# The NASA's Space disciplines ( 1958 – 1981 )

( edited by Franco Mauri )

The National Aeronautics and Space Administration ( NASA ) is an independent agency of the U.S. Federal Government responsible for the civil space program, aeronautics research, and space research. NASA was established in 1958, succeding the National Advisory Committee for Aeronautics ( NACA ), to give the U.S space development effort a distinctly civilian orientation, emphasizing peaceful applications in space science. NASA has conducted many manned and uncrewed spaceflight programs throughout its history. The uncrewed programs launched America's first artificial satellites into Earth orbit for scientific and communications purposes, and sent scientific probes to explore the planets of the Solar System, starting with Venus and Mars. The manned programs sent the first Americans into low Earth orbit, won the " race to the Moon " engaged with the Soviets, developed the Space Shuttle, a semi-reusable vehicle, and the ISS, with the cooperation of several nations.

The covers are commented explaining the primary objectives of the mission. The disciplines, sometimes, do not appear among the primary objectives; they are part of a global program, articulated between the various specializations, on the basis of which NASA programs and develops its space projects.

The collection is mainly divided into five chapters :

1 HUMAN CREWED MISSIONS

2 ROCKETS AND BOILERPLATES

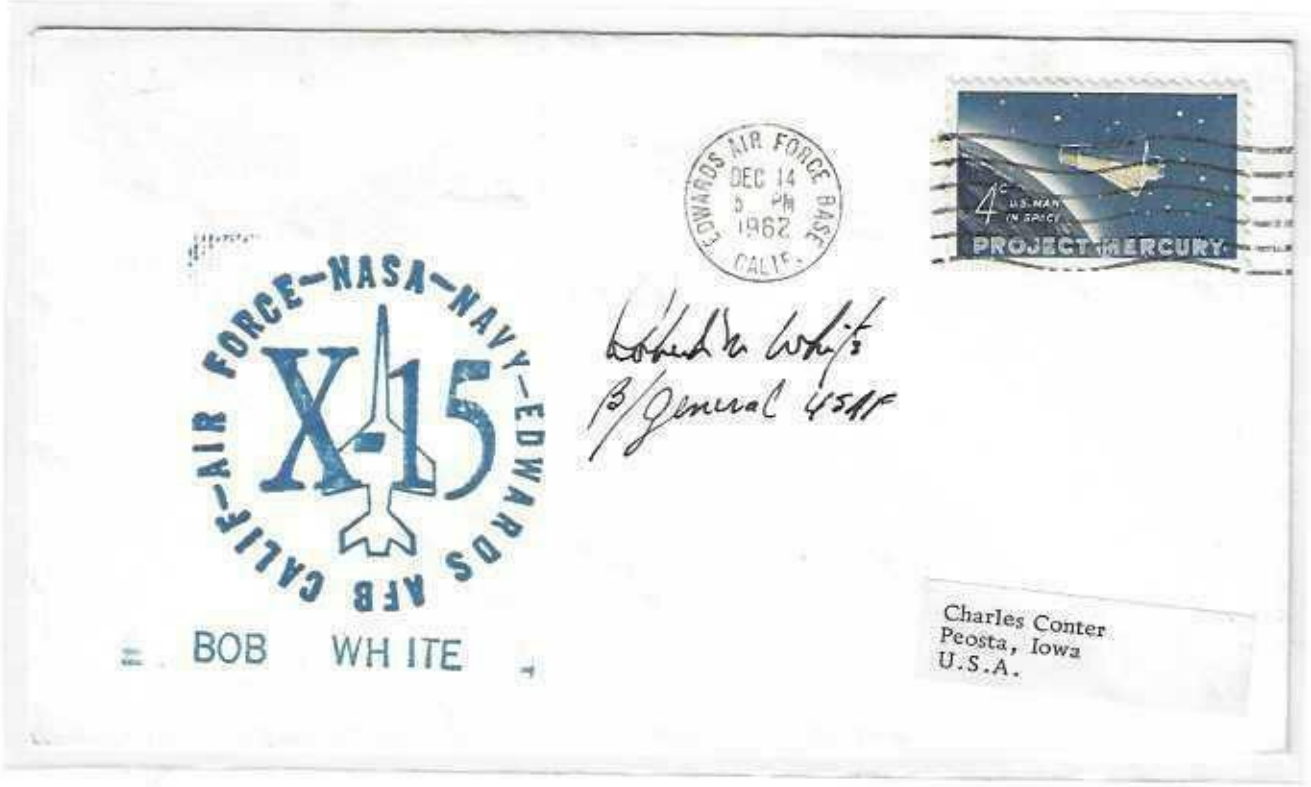
3 INTERPLANETARY SPACE PROBES

4 EXPLORER SATELLITES

5 VARIOUS SATELLITES


KSC, MAY 14, 1973. Launch of Skylab 1 mission. Among the missions conducted by NASA, between 1958 and 1981, the one that counts the most disciplines is the Skylab 1 mission, exactly 8 : astronomy, engineering, Earth science, human crew, life science, planetary science, solar physics, space physics. Follows the Apollo 16 mission with 7 disciplines.

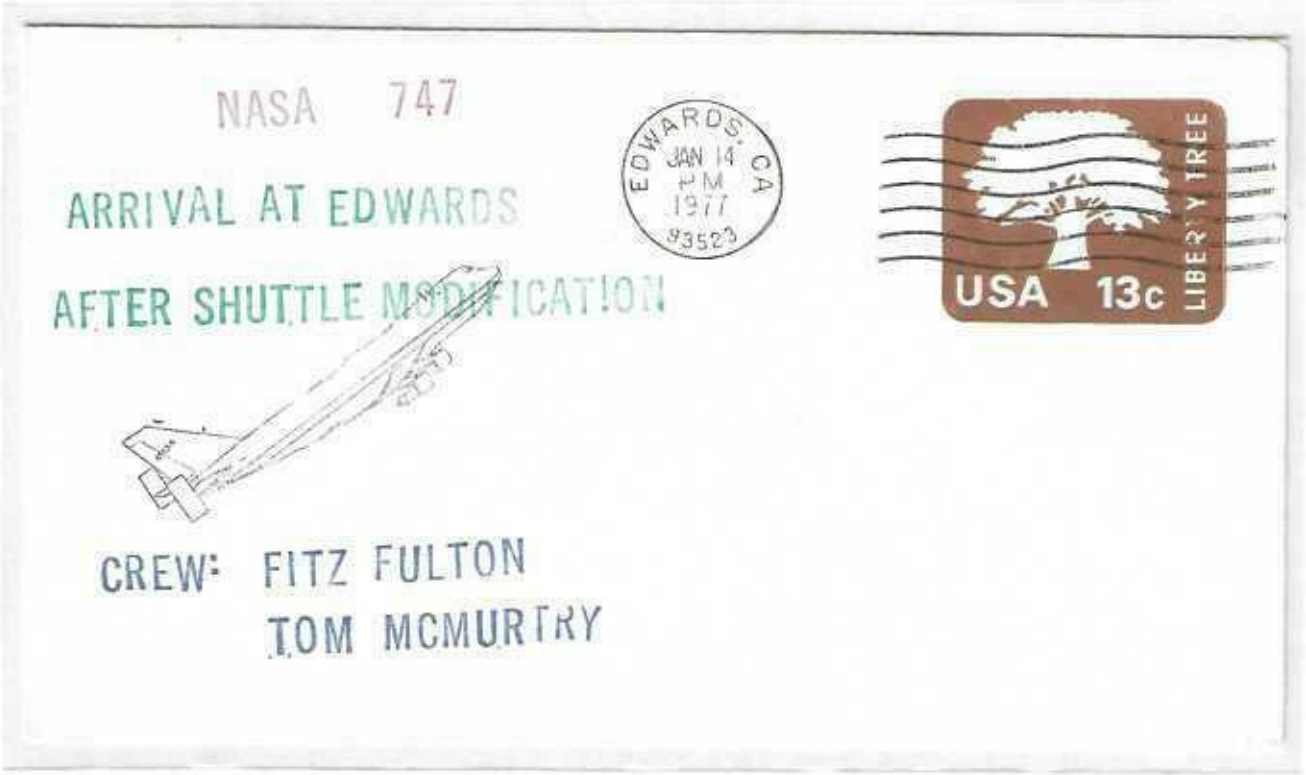
# HUMAN CREW : THE X-15 AND X-24B PLANE-ROCKETS




DECEMBER 14, 1962. Edwards AFB machine cancel on the date and time of flight. The plane-rocket X-15 reach altitudes and speed never touched until then, becoming a test bench on the human body, submitted directly to strong accelerations and stresses.


MARCH 20, 1975. Edwards AFB machine cancel on the date and time of flight. Commemorative cover signed by Robert White, X-15 pilot, astronaut. Already on August 1, 1973, the experimental aircraft X-24B, which can be considered the prototype of Space Shuttle, makes its first flight piloted by John Manke, released by a mother-plane B-52 at 12,000 meters of altitude.

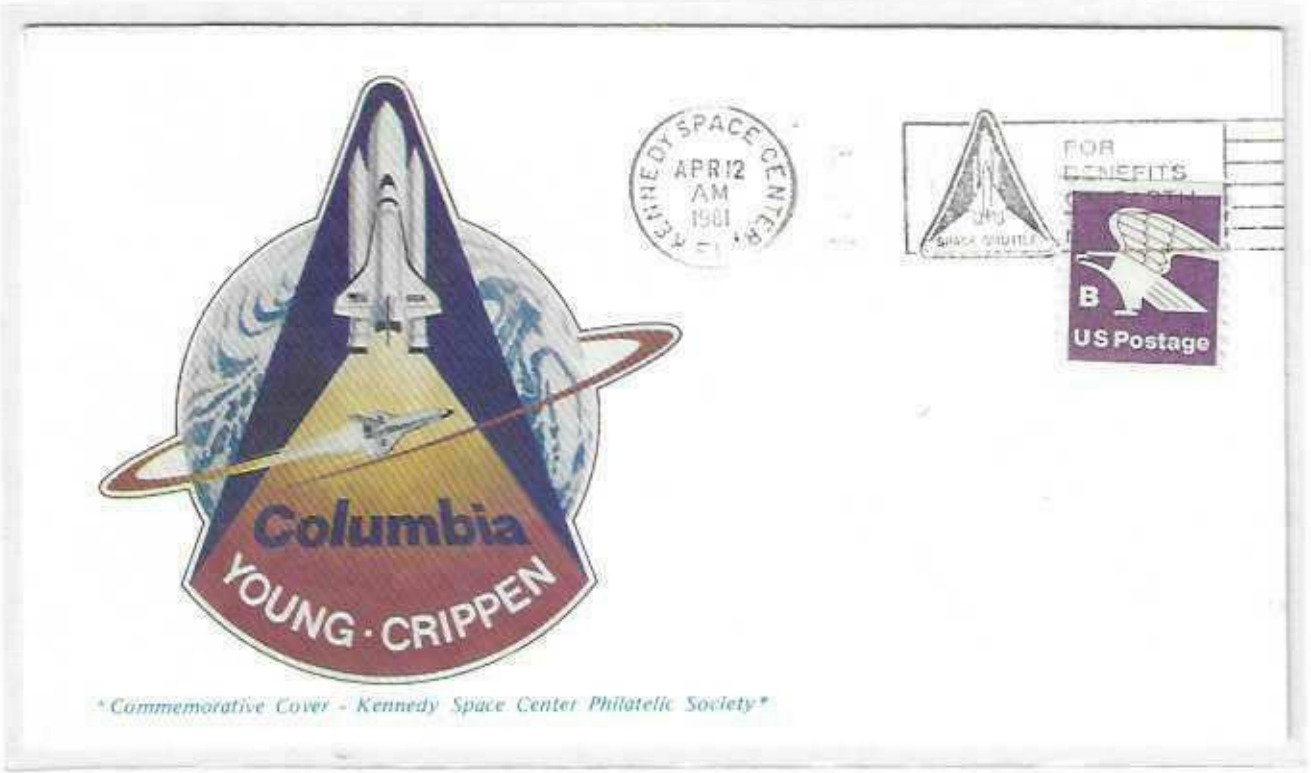
# HUMAN CREW : THE ENTERPRISE SHUTTLE




JANUARY 14, 1977. Edwards AFB machine cancel on the date and time of the modified " Jumbo " arrival. To transport the Shuttle, still not motorized, between the various sites, in 1974 NASA acquires a Boeing 747 used which is equipped for the transport of the Shuttle on the back of the fuselage.


Approach and Landing Test ( ALT FF-1 ). AUGUST 12, 1977. Commemorative cover manually cancelled in Edwards AFB on the date and time of skygliding. The shuttle Enterprise, released from the 747 at 7,000 m of altitude, lands after 5 minutes and 23 seconds on the track dry lake at the speed of 400 km/h.

# HUMAN CREW : THE STS-1 MISSION

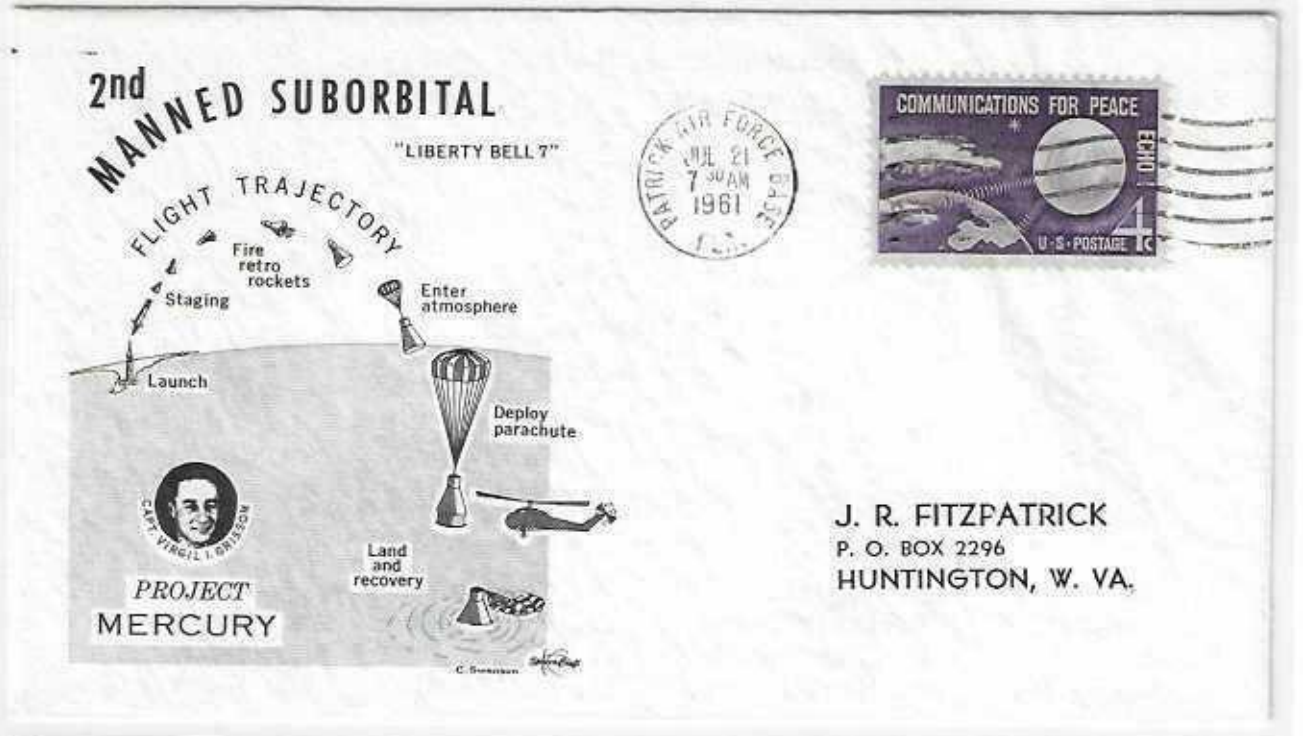



STS-1 Columbia mission. APRIL 12, 1981. KSC machine pictorial cancel on the date and time of launch. First manned orbital test of the Space Transportation System with astronauts John Young and Robert Crippen. Mission duration was 54 hours, 20 minutes, 53 seconds.


STS-1 Columbia mission. APRIL 13, 1981. Houston machine cancel affixed during the mission. Demonstrate safe launch into orbit and safe return of the orbiter and crew. Verify the combined performance of the entire Shuttle vehicle-orbiter, solid rocket booster, and external tank. Major systems tested successfully.

# ENGINEERING, HUMAN CREW : THE MERCURY MR-3, MR-4 MISSIONS


Mercury MR-3 mission ( Freedom 7 ). MAY 5, 1961. Patrick AFB machine cancel on the date and flight of launch. The objectives of MR-3 were to familiarize man with a brief but complete space flight experience, from the liftoff to the landing phases of the flight ( with weightlessness lasting for about 5 minutes ); evaluate man's ability to perform as a functional unit during space flight by demonstrating manual control of spacecraft attitude before, during, and after retrofire and by use of voice communications during flight; study man's physiological reactions during space flight; recover the astronaut and spacecraft.



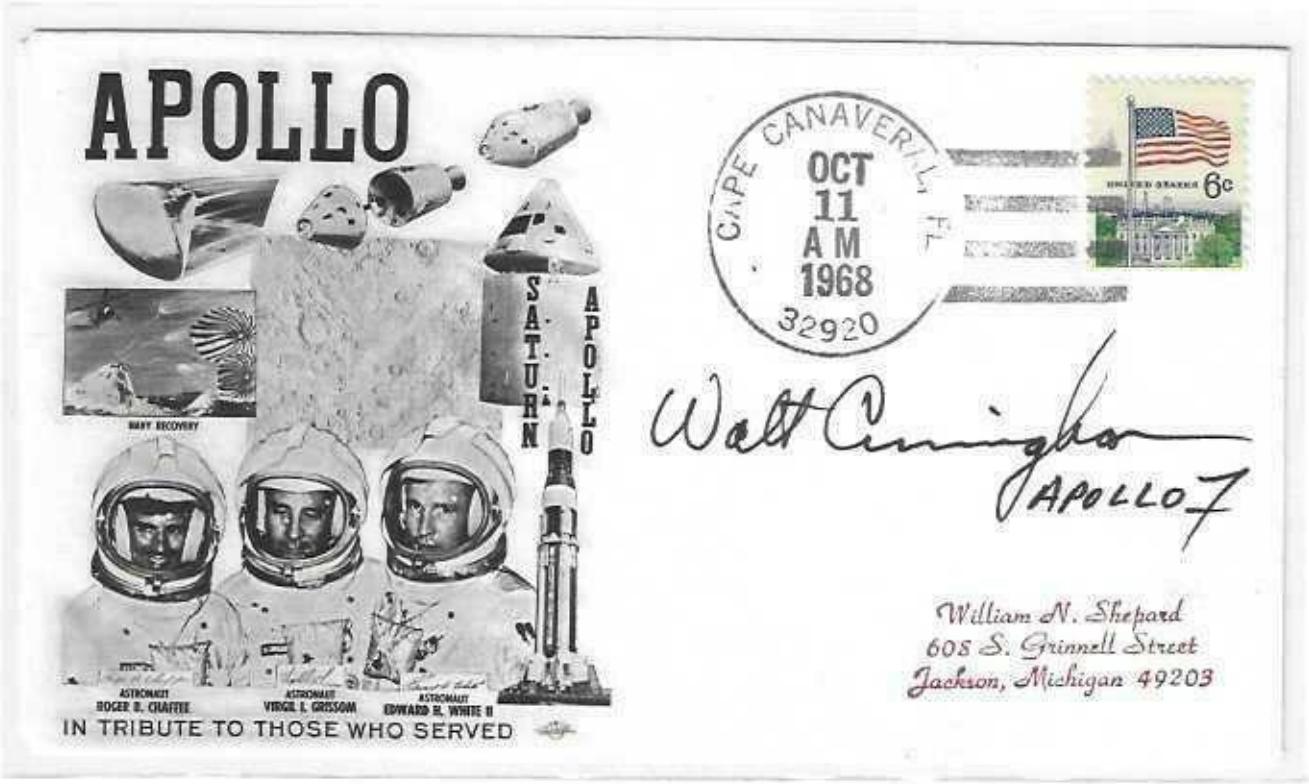

Mercury MR-4 mission ( Liberty Bell 7 ). JULY 21, 1961. Patrick AFB machine cancel on the date and time of launch. From the liftoff to reentry, operational sequences were similar to those of the first manned suborbital flight. The main configuration differences from the MR-3 spacecraft was the addition of a large viewing window and an explosively actuated side hatch.

# EARTH SCIENCE, HUMAN CREW : THE GEMINI 6A MISSION

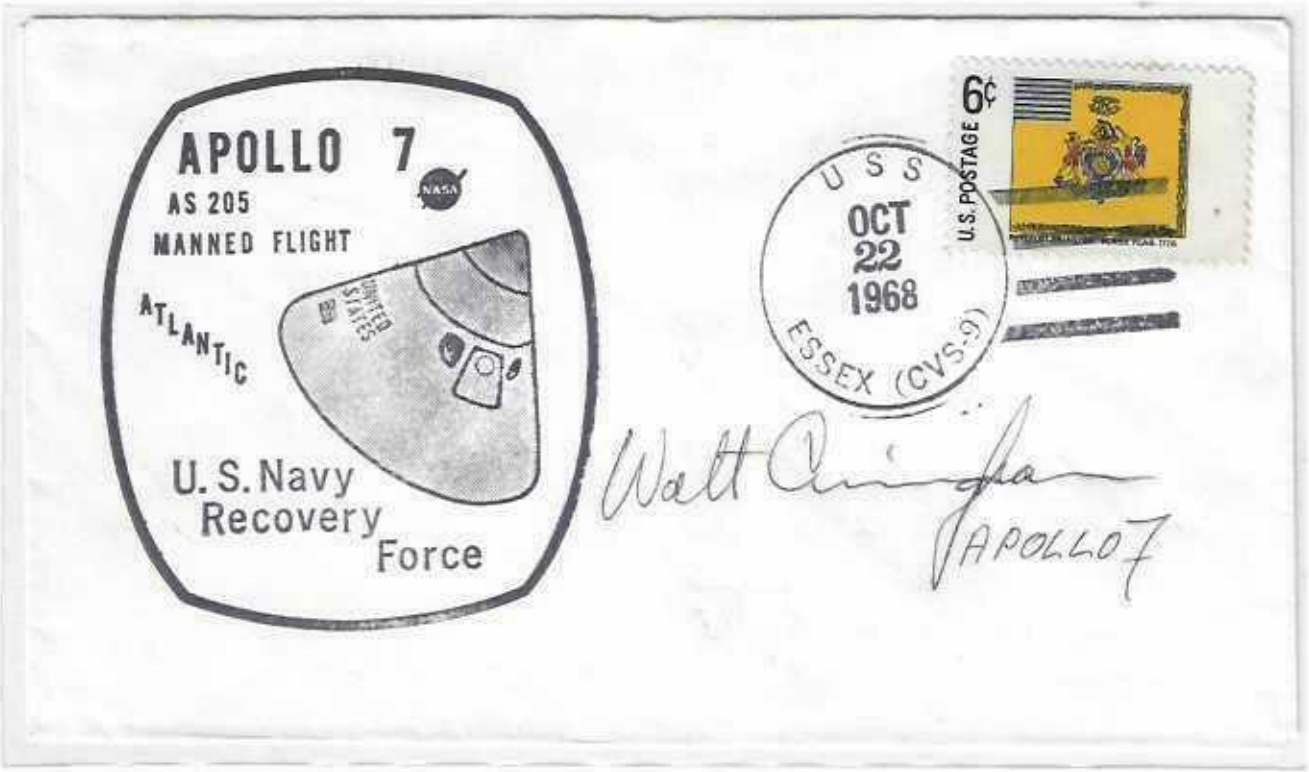

Gemini 6A mission. DECEMBER 15, 1965. KSC machine cancel on the date and time of launch. Gemini 6A was the fifth crewed Earth-orbiting spacecraft of the Gemini series, having been launched after Gemini 7. The mission was originally designated Gemini 6 and scheduled for launch on 25 October but was cancelled when the Agena target vehicle failed to go into orbit an hour earlier.


Gemini 6A mission. DECEMBER 15, 1965. Cape Canaveral manual cancel on the date and time of rendezvous. The mission priorities were to demonstrate on-time launch procedures, closed-loop rendezvous capabilities, and stationkeeping techniques with Gemini 7. Other objectives were to evaluate the spacecraft reentry guidance capabilities, and conduct spacecraft systems tests and four experiments.

# EARTH SCIENCE, HUMAN CREW : THE APOLLO 7 MISSION




Apollo 7 mission ( AS-205 ). OCTOBER 11, 1968. Cape Canaveral manual cancel on the date and time of launch. Apollo 7 was the first crewed flight of the Apollo spacecraft. The primary objectives of the Earth orbiting mission were to demonstrate Command and Service Module ( CSM ), crew, launch vehicle, and mission support facilities performance and to demonstrate CSM rendezvous capability.




Apollo 7 mission ( AS-205 ). OCTOBER 22, 1968. Primary recovery ship USS Essex manual cancel on the date and time of splashdown. Many tests were performed over the 11 days mission, including sextant calibration, attitude control, evaporator, navigation, radar, thermal control system, and SM propulsion system

# HUMAN CREW, LIFE SCIENCE : THE SKYLAB II AND III MISSIONS


Skylab II mission ( Skylab 3 ). JULY 28, 1973. KSC machine pictorial cancel on the date and time of launch. Continued maintenance of the space station, and extensive scientific and medical experiments. Installed a twinpole solar shield on EVA, performe major in-flight maintenance, doubled previous length of time in space.

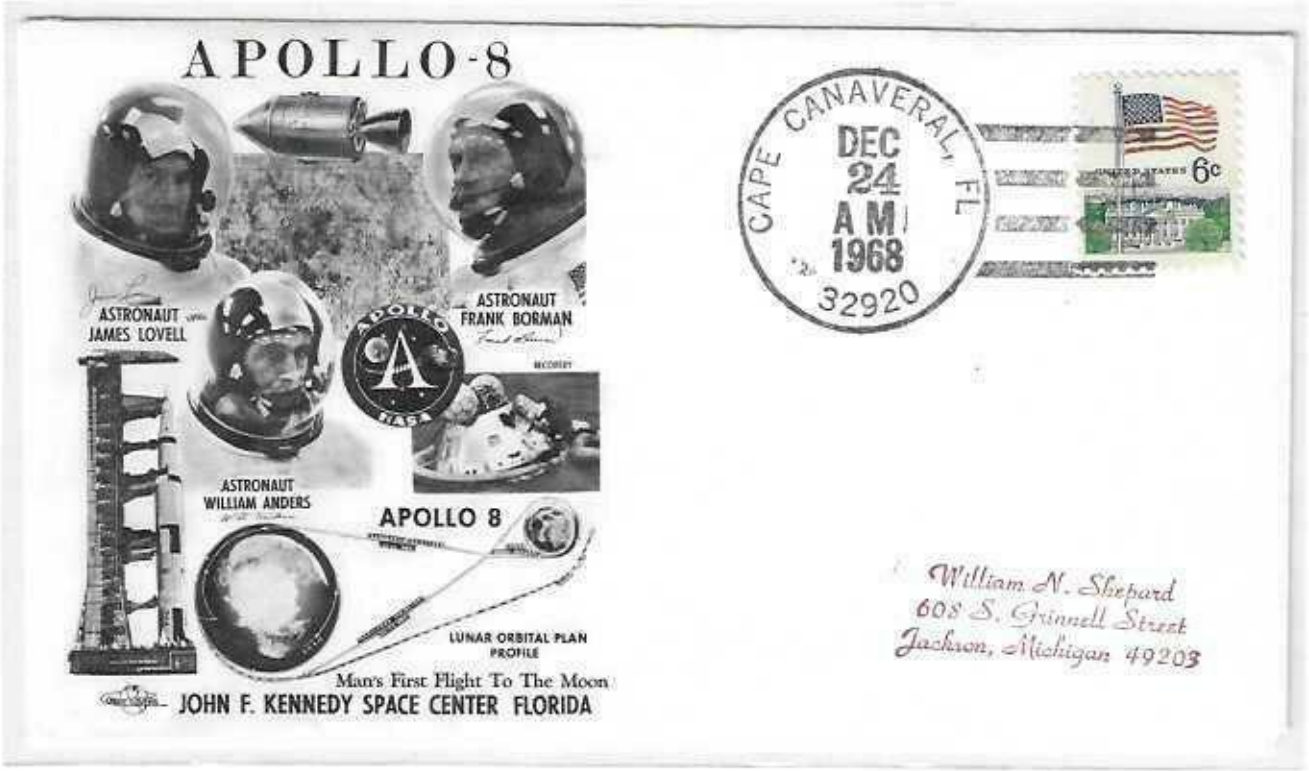

Skylab III mission. NOVEMBER 16, 1973. KSC machine cancel on the date and time of launch. Last of the Skylab missions that included observation of the comet Kohoutek and numerous experiments. Increased previous length of time by about 50%.

# HUMAN CREW, LIFE SCIENCE : THE APOLLO-SOYUZ TEST PROJECT


ASTP mission. JULY 15, 1975. Moscow machine cancel on the date of Soyuz's launch.


ASTP mission ( Soyuz-Apollo ). JULY 17, 1975. Cape Canaveral machine cancel on the date and time of docking. The U.S. and the U.S.S.R. launched an Apollo spacecraft and a Soyuz spacecraft, respectively, as a joint effort. After docking, crew transfer took place, with the Apollo crew first visiting the Soyuz. The combined crews performed joint experiments and presented radio and TV reports.

# HUMAN CREW, PLANETARY SCIENCE : THE APOLLO 8 MISSION




Apollo 8 mission ( AS-503 ) DECEMBER 24, 1968. Cape Canaveral manual cancel on the date and time of lunar insertion. The Apollo 8 spacecraft consisted of a CM similar to Apollo 7, except that the forward pressure and ablative hatches were replaced by a combined forward hatch, which would be used for transfer to the LM on later mission. The mission achieved operational experience, and tested the Apollo CM systems, including communications, tracking, and life-support, in cis-lunar space and lunar orbit, and allowed evaluation of crew performance on a lunar orbiting mission. The crew photographed the lunar surface, both farside and nearside, obtaining informations necessary for future Apollo landings.


Apollo 8 mission ( AS-503 ). DECEMBER 27, 1968. Primary recovery ship USS Yorktown machine cancel on the date and time of splashdown.

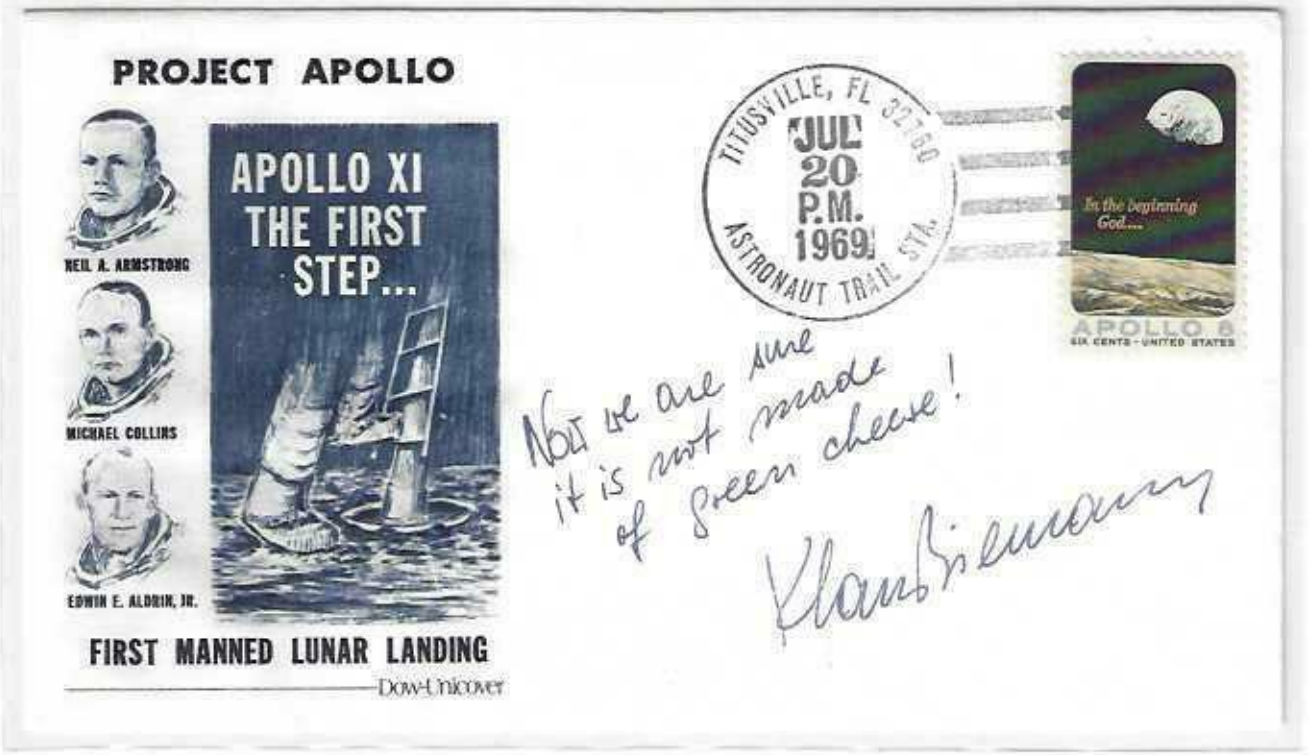
# HUMAN CREW, PLANETARY SCIENCE : THE APOLLO 10 MISSION


Apollo 10 mission ( AS-505 ). MAY 18, 1969. Cape Canaveral manual cancel on the date and time of launch. The primary objectives of the mission were to demonstrate crew, space vehicle, and mission support facilities during a manned lunar mission and to evaluate LM performance in cislunar and lunar environment. The mission was a full " dry run " for the Apollo 11 mission, in which all operation except the actual lunar landing were performed.


Apollo 10 mission ( AS-505 ). MAY 26, 1969. Primary recovery ship USS Princeton machine cancel on the date and time of splashdown.

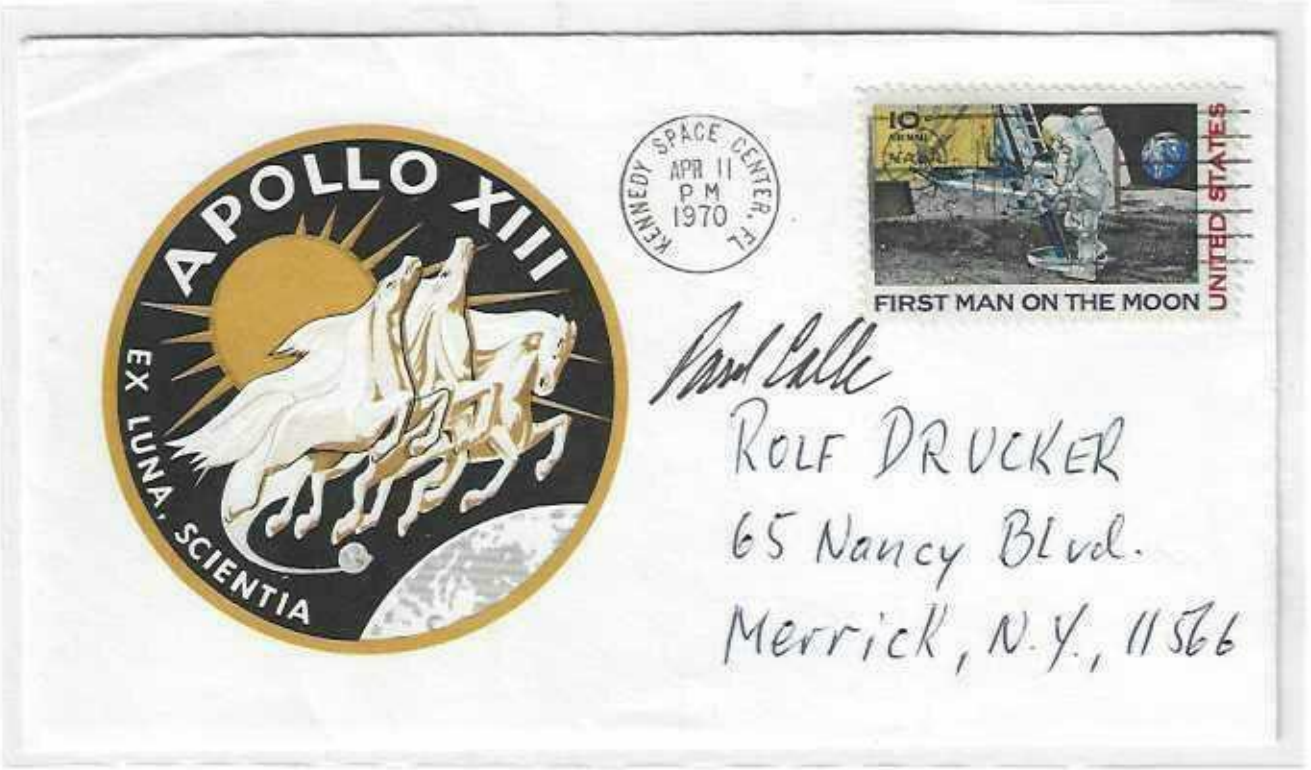
# HUMAN CREW, PLANETARY SCIENCE : THE APOLLO 11 MISSION


Apollo 11 mission ( AS-506 ). JULY 16, 1969. KSC machine pictorial cancel on the date and time of launch. Official cachet. The primary objective was to complete a national goal set by President John F. Kennedy on May 25, 1961 : perform a crewed lunar landing and return to Earth by the end of the decade.

