosmic Ray Experiment: Dr. Frank B. McDonald, Principal Investigator, Goddard Space Flight Center; and coinvestigators, Dr. Tycho von Rosenbinge, National Academy of Science Fellow, and Dr. Bonnard Teegarden, Goddard Space Flight Center.

2. Galactic and Solar Particle Composition and Spectra Experiment: Dr. J. A. Simpson, University of Chicago, Principal Investigator; and coinvestigators, Dr. M. Garcia-Munoz, S. Verma, and Dr. J. Hsieh, University of Chicago.

3. Low-Energy Proton and Electron Differential-Energy Analyzer Experiment: Dr. L. A. Frank, Principal Investigator, University of Iowa.

4. Energetic Particle Experiment: Dr. Kinsey Anderson, Principal Investigator, University of California (Berkeley).

5. Solar Proton Monitoring Experiment: Dr. Carl Bostrom, Principal Investigator, Johns Hopkins University Applied Physics Laboratory; and coinvestigators, Dr. D. S. Beall, APL, and Dr. Donald J. Williams, NOAA, Boulder, Colorado.

6. Solar and Distant Magnetosphere Electrons Experiment: Dr. Thomas L. Cline, Principal Investigator, Goddard Space Flight Center, and coinvestigator, Dr. K. Brunstein, Bendix Corp., Columbia, Md.

7. Plasma Experiment: Dr. Keith W. Ogilvie, Principal Investigator, Goddard Space Flight Center.

8. Los Alamos-Sandia Plasma Experiment: Dr. S. J. Bame, Principal Investigator, University of California (Los Angeles) and coinvestigator, Dr. J. R. Asbridge, Los Alamos Scientific Laboratory of the University of California.

9. Direct Current Electric Fields Experiment: Dr. Thomas L. Aggson, Principal Investigator, Goddard Space Flight Center; and coinvestigator, Dr. James P. Heppner, Goddard Space Flight Center.

10. Alternating Current Electric and Magnetic Field Experiment: Dr. Doanld Gurnett, Principal Investigator, University of Iowa; and coinvestigators, Dr. P. J. Kellog, University of Minnesota; Dr. Thomas L. Aggson and Dr. James P. Heppner, Goddard Space Flight Center.

11. Magnetic-Field Experiment: Dr. Norman F. Ness, Principal Investigator, Goddard Space Flight Center; and coinvestigator, R. J. Seek, Goddard Space Flight Center.

12. Radio Astronomy Experiment: Professor W. C. Erickson, Principal Investigator, University of Maryland; and coinvestigators, Professor F. T. Haddock, University of Michigan, and Dr. Robert G. Stone, Goddard Space Flight Center.

13. SDP-3 Computer Engineering Experiment: Rodger A. Cliff, Principal Investigator, Goddard Space Flight Center.

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