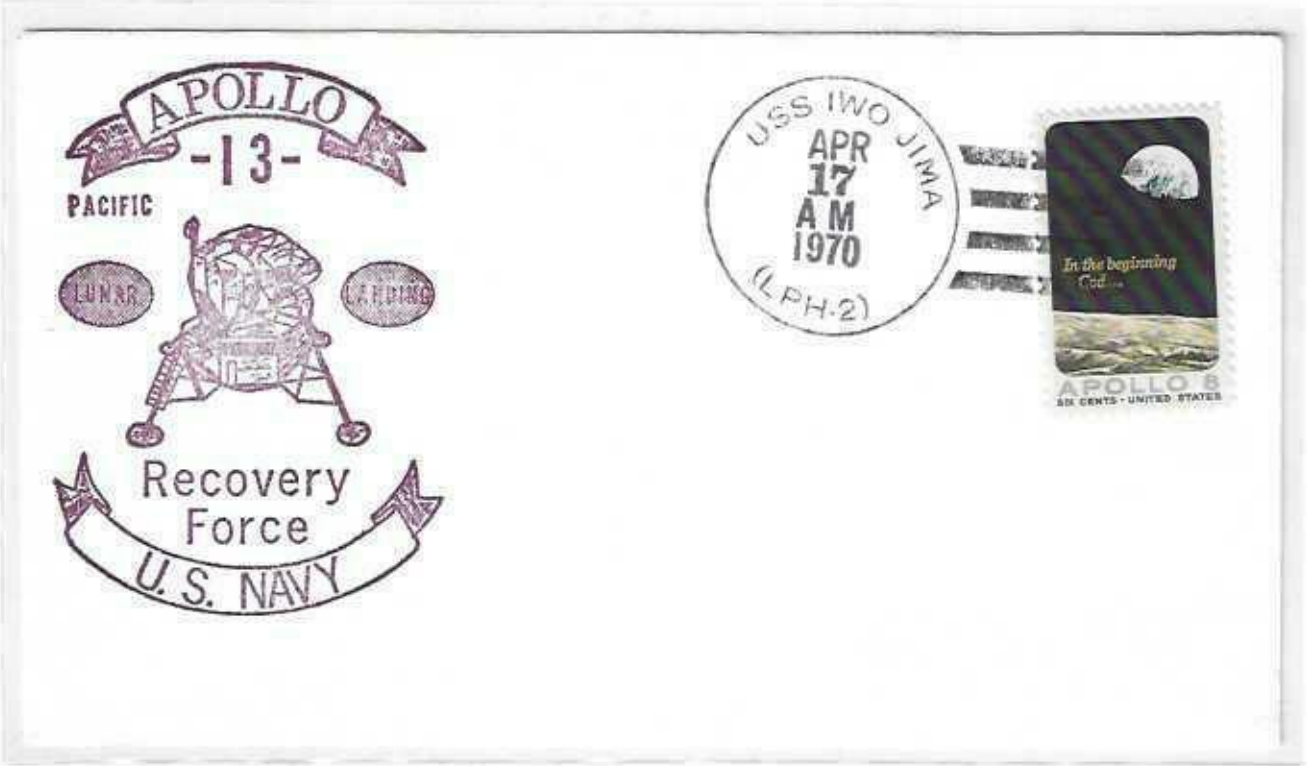



Apollo 11 mission ( AS-506 ). JULY 20, 1969. Titusville manual cancel on the date and time of moon landing. The secondary objectives of this mission were to : obtain data to assess the capability and limitations of the astronauts and his equipment in the lunar surface environment; perform selenological inspection and sampling, take television and photographic images.

# HUMAN CREW, PLANETARY SCIENCE : THE APOLLO 13 MISSION

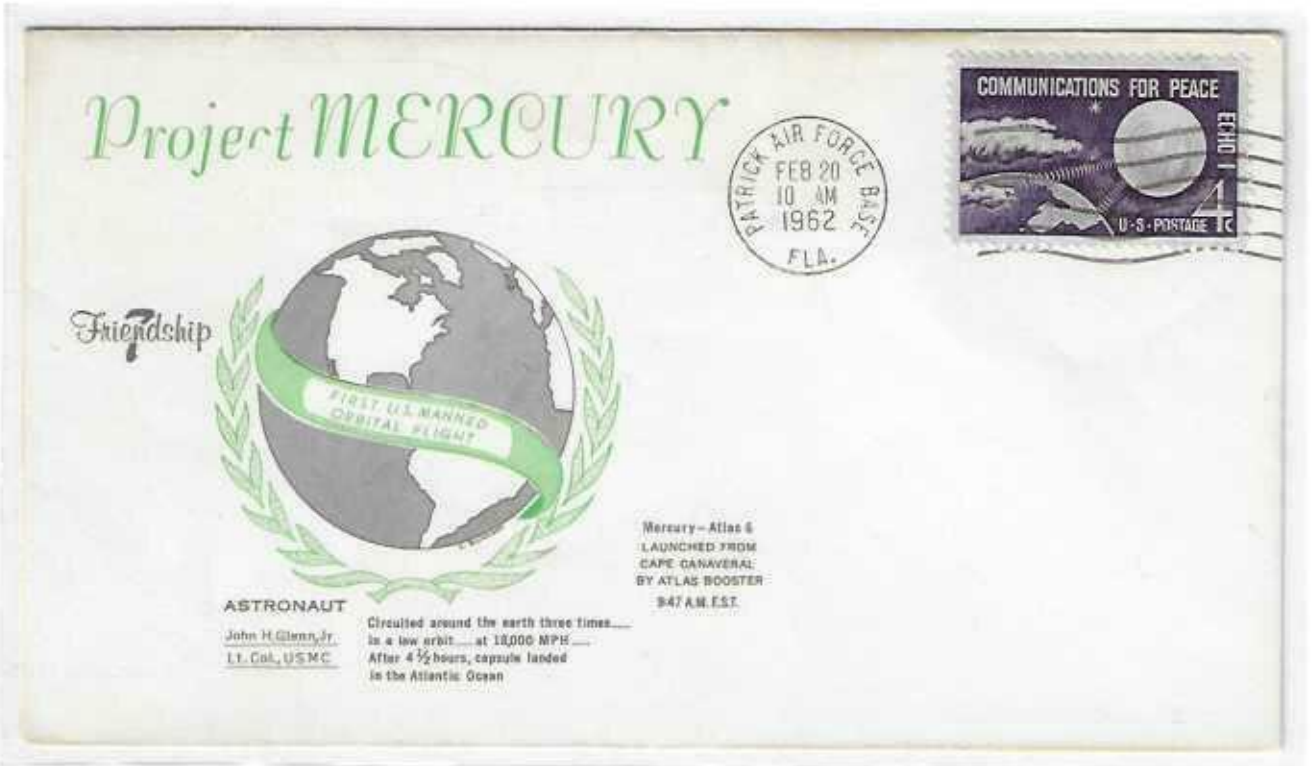



Apollo 13 mission ( AS-508 ). APRIL 11, 1970. KSC machine cancel on the date and time of launch. The mission was aborted after rupture of SM oxygen tank.The objectives of Apollo 13 were : landing accuracy improvement techniques, extravehicular communications system performance, contingency and selected sample collection, television coverage, lunar surface close-up photographic experiment, ALSEP III experiment, lunar field geology experiment, and solar wind composition experiment.

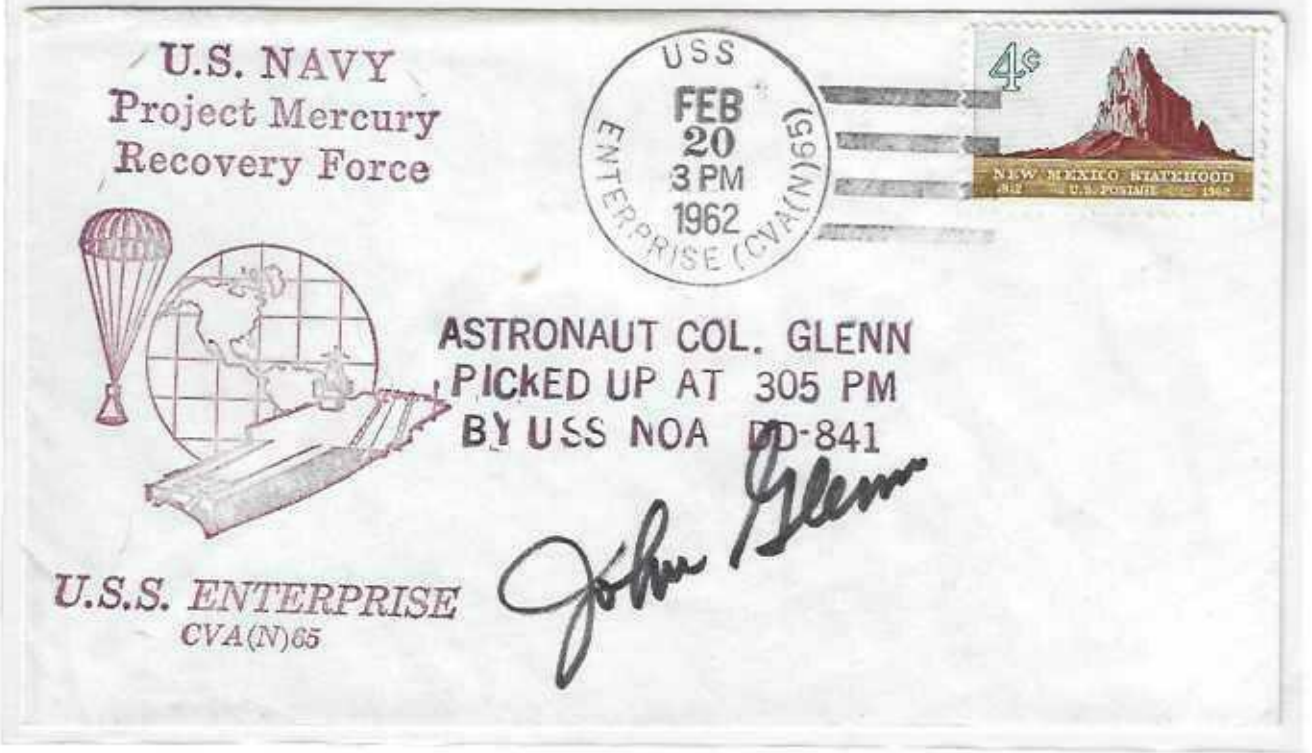



Apollo 13 mission ( AS-508 ). APRIL 17, 1970. Primary recovery ship USS Iwo Jima manual cancel on the date and time of splashdown.

# ENGINEERING, EARTH SCIENCE, HUMAN CREW : THE MERCURY MA-6

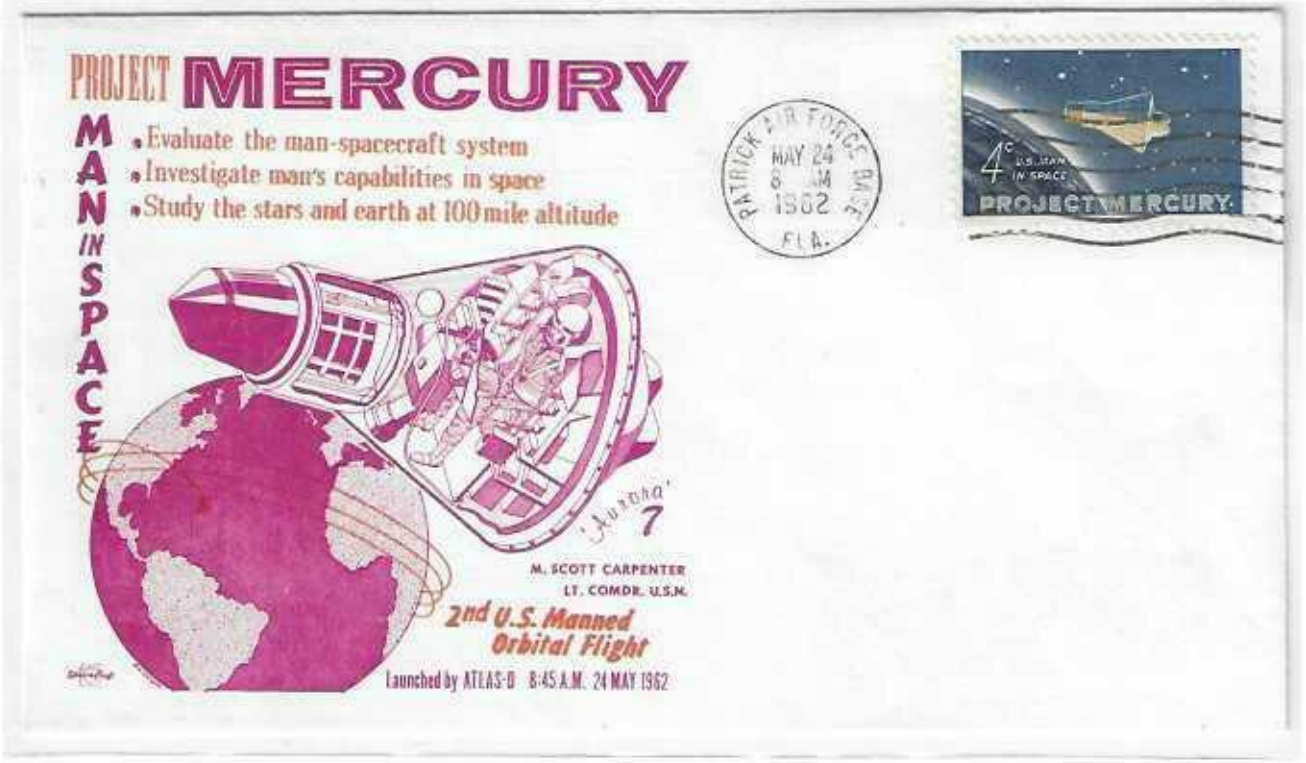



Mercury MA-6 mission ( Friendship 7 ). FEBRUARY 20, 1962. Patrick AFB machine cancel on the date and time of launch. First orbital flight of an American rocket with a human on board. The objectives were to: evaluate the performance of a man-spacecraft system in a three-orbit mission; evaluate the effects of space flight on the astronaut; obtain the astronaut's evaluation of the operational suitability of the spacecraft, and supporting systems for manned space flight.




Mercury MA-6 mission ( Friendship 7 ). FEBRUARY 20, 1962. Secondary recovery ship USS Enterprise manual cancel on the date and time of splashdown. Prior to the flight there had been concerns regarding the physiological effects of prolonged weightlessness and exposure to radiation on the astronauts.

# ENGINEERING, EARTH SCIENCE, HUMAN CREW : THE MERCURY MA-7




Mercury MA-7 mission ( Aurora 7 ). MAY 24, 1962. Patrick AFB machine cancel on the date and time of launch. The objectives of MA-7 were similar to MA-6, also to : obtain the astronaut's opinions on the operational suitability of the spacecraft systems; evaluate the performance of spacecraft systems replaced or modified as a result of previous missions; exercise and evaluate further the performance of the Mercury Worldwide Network.

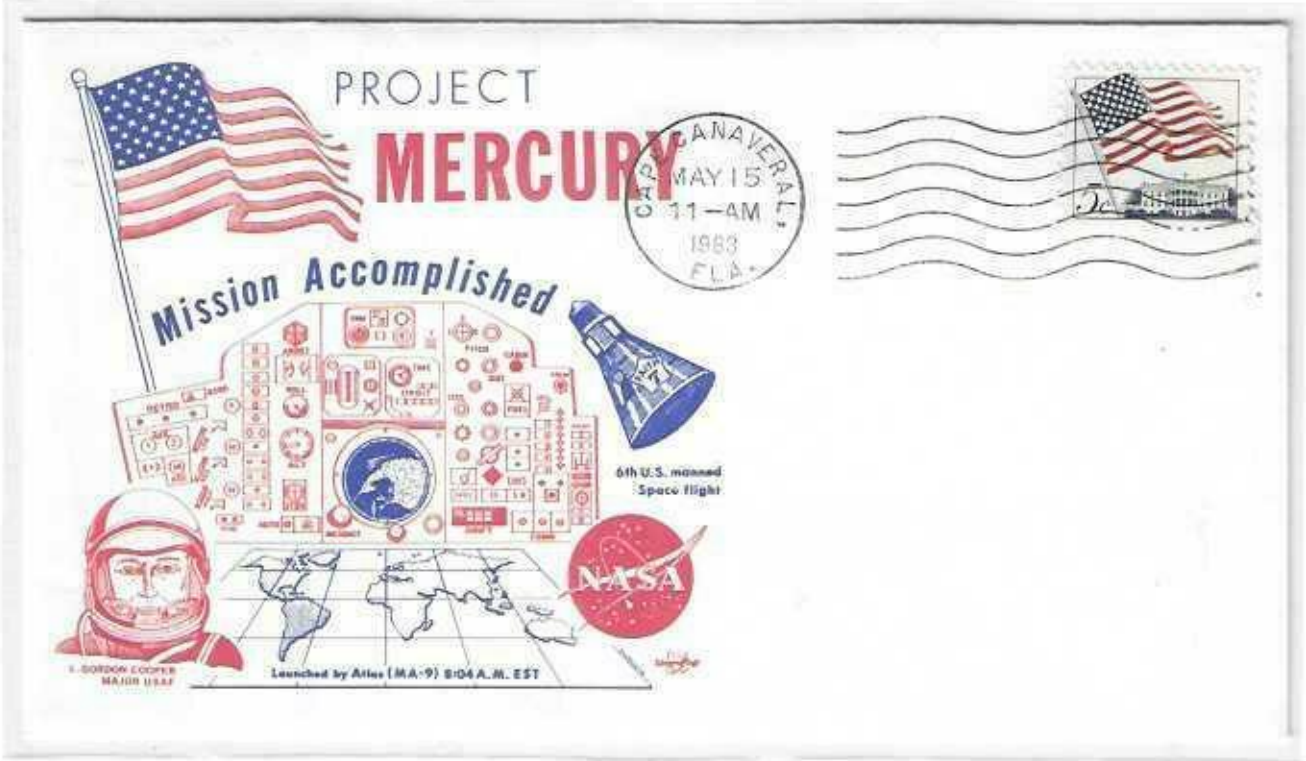

Mercury MA-7 mission ( Aurora 7 ). MAY 24, 1962. Port Canaveral machine cancel on the date and time of launch. Two experiment were on board of MA-7. One was a ballon, deployed and inflated to measure drag and provide visibility data. The other was a device to study the behavior of liquid in a weightless state.

# ENGINEERING, EARTH SCIENCE, HUMAN CREW : THE MERCURY MA-8


Mercury MA-8 mission ( Sigma 7 ). OCTOBER 3, 1962. manual cancel on the date and time of launch. The objectives of MA-8 were similar to MA-7, also to : evaluate the performance of the man-spacecraft system in a six-pass orbital mission, evaluate the performance of spacecraft systems replaced or modified as a result of previous three-pass orbital missions, evaluate the performance of the mission support forces and establish their suitability for extended manned flight.


Mercury MA-8 mission ( Sigma 7 ). OCTOBER 3, 1962. Primary recovery ship USS Kearsarge machine cancel on the date and time of splashdown. Four experiments were conducted as a part of the MA-8 flight : one was a light visibility experiment, the second was a nuclear radiation experiment, a third was an investigation on the ablation of various materials, the final experiment used a 70 mm camera with various filters, for comparison with similar images obtained by other satellite programs.

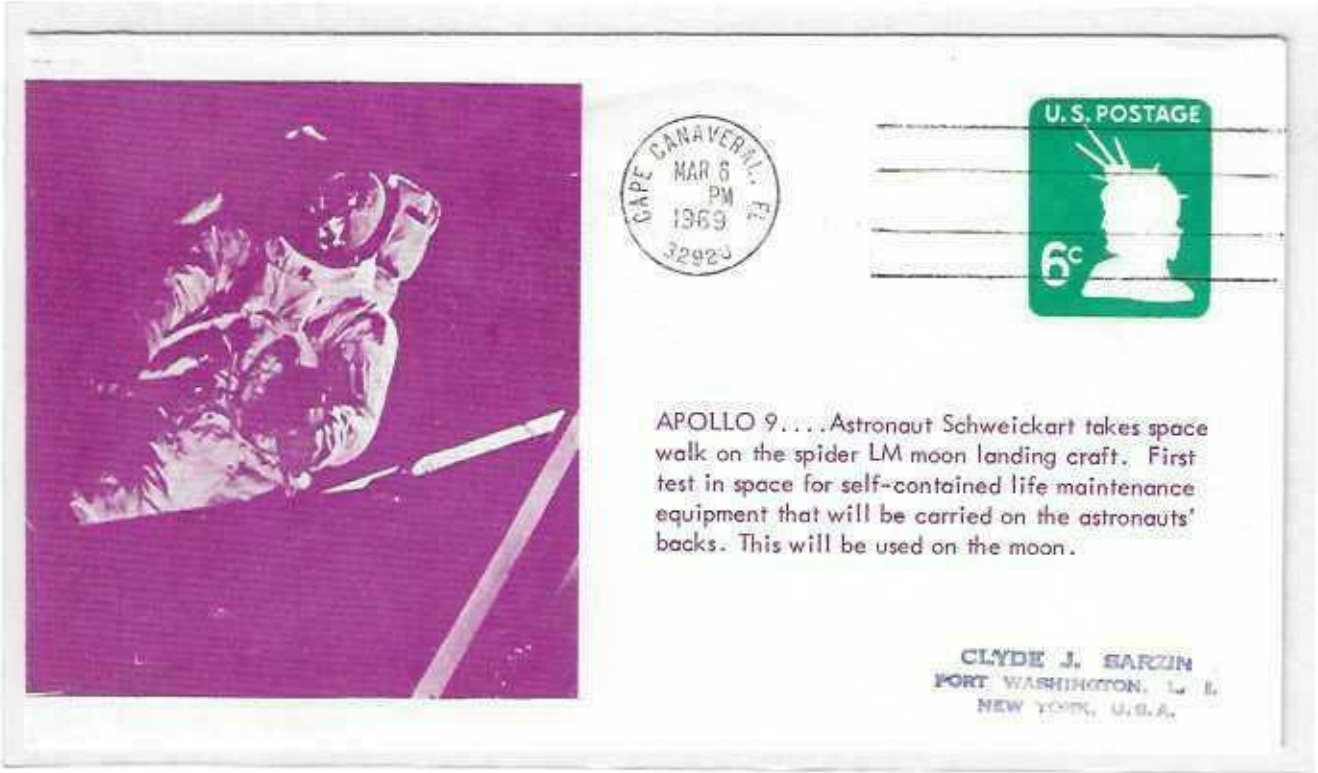
# ENGINEERING, EARTH SCIENCE, HUMAN CREW : THE MERCURY MA-9



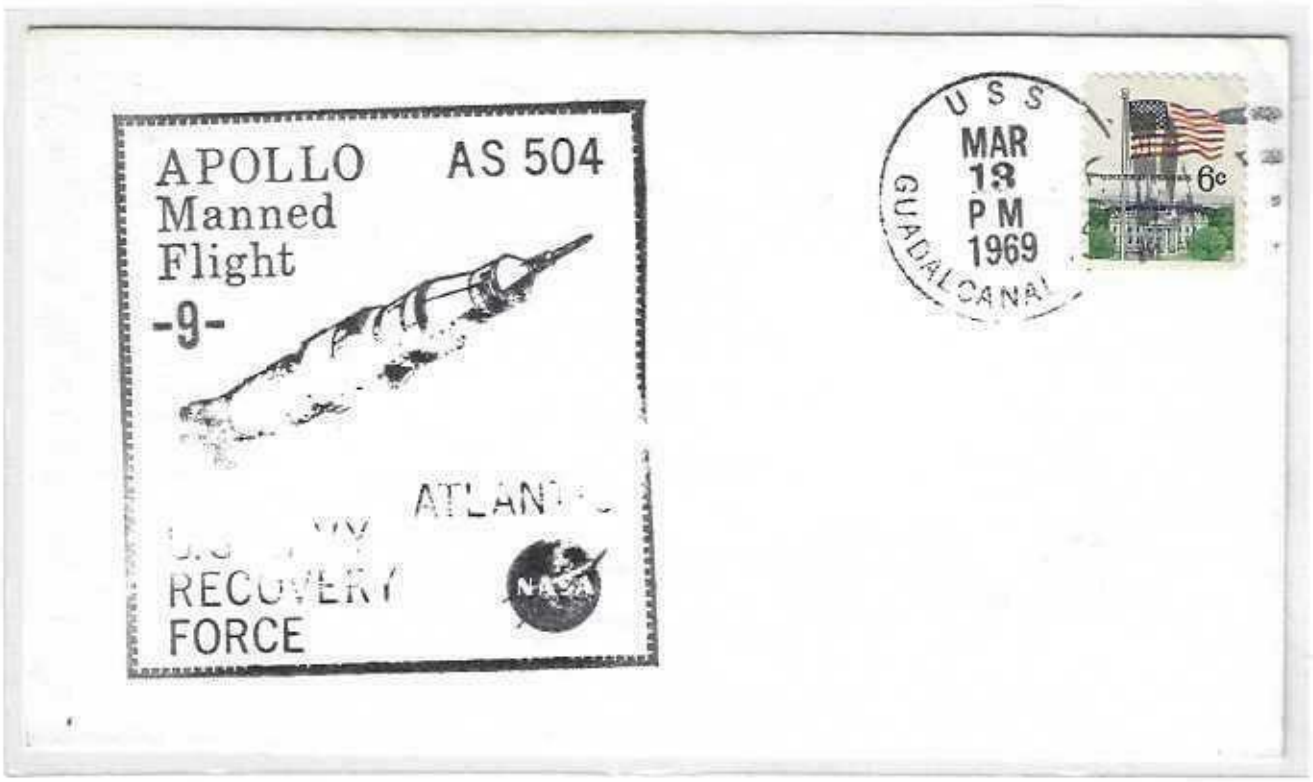

Mercury MA-9 mission ( Faith 7 ). MAY 16, 1963. Cape Canaveral machine cancel on the date and time of launch. The objectives of MA-9 were to : evaluate the effects on the astronauts of one day in orbital flight; verify that man can function for an extended period in space; evaluate the combined performance of the astronaut and a Mercury spacecraft specifically modified for the mission.


Mercury MA-9 mission ( Faith 7 ). MAY 16, 1963. Primary recovery ship USS Kearsarge machine cancel on the date and time of splashdown. A number of in-flight experiments were planned for and carried out during the MA-9 flight. They included two visual acquisition and perception studies, several photographic studies, two radiation package, a tethered balloon experiment, a study of the behavior of fluids in zero gravity, and a micrometeorite study.

# ENGINEERING, EARTH SCIENCE, HUMAN CREW : THE APOLLO 9




Apollo 9 mission ( AS-504 ). MARCH 6, 1969. Cape Canaveral machine cancel on the date and time of the lunar EVA. The primary objective of the mission was to test all aspects of the Lunar Module in Earth orbit, including operation of the LM as an independent self-sufficient spacecraft and performance of docking and rendezvous maneuvers which would be performed in actual lunar missions. Other concurrent objectives included overall checkout of launch vehicle and spacecraft systems, crew, and procedures.




Apollo 9 mission ( AS-504 ). MARCH 13, 1969. Primary recovery ship USS Guadalcanal manual cancel on the date and time of splashdown.

# EARTH SCIENCE, HUMAN CREW, LIFE SCIENCE : THE GEMINI 3


Gemini 3 mission. MARCH 23, 1965. manual cancel on the date and time of launch.
First crewed Earth-orbiting spacecraft of the Gemini series with the primary objective of demonstrating the crewed qualifications of the spacecraft, including evaluation of the two-man Gemini design, the worldwide tracking network, the Orbital Attitude and Maneuver System ( OAMS ), the control of reentry flight path and landing point, spacecraft systems, and spacecraft recovery. Secondary objectives included evaluation of flight crew equipment and effects of low level launch vehicle oscillations ( POGO ) on the crew, performance of three experiments, and to obtain photographic coverage from orbit.

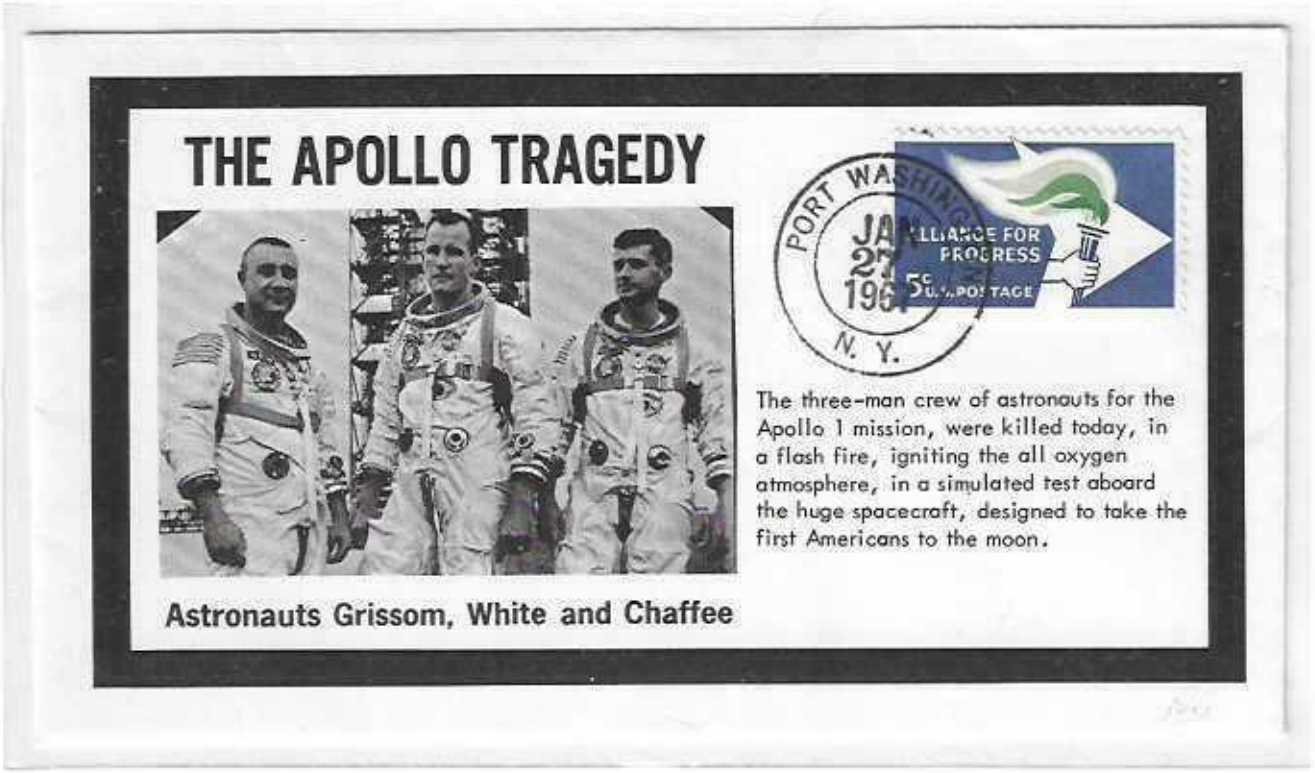

Gemini 3 mission. MARCH 23, 1965. Secondary recovery ship USS Barsfield manual cancel on the date and time of splashdown.

# EARTH SCIENCE, HUMAN CREW, LIFE SCIENCE : THE STS-2 MISSION


STS-2 Columbia mission. NOVEMBER 12, 1981. KSC machine cancel on the date and time of launch. The flight carried the first scientific payload OSTA-1 ( Office of Space and Terrestrial Application 1 ). The instruments from the OSTA-1 payload were designed to perform remote sensing of the Earth's atmosphere, oceans, and land resources. A pallet, supplied by the ESA, made the interface between the payload bay and the five experiments.

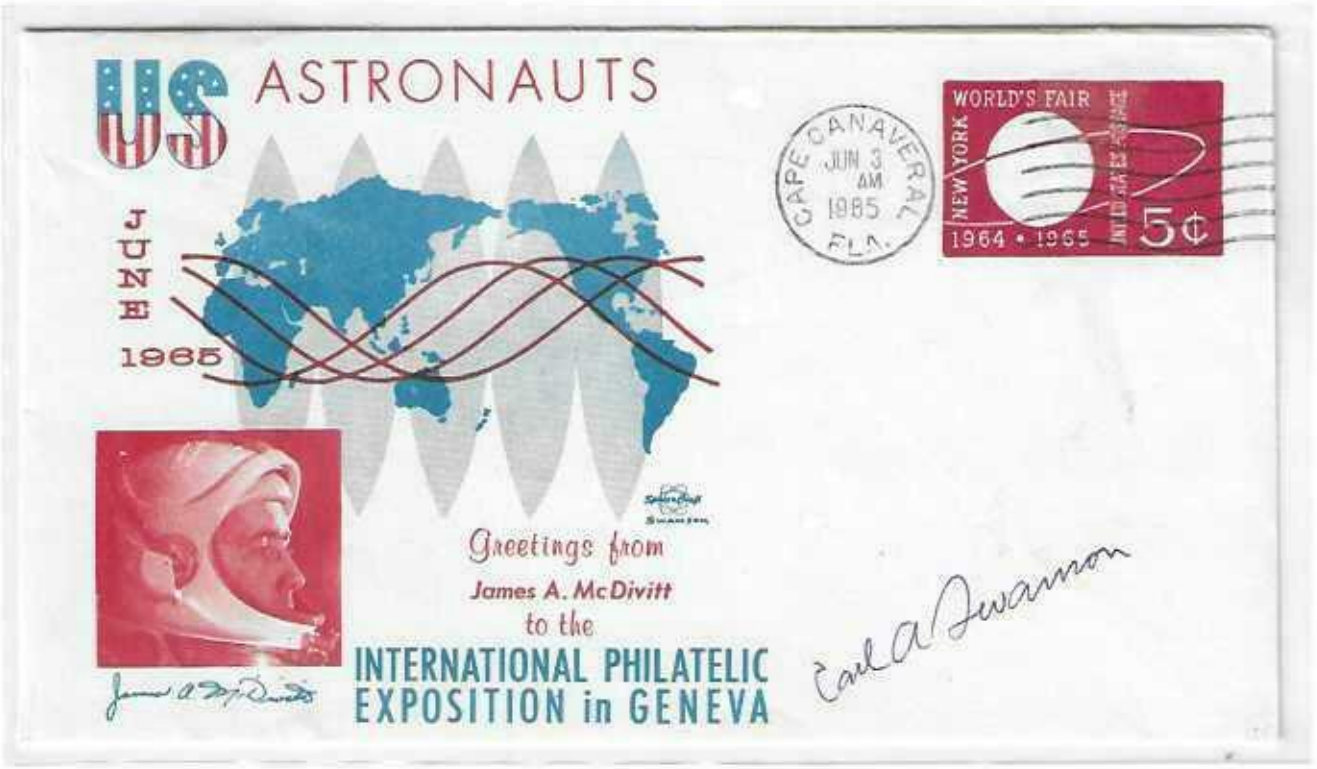

STS-2 Columbia mission. NOVEMBER 14, 1981. Edwards machine cancel on the date and time of landing.

# EARTH SCIENCE, HUMAN CREW, LIFE SCIENCE : THE APOLLO 1




Apollo 1 mission ( AS-204 ). JANUARY 27, 1967. Port Washington manual cancel on the date of tragedy. Project Apollo would be the final leg of the race that would actually reach for the Moon. It was now 1967 and the decade was running out. President Kennedy's goal of reaching the Moon before the end of the decade was in doubt. The contractors working on the Apollo, and the astronauts themselves put in many long hours. It was a work schedule rushing head-on into burnout and it began to take its toll. The first manned Apollo mission was designated Apollo AS-204. This mission was supposed to be the shakedown voyage for the new Apollo Command and Service Modules in Earth orbit.

# HEART SCIENCE, HUMAN CREW, SPACE PHYSICS : THE GEMINI 4




Gemini 4 mission. JUNE 3 , 1965. Cape Canaveral machine cancel on the date and time of launch. The objective of the mission was to test the performance of the astronauts and capsule and to evaluate work procedures, schedules, and flight planning for an extended length of time in space. Secondary objectives included demonstration of EVA in space, conduct stationkeeping and rendezvous maneuvers, evaluate spacecraft systems, demonstrate the capability to make significant in-plane and out-of-plane maneuvers, and use of the maneuvering system as a backup reentry system, and conduct 11 experiments.

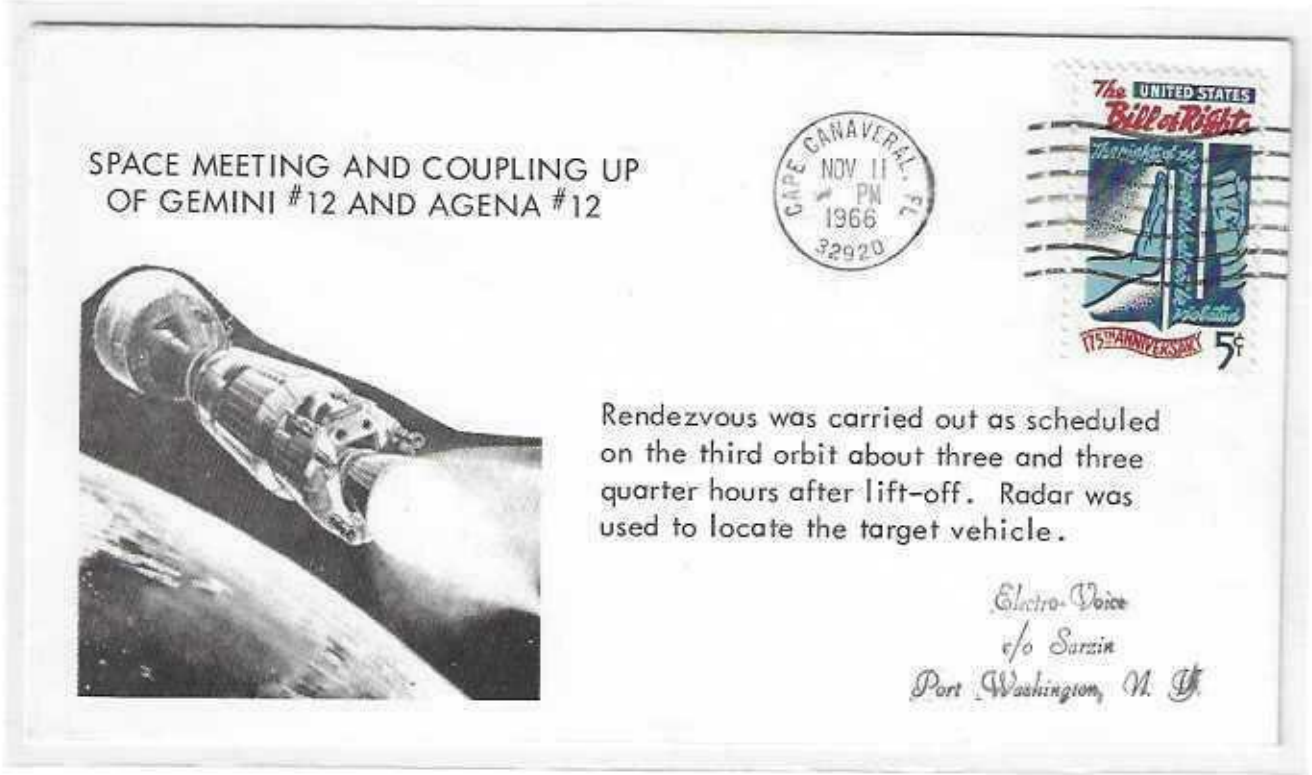

Gemini 4 mission. JUNE 7, 1965. Primary recovery ship USS Wasp machine cancel on the date and time of splashdown.

# EARTH SCIENCE, HUMAN CREW, SPACE PHYSICS : THE GEMINI 7

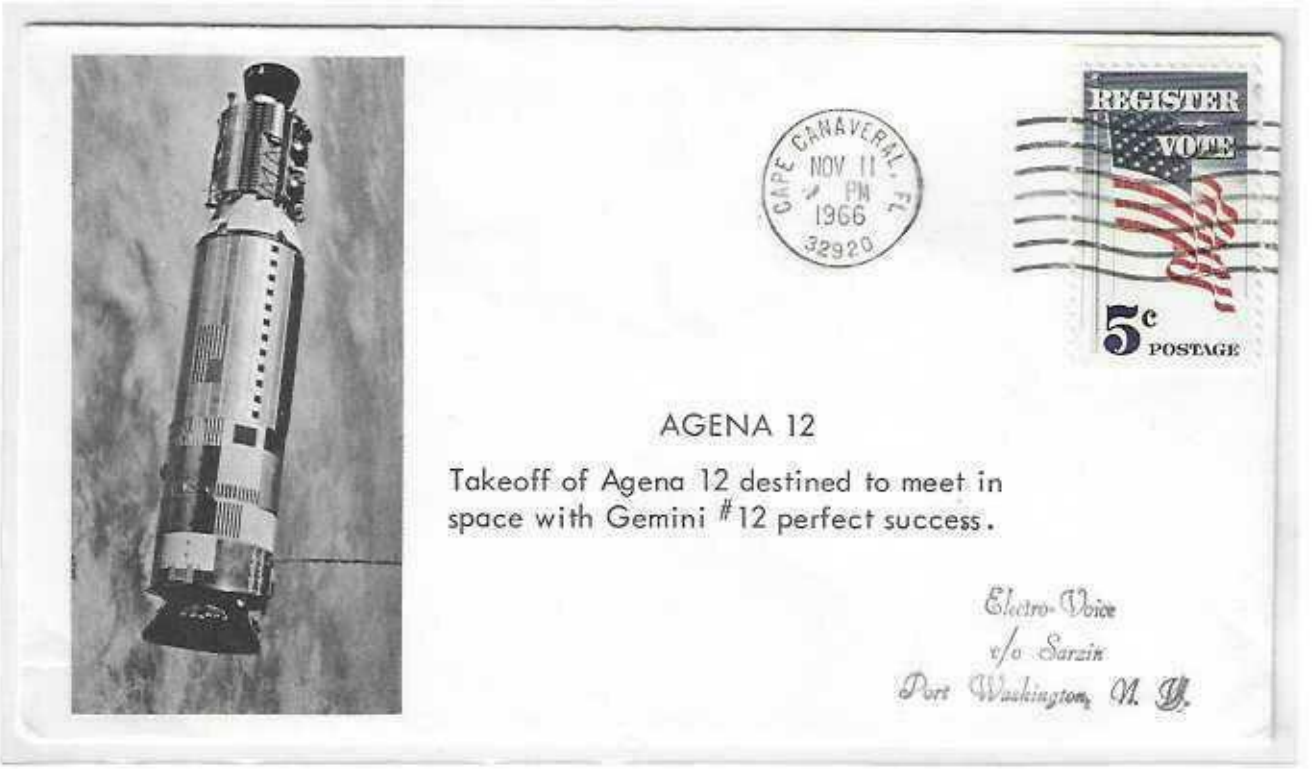

Gemini 7 mission. DECEMBER 4, 1965. Cape Canaveral machine cancel on the date and time of launch. Its mission priorities were to : demonstrate a 2-week flight; perform stationkeeping with the Gemini launch vehicle stage; evaluate the " shirt sleeve" environment and the lightweight pressure suit; act as a rendezvous target for Gemini 6, and demonstrate controlled reentry close to the target landing point. The crew members had three scientific, four technological, four spacecraft, and eight medical experiments to perform.


Gemini 7 mission. DECEMBER 18, 1965. Primary recovery ship USS Wasp machine cancel on the date and time of splashdown.

# HUMAN CREW, LIFE SCIENCE, SPACE PHYSICS : THE GEMINI 12

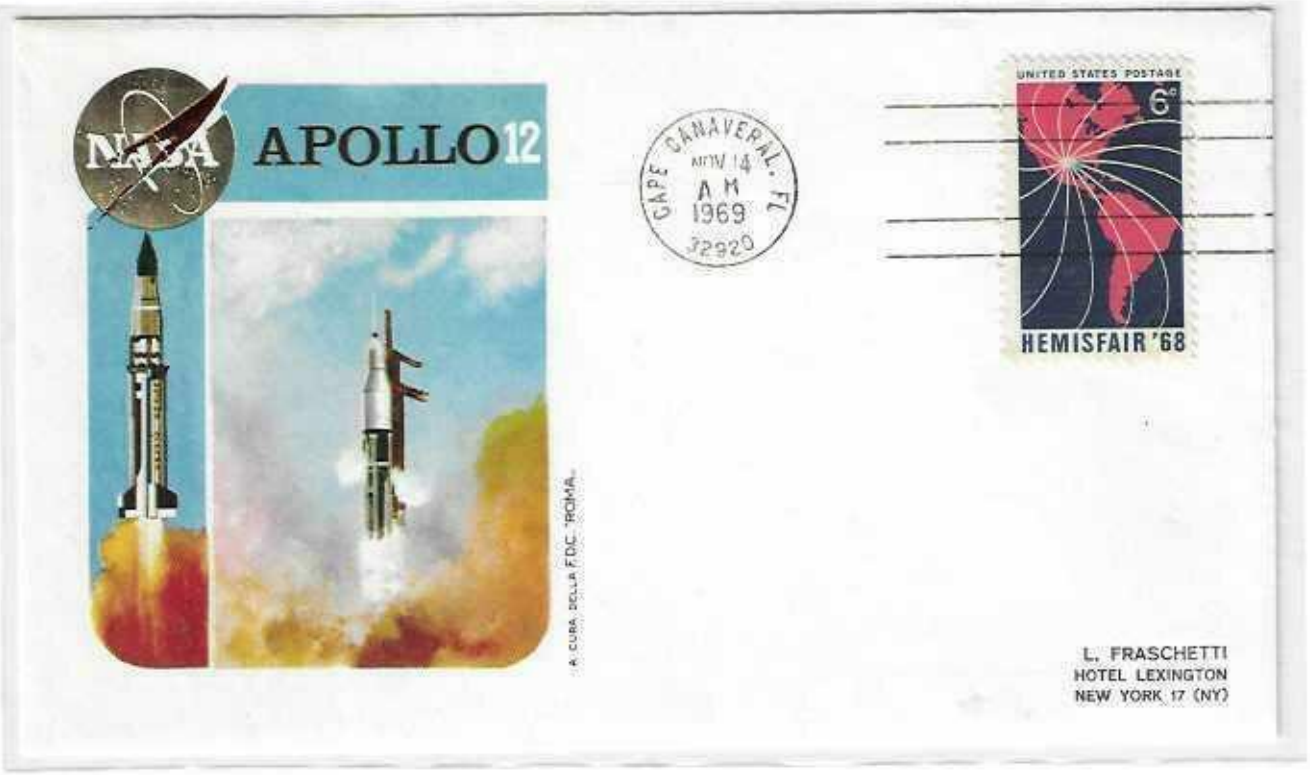



Gemini 12 mission. NOVEMBER 11, 1966. Cape Canaveral manual cancel on the date and time of launch. This mission was scheduled to perform rendezvous and docking with the Agena target vehicle, to conduct three EVA operations, to conduct a tethered stationkeeping exercise, to perform docked maneuvers using the Agena propulsion system to change orbit, and demonstrate an automatic reentry. There were also 14 scientific, medical, and technological experiments on board.




Gemini 12 mission. NOVEMBER 11, 1966. Cape Canaveral machine cancel on the date and time of docking.

# HUMAN CREW, PLANETARY SCIENCE, SPACE PHYSICS : THE APOLLO 12

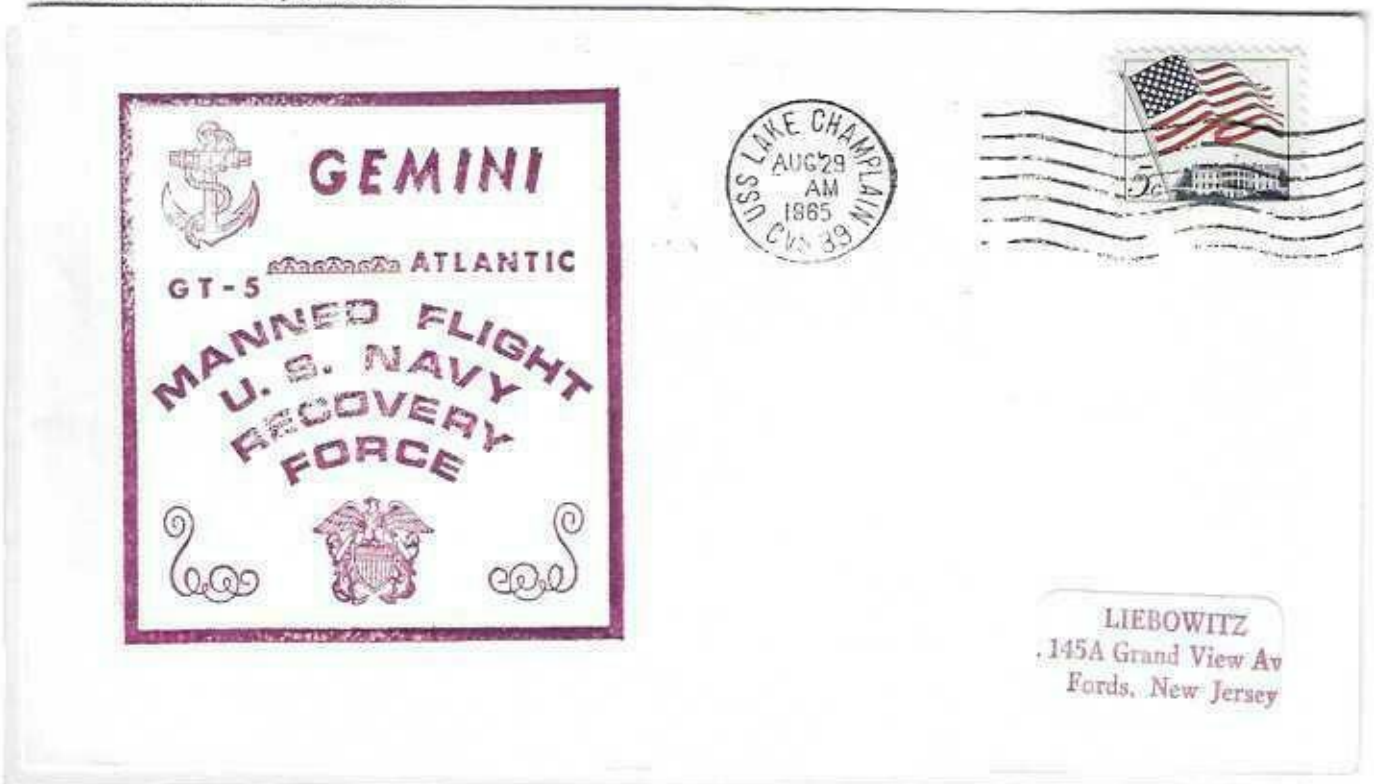



Apollo 12 mission ( AS-507 ). NOVEMBER 14, 1969. Cape Canaveral machine cancel on the date and time of launch. Included on the LM was the ALSEP, containing scientific experiments to be deployed and left on the lunar surface and other scientific and sample collection apparatus. The experiments designed on the Moon were geologic sample collection, surface photography, soil mechanics investigations to study the physical properties of the lunar regolith, the solar wind composition experiment which collected samples of solar wind for return to Earth, and collection of parts of the Surveyor 3 spacecraft.


Apollo 12 mission ( AS-507 ). NOVEMBER 19, 1969. Titusville manual cancel on the date and time of moon landing.

# ASTRONOMY, EARTH SCIENCE, HUMAN CREW, SPACE PHYSICS : THE GEMINI 5 MISSION


Gemini 5 mission. AUGUST 21, 1965. Cape Canaveral machine cancel on the date and time of launch. The flight was designed to last eight days and test rendezvous procedures using a rendezvous evaluation pod. Secondary objectives included demonstration of all phases of guidance and control system to support rendezvous and controlled reentry guidance, to evaluate the fuel cell power system and rendezvous radar, to test the capability of either pilot to maneuver the spacecraft in orbit to close proximity with another object, and to conduct 17 experiments.



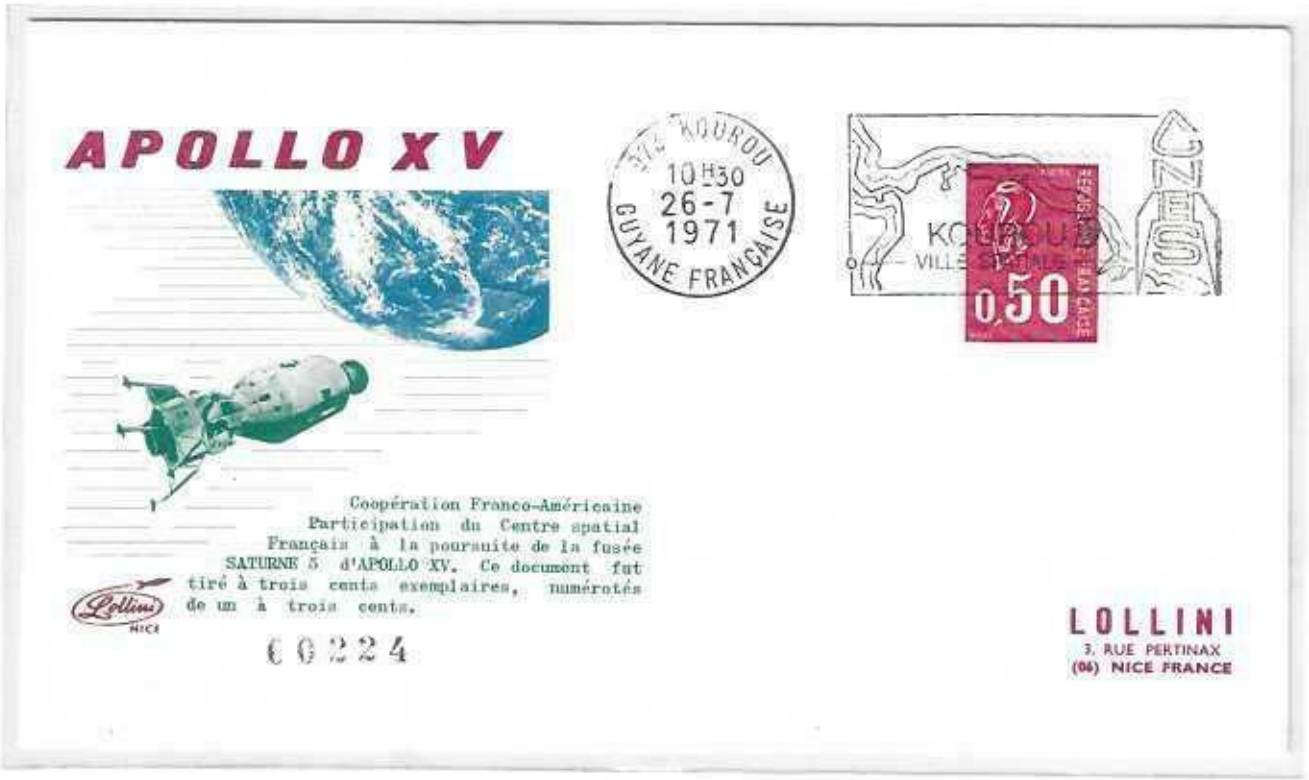

Gemini 5 mission. AUGUST 29, 1965. Primary recovery ship USS Lake Champlain machine cancel on the date and time of splashdown.

# ASTRONOMY, HUMAN CREW, PLANETARY SCIENCE, SPACE PHYSICS : THE APOLLO 14 MISSION


Apollo 14 mission ( AS-509 ). JANUARY 31, 1971. Cape Canaveral machine cancel on the date and time of launch. During their stay on the Moon, the astronauts set up scientific experiments, took photographs, and collected lunar samples. Primary objectives of this mission were to : perform selenological inspection, survey, and sampling of materials in a preselected region of the Fra' Mauro formation; deploy and activate the Apollo lunar surface experiment package; develop man's capability to work in the lunar environment; obtain photographs of candidate exploration sites; study of solar wind composition; execute operational tests for Manned Spacecraft Center and Department of Defense.


Apollo 14 mission ( AS-509 ). FEBRUARY 5, 1971. KSC machine cancel on the date and time of moon landing.

# EARTH SCIENCE, HUMAN CREW, PLANETARY SCIENCE, SPACE PHYSICS : THE APOLLO 15 MISSION




Apollo 15 mission ( AS-510 ). JULY 26, 1971. Kourou machine cancel on the date and time of launch. The experiments programmed on the Moon, in addition to the ALSEP suite, were geologic sample collection, surface photography, soil mechanics investigations to study physical properties of the lunar regolith, and the solar wind composition experiment which collected samples of solar wind particles for return to Earth. The LM also carried a Lunar Roving Vehicle ( LRV )

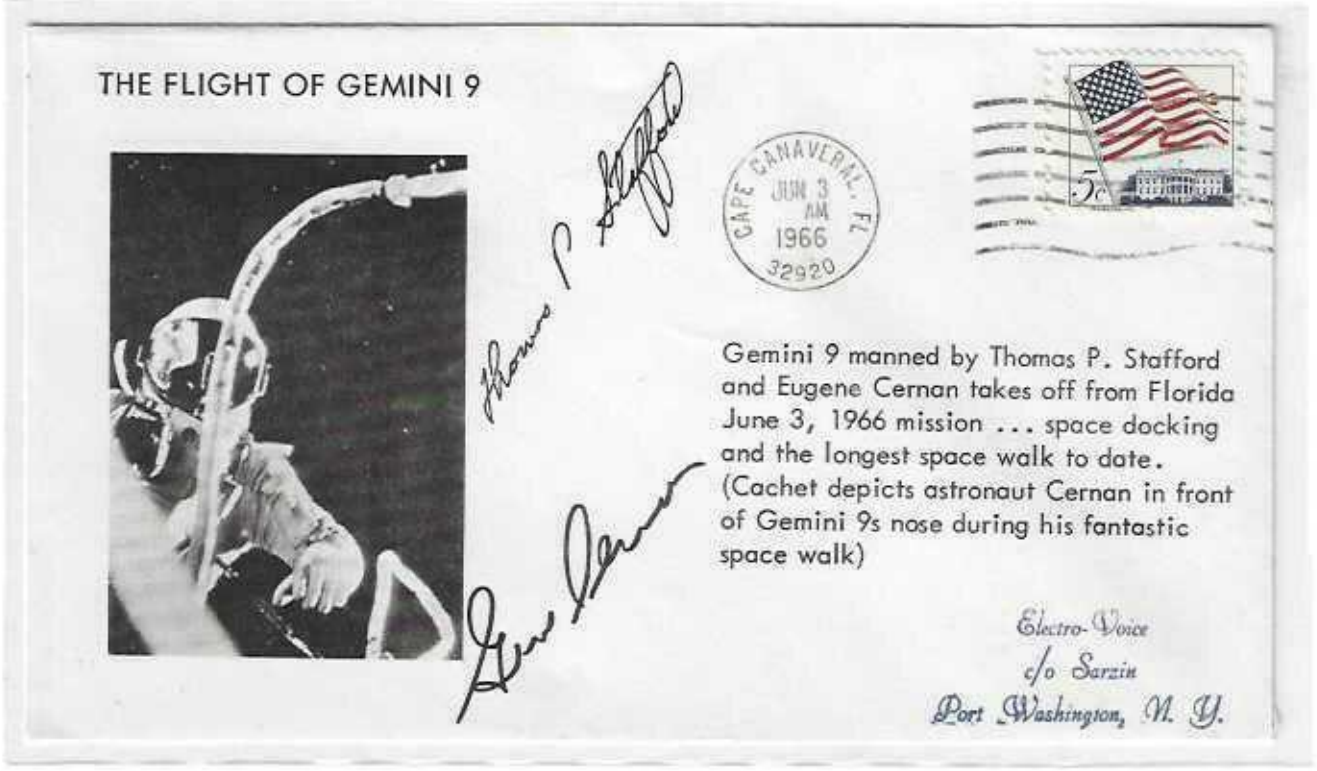

Apollo 15 mission ( AS-510 ). AUGUST 2, 1971. Houston machine cancel on the date and time of the lunar EVA.

# ASTRONOMY, HUMAN CREW, LIFE SCIENCE, PLANETARY SCIENCE : THE APOLLO 17

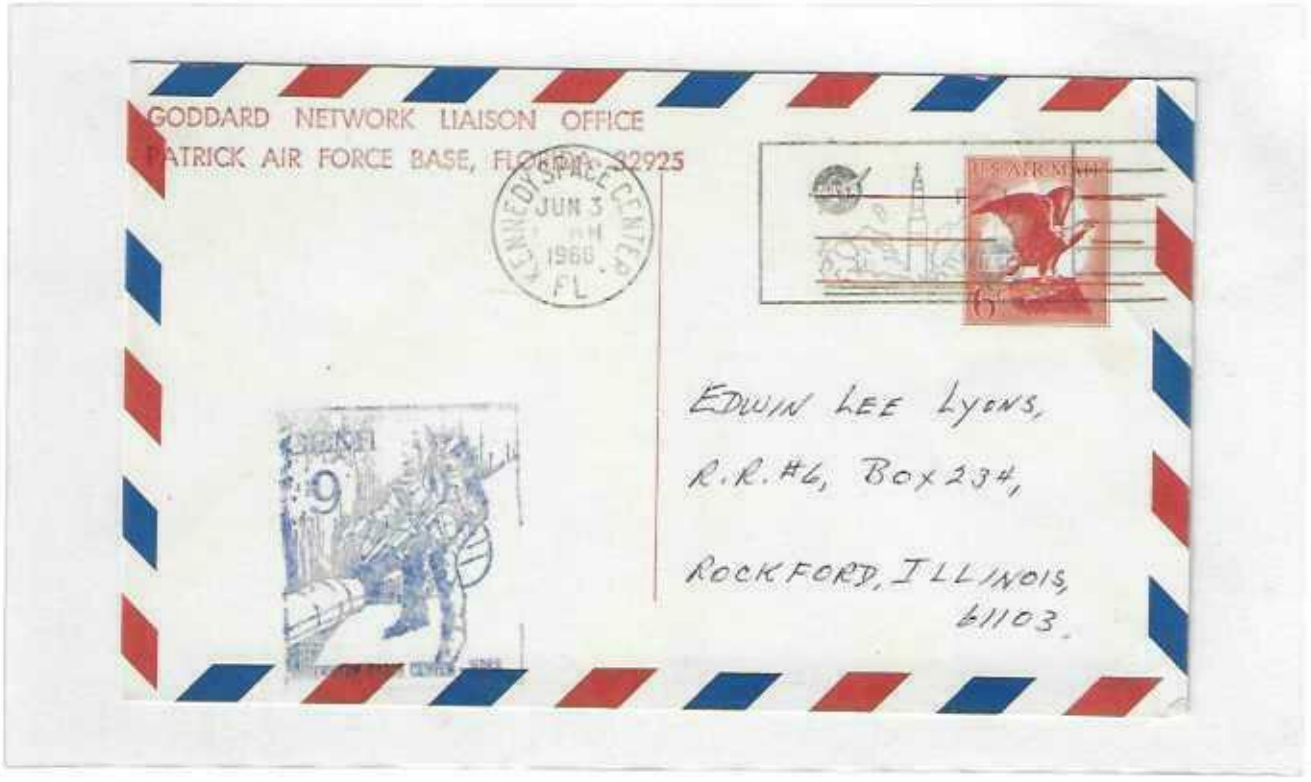

Apollo 17 mission ( AS-512 ). DECEMBER 7, 1972. Cape Canaveral machine cancel on the date and time of launch.This mission was the final in a series of three J-type missions. Apollo 17 was indeed a fitting capstone to the Apollo missions, the most impressively mission, exemplifying the Apollo Program. Spacecraft primary objectives were to : perform selenological inspection, survey,and sampling of materials in the Taurus-Littrow region; emplace and activate surface experiments; conduct inflight experiments and photographic tasks. Detailed objectives were to : record visual observation, from lunar orbit, of particular lunar surface features and processes; obtain data on the visual light flash phenomenon; obtain data on Apollo spacecraft-induced contamination ( Skylab contamination study ); obtain data on whole body metabolic gains or losses; obtain data on the use of the protective pressure garment.


Apollo 17 mission ( AS-512 ). DECEMBER 19, 1972. Primary recovery ship USS Ticonderoga manual cancel on the date and time of splashdown.

# ASTRONOMY, EARTH SCIENCE, HUMAN CREW, PLANETARY SCIENCE, SPACE PHYSICS : THE GEMINI 9A MISSION

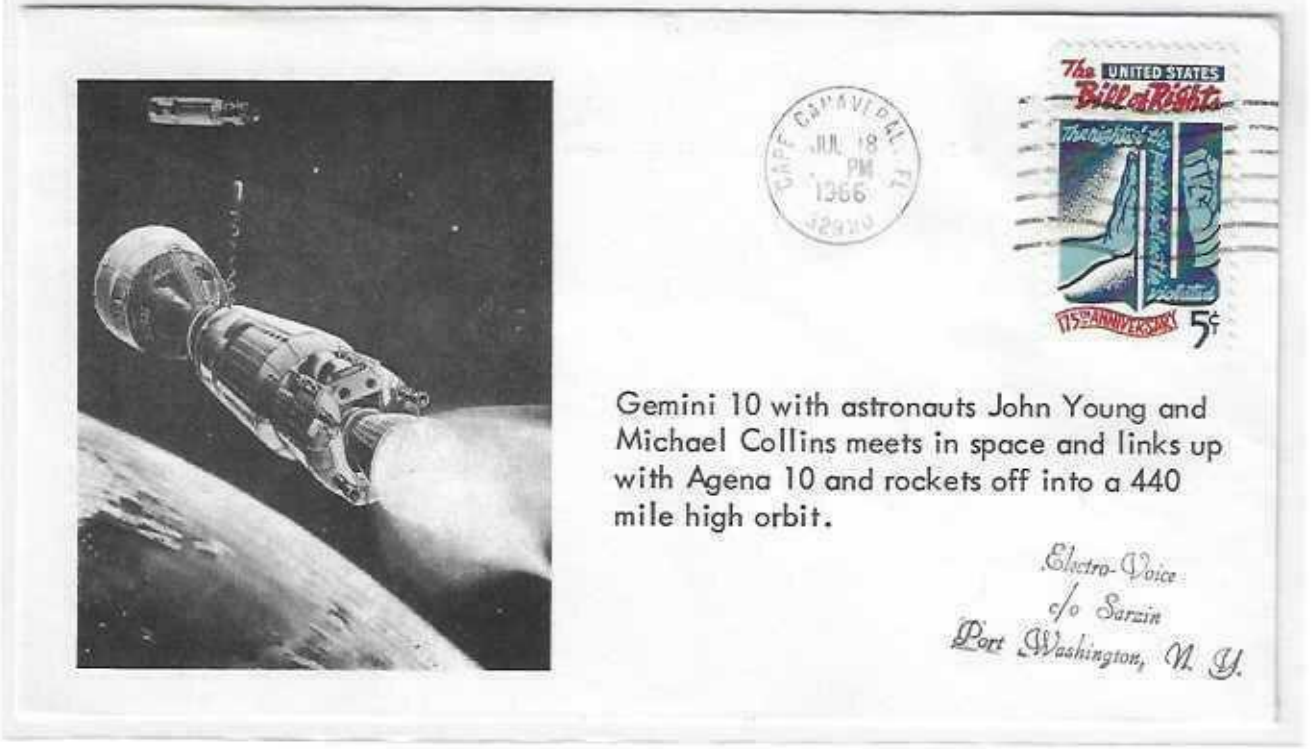



Gemini 9A mission ( Gemini 9 ). JUNE 3, 1966. Cape Canaveral machine cancel on the date and time of launch. Primary mission objectives were to demonstrate : rendezvous techniques and docking with a target vehicle to simulate maneuvers to be carried out on future Apollo missions; an EVA spacewalk to test the Astronaut Maneuvering Unit ( AMU ); precision landing capability. Scientific objectives included obtain zodiacal light and airglow horizon photographs. Two micrometeorite studies were to be carried out, and there were also one medical and two technologicalexperiments.




Gemini 9A mission ( Gemini 9 ). JUNE 3, 1966. KSC machine cancel on the date and time of first rendezvous.

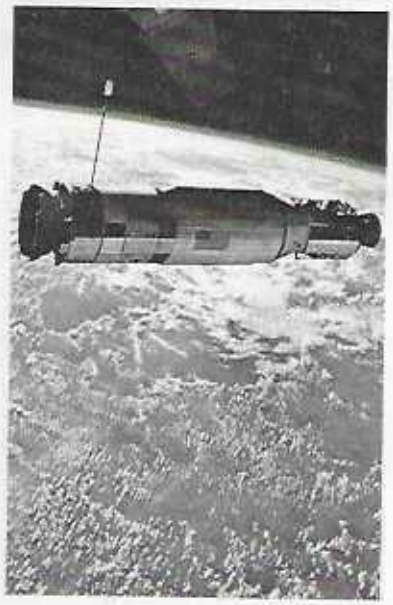
# ASTRONOMY, EARTH SCIENCE, HUMAN CREW, PLANETARY SCIENCE, SPACE PHYSICS : THE GEMINI 10 MISSION




Gemini 10 mission. JULY 18, 1966. Cape Canaveral machine cancel on the date and time of docking. The mission plan included a rendezvous with the Gemini 8 Agena target, two EVA excursions, and the performance of 15 scientific, technological, and medical experiments. The scientific experiments were related to : zodiacal light, synoptic terrain, and synoptic weather photography, micrometeorite collection, UV astronomical camera, ion wake measurements, and meteoroid erosion.


Gemini 10 mission. JULY 21, 1966. Primary recovery ship USS Guadalcanal manual cancel on the date and time of splashdown.

# ASTRONOMY, EARTH SCIENCE, HUMAN CREW, LIFE SCIENCE, SPACE PHYSICS : THE GEMINI 11 MISSION



CAPE CANAVERAL, FL. SEP 12 AM 1966 32920


SUCCESSFUL LAUNCHING OF AGENA #11

Purpose to link-up in space on its first orbit with Conrad and Gordon's Gemini #11.

Electro-Data
c/o Sarzin
Port Washington, N. Y.

Gemini 11 mission. SEPTEMBER 12, 1966. Cape Canaveral machine cancel on the date and time of GATV 11 launch. The 3-days mission was designed to achieve a first orbit rendezvous and docking with the Agena target vehicle, to accomplish two EVAs tests, to perform docking practice, docked configuration maneuvers, tethered operations, parking of the Agena target vehicle, and demonstrate an automatic reentry. There were also eight scientific and four technological experiments on board.



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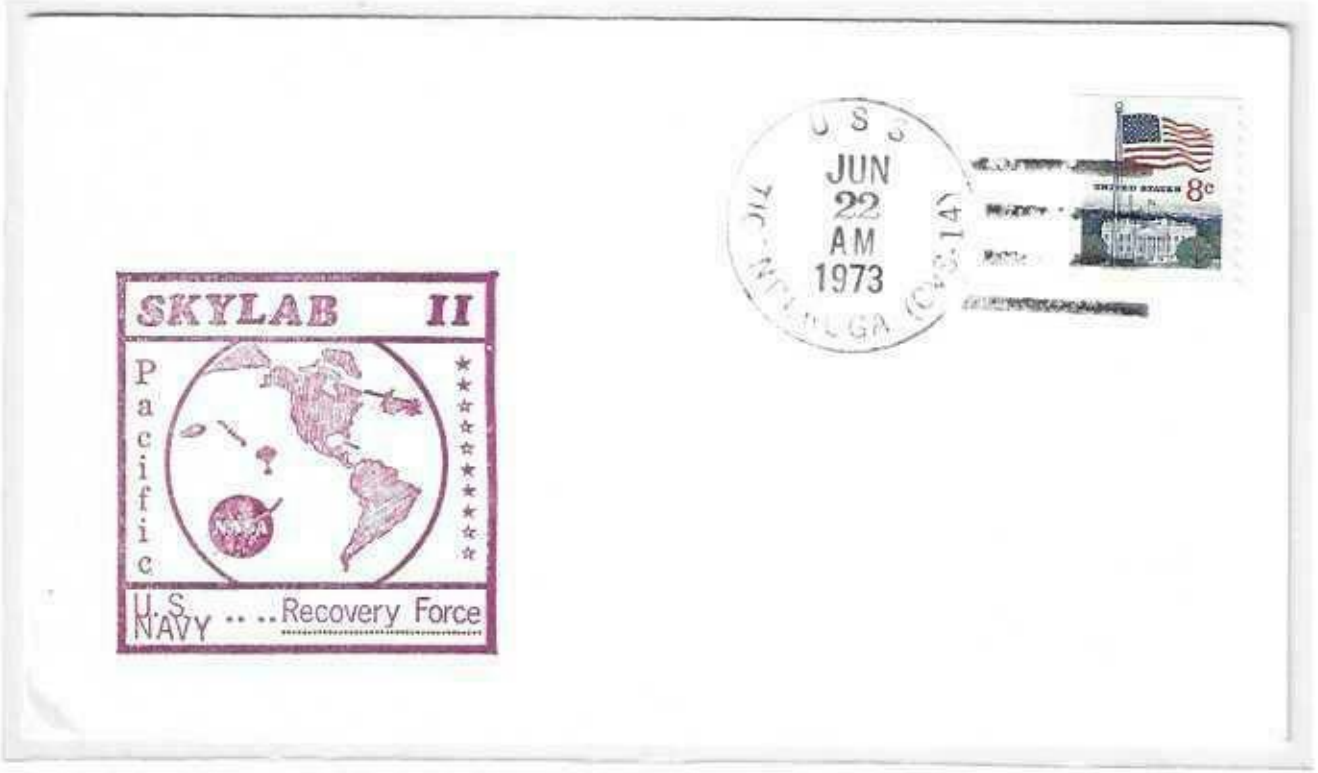
Uerdingerstrasse 23/II
Germany West Europe

printed matter

Gemini 11 mission. SEPTEMBER 15, 1966. Primary recovery ship USS Guam manual cancel on the date and time of splashdown.

# ENGINEERING, HUMAN CREW, LIFE SCIENCE, MICROGRAVITY, SPACE PHYSICS : THE SKYLAB I MISSION


Skylab I mission ( Skylab 2 ). MAY 25, 1973. KSC machine cancel on the date and time of launch. First manned mission. The primary objectives of this mission were to : deploy of a parasol sunshade that cooled the inside temperatures; released solar array wing on EVA; double previous length of time in space; conduct solar astronomy and Earth resources experiments, medical studies and five student experiments.




Skylab I mission ( Skylab 2 ). JUNE 22, 1973. Primary recovery ship USS Ticonderoga on the date and time of splashdown.

# ASTRONOMY, EARTH SCIENCE, HUMAN CREW, LIFE SCIENCE, PLANETARY SCIENCE, SPACE PHYSICS : THE GEMINI 8


Gemini 8 mission. MARCH 16, 1966. Cape Canaveral machine cancel on the date and time of launch. The primary mission objectives were to perform rendezvous and four docking tests with the Agena target vehicle and to execute an EVA experiment. Other objectives included parking the Agena in a 410 km circular orbit, performing a rendezvous with Agena, conduct systems evaluation, evaluating the auxiliary tape memory unit, and demonstration of controlled reentry. Ten technological, medical, and scientific experiments were carried on board.


Gemini 8 mission. MARCH 17, 1966. Designated primary recovery ship USS Boxer machine cancel on the date and time of splashdown.

# ASTRONOMY, ENGINEERING, HUMAN CREW, LIFE SCIENCE, PLANETARY SCIENCE, MICROGRAVITY, SOLAR PHYSICS : APOLLO 16


Colorano "Silk" Cachet


**APOLLO 16 – MOONLANDING – APRIL 20, 1972** – Problems began shortly after 3 p.m. when command module pilot Ken Mattingly was supposed to fire the main spacecraft engine to lift the command module "Casper" in an orbit higher than the lunar lander "Orion" – only one of the two systems was working. Trouble shooting the problem at Mission control, engineers found that the two main systems were working well. The problem was down the line in one of two electronic feedback loops. This eased worries considerably and Apollo 16 was given the "go" and landed on the moon at 9:23 p.m. – six hours later than scheduled.

Apollo 16 mission ( AS-511 ). APRIL 20, 1972. Houston manual cancel on the date and time of moon landing. Three primary objectives were to : inspect, survey, and sample materials and surface features at a selected landing site in the Descartes region; emplace and activate surface experiments; conduct in-flight experiments and photographic tasks from lunar orbit. Additional objectives included performance of experiments requiring zero gravity and engineering evaluation of spacecraft and equipment, LRV, crew participation to 19 experiments. Orbital science experiments were concentrated in an array of instruments and cameras in the scientific instrument module, or SIM, bay.


Apollo 16 mission ( AS-511 ). APRIL 27, 1972. Primary recovery ship USS Ticonderoga manual cancel on the date and time of splashdown.

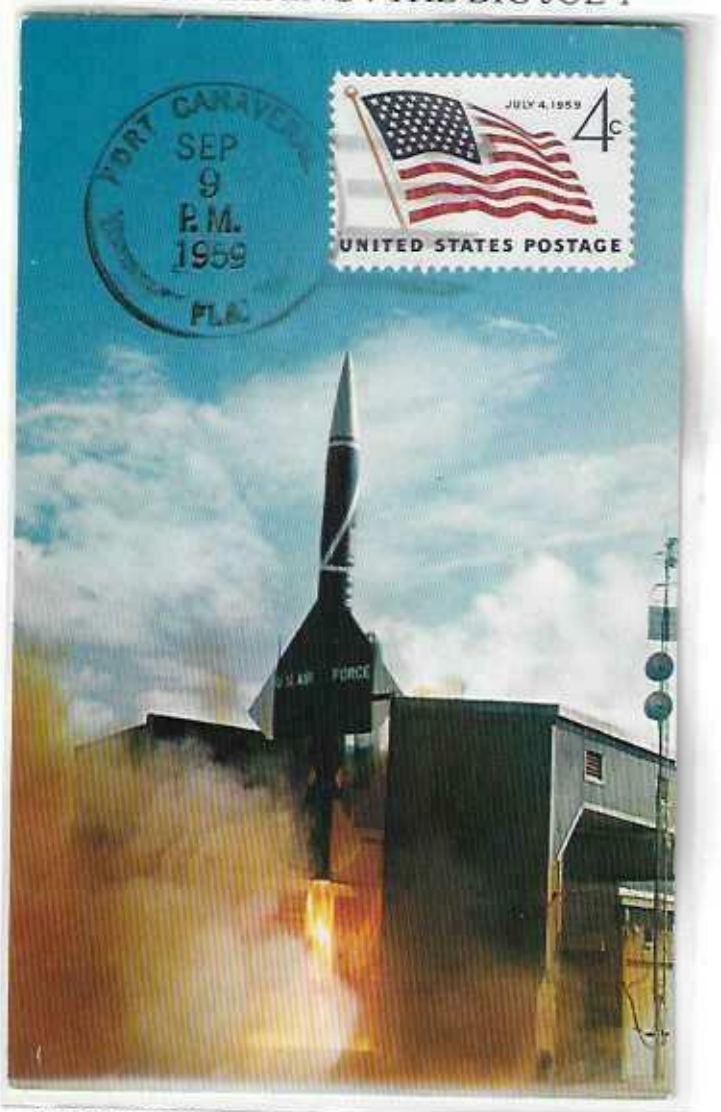
ASTRONOMY, ENGINEERING, EARTH SCIENCE, HUMAN CREW, LIFE SCIENCE, PLANETARY SCIENCE, SOLAR PHYSICS, SPACE PHYSICS : THE SKYLAB 1, THE U.S. SPACE LABORATORY


Skylab 1 mission. MAY 14, 1973. Cape Canaveral manual cancel on the date and time of launch. When the Saturn rocket was developed in the mid-60s, enabling some heavy lifting into space, the Skylab Program began to take shape. Following cancellation of Apollo 18, 19, and 20, we had a lot of hardware lying around gathering dust, so we put it to some remarkably good use. Skylab weighed about 100 tons. It had a volume of 283.17 cubic meters and was separated into two " floors ". The upper floor contained storage lockers and a large empty space for conducting experiments, and two airlocks. The largest piece of scientific equipment was the " Apollo Telescope Mount ", or ATM, used to make spectrographic analyses of the Sun.


Skylab 1 mission. MAY 14, 1973. KSC machine cancel on the date and time of launch.

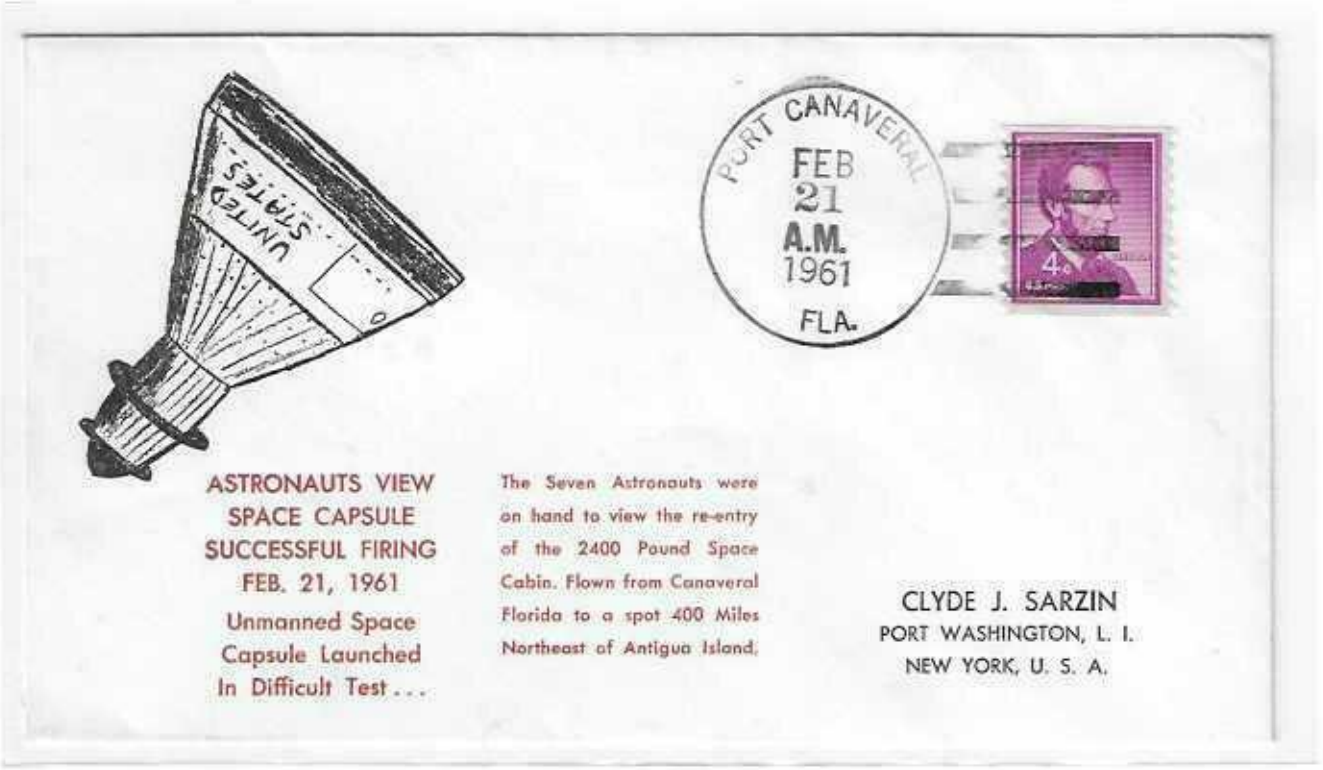
# 2. ROCKETS AND BOILERPLATES

## ENGINEERING : THE BIG JOE 1




Big Joe 1 ( BJ-1 ) mission. SEPTEMBER 9, 1959. Port Canaveral manual cancel on the date and time of launch. It launched an unmanned boilerplate Mercury capsule. It was also the first launch of a spacecraft in Project Mercury. The Mercury capsule flew a 2,408 km ballistic flight to the altitude of 153 km. The boilerplate Mercury, having landed some 500 miles short of target point, was found to have survived the mission in good conditions, and verified the ablative heat shield.

# ENGINEERING : THE MA-2 AND THE LJ-5B




Mercury-Atlas 2 ( MA-2 ) mission. FEBRUARY 21, 1961. Port Canaveral manual cancel on the date and time of launch. Test objectives for this flight were concerned with the ability of the spacecraft to withstand reentry under the temperature critical abort conditions and with the capability of the Atlas to meet the proper injection conditions. MA-2 flew a successful suborbital mission that lasted 17 min., 56 sec. Altitude reached was 183 km, maximum speed 21,287 km/h.

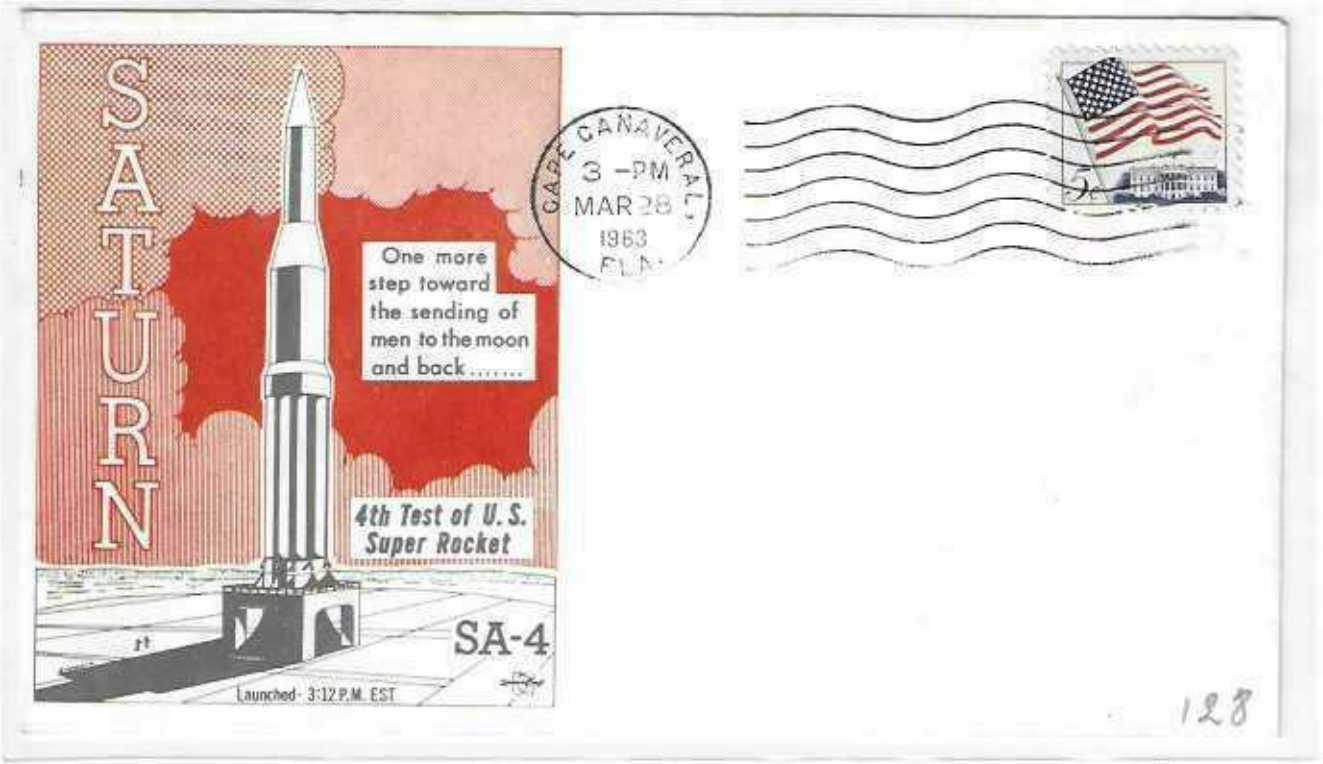

Little Joe 5-B ( LJ-5B ) mission. APRIL 28, 1961. Wallops Island machine cancel on the date and time of launch. It was an unmanned Launch Escape System of the Mercury spacecraft. The Little Joe 5B flew to an altitude of 5 km, and a range of 14 km. The mission lasted 5 min., 25 sec. Maximum speed was 2,865 km/h, and acceleration was 10g. The mission was a success and Mercury spacecraft ( #14A ) was recovered.

# ENGINEERING : THE APOLLO SA-2 AND SA-3


Apollo SA-2 mission. APRIL 25, 1962. Patrick AFB machine cancel on the date and time of launch. The first payload was called Project Highwater. The inert S-IV and S-V stages for these launches carried 109,000 liters of ballast water for release in upper atmosphere. This was used to study the effects on radio transmission and changes in local weather conditions.


Apollo SA-3 mission. NOVEMBER 16, 1962. Cape Canaveral manual cancel on the date and time of launch. This was the first flight with a fully fueled first stage. The flight verification test were all met. The Saturn 1st stage carried upper stages filled with 87,000 liters of water on a sub-orbital flight to a peak altitude of 167 km. At this point, it was detonated by radio command, releasing the water into the ionosphere. This cloud experiment, Project Highwater II, was hoped to provide data on atmospheric physics but poor telemetry made the results questionable.

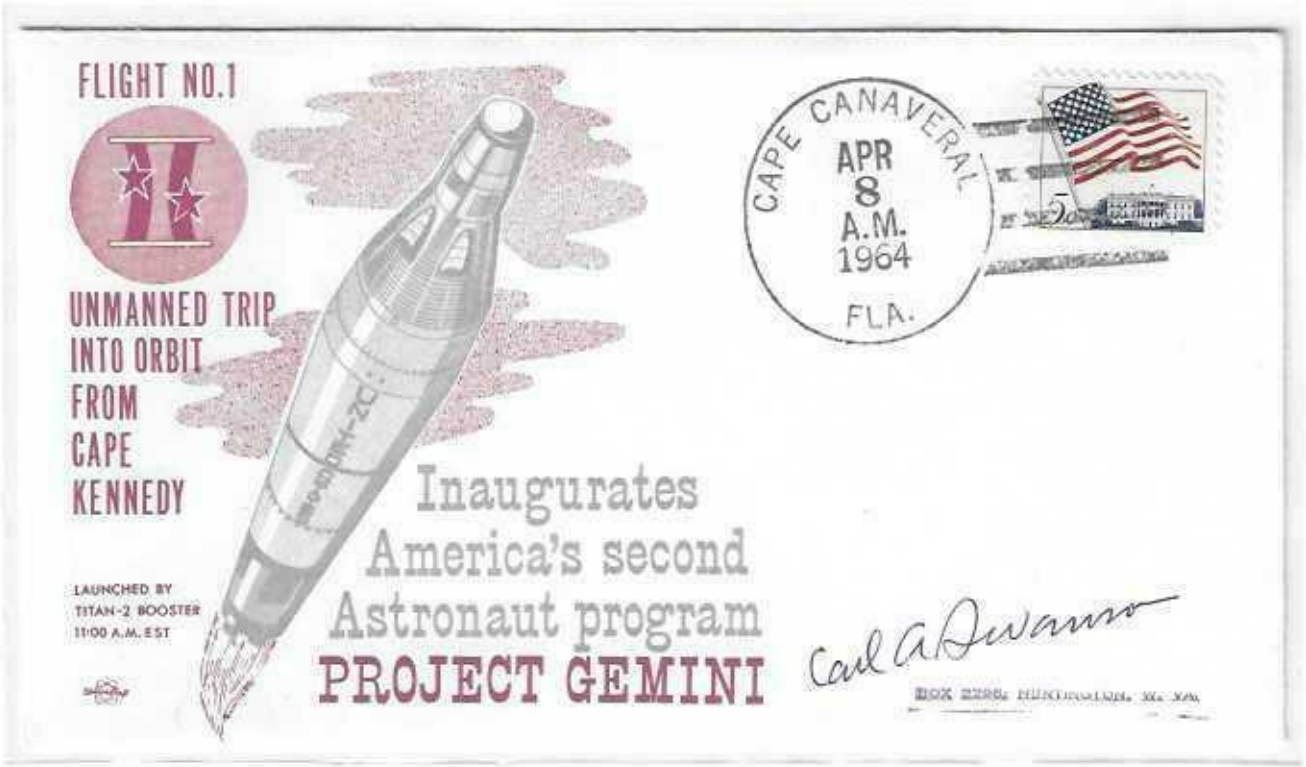
# ENGINEERING : THE APOLLO SA-4 AND SA-5



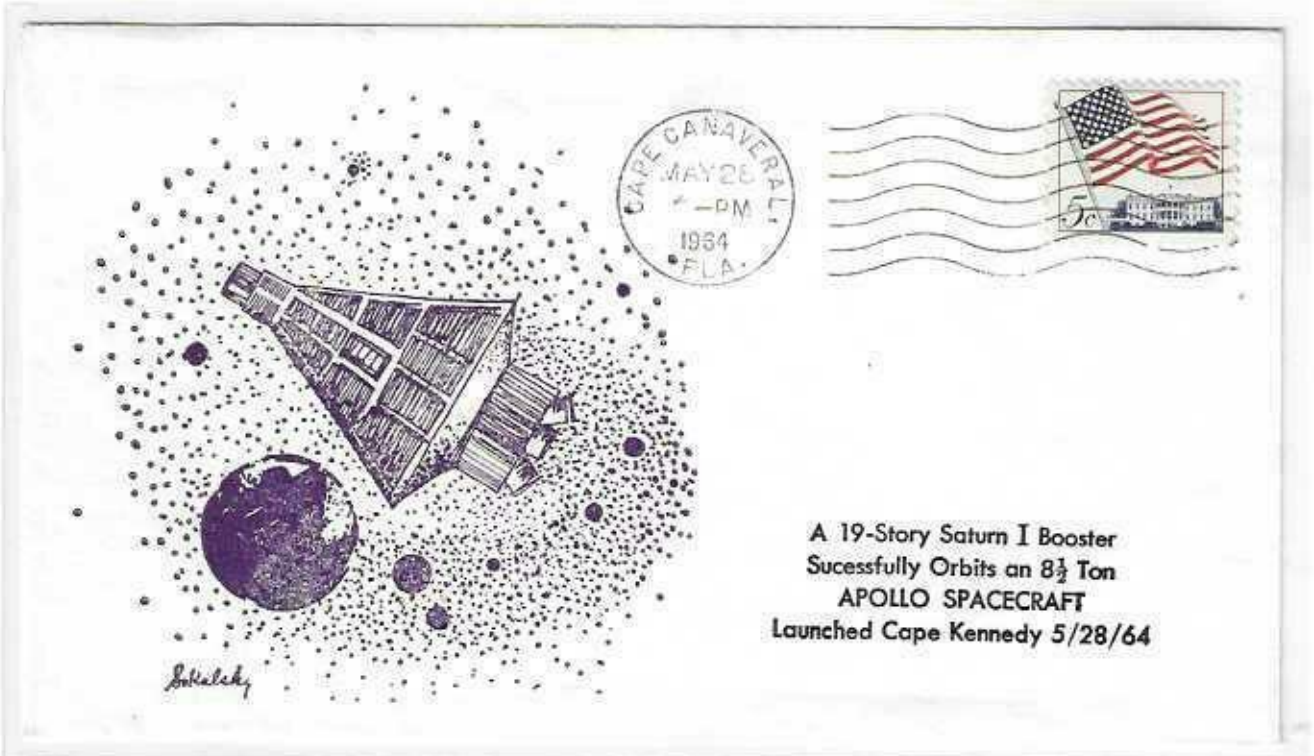

Apollo SA-4 mission. MARCH 28, 1963. Cape Canaveral machine cancel on the date and time of launch. This was the final of a series of four tests of the Saturn 1st stage and completed the Block 1 Saturn tests. The rocket was launched on a sub-orbital flight to an altitude of 129 km. After 100 sec. of flight, a pre-set timer cut off engine #5 as planned to test " engine-out " capability of the booster. The rocket then continued to operate properly, the propellant system rerouting the fuel to the other seven engines, and the flight continued.


Apollo SA-5 mission. JANUARY 29, 1964. Cape Canaveral machine cancel on the date and time of launch. It was the first flight of the Block II Saturn. This Saturn I was used for a launch vehicle development test. It was also the first live flight of the LOX / LH2 ( liquid oxygen / liquid hydrogen ) fueled second stage S-IV. For the first time in Apollo Program, this flight would be an orbital mission. The whole Stage Separation System worked perfectly with the retrorockets firing on the first stage to decelerate it.

# ENGINEERING : THE GEMINI GT-1 AND THE APOLLO SA-6

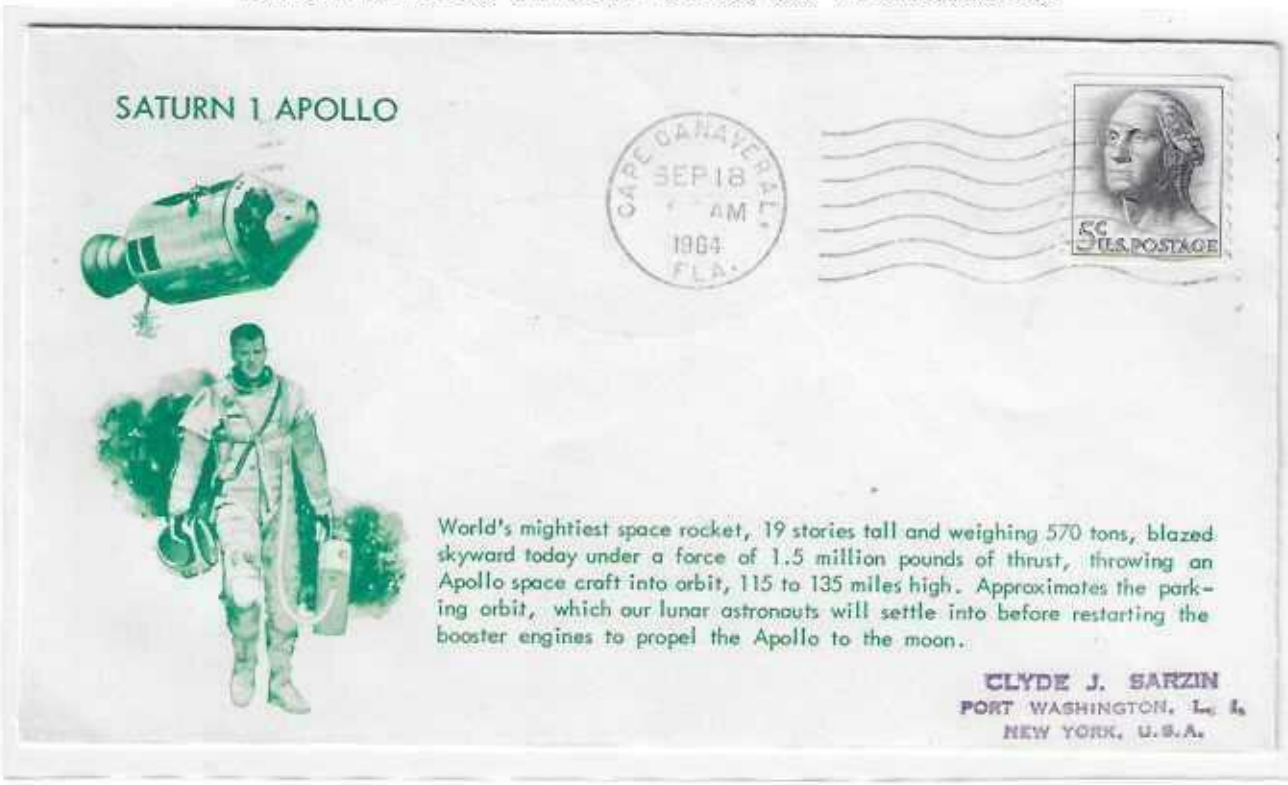



Gemini GT-1 mission. APRIL 8, 1964. Cape Canaveral manual cancel on the date and time of launch. Successful orbital test of the Titan 2 launch vehicle, spacecraft structural integrity, and launch vehicle-spacecraft compatibility. Unmanned, no plan to recover. Mission terminated after three orbits, and spacecraft disintegrated 3,5 days after launch. All primary and secondary objectives achieved.

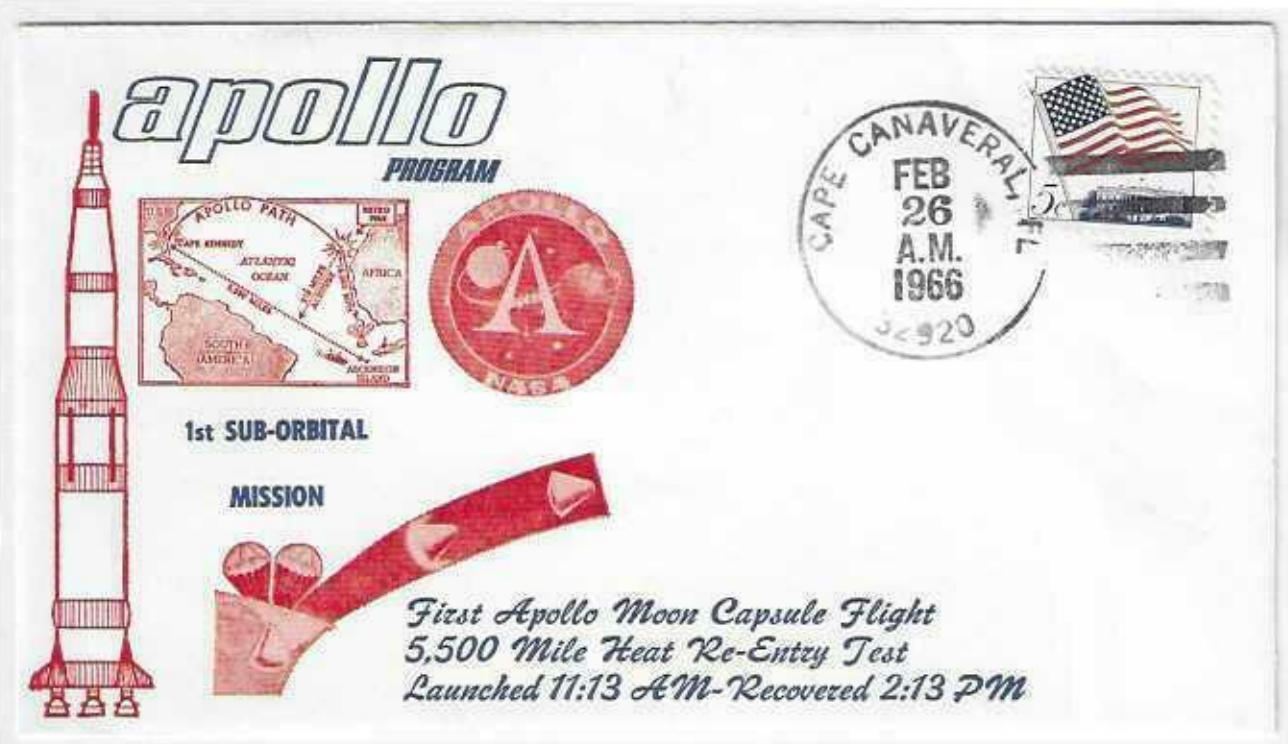



Apollo SA-6 mission. MAY 28, 1964. Cape Canaveral machine cancel on the date and time of launch. The Saturn 1 launch vehicle was a two-stage booster with the Apollo payload attached to the S-IV second stage. The Apollo payload was a boilerplate Command and Service Module ( BP13 ). The primary objective was further qualification of the Saturn 1 launch vehicle, and continued development of the technology necessary to build the more powerful Saturn 1B and V. The Apollo boilerplate had a mass of 7,700 kg.

# ENGINEERING : THE APOLLO SA-7 AND AS-201




Apollo SA-7 mission. SEPTEMBER 18, 1964. Cape Canaveral machine cancel on the date and time of launch. The Saturn 1 vehicle demonstrated launch vehicle/spacecraft compatibility, and tested the Launch Escape System. It carried a boilerplate model CM and SM and an instrument unit to Earth orbit, similar to the interim orbit planned for future Apollo astronaut mission. A 305 cm high escape tower was mounted on top to support a 470 cm launch escape motor. The spacecraft orbit decayed on September 22, after 59 orbits.




Apollo AS-201 mission. FEBRUARY 26, 1966. Cape Canaveral manual cancel ( plugged 9 ) on the date and time of launch. This was the first flight of the two-stages Saturn 1B. The objectives of the flight were to verify the structural integrity, launch loads, stage separation, and operation of subsystems, and evaluate heatshield ( not achieved ) and mission support facilities. The CSM reached a maximum altitude of 499 km over the Atlantic Ocean before beginning its descent. The SM was jettisoned and the CM reentered.

# ENGINEERING : THE APOLLO AS-203 AND AS-202

SATURN 203

Uprated Saturn launching hurls 29 ton S-IVB into earth orbit and conducts engineering experiments with liquid hydrogen fuel which is the propulsion force that will propel the Apollo spacemen into a Lunar orbit.

CLYDE J. SARZIN
PORT WASHINGTON, L
NEW YORK, U.S.A.

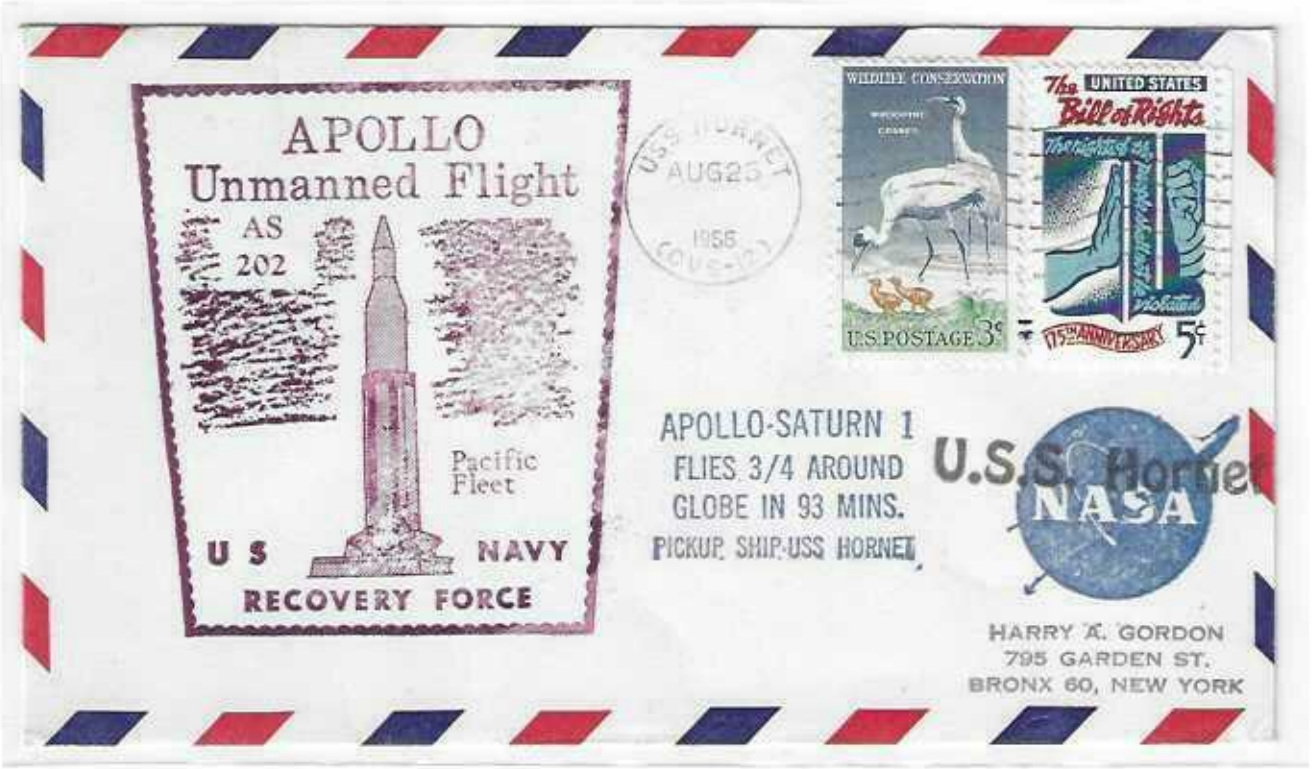
Apollo AS-203 mission. JULY 5, 1966. Patrick AFB machine cancel on the date and time of launch. The mission was an unmanned test of the S-IVB second stage, and the IU ( Instrument Unit ) of the Saturn V, to obtain flight information under orbital conditions. The two-stages launch vehicle boosted the payload consisting of the S-IVB, IU, and a nose cone into a 188 km circular orbit. The engine's capability to restart after coast was demonstrated.


Apollo 7

Scott Carpenter

Apollo AS-202 mission. AUGUST 25, 1966. Cape Canaveral machine cancel on the date and time of launch. The Saturn 1B payload consisting of the Apollo CSM-011. After both stages completed their burns, and separated, the SM propulsion engine burned to boost the spacecraft to a peak altitude of 1,128.6 km. The rapid restart capability of the SM's engines was tested, the last separating the SM from the CM. The firing also accelerated the CM reentry to greater than 32,000 km/h.

# ENGINEERING : THE APOLLO AS-202 AND THE APOLLO 4




Apollo AS-202 mission. AUGUST 25, 1966. Primary recovery ship USS Hornet machine cancel on the date and time of splashdown.


Apollo 4 ( AS-501 ) mission. NOVEMBER 9, 1967. KSC machine pictorial cancel on the date and time of launch. Official cachet. The unmanned Saturn/Apollo 4 mission was the first all-up test of three stage Saturn V rocket. It carried a payload of an Apollo CSM into Earth orbit. After two orbit, the third stage was reignited for a simulated translunar injection burn, putting the spacecraft into an Earth-intersecting trajectory, with an apogee of 17,346 km. The S-IVB stage then separated from the CSM. Later, the Service Propulsion System was re-ignited to accelerate the CSM to beyond lunar trajectory return velocities.

# ENGINEERING : THE APOLLO 5 AND 6


Apollo 5 ( AS-204 ) mission. JANUARY 22, 1968. KSC machine pictorial cancel on the date and time of launch. Official cachet. It was the first test flight of the Lunar Module ( LM ). After launch, the S-IVB second stage ignited to insert the spacecraft into an Earth orbit. The nose cone was jettisoned and the LM was separated. A planned Descent Propulsion System ( DPS ) was cut short after only 4 sec., due to overly conservative programming of the flight software. The Ascent Propulsion System ( APS ) was ignited simultaneously with the DPS being shut down.


Apollo 6 ( AS-502 ) mission. APRIL 4, 1968. Cape machine cancel on the date and time of launch. The unmanned Saturn/Apollo 6 mission was designed as the final qualification of the Saturn V launch vehicle and Apollo spacecraft for manned Apollo missions.


Apollo 6 ( AS-502 ) mission. APRIL 4, 1968. Vandenberg AFB machine cancel on the date and time of launch. The spacecraft consisted of three stage Saturn V, the Apollo CSM, and a boilerplate LM, including CM recovery. After two orbits, the third stage failed to reignited as planned, so the SM propulsion system was used to boost the spacecraft an apogee of 22,225 km, from which the planned lunar reentry simulation took place at 36,025 km/h.


Apollo 6 ( AS-502 ) mission. APRIL 4, 1968. Primary recovery ship USS Okinawa manual cancel on the date and time of splashdown.

# PLANETARY SCIENCE : THE APOLLO SA-1


Apollo SA-1 mission. OCTOBER 27, 1961. Port Canaveral manual cancel on the date and time of launch. SA-1 was the first flight of the Saturn I space launch vehicle, the first in the Saturn family. This first flight was designed to test the structure of the launch vehicle during a suborbital flight. The Saturn I booster was a huge increase in size and power over anything previously launched. NASA planned to test each rocket stage in separate launches, so for SA-1 the only live stage was the S-I first stage, which launches in a simulated flight the upper stages filled with water.

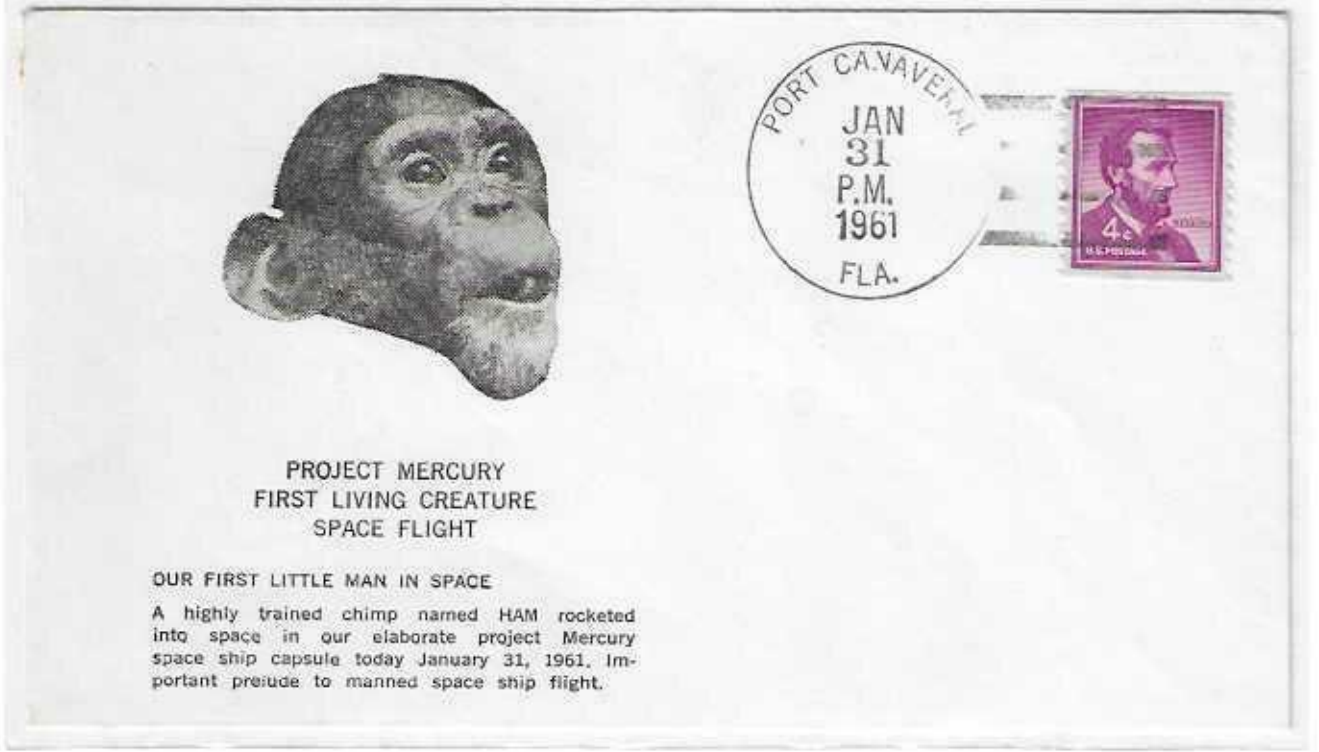

Apollo SA-1 mission. OCTOBER 27, 1961. Patrick AFB machine cancel on the date and time of launch.

# PLANETARY SCIENCE : THE GEMINI GT-2


Gemini GT-2 mission. JANUARY 19, 1965. Cape Canaveral manual cancel on the date and time of launch. This was the second uncrewed Gemini test mission, consisting of a sub-orbital ballistic flight and reentry with the primary objectives being to demonstrate the adequacy of the spacecraft reentry module's heat protection during a maximum heating rate return, the structural integrity of the spacecraft, and the performance of its systems. The spacecraft was a cone-shaped capsule consisting of two components, a reentry module and an adaptor module.


Gemini GT-2 mission. JANUARY 19, 1965. Primary recovery ship USS Lake Champlain manual cancel on the date and time of splashdown.


Mercury-Redstone 1A ( MR-1A ) mission. DECEMBER 19, 1960. Patrick AFB machine cancel on the date and time of launch. The mission objectives of this unmanned suborbital flight were to qualify the spacecraft for space flight and qualify the system for an upcoming primate suborbital flight. The spacecraft tested its instrumentation, posigrade rockets, retrorockets, and recovery system. The flight was completely successful.



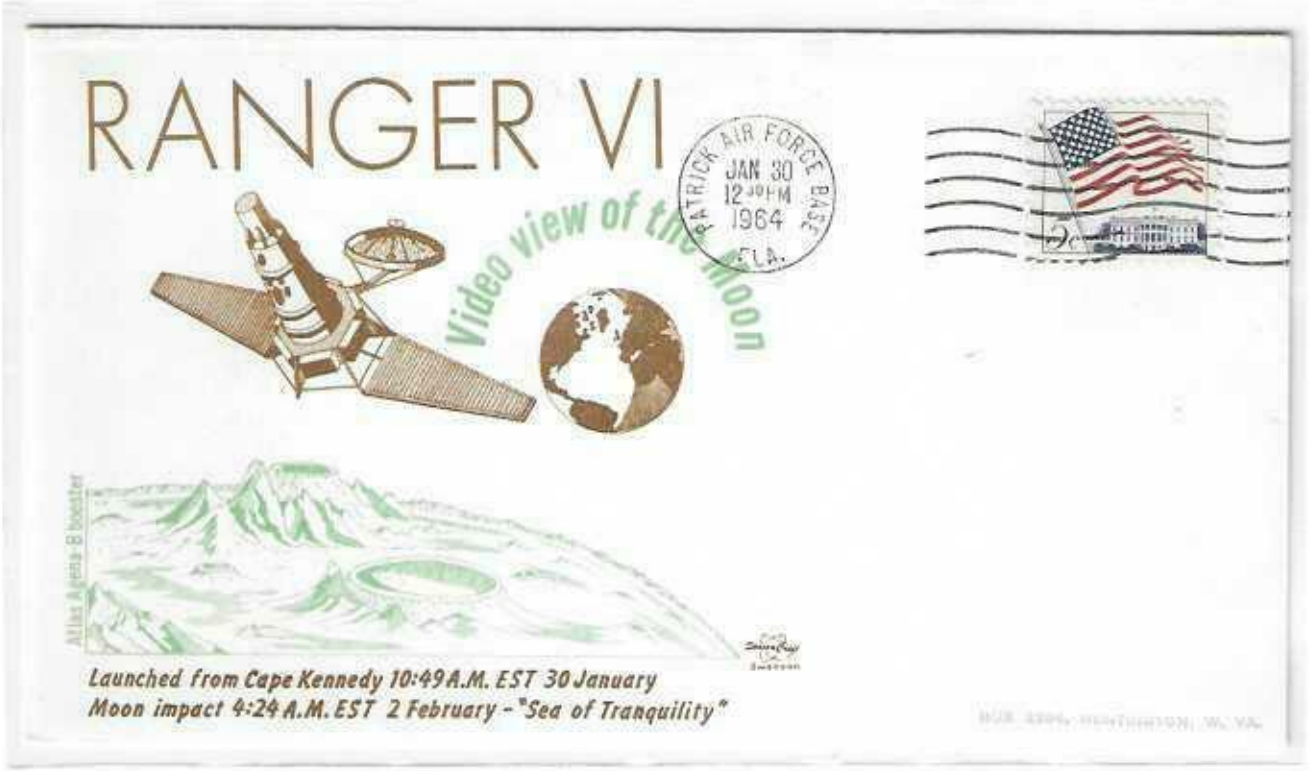

Mercury-Redstone 2 ( MR-2 ) mission. JANUARY 31, 1961. Port Canaveral manual cancel on the date and time of launch. It was the penultimate test flight of the Mercury-Redstone launch vehicle prior to the first manned american space mission. Mercury spacecraft ( #5 ) carried Ham the Chimp on a suborbital flight, and contained six new systems : environmental control system, attitude stabilization control system, live retrorockets, voice communications systems, " closed loop " abort sensing system, and a pneumatic landing bag.


Mercury-Atlas 4 ( MA-4 ) mission. SEPTEMBER 13, 1961. Patrick AFB machine cancel on the date and time of launch. This flight was an orbital test of the Mercury Tracking Network, and the first successful orbital flight test of the Mercury Program. It had demonstrated the ability of the Atlas rocket to lift the Mercury capsule into orbit, and of the capsule and its systems to operate completely autonomously, and it had succeded in obtaining pictures of the Earth.


Mercury-Atlas 5 ( MA-5 ) mission. NOVEMBER 29, 1961. Port Canaveral manual cancel on the date and time of launch. This mission was the second and final orbital qualification flight of the Mercury systems, prior to manned orbital flight. On board was a 17 kg, five-year-old chimpanzee, named Enos, which performed various psychomotor activities during the flight and was found to be in excellent physical conditions following splashdown.

# INTERPLANETARY SPACE PROBES

## PLANETARY SCIENCE : THE RANGER 6




Ranger 6 mission. JANUARY 30, 1964. Patrick AFB machine cancel on the date and time of launch. The spacecraft carried six television vidicon cameras, two full-scan cameras, and four partial scan cameras. A review board determined the most likely cause of failure was due to an arc-over in the TV power system when it inadvertently turned on for 67 seconds approximately 2 minutes after launch, during the period of booster-engine separation.

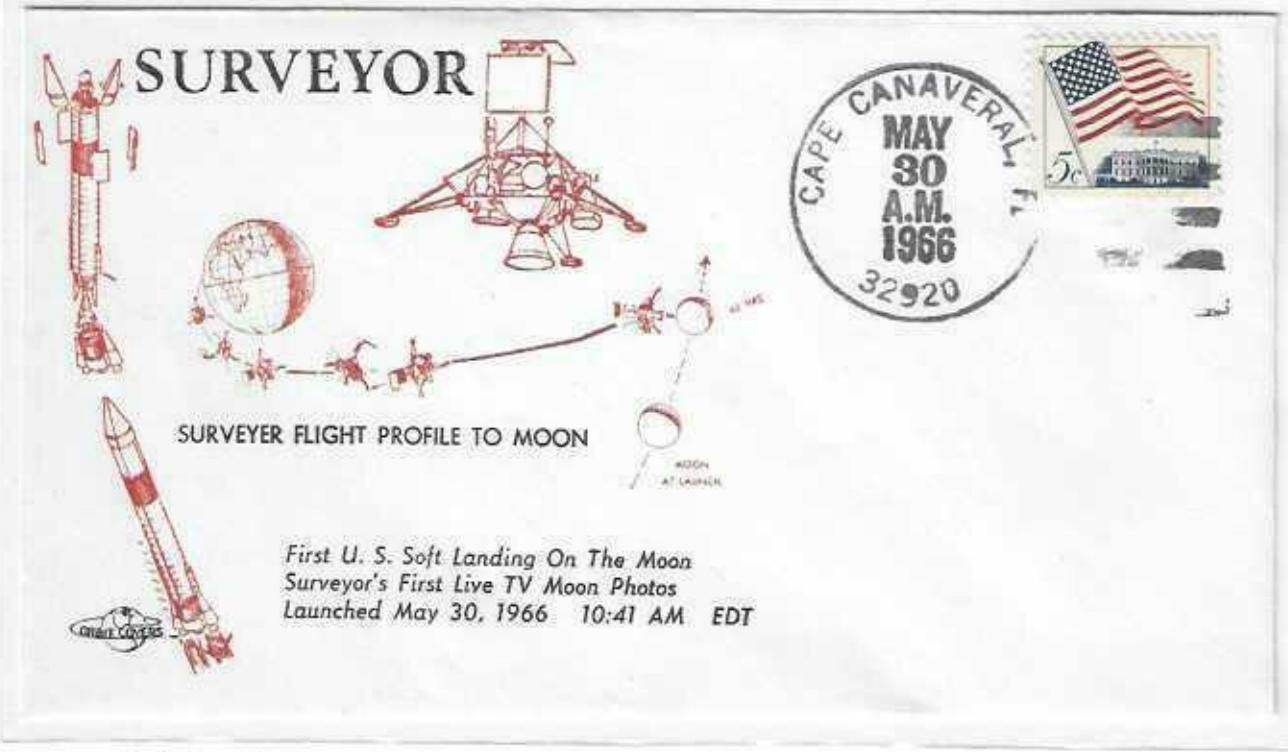
# PLANETARY SCIENCE : THE RANGER 7 AND 8


Ranger 7 mission. JULY 28, 1964. Cape Canaveral machine cancel on the date and time of launch. Ranger 7 reached the Moon on 31 July. It impacted in an area between Mare Nubium and Oceanus Procellarum. The F-channel began its one minute warm up 18 minutes before impact. Transmission of 4,308 photographs of excellent quality occurred over the final 17 minutes of flight.


Ranger 8 mission. FEBRUARY 17, 1965. Cape Canaveral manual cancel on the date and time of launch. On 18 February, at a distance of 160,000 km from Earth, the planned mid-course maneuver took place.Transmission of 7,137 photographs of good quality occurred over the final 23 minutes of flight. The final image taken before impact has a resolution of 1.5 m.

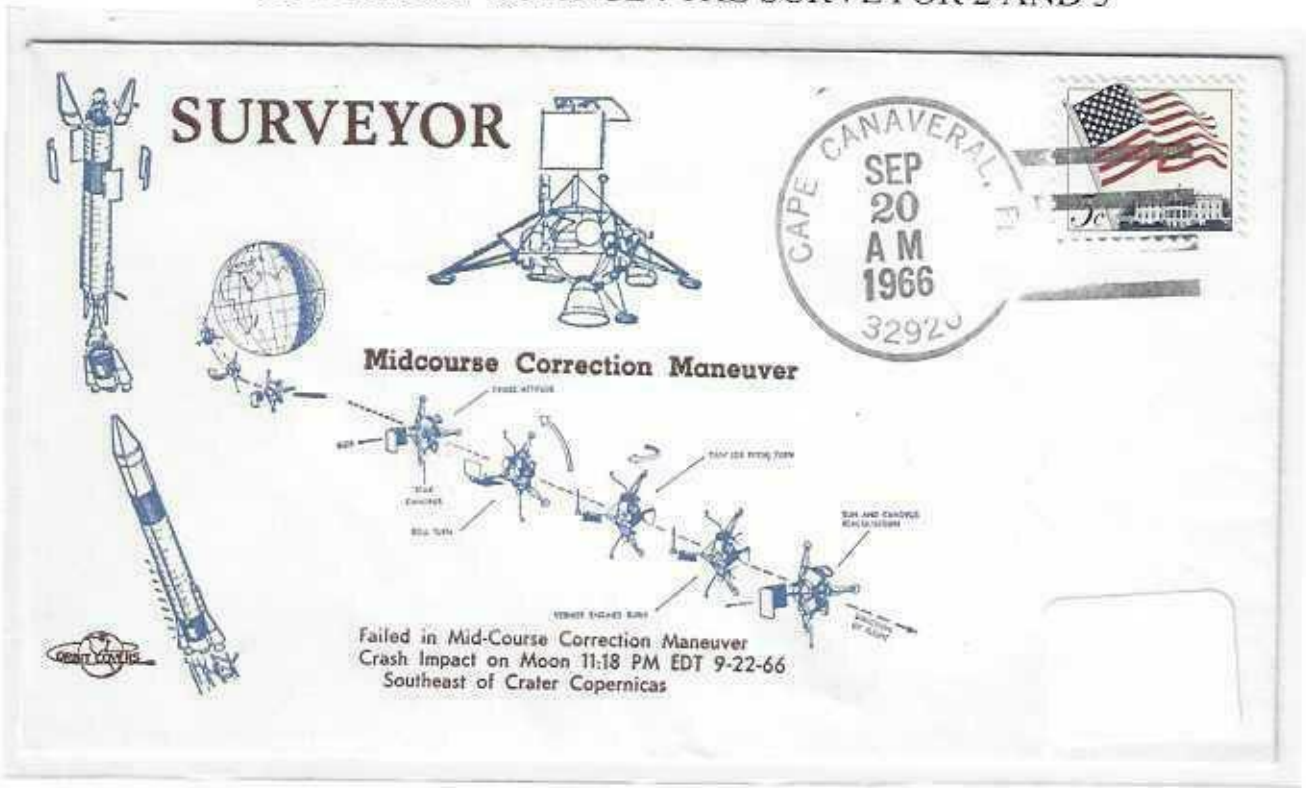
# PLANETARY SCIENCE : THE RANGER 9 AND SURVEYOR 1


Ranger 9 mission. MARCH 21, 1965. Cape Canaveral manual cancel on the date and time of launch. The spacecraft reached the Moon on 24 March, 1965. Impact occurred in the crater Alphonsus at a velocity of 2.67 km/sec. The spacecraft performance was excellent. Transmission of 5,814 good contrast photographs was made during the final 19 minutes of flight. Real time television coverage with live network broadcasts of many of the F-channel images were provided for this flight.

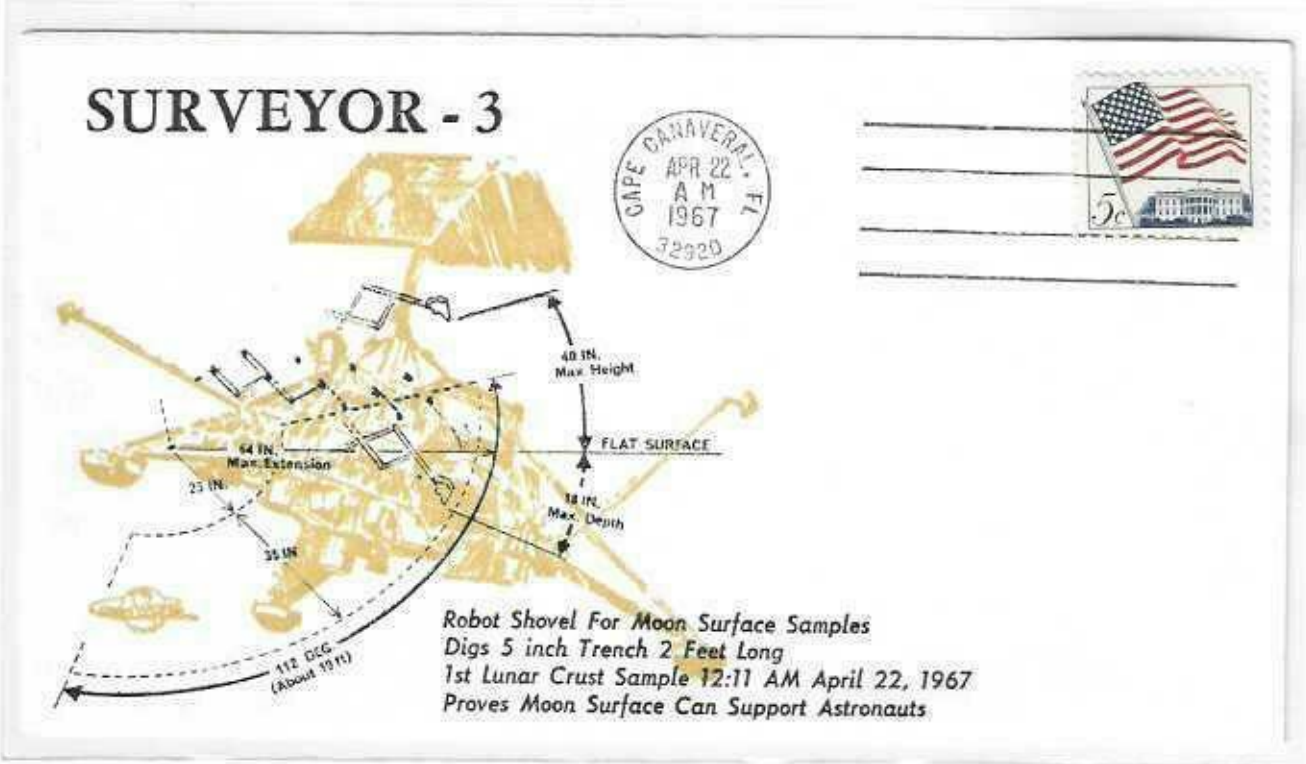



Surveyor 1 mission. MAY 30, 1966. Cape Canaveral manual cancel on the date and time of launch. The spacecraft was launched on an Atlas Centaur rocket and, about 63 hours after launch, reached the Moon in southwest Oceanus Procellarum. The mission was considered a complete success and demonstrate the technology necessary to achieve landing and operation on the lunar surface. Photography session were performed and the television system transmitted pictures of the spacecraft footpad and surrounding lunar terrain and surface materials.

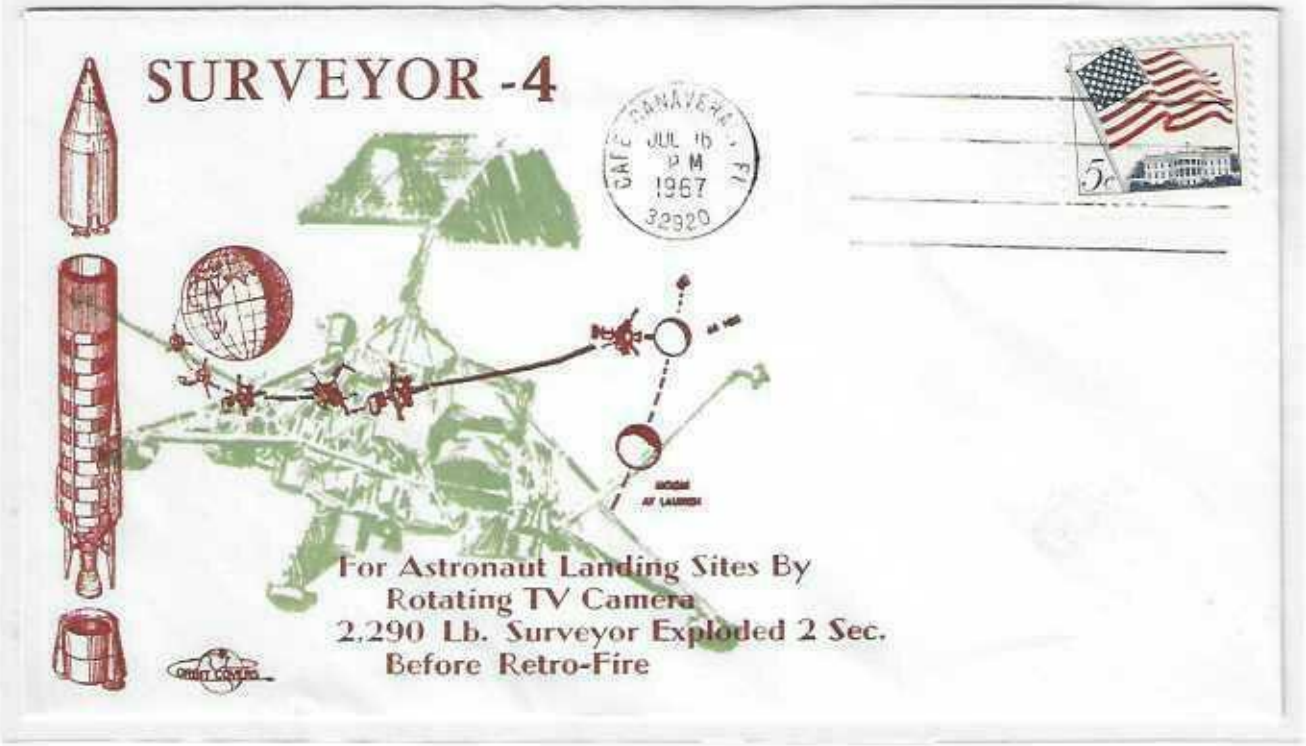
# PLANETARY SCIENCE : THE SURVEYOR 2 AND 3



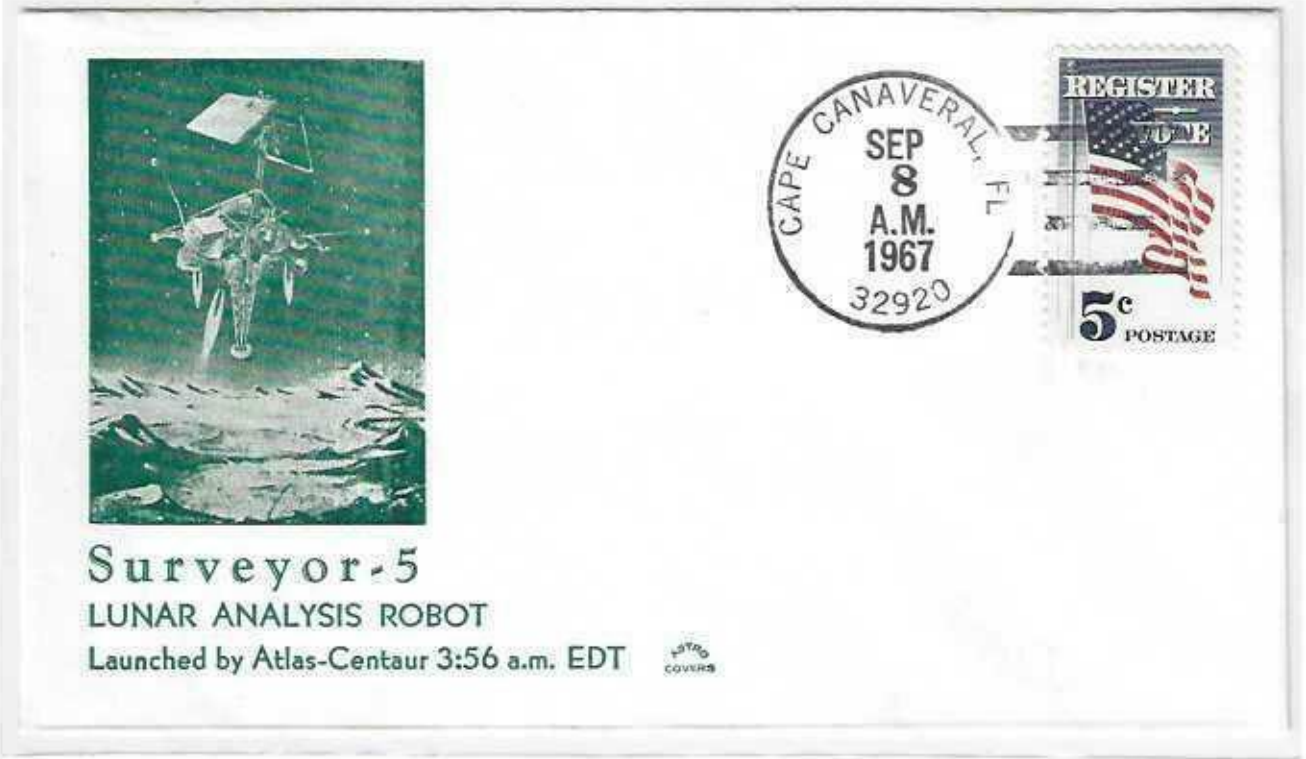

Surveyor 2 mission. SEPTEMBER 20, 1966. Cape Canaveral manual cancel on the date and time of launch. The target area proposed was within Sinus Medii. During the midcourse maneuver, one vernier engine failed to ignite, causing the spacecraft to tumble. It impacted the Moon on 23 September, 1966. Surveyor 2 was also equipped to return data on radar reflectivity of the lunar surface, bearing strength of the lunar surface, and spacecraft temperatures for use in the analysis of lunar surfaces temperatures.




Surveyor 3 mission. APRIL 22, 1967. Cape Canaveral machine cancel on the date and time of experiments. The most exciting experiment was the deployment of the Remote Scooper Arm which, via commands from Earth, dug four trenches and performed four bearing tests and thirteen impact tests based on these experiments, scientists concluded that lunar soil had a consistency similar to wet sand, with a bearing strength of 0.7 kg per square centimeter-solid enough for an Apollo Lunar Module. Last contact was made on 4 May, 1967, two days after the lunar night began.

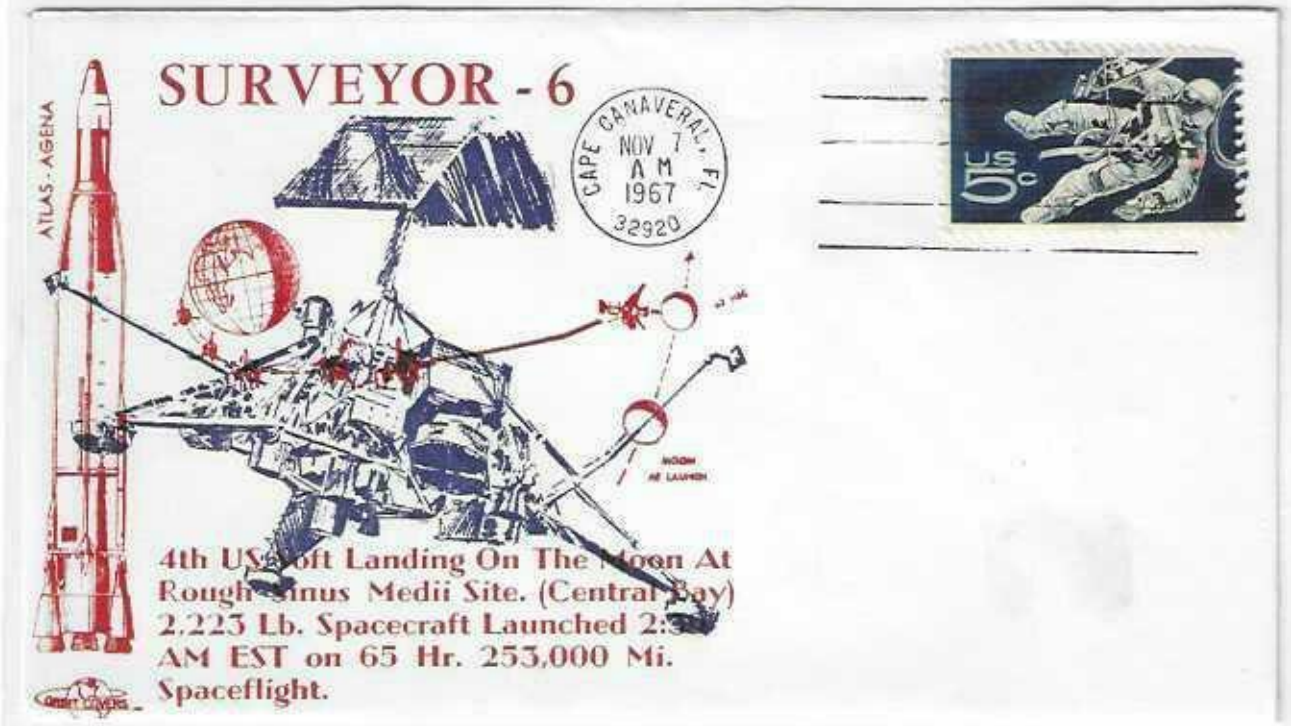



Surveyor 4 mission. JULY 16, 1967. Cape Canaveral machine cancel on the date and time of the descent phase. Equipment on board included a television camera and auxiliary mirrors, a soil mechanics surface sampler, strain gauges on the spacecraft landing legs, and numerous engineering sensor. After a flawless flight to the Moon, radio signals from the spacecraft ceased during the terminal descente phase on 17 July, 1967, approximately 2.5 minutes before touchdown.




Surveyor 5 mission. SEPTEMBER 8, 1967. Cape Canaveral manual cancel on the date and time of launch. The specific objectives for this mission were to perform a soft landing on the Moon, in Mare Tranquillitatis, and obtain postlanding television pictures of the lunar surface, to conduct a vernier engine erosion experiment, determine the relative abundances of the chemical elements in the lunar soil by operation of the Alpha-Scattering Instrument, obtain touchdown dynamics data, and obtain thermal and radar reflectivity data

# PLANETARY SCIENCE : THE SURVEYOR 6 AND 7




Surveyor 6 mission. NOVEMBER 7, 1967. Cape Canaveral machine cancel on the date and time of launch. On 17 November, the vernier engines were fired for 2.5 sec., causing Surveyor to lift off the lunar surface 3 to 4 meters and land about 2.4 meters west of its original position. This lunar " hop " represented the first powered takeoff from the lunar surface and furnished new informations on the effects of firing rocket engines on the Moon. A total of 30,027 images were transmitted to Earth.


Sueveyor 7 mission. JANUARY 7, 1968. Cape Canaveral manual cancel on the date and time of launch. It was the only Surveyor craft to land in the lunar highland region, near Tycho Crater. This spacecraft was similar in design to previous Surveyors, but it carried more scientific equipment, including a television camera.Of the auxiliary mirrors, three were used to observe areas below the spacecraft,one to provide stereoscopic views of the surface sampler area, and seven to show lunar material deposited on the spacecraft.


Viking 1 mission. AUGUST 20, 1975. KSC machine cancel on the date and time of launch. The Viking Project consisted of launches of two separate spacecraft to Mars. Each spacecraft consisted of an orbiter and a lander. After orbiting Mars and returning images, used for landing sites selection, the orbiter and lander detached and the lander entered the martian atmosphere and soft-landed at the selected site. Following launch and a ten month cruise to Mars, the orbiter began returning global images of Mars.


Viking 1 mission. JUNE 19, 1976. Vandenberg AFB machine cancel on the date and time of insertion in martian orbit. Scientific instruments for conducting imaging, atmospheric water vapor, and infrared thermal mapping were enclosed in a temperature controlled, pointable scan platform extending from the base of the orbiter. The scientific instrumentation had a total mass of approximately 72 kg. Radio science investigations were also done using the spacecraft transmitter.

# PLANETARY SCIENCE : THE VIKING 1 AND 2


Viking 1 mission. JULY 20, 1976. Vandenberg AFB machine cancel on the date and time of Mars touch down, at Chryse Planitia. Transmission of the first surface image began 25 seconds after landing and took about 4 minutes. In the next 7 minutes, the second picture of the 300° panoramic scene was taken. On the day after the landing the first color picture of the surface of Mars was taken. The orbiter primary mission ended at the beginning of solar conjunction on 5 November, 1976.


Viking 2 mission. SEPTEMBER 9, 1975. KSC machine pictorial cancel on the date and time of launch. Official cachet. Following launch and a 333 day cruise to Mars, the Viking 2 orbiter began returning global images prior to orbit insertion. Imaging of candidate sites was begun and the landing site was selected based on these pictures and the images returned by Viking 1 orbiter.

# PLANETARY SCIENCE : THE VIKING 2


Viking 2 mission. AUGUST 7, 1976. Vandenberg AFB machine cancel on the date and time of insertion in martian orbit. The lander carried instruments to achieve the primary scientific objectives of the lander mission : to study the biology, chemical composition ( organic and inorganic ), meteorology, seismology, magnetic properties, appearance, and physical properties of the martian surface and atmosphere. Two 360-degree cylindrical scan cameras were mounted near one long side of the base.


Viking 2 mission. SEPTEMBER 3, 1976. Vandenberg AFB machine cancel on the date and time of Mars touch down. At the time of separation, on 3 September, the lander was orbiting at about 4 km/sec. At 6 km altitude, at about 250 m/s, the 16 m diameter lander parachute were deployed. In 45 sec. the parachute had slowed the lander to 60 m/s. The lander touched down about 200 km west of the crater Mie in Utopia Planitia It operated for 1,281 Mars days, and data was turned off on April 11, 1980, when its batteries failed.

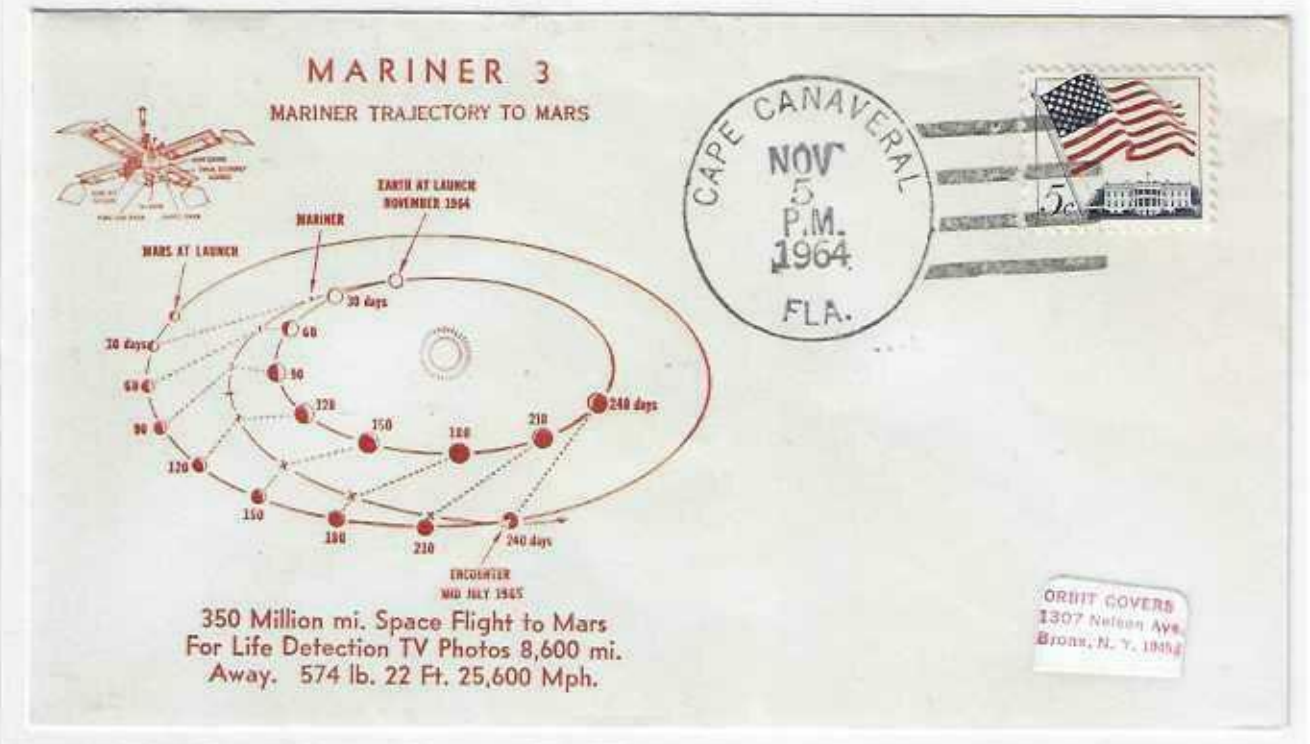
## PLANETARY SCIENCE: THE VIKING 2


Viking 2 mission. SEPTEMBER 9, 1975. KSC machine pictorial cancel on the date and time of launch.

## PLANETARY SCIENCE, SOLAR PHYSICS : THE RANGER 3


Ranger 3 mission. JANUARY 26, 1962. Patrick AFB machine cancel on the date and time of launch. The spacecraft was designed to continue testing for development of lunar and interplanetary spacecraft, to transmit pictures of the lunar surface during a period of 10 min., prior to impacting on the Moon. Because a malfunction in the booster guidance system, Ranger 3 missed the Moon by approssimately 36,000 km.

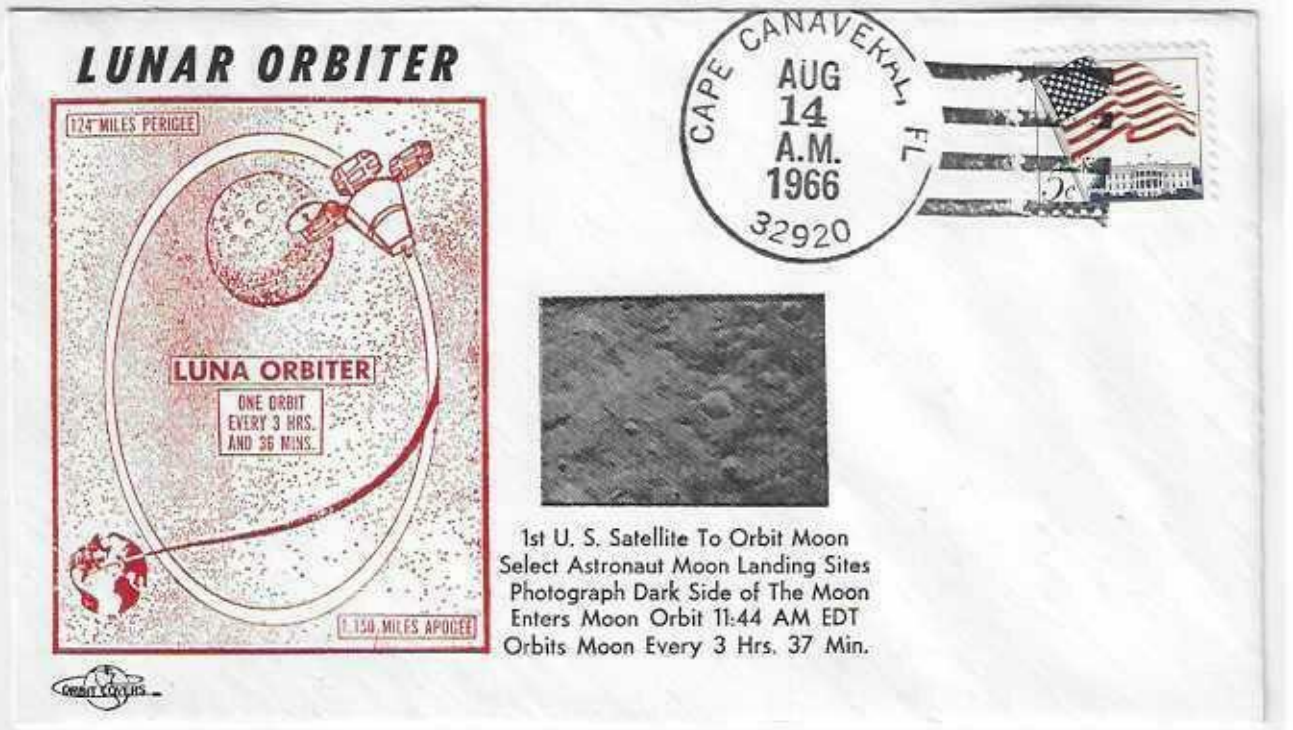

Pioneer 1 mission. OCTOBER 11, 1958. Port Canaveral manual cancel on the date and time of launch. Pioneer 1, the second and most successful of three Project Able space probes, and the first spacecraft launched by the newly formed NASA, was intended to study the ionizing radiation cosmic rays, magnetic fields, and micrometeorites in the vicinity of the Earth, and in a lunar orbit. The spacecraft did not reach the Moon due to an incorrectly set valve in the upper stage. This resulted in a ballistic trajectory with a peak altitude of 113,800 km around 1,300 local time.



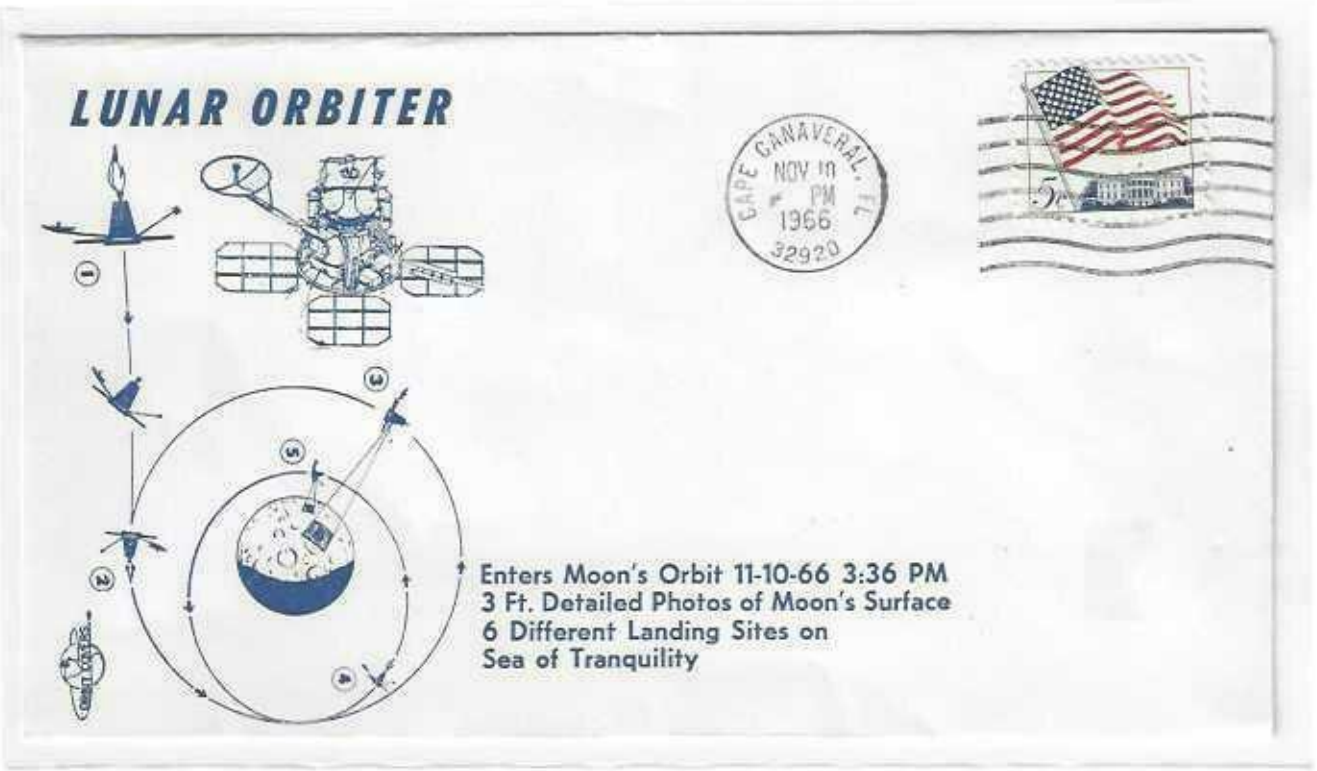

Mariner 3 mission. NOVEMBER 5, 1964. Cape Canaveral manual cancel on the date and time of launch. Mariner 3 was a 260 kg solar-cell and battery powered spacecraft designed to make scientific measurements in the vicinity of Mars, and to obtain photographs of the planet's surface. A protective shield failed to eject after tha spacecraft had passed through the atmosphere, preventing the spacecraft from attaining its its prescribed Mars trajectory.

# PLANETARY SCIENCE, SPACE PHYSICS : THE RANGER 4 AND LUNAR ORBITER 1

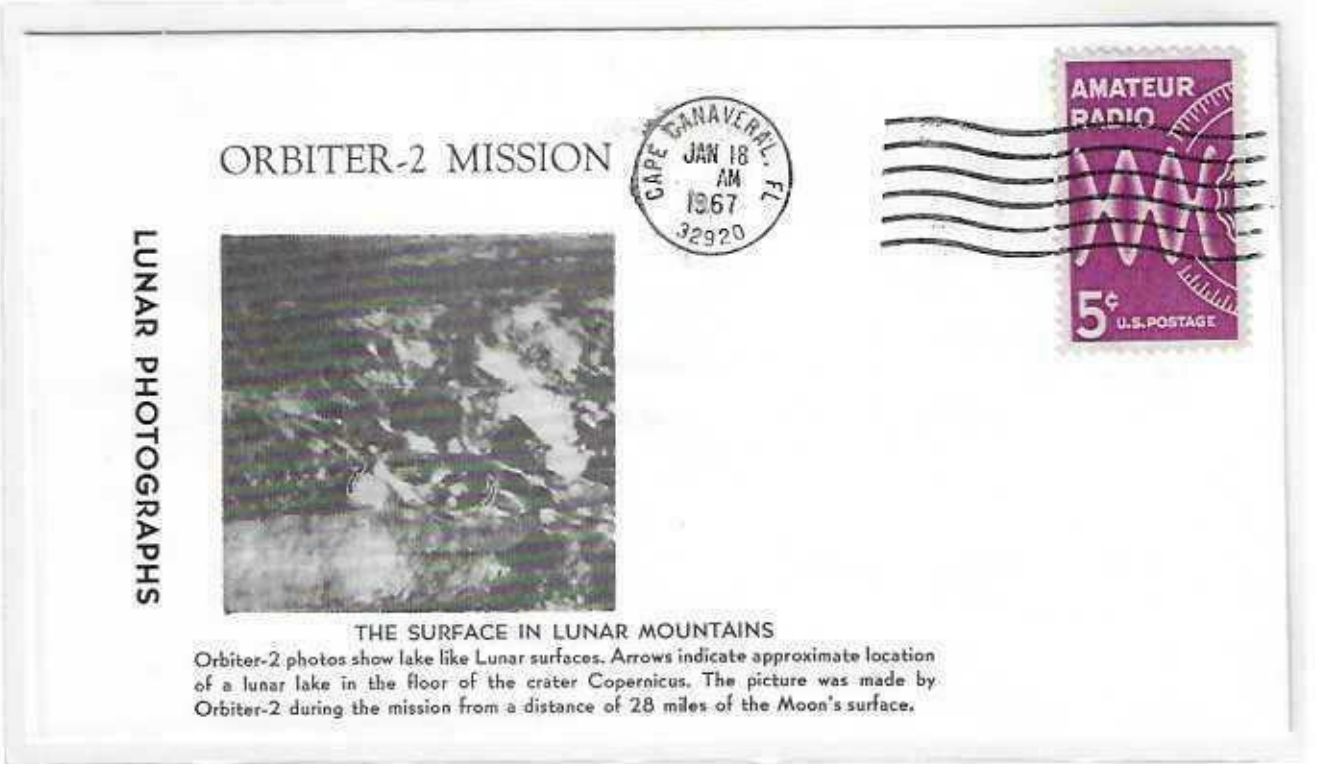

Ranger 4 mission. APRIL 23, 1962. Port Canaveral manual cancel on the date and time of launch. An onboard computer failure caused failure of the deployment of the solar panels and navigation systems. The spacecraft impacted on the far side of the Moon, without returning any scientific data, on April 26, 1962, after 64 hours of flight.




Lunar Orbiter 1 mission. AUGUST 14, 1966. Cape Canaveral manual cancel. Launched on August 10, 1966, Lunar Orbiter 1 was injected into an elliptical near-equatorial lunar orbit, 92.1 hours after launch. The spacecraft was designed primarily to photograph smooth areas of the lunar surface for selection and verification of safe landing sites for the Surveyor and Apollo mission. During its mission, the probe took 207 frames, covering an area of 5.18 million square km.

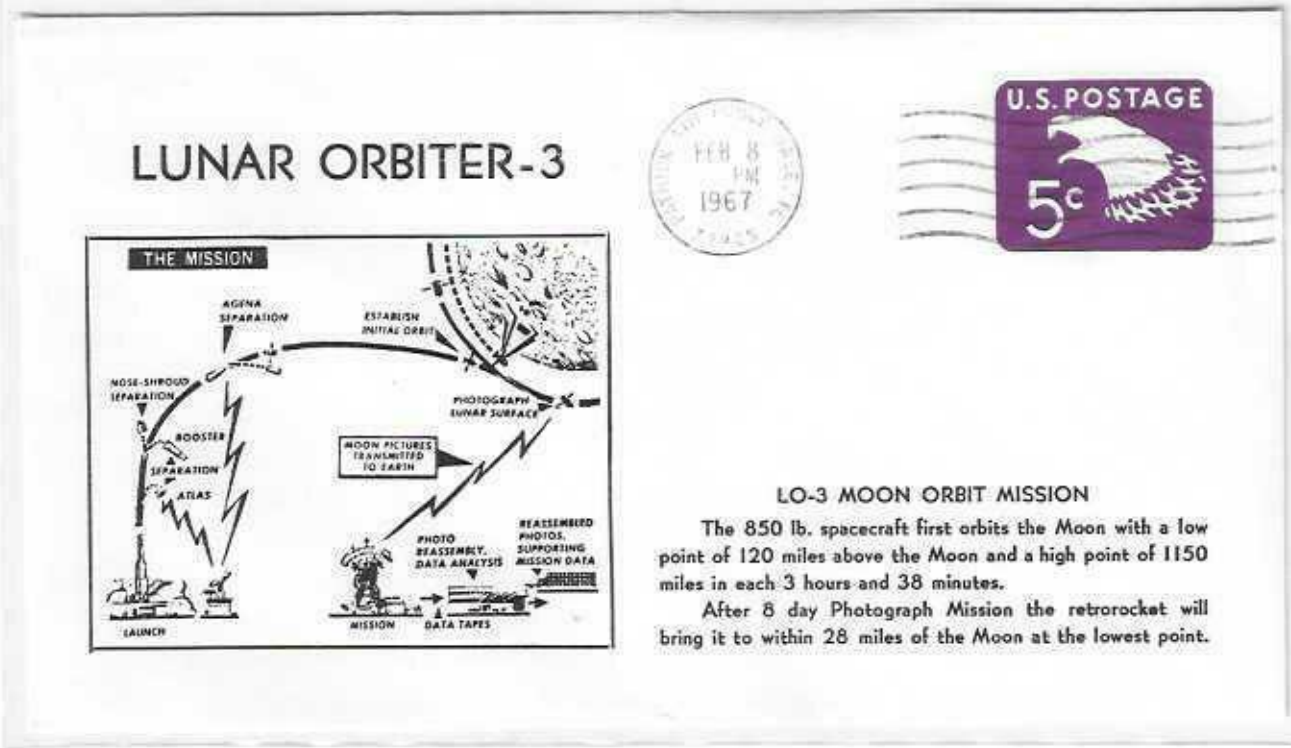



Lunar Orbiter 2 mission. NOVEMBER 10, 1966. Cape Canaveral machine cancel. The spacecraft was placed in a cislunar trajectory and injected into an elliptical near-equatorial lunar orbit for data acquisition after 92.5 hours flight time. The spacecraft was also equipped to collect selenodetic, radiation intensity, and micrometeoroid impact data. On 8 December, 1966, the orbit inclination was altered to provide new data on lunar gravity. The perilune was lowered to 49.7 km five days later, after 33 orbits.




Lunar Orbiter 2 mission. JANUARY 18, 1966. Cape Canaveral machine cancel on the date and time of lunar orbits. The spacecraft acquired photograph data from November 18 to 25, 1966, and readout occurred through December 7, 1966. A total of 609 high resolution and 208 medium resolution frames were returned, most of excellent quality, with resolutions down to 1meter. The spacecraft was used for tracking purpose until it impacted the lunar surface on October 11, 1967.

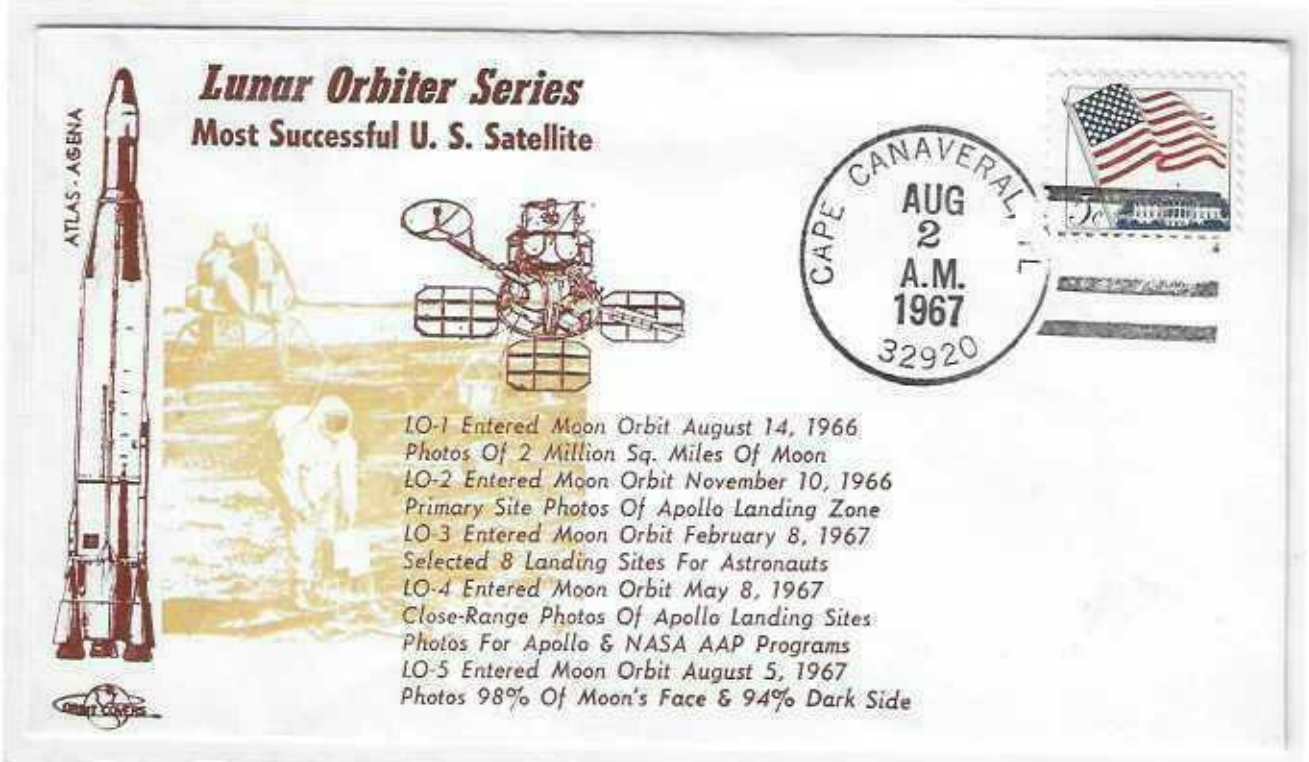
# PLANETARY SCIENCE, SPACE PHYSICS : THE LUNAR ORBITER 3 AND 4




Lunar Orbiter 3 mission. FEBRUARY 8, 1967. Patrick AFB machine cancel on the date and time of first lunar orbit. After 4 days ( 25 orbits ), of tracking the orbit was changed to 55 x 1,847 km. The spacecraft acquired photographic data from February 15 to 23, 1967. A total of 149 medium resolution and 477 high resolution frames were returned. Included was a frame of Surveyor 1 landing site, permetting identification of the location of the spacecraft on the surface. The spacecraft was used for tracking purposes until it impacted the lunar surface on October 9, 1967.


Lunar Orbiter 4 mission. MAY 4, 1967. Cape Canaveral machine cancel on the date and time of launch. The spacecraft was designed to take advantage of the fact that the three previous lunar orbiters had completed the required needs for Apollo mapping and site selection, increasing the scientific knowledge of their nature, origin, and processes.

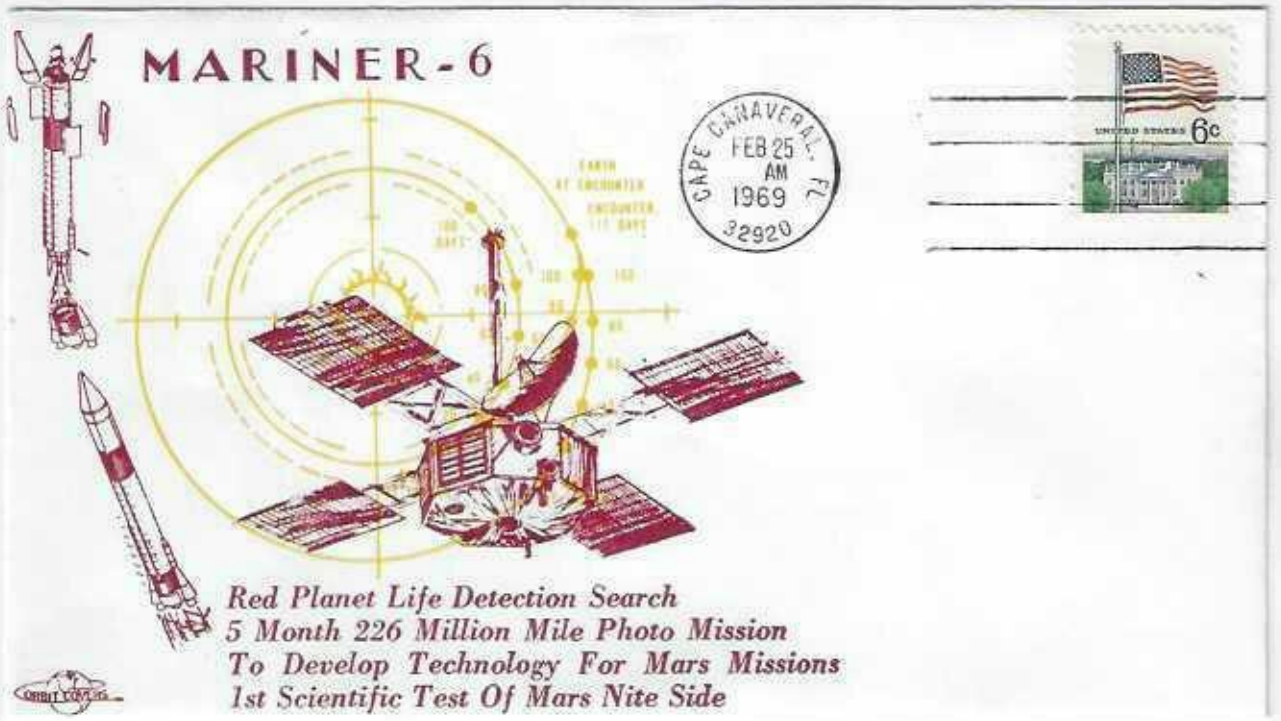

Lunar Orbiter 4 mission. MAY 8, 1967. Cape Canaveral machine cancel on the date and time of the entry in lunar orbit. After initial photography, on May 11, 1967, problems with camera and readout drive mechanism resulted in a decision to terminate the photographic portion of the mission on 26 May. A total of 419 high resolution and 127 medium resolution frames were acquired, covering 99% of the Moon's near side at resolution from 58 to 134 meters. It impacted the lunar surface no later than October 31, 1967.



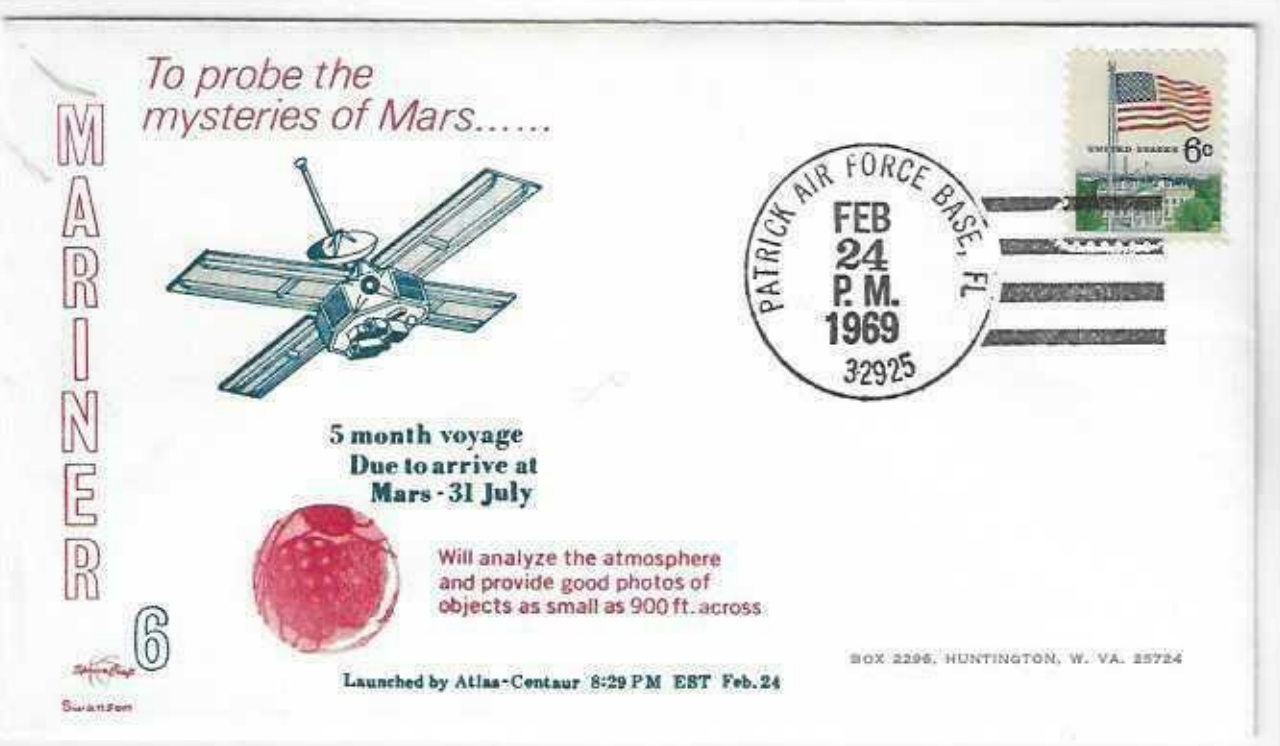

Lunar Orbiter 5 mission. AUGUST 2, 1967. Cape Canaveral manual cancel. Launched on August 1, 1967, the spacecraft entered into a terrestrial parking orbit. The last of the Lunar Orbiter series was designed to take additional Apollo and Surveyor landing site photographic and to take broad survey images of unphotographed parts of the Moon's far side. The spacecraft acquired photographic data from August 6 to 18, 1967, bringing the cumulative photographic coverage by the Lunar Orbiters to 99% of the Moon surface.

# ASTRONOMY, PLANETARY SCIENCE : THE RANGER 5


Ranger 5 mission. OCTOBER 18, 1962. Cape Canaveral manual cancel on the date and time of launch. Due to an unknow malfunction after injection into lunar trajectory from Earth parking orbit, the spacecraft failed to receive power. The batteries ran down after 8 hours, 44 min., rendering the spacecraft inoperable. Ranger 5 missed the Moon by 725 km. Gamma-ray data were collected for 4 hours prior to the loss of power. Ranger 5 was designed to transmit pictures of the lunar surface on Earth stations during a period of 10 min. of flight, prior to impacting on the Moon, to rough-land a seismometer capsule on the Moon, to collect gamma-ray data in flight, to study radar reflectivity on the lunar surface, and to continue testing of the Ranger program for development of lunar and interplanetary spacecraft.

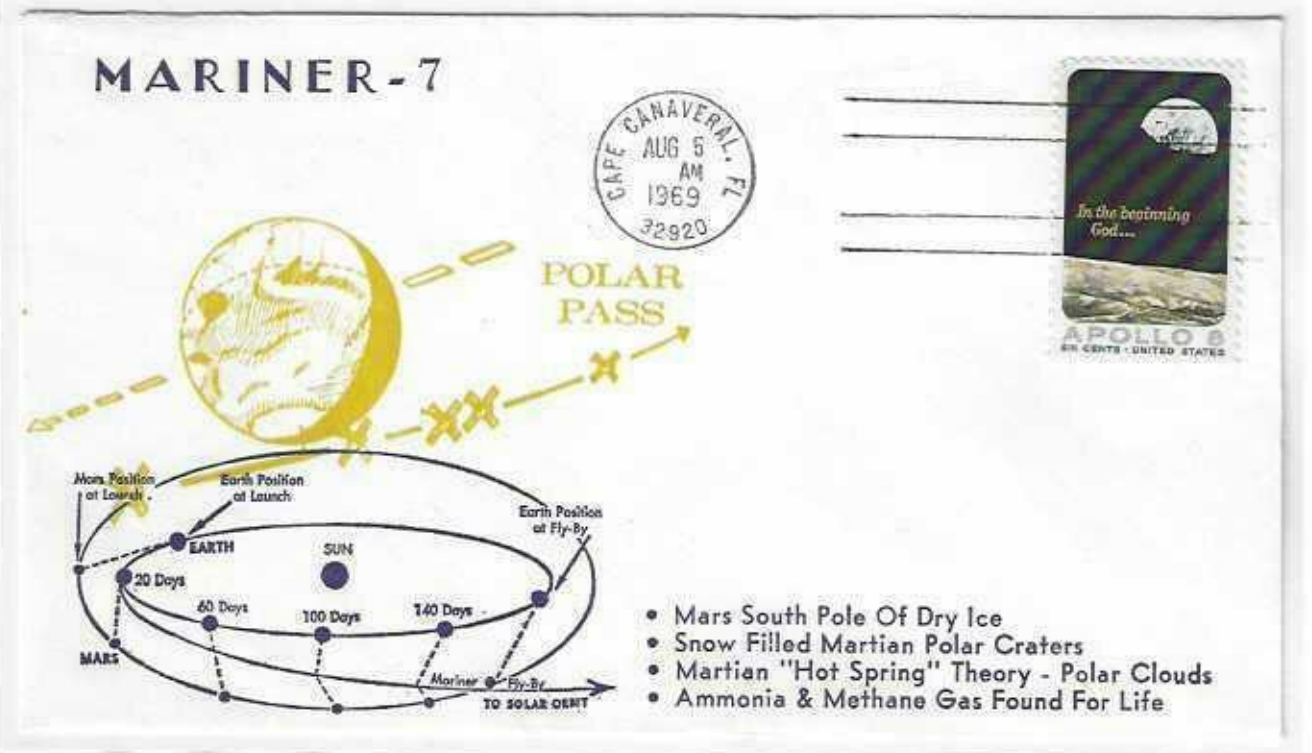



Mariner 6 mission. FEBRUARY 25, 1969. Cape Canaveral machine cancel on the date and time of launch. The primary objective of the mission were to study the surface and atmosphere of Mars during close flybys to establish the basis for future investigations, particularly those relevant to the search for extraterrestrial life, and to demonstrate and develop technologies required for future Mars missions, and other long-duration missions far from the Sun. On 31 July the near-encounter phase began, including collection of 26 close-up images.




Mariner 6 mission. FEBRUARY 24, 1969 ( EST ). Patrick AFB manual cancel on the date and time of launch. Closest approach occurred at a distance of 3,431 km from the martian surface, Science and imaging data were played back and transmitted over the next few days. Mariner 6 returned 49 far encounter and 26 near encounter images, which showed the surface of Mars to be very different from that of the Moon.


Mariner 7 mission. MARCH 27, 1969. Cape Canaveral machine cancel on the date and time of launch. Mariner 6 and 7 comprised a dual-spacecraft missions to Mars. On 2 August 1969, Mariner 7 began the far-encounter sequence, involving imaging of Mars with the narrow anglecamera. Over the next 57 hours, ending about 5 hours before closest approach, 93 images of Mars were taken and transmitted.

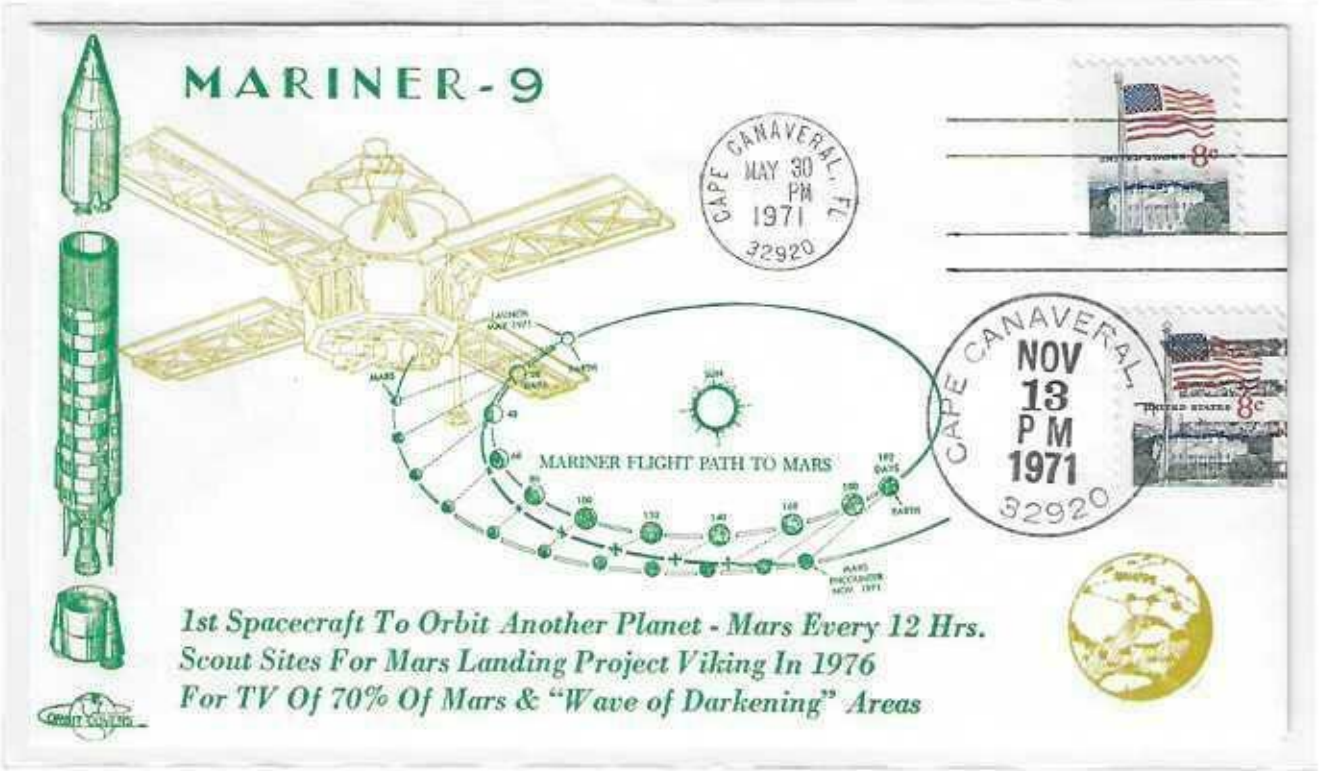



Mariner 7 mission. AUGUST 5, 1969. Cape Canaveral machine cancel on the date and time of closest approach, 3,430 km above the martian surface. Over this period, 33 near-encounter images were taken. Science and imaging data were played back and transmitted over the next few days. The total data return for Mariner 6 and 7 was 800 millions bits. Mariner 7 returned 93 far and 33 near encounter images. Close-ups from the near encounter phases covered 20% of the surface.

# ASTRONOMY, PLANETARY SCIENCE, SPACE PHYSICS : THE MARINER 2 AND 5

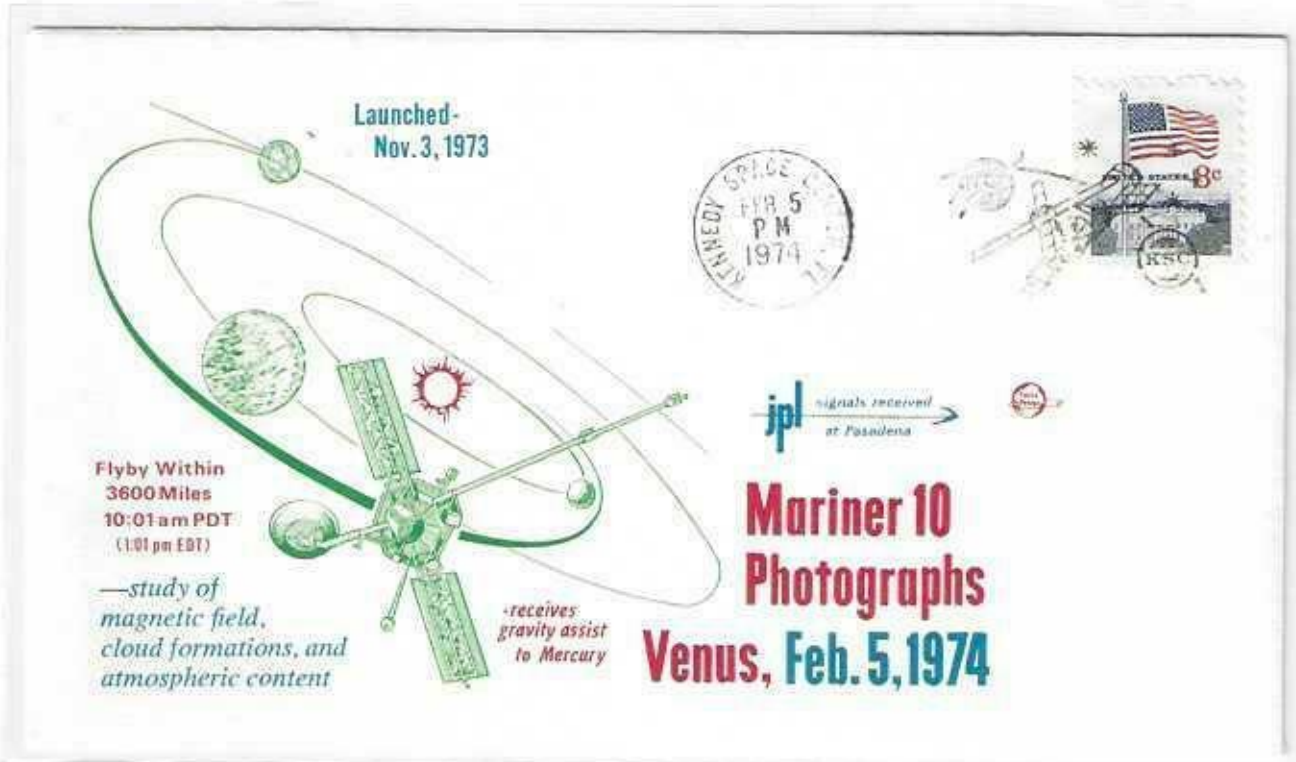

Mariner 2 mission. AUGUST 27, 1962. Port Canaveral manual cancel on the date and time of launch. The Mariner 2 spacecraft was the first spacecraft to successfully encounter another planet. It was a backup for the Mariner 1 mission, which failed shortly after launch to Venus. The objective of the mission was to fly by Venus and return data on the planet's atmosphere, magnetic field, charged particle environment and mass. The spacecraft passed below the planet at its closest distance of 34,773 km on 14 December, 1972.


Mariner 5 mission. JUNE 14, 1967. Patrick AFB machine cancel on the date and time of launch. Mariner 5 was a refurbished backup spacecraft for the Mariner 4 mission, and was converted from a Mars mission to a Venus mission. The project objectives were to pass within 2,000 km of Venus to provide data on the structure of the planet's atmosphere, and its radiation and magnetic field environment. The spacecraft reached Venus on 19 October, 1967, closest approach at 4,094 km, approx. 79.5 million km from Earth.




Mariner 9 mission. MAY 30, 1971. Cape Canaveral machine cancel on the date and time of launch. The Mariner 9 mission was planned to consist of two spacecraft to orbit Mars on complementary missions, but due to the failure of Mariner 8 to launch properly, only one spacecraft was available. Mariner 9 combined mission objectives of both Mariner 8 ( mapping 70% of the martian surface ), and Mariner 9 ( a syudy of temporal changes in the martian atmosphere and on the martian surface ).


Mariner 9 mission. NOVEMBER 13, 1971. Vandenberg AFB machine cancel on the date and time of approach to Mars. Mariner 9 arrived at Mars on 14 November 1971. It is the first spacecraft to orbit another planet. The spacecraft gathered data on atmospheric composition, density, pressure, and temperature, and also the surface composition, temperature, gravity, and topographic of Mars. A total of 54 billion bits of scientific data were returned, including 7,329 images covering the entire planet.




Mariner 10 mission. FEBRUARY 5, 1974. KSC machine pictorial cancel on the date and time of Venus flyby. Mariner 10 was the first spacecraft to visit Mercury. It was also the first spacecraft to use the gravitational pull of one planet ( Venus ) to reach another ( Mercury ), and the first spacecraft mission to visit two planets. The primary scientific objectives were to measure Mercury's environment, atmosphere, surface, and body characteristics, and to make similar investigation of Venus.

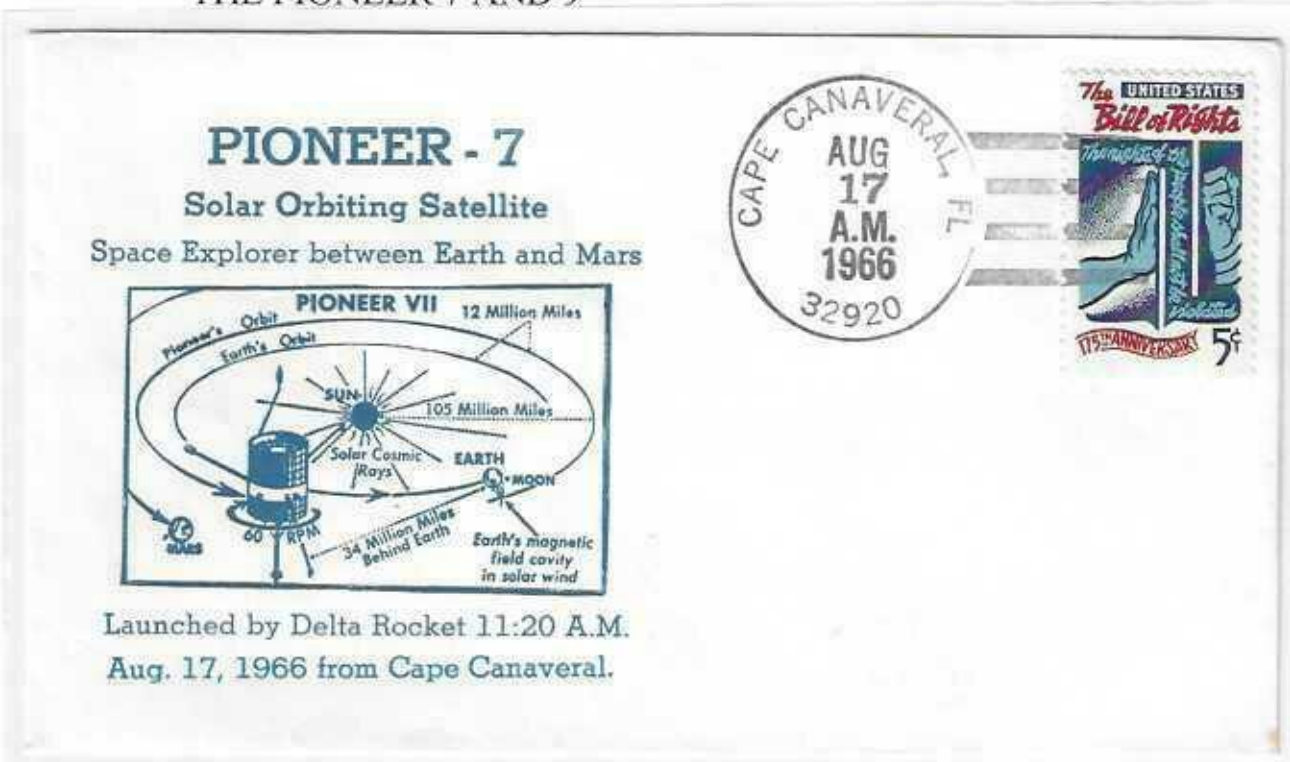

Mariner 10 mission. MARCH 16,1975. Cape Canaveral machine cancel on the date and time of the 3rd Mercury flyby. Mariner 10 crossed the orbit of Mercury on 29 March, 1974, at a distance of 704 km. A second encounter with Mercury, when more photographs were taken, occurred on 21 September, 1974, at an altitude of 48,069 km. A third and last encounter, at an altitude of 327 km, with additional photography of about 300 frames and magnetic field measurements, occurred on 16 March, 1975.

# ASTRONOMY, PLANETARY SCIENCE, SPACE PHYSICS : THE PIONEER 8 AND MARINER 8

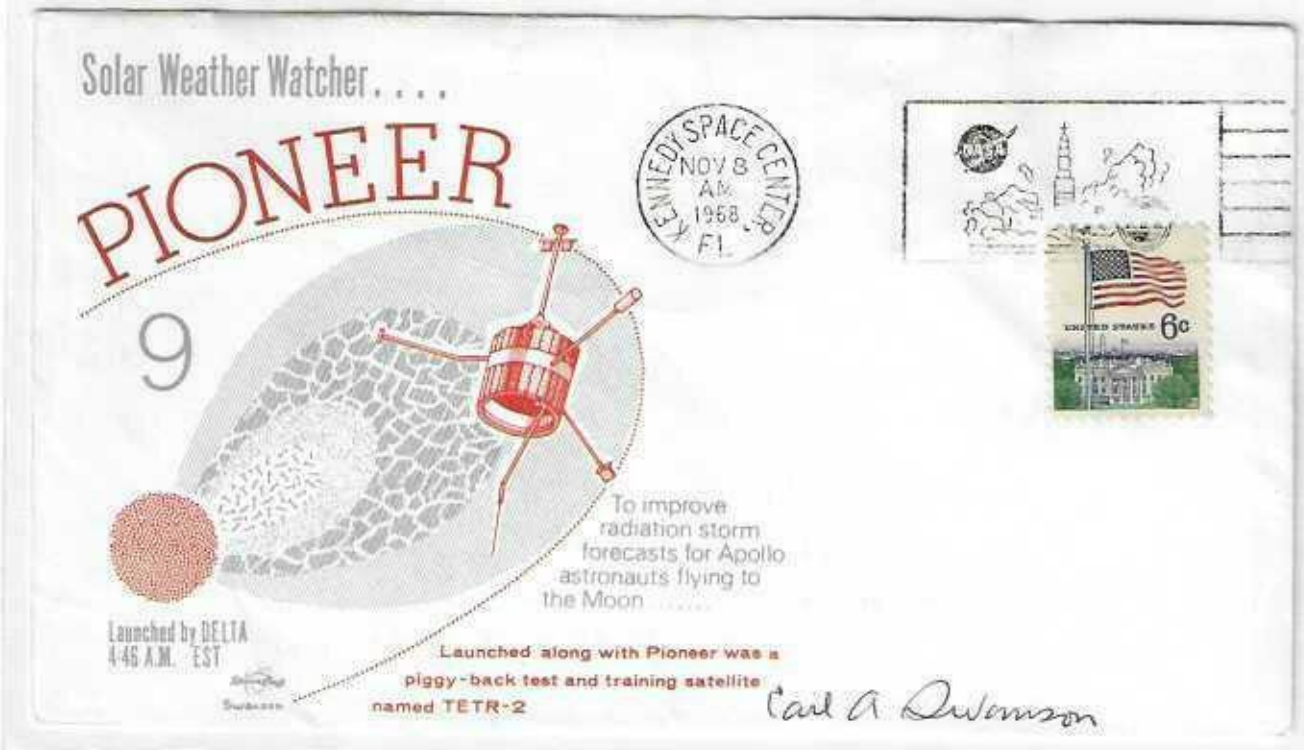

Pioneer 8 mission. DECEMBER 13, 1967. Cape Canaveral machine cancel on the date and time of launch. The spacecraft, launched into a heliocentric orbit, first crossed the geomagnetic tail at a downstream distance of 500-800 R ( E ) as it left the Earth-Moon system, and during a two-week period, centered on January 23, 1968, the magnetometer, plasma probe, and plasma wave instrument all detected specific tail-related phenomena.


Mariner 8 mission. MAY 10, 1971. KSC machine cancel. Launched on May 9, 1971. The Mariner Mars 71 Project consisted of two spacecraft ( Mariner 8 and 9 ), each of which would be inserted into a martian orbit, and each of which would perform a separate but complementary mission. The two spacecraft would have orbited the planet Mars a minimum 90 days, during which time data would be gathered on the composition, density, pressure, temperature, and topographic of the surface. The Centaur shut down 365 sec. after launch.

# ASTRONOMY, PLANETARY SCIENCE, SPACE PHYSICS : THE PIONEER 7 AND 9

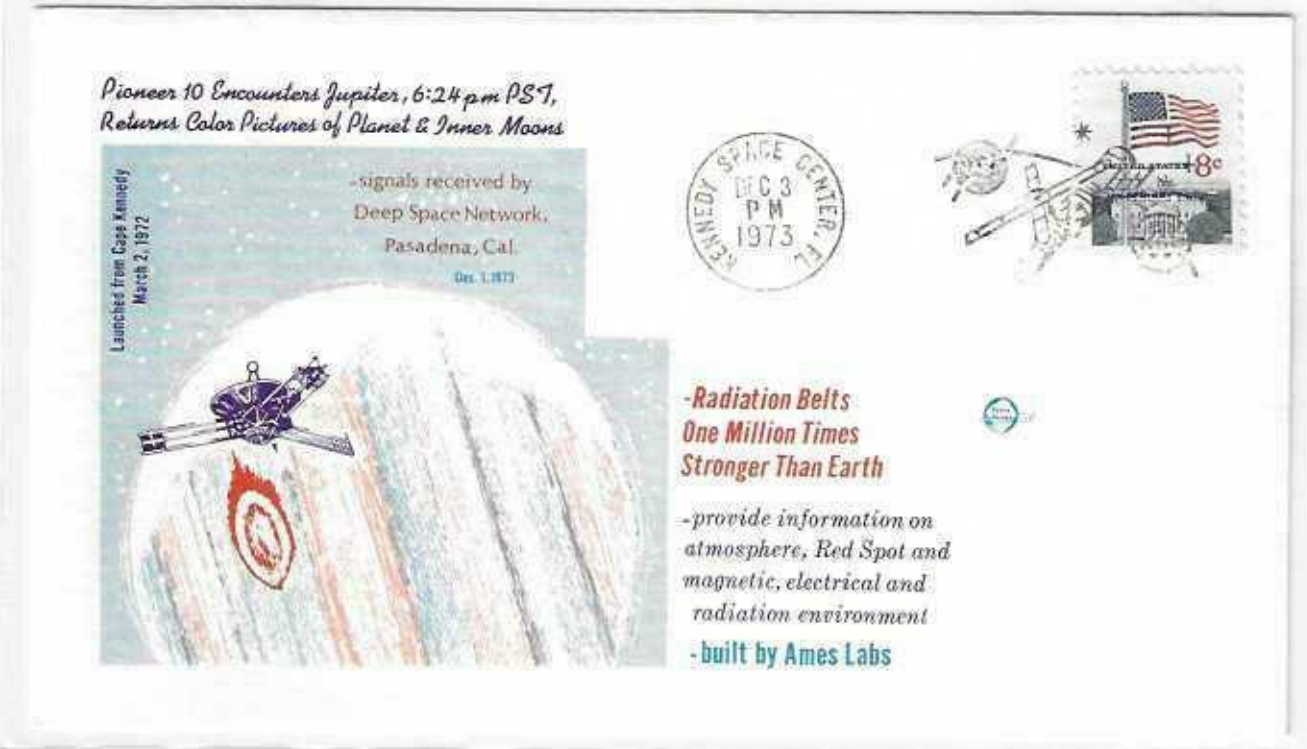



Pioneer 7 mission. AUGUST 17, 1966. Cape Canaveral manual cancel on the date and time of launch. The spacecraft carried experiments to study positive ions and electrons in the solar wind, the interplanetary electron density, solar and galactic cosmic rays,and the interplanetary magnetic field. Pioneer 6-7-8 and 9 formed a ring of solar-weather stations. Pioneer 7 recorded Earth's magnetic tail more than 19 million km from the planet, three times further than previously recorded.

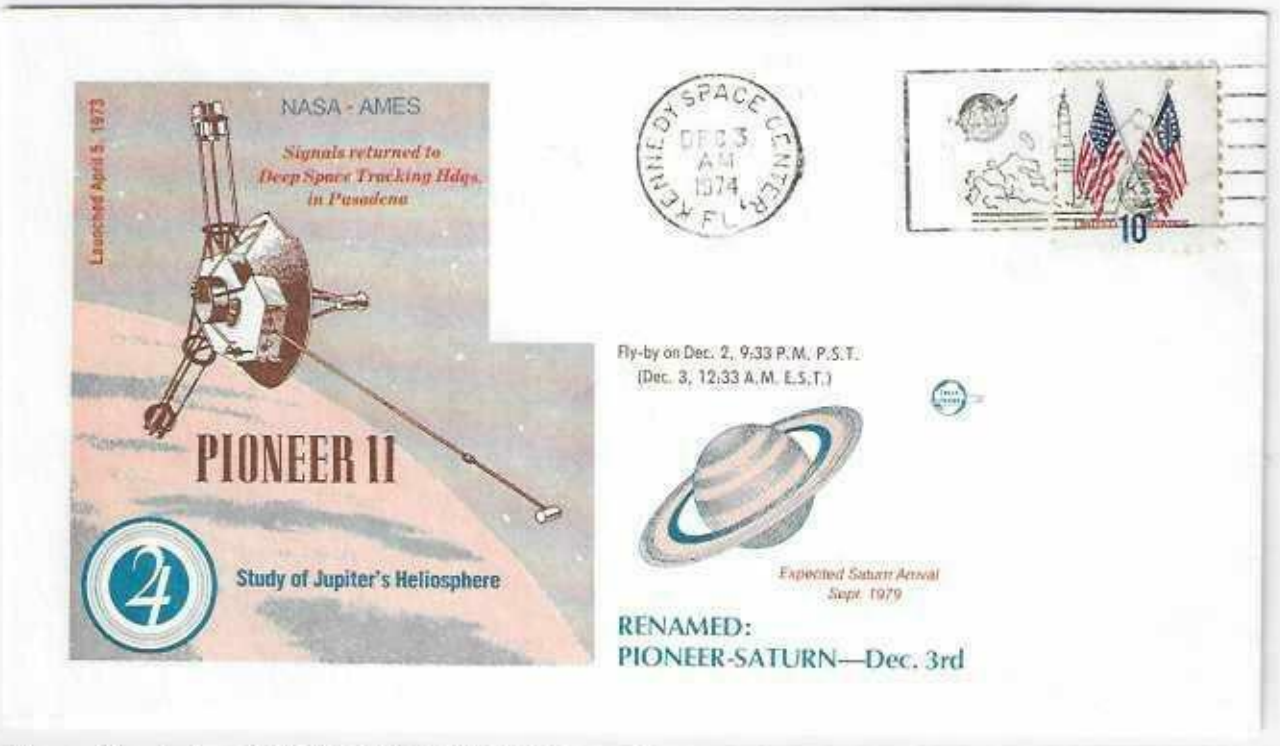



Pioneer 9 mission. NOVEMBER 8, 1968. KSC machine cancel on the date and time of launch. The solar disturbances of August 1972 produced large-scale solar wind perturbations that were detected by Pioneer 9 plasma probe, electric field detector, and magnetometer for an extended time period commencing early on August 3. It is demonstrate that no measurable signals were detected in the broad band electric field channel unless the proton density was high enough to yeld a proton plasma frequency with f greather of about 100 Hz

# ASTRONOMY, PLANETARY SCIENCE, SPACE PHYSICS : THE PIONEER 10 AND 11

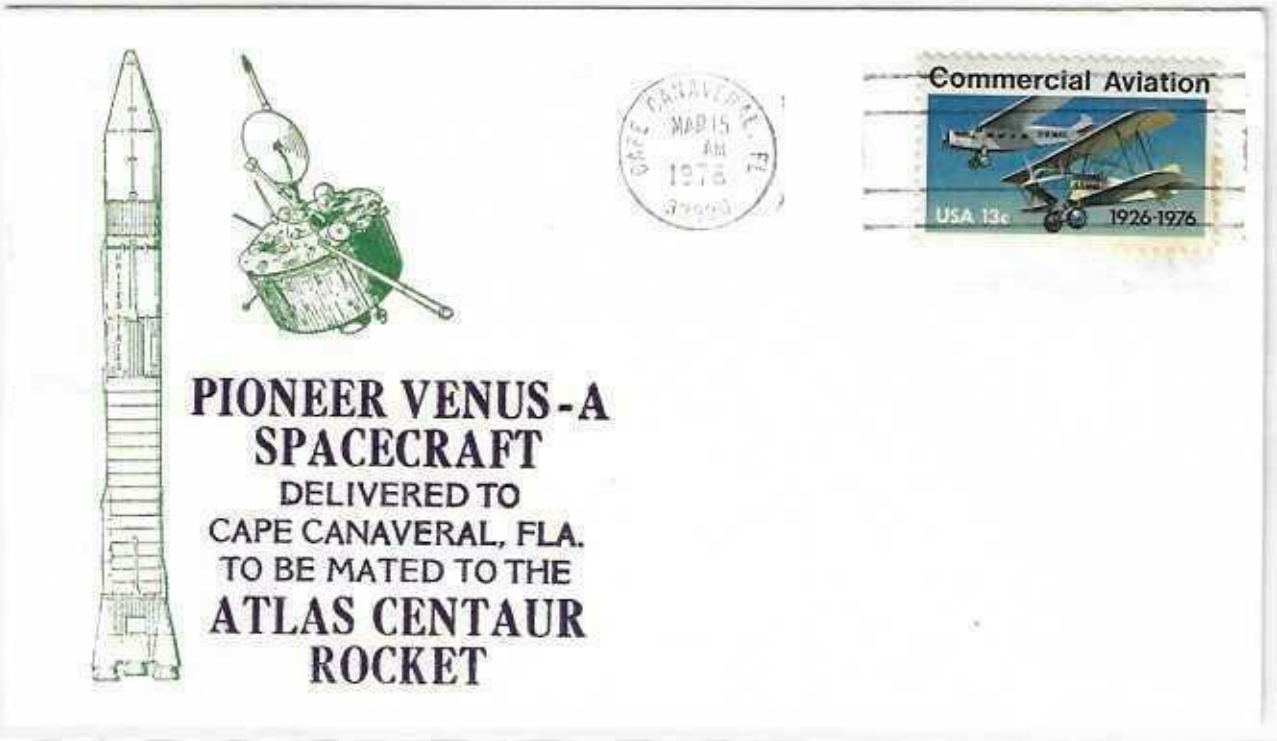



Pioneer 10 mission. DECEMBER 3, 1973. KSC machine cancel on the date and time of Jupiter encounter. The spacecraft achieved its closest approach to Jupiter on 4 December, 1973, when it reached approximately 2.8 Jovian radii, about 200,000 km. The mission was the first to be sent the outer solar system and the first to investigate the planet Jupiter, after which it followed an escape trajectory from the solar system. Fifteen experiments were carried to investigate and to photograph Jupiter and its satellites.

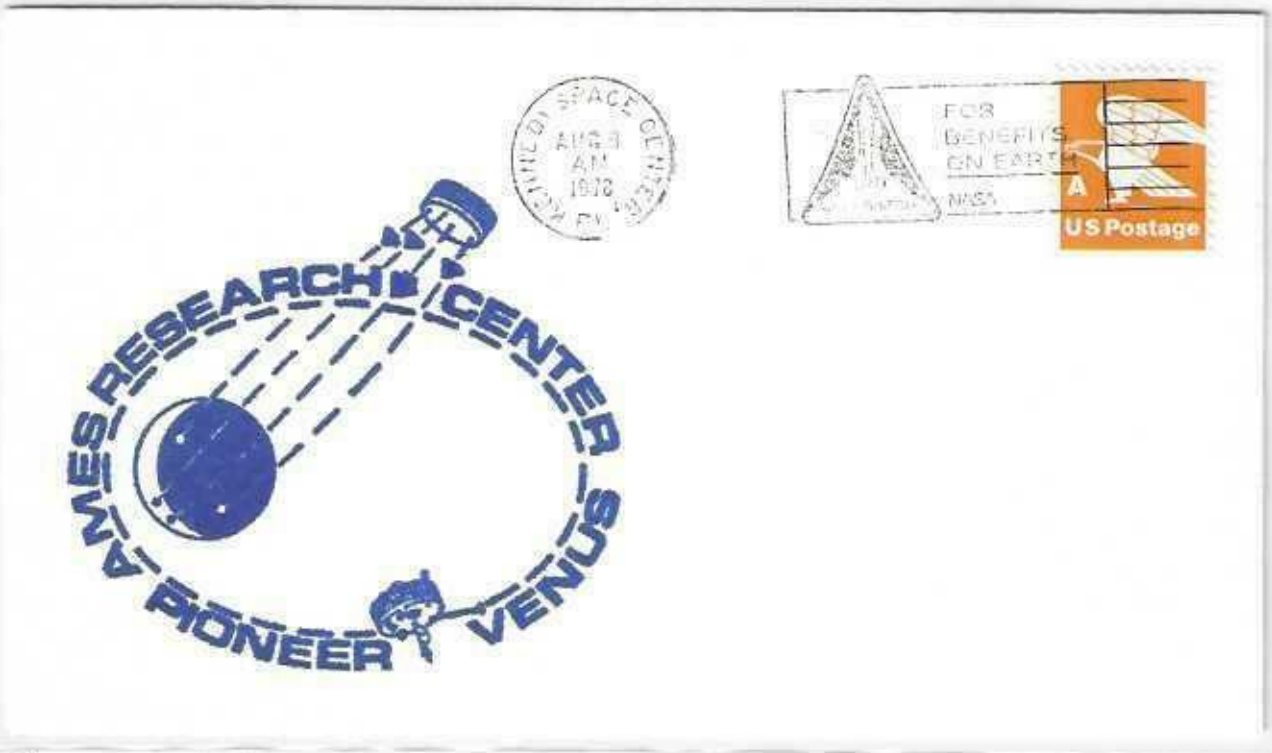



Pioneer 11 mission. DECEMBER 3, 1974. KSC machine cancel on the date and time of closest approach to Jupiter, within 43,000 km of Jupiter's cloud tops. Pioneer 11 was the first spacecraft to explore the planet Saturn and its main rings. Pioneer 11, like Pioneer 10, used Jupiter's gravitational field to alter its trajectory radically. It passed close to Saturn on 1 September 1979, at a distance of 21,000 km from Saturn's cloud tops, and then it followed an escape trajectory from the solar system.

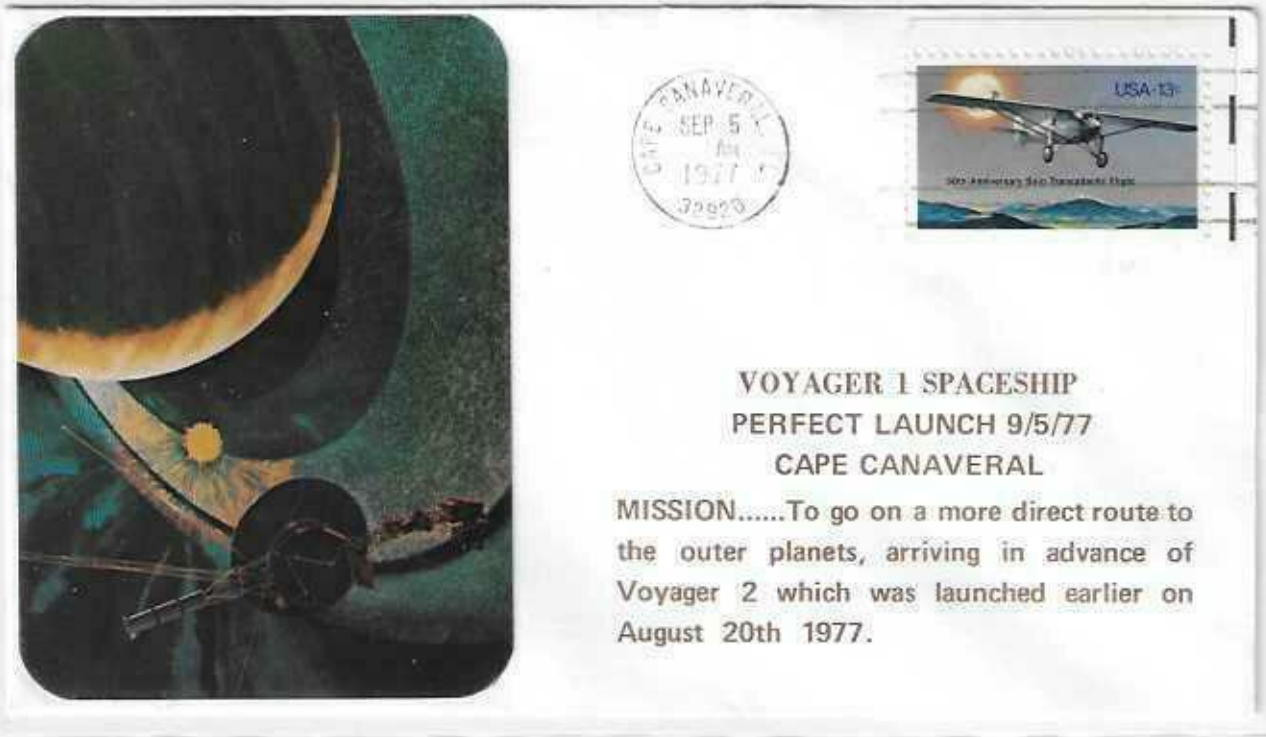
# ASTRONOMY, PLANETARY SCIENCE, SPACE PHYSICS : THE PIONEER VENUS A AND PIONEER VENUS 2




Pioneer Venus-A ( Pioneer 12 ) mission. MARCH 15, 1978. Cape Canaveral machine cancel on the date and time of delivery. Launched on May 20, 1978. The Pioneer Venus Project's main objective was to investigate the solar wind in the venusian environment, map the planet's surface through a radar imaging system, and study the characteristics of the upper atmosphere and ionosphere. Pioneer Venus consisted of two spacecraft: the orbiter and the multiprobe. It reached orbit around Venus on 4 December, 1978.




Pioneer Venus 2 ( Pioneer 13 ) mission. AUGUST 8, 1978. KSC machine cancel on the date and time of launch. Pioneer Venus 2 reached Venus on December 9, 1978. It was made of five separate probes : the probe transporter ( referred to as the BUS ), a large atmospheric entry probe ( called SOUNDER ), and 3 small probes. The Sounder released from the Bus on November 15, 1978. The three smaller probes released on November 19. The probes sent data to Earth as they descended toward the surface.

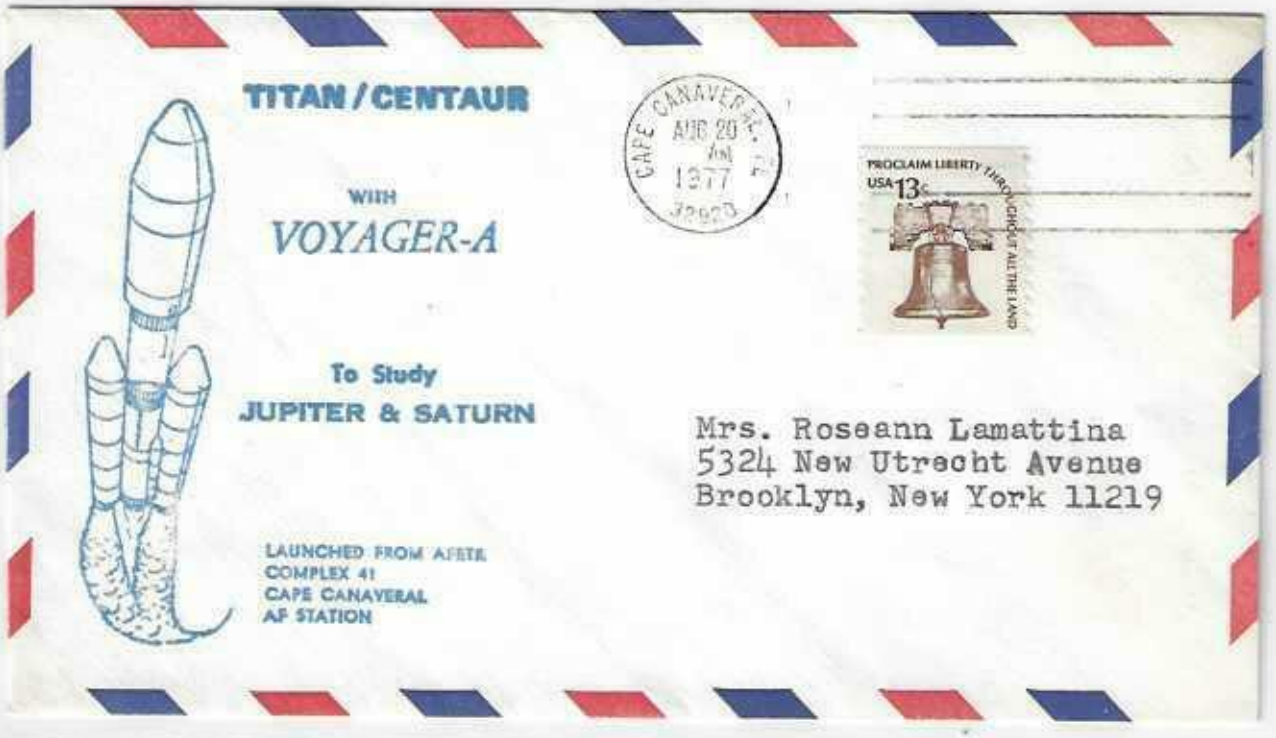



Voyager 1 mission. SEPTEMBER 5, 1977. Cape Canaveral machine cancel on the date and time of launch. Originally planned as a Grand Tour of the outer planets, including dual launches to Jupiter, Saturn, and Pluto in 1976-77, and dual launches to Jupiter, Uranus, and Neptune in 1979, budgetary constrains caused a dramatic rescoping of the project to two spacecraft, each of which would go to only Jupiter and Saturn. Although launched 16 days after Voyager 2, Voyager 1's trajectory was the quicker one to Jupiter.

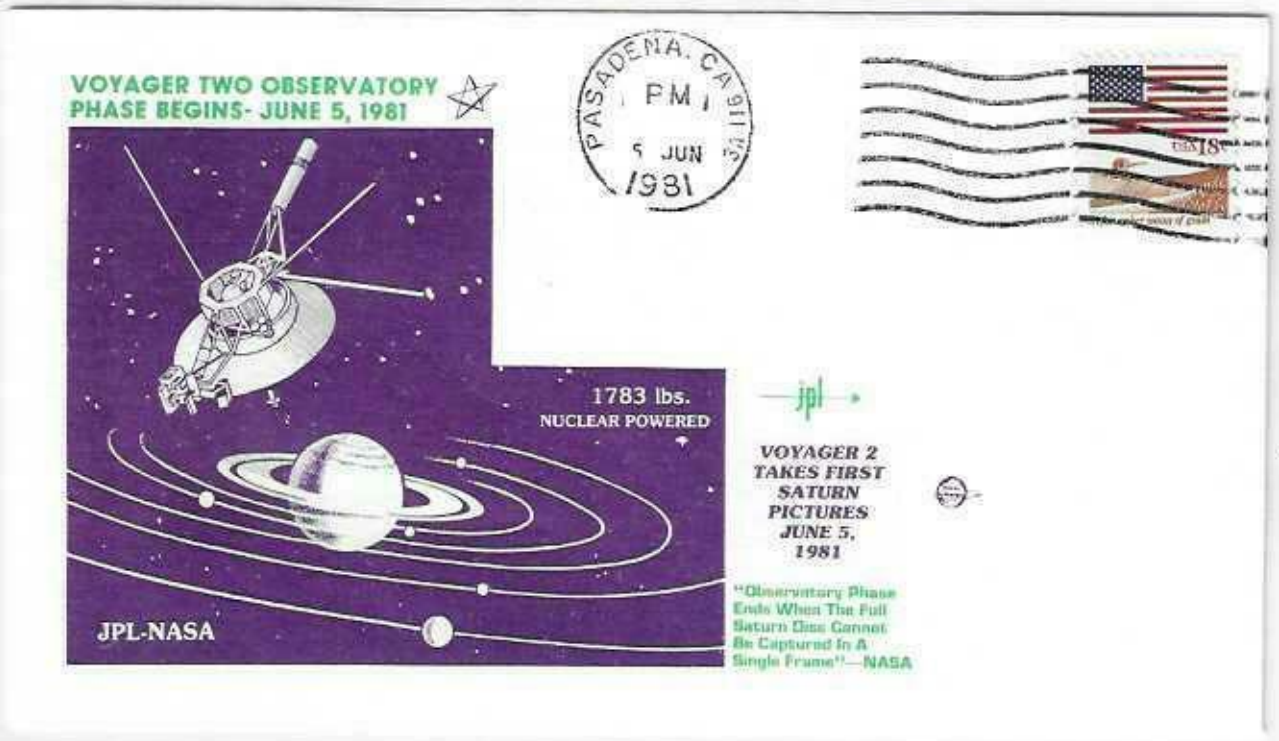

Voyager 1 mission. NOVEMBER 10, 1980. Pasadena machine cancel on the date and time of first pictures of Saturn. Each Voyager had as its major objectives at each planet to : investigate the circulation, dynamics, structure, and composition of the atmosphere, characterize the morphology, geology, and physical state of the satellites of the planet, provided improved valves for the mass, size, and shape of the planet, satellites and any rings, determine the magnetic field structure and study the energetic trapped particles and plasma therein

# ASTRONOMY, PLANETARY SCIENCE, SPACE PHYSICS : THE VOYAGER 1 AND 2


Voyager 1 mission. NOVEMBER 12, 1980. Pasadena machine cancel on the date and time of closest approach to Saturn. Some 18,000 images of Jupiter and its satellites were taken by Voyager 1. In addition, roughly 16,000 images of Saturn, its rings, and satellites were obtained. After nearly 9 years of dormancy, on 14 Feb. 1990, Voyager 1 looked back and took the first " family portrait " of the solar system, a mosaic of 60 frames of the Sun and 6 of the planets ( Venus, Earth, Jupiter, Saturn, Uranus, and Neptune ).



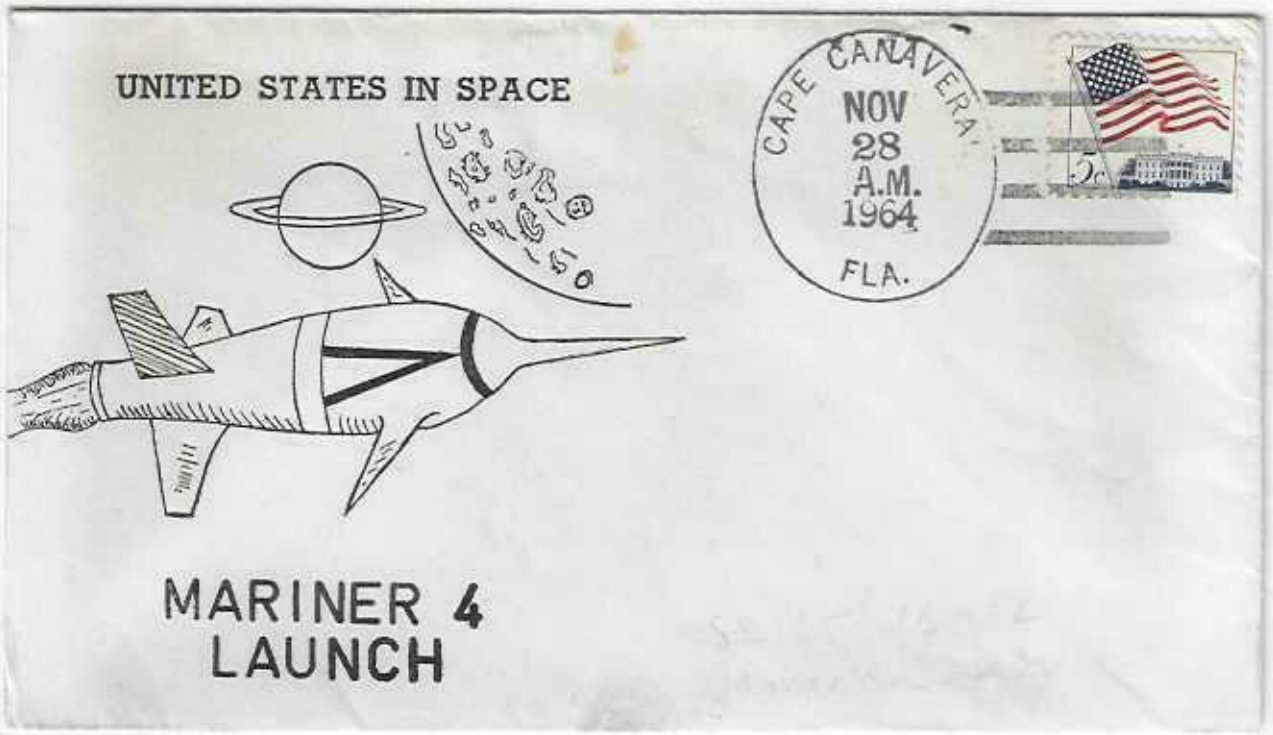

Voyager 2 mission. AUGUST 20, 1977. Cape Canaveral machine cancel on the date and time of launch. Voyager, because of its distance to Earth and the resulting time-lag for commanding, was designed to operate in a highly-autonomous manner. In order to do this and carry out the complex sequences of spacecraft motions and instruments operations, three interconnected on-board computers were utilized.




Voyager 2 mission. JUNE 5, 1981. Pasadena machine cancel on the date and time of first Saturn pictures. Although use of the backup receiver made communications with the spacecraft more difficult, engineers were able to find workarounds.Despite the difficulties encountered, scientists and engineers had been able to make Voyager enormously successful. As a result, approval was granted to extend the mission, first to Uranus, then to Neptune, and later to continue observations well past Neptune.


Voyager 2 mission. JULY 9, 1979. Cape Canaveral machine cancel on the date and time of its journey to Saturn. Voyager 2 made successful flybys of Uranus ( January 24, 1986 ), and Neptune ( August 25, 1989 ). The space probe was successfully able to obtain about 8,000 images of Uranus and its satellites. Additional improvements in the on-board software and use of image compression techniques, allowed about 10,000 images of Neptune and its satellites to be taken.

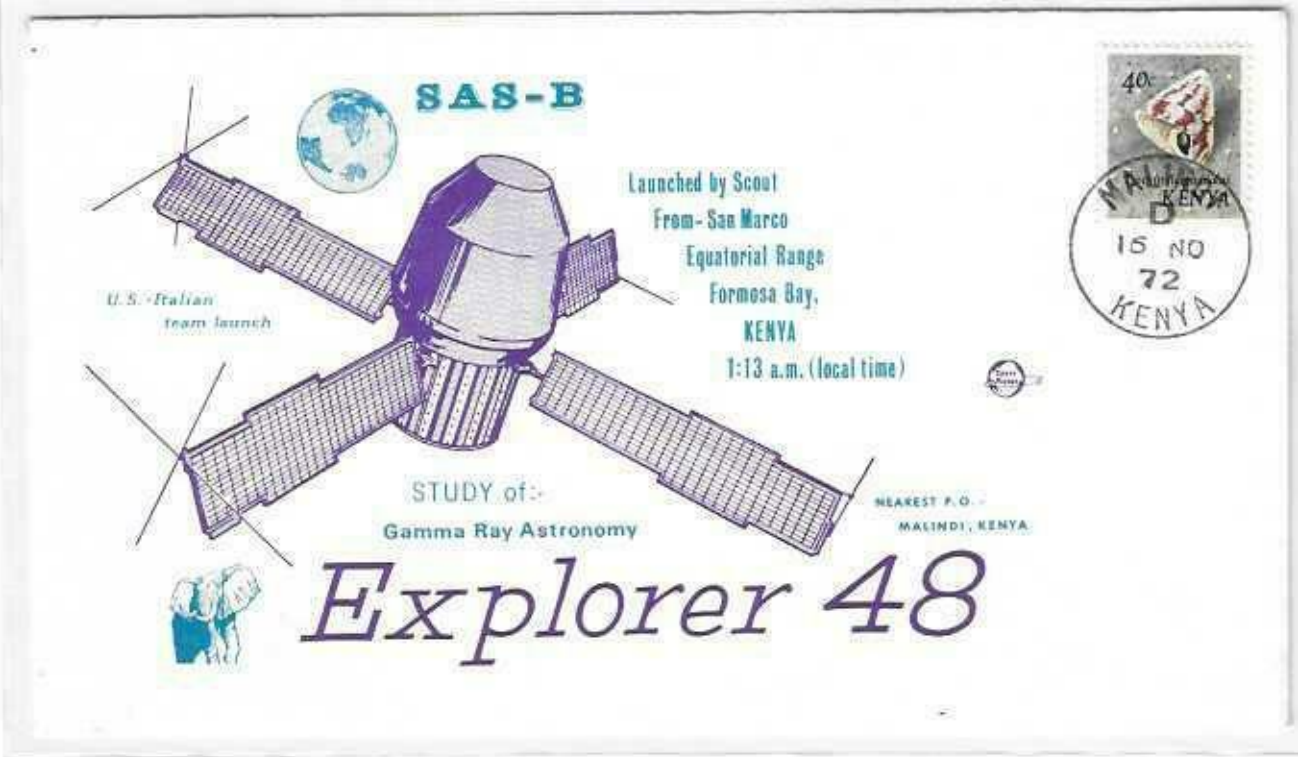
# ASTRONOMY, PLANETARY SCIENCE, SOLAR PHYSICS, SPACE PHYSICS : THE MARINER 4 AND PIONEER 6




Mariner 4 mission. NOVEMBER 28, 1964. Cape Canaveral manual cancel on the date and time of launch. This mission represented the first successful flyby of Mars, returning the first pictures of the martian surface. The closest approach was 9,846 km from the martian surface, on July 15, 1965. The images returned showed a Moon-like cratered terrain. A surface atmospheric pressure of 4.1 to 7.0 mb and daytime temperatures of -100 deg.C were estimated and no magnetic field was detected.


Pioneer 6 mission. DECEMBER 16, 1965. Patrick AFB machine cancel on the date and time of launch. It was the first in a series of solar-orbiting satellites designed to obtain measurements on a continuing basis of interplanetary phenomena from widely separated points in space. Its original design life expentancy was only 6 months. The Pioneer 6-9 program has been touted as one of the least expensive of all NASA spacecraft programs in terms of scientific results per US dollar spent.

# EXPLORER SATELLITES. ASTRONOMY : THE EXPLORER 48 AND 53




SAS-B ( EXPLORER 48 ) mission. NOVEMBER 15, 1972. Malindi manual cancel on the date and time of launch. It was the second in the series of small spacecraft designed to extend the astronomical studies in the x-ray, gamma ray, ultraviolet, visible, and infrared regions. The primary objective was to measure the spatial and energy distribution of primary galactic and extragalactic gamma radiation with energies between 20 and 300 MeV.

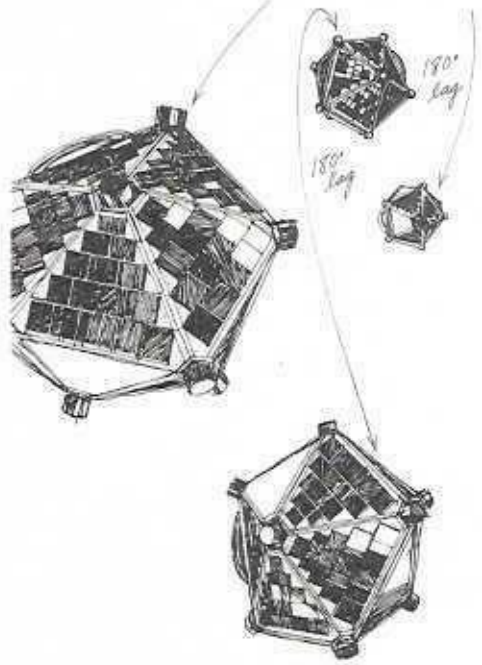

SAS-C ( EXPLORER 53 ) mission. MAY 7, 1975. Greenbelt machine cancel on the date and time of launch. The spacecraft was launched from San Marco platform into a near-circular, equatorial orbit. SAS-C was the third in the series of small spacecraft whose objectives were to survey the celestial sphere for sources radiating in the x-ray, gamma ray, and other spectrals regions.

# EARTH SCIENCE : THE EXPLORER 19 AND 24



EXPLORER 19 THE CHRISTMAS STAR SATELLITE LAUNCHED VANDENBERG AIRFORCE BASE 19th of DECEMBER 1963 VISIBLE FROM THE EARTH AS A STAR OF THE THIRD MAGNITUDE.

AD-A ( EXPLORER 19 ) mission. DECEMBER 19, 1963. Vandenberg AFB machine cancel on the date and time of launch. It was the second in a series of 3.66 m inflatable spheres placed into orbit to determine atmospheric densities. Explorer 19 was launched while Explorer 9, the first satellite in the series, was still active, so that densities in two different portions of the atmosphere were sampled simultaneously. The spacecraft was successfully orbited, but its apogee was lower than planned.






EXPLORER 24 and EXPLORER 25

Launched with single booster.
Vandenberg Air Force Base.
First time two satellites sent
into orbit at the same time.

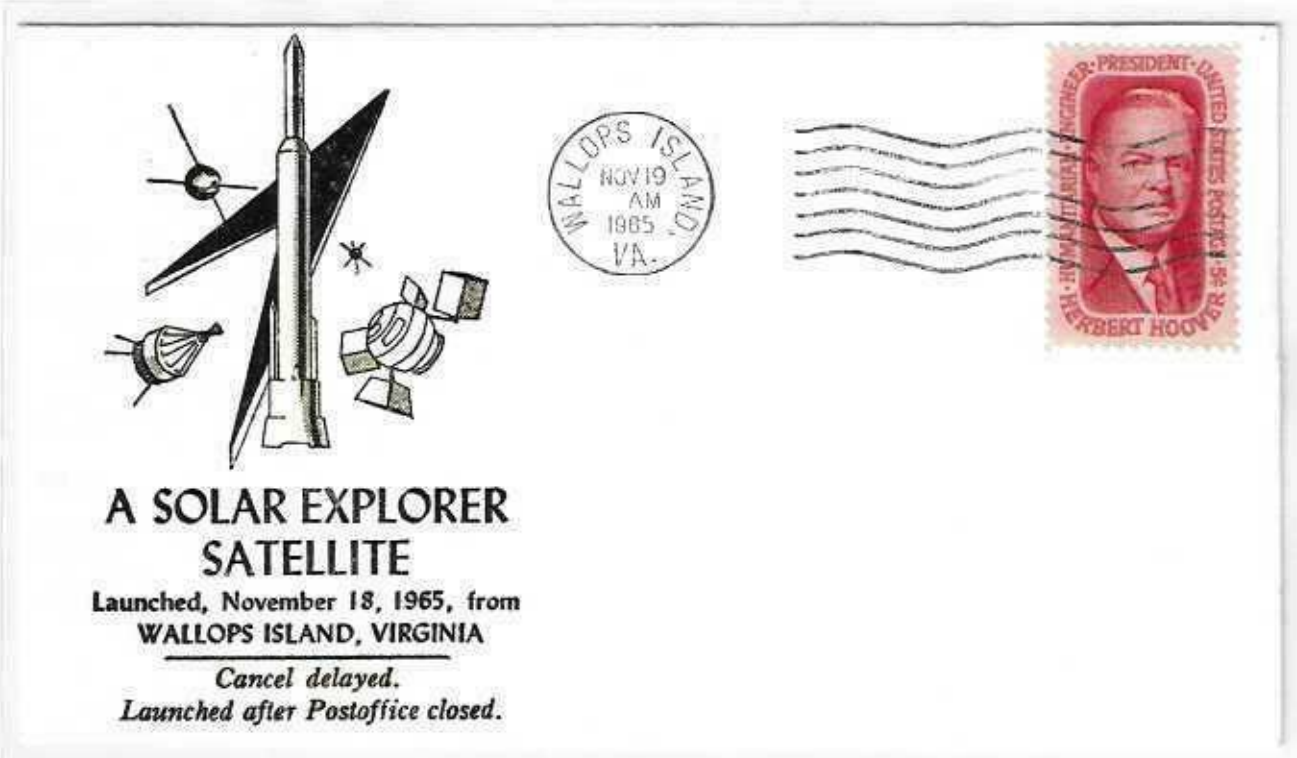
AD-B ( EXPLORER 24 ), INJUM 4 ( EXPLORER 25 ) missions. NOVEMBER 21, 1964. Vandenberg AFB machine cancel on the date and time of launch. Explorer 24 was designed to yield atmospheric density. The primary objective of Explorer 25 mission was to make measurements of the influx of energetic particles into the Earth's atmosphere, and to study atmospheric heating and the increase in scale height which have been correlated with geomagnetic activity.

# EARTH SCIENCE : THE EXPLORER 29 AND 39


GEOS 1 ( EXPLORER 29 ) mission. NOVEMBER 6, 1965. Patrick AFB machine cancel on the date and time of launch. The Geodetic Earth Orbiting Satellite spacecraft was a gravity-gradient-stabilized, solar-cell-powered unit designed exclusively for geodetic studies. It was the first successful active spacecraft of the National Geodetic Satellite Program. Acquisition and recording of data were the responsibility of the GSFC Space Tracking and Data Acquisition Network ( STADAN ).

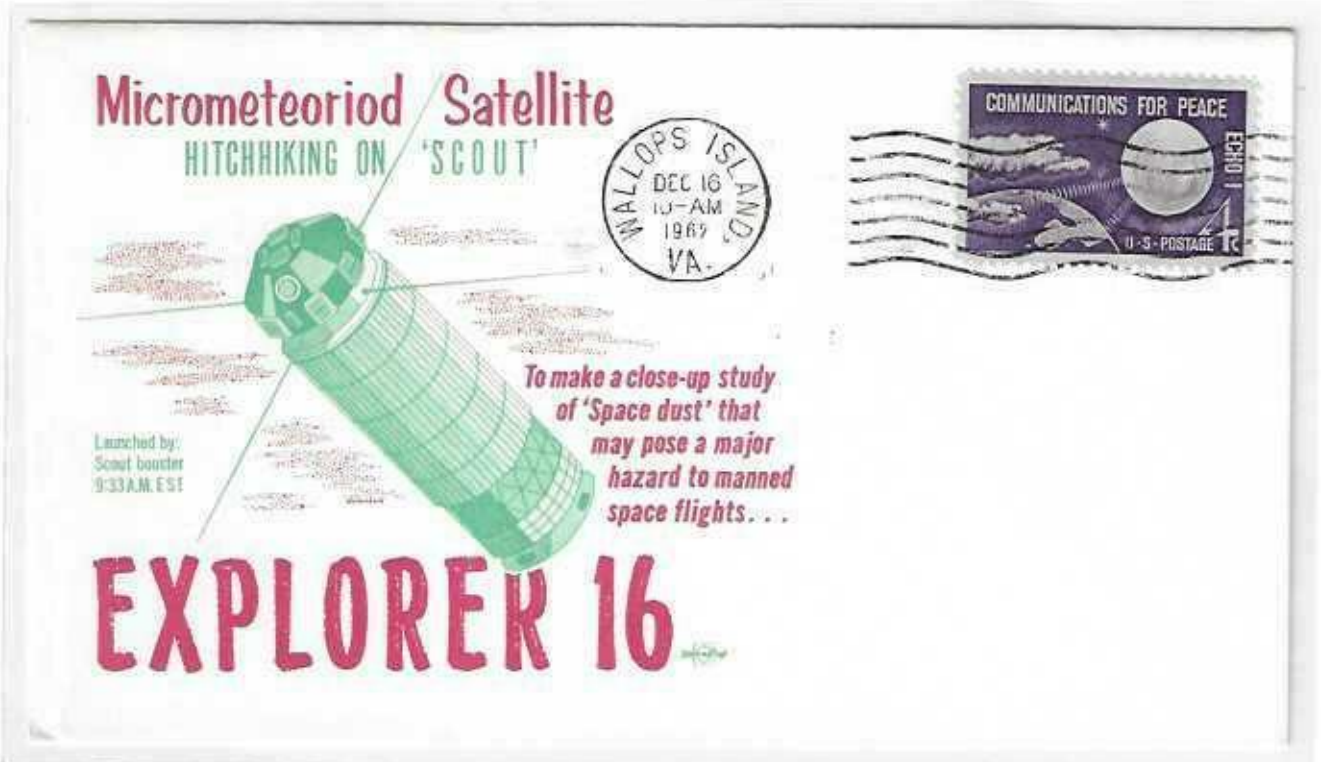

AD-C ( EXPLORER 39 ), INJUN 5 ( EXPLORER 40 ) missions. AUGUST 8, 1968. Vandenberg AFB machine cancel on the date and time of launch. Explorer 39 was an inflatable sphere. It was orbited to make atmospheric density determinations. The spacecraft was successfully launched into a nearly polar, highly elliptical orbit. It was folded and carried into orbit together with ejection and inflation equipment, as part of the payload of Explorer 40.


HCMM ( EXPLORER 58 ) mission. APRIL 26, 1978. Vandenberg AFB machine cancel on the date and time of launch. The Heat Capacity Mapping Missio spacecraft was the first of a series of Application Explorer Mission ( AEM ). The objective of HCMM was to provide comprehensive, accurate, high-spatial-resolution thermal surveys of the surface of the Earth. Only real-time data were transmitted when the satellite came within reception range of seven ground stations.




SOLRAD 8 ( EXPLORER 30 ) mission. NOVEMBER 19, 1965. Wallops Island machine cancel on the date and time of launch. The satellite was one of the SOLRAD series that began in 1960, to provide continuous coverage of solar radiation with a set of standard photometers. Data were transmitted in real time by means of an FM/AM telemetry system and were recorded by the stations on the STADAN tracking network. The satellite performed normally except for the spin system.


S55A ( EXPLORER 13 ) mission. AUGUST 25, 1961. Wallops Island manual cancel on the date and time of launch. The objectives of the flight were to test vehicle performance and guidance and to investigate the nature and effects of micrometeoroids on the spacecraft systems. The orbit was lower than planned and the spacecraft reentered the atmosphere on August 28, 1961.




S55B ( EXPLORER 16 ) mission. DECEMBER 16, 1962. Wallops Island machine cancel on the date and time of launch. The cylindrically shaped spacecraft was built around the burned-out fourth stage of the Scout launch vehicle. Its purpose was to obtain data on the near-Earth meteoroid environment, thus providing an accurate estimate of the probability of penetration in spacecraft structures by meteoroids and allowing a more confident definition of the relationship between penetration flux and material thickness to be derived.

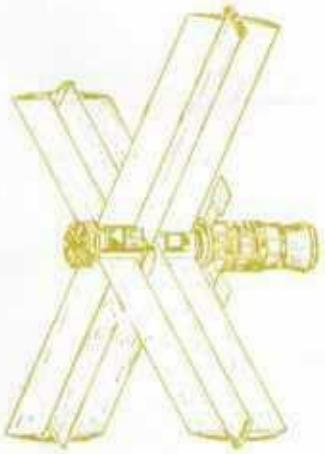
# PLANETARY SCIENCE : THE EXPLORER 23 AND 46


## EXPLORER XXIII

NASA launches meteoroid detection satellite from U.S. rocket launching station at Wallops Island, Virginia. Its primary purpose is to provide future manned space craft with the accurate knowledge of the penetration capabilities of space debris, thereby safeguarding the lives of our spacemen and paving the way for passenger service to the stars.

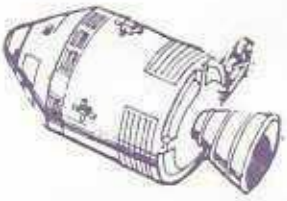
S55C ( EXPLORER 23 ) mission. NOVEMBER 6, 1964. Wallops Island machine cancel on the date and time of launch. The satellite was the third in the series of S55 micrometeoroid satellite orbited by NASA. The spacecraft operated satisfactorily during its 1 year life, and all mission objectives were accomplished, except for the cadmium sulfide cell detector experiment, which was damaged on liftoff and provided no data.

## EXPLORER - 46



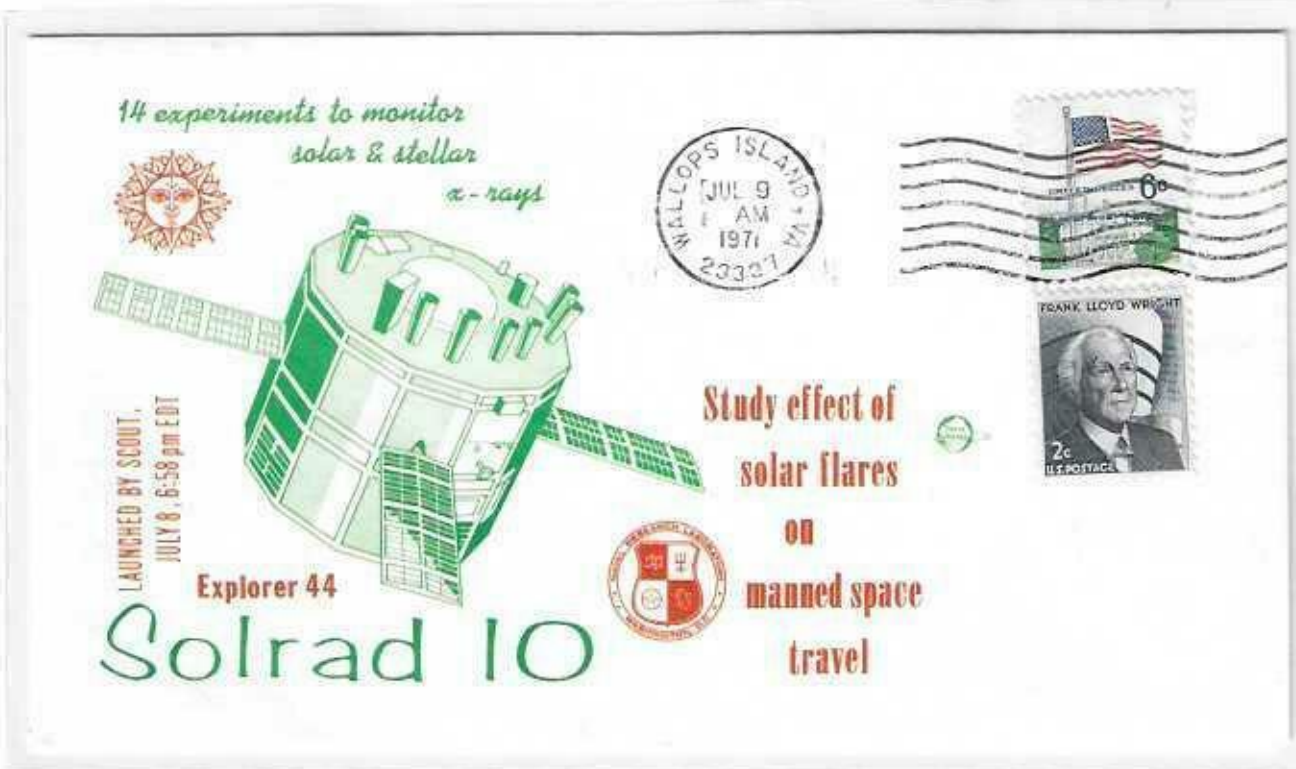
To Gather Data On Meteoroid Penetration Rates
On Spacecraft Impacting At 45 Miles Per Second.
Test Ability Of Bumper Sheet Concept To Protect
Spacecraft. Check On Meteoroid Speeds & Quantities



Meteoroid Technology Satellite ( EXPLORER 46 ) mission. AUGUST 13, 1972. Wallops Island machine cancel. Launched on August 13, the objectives were to measure the meteoroids penetration rates in the bumper-protected target, and to obtain data on meteoroid velocity and flux distribution. Bumper targets extended from the satellite, giving it an overall widt of 701.5 cm.

# SOLAR PHYSICS : THE EXPLORER 37 AND 44


SOLRAD 9 ( EXPLORER 37 ) mission. MARCH 5, 1968. Wallops Island machine cancel on the date and time of launch. This NRL satellite was one of the SOLRAD series that began in 1960 to provide continuous coverage of solar radiation with a set of standard photometers. Individual scientists and institutions were invited to receive and use the data transmitted on the 136 MHz telemetry band on the standard IRIG channels 3 trough 8.




SOLRAD 10 ( EXPLORER 44 ) mission. JULY 9, 1971. Wallops Island machine cancel. Launched on July 8, by a Scout rocket. It was a spin-stabilized satellite, was one of the SOLRAD series designed to provide continuous coverage of wavelength and intensity changes in solar radiation in the UV, soft, and hard x-ray regions. Eighteen solar sensors were mounted pointing parallel to the spin axis of the satellite, which pointed directly at the solar disc.

# SPACE PHYSICS : THE EXPLORER 4 AND 12


EXPLORER 4 mission. JULY 26, 1958. Patrick AFB machine cancel on the date and time of launch. It was a cylindrically shaped satellite instrumented to make the first detailed measurements of charged particles ( protons and electrons ) trapped in the terrestrial radiation belts. An unexpected tumble motion of the satellite made the interpretation of the detector data very difficult. The spacecraft decayed from orbit after 454 days, on October 23, 1959.


EPE-A ( EXPLORER 12 ). AUGUST 15, 1961. Port Canaveral manual cancel. Launched on August 16 by a Thor-Delta rocket. It was a spin-stabilized, solar-cell-powered spacecraft instrumented to measure cosmic ray particles, trapped particles, solar wind protons, and magnetospheric and interplanetary magnetic fields. It was the first of the S 3 series of spacecraft, which also included Explorers 14, 15 and 26. Good data were recorded for approximately 90% of the active lifetime of spacecraft.

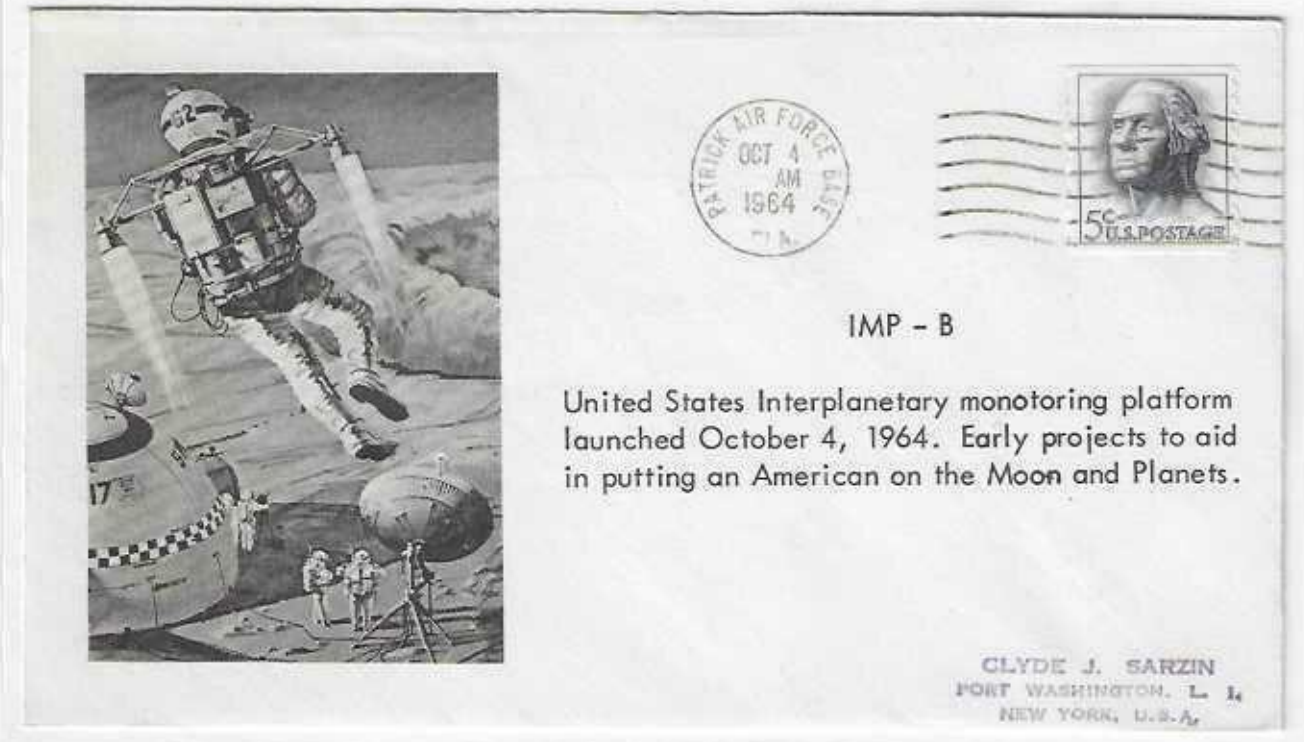
# SPACE PHYSICS : THE EXPLORER 14 AND 15


EPE-B ( EXPLORER 14 ) mission. OCTOBER 3, 1962. Launched on October 2 by a Thor-Delta rocket. The time required to sample the 16 channels ( one frame period ) was 0.323 s. Half of the channels were used to convey eight-level digital information, and the others were used for analog information. Good data were recorded for approximately 85% of the active lifetime of the spacecraft. On August 11, 1963, the encoder malfunctioned terminating the transmission of usable data.


EPE-C ( EXPLORER 15 ) mission. OCTOBER 28, 1962. Cape Canaveral manual cancel. Launched on October 27. The backup payload for Explorer 14 was modified and used for Explorer 15. The instrumentation included three sets of particle detectors to study both electrons and protons, and a two-axis fluxgate magnetometer to determine magnetic aspect. During launch the spacecraft failed to despin. The spin rate ranged from 72.9 to 73.2 rpm during the life of the spacecraft.

# SPACE PHYSICS : THE EXPLORER 18 AND 21

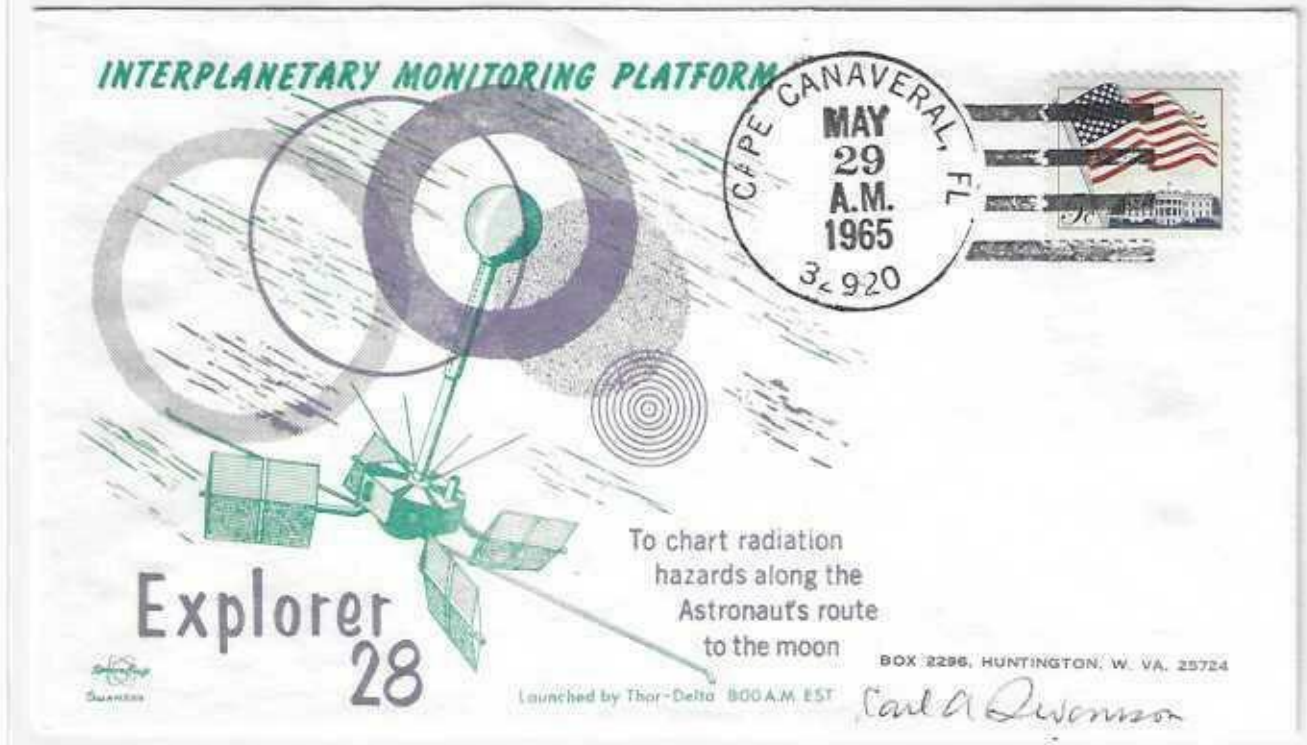

IMP-A ( EXPLORER 18 ) mission. NOVEMBER 27, 1963. Cape Canaveral machine cancel on the date and time of launch. It was a solar-cell and chemical-battery powered spacecraft instrumented for interplanetary and distant magnetospheric studies of energetic particles, cosmic rays, magnetic fields, and plasma. After every third normal sequence there was an 81.9 interval of rubidium vapor magnetometer analog data transmission.




IMP-B ( EXPLORER 21 ) mission. OCTOBER 4, 1964. Patrick AFB machine cancel on the date and time of launch. The significant deviation of the spin rate and direction from the planned values and the achievement of an apogee of less than half the planned value adversely affected data usefulness. Otherwise, spacecraft systems performed well, with nearly complete data transmission for the first four months and for the sixth mounth after launch.

# SPACE PHYSICS : THE EXPLORER 26 AND 28


EPE-D ( EXPLORER 26 ) mission. DECEMBER 21, 1964. Cape Canaveral manual cancel on the date and time of launch. It was a spin-stabilized, solar-cell powered spacecraft instrumented to measure trapped particles and the geomagnetic field. The initial spin rate was 33 rpm. The spin rate decreased with time to 2 rpm on September 9, 1965. For the balance of its life, the spacecraft was coning or tumbling at a rate of about 1 rpm. On May 26, 1967, the telemeter failed.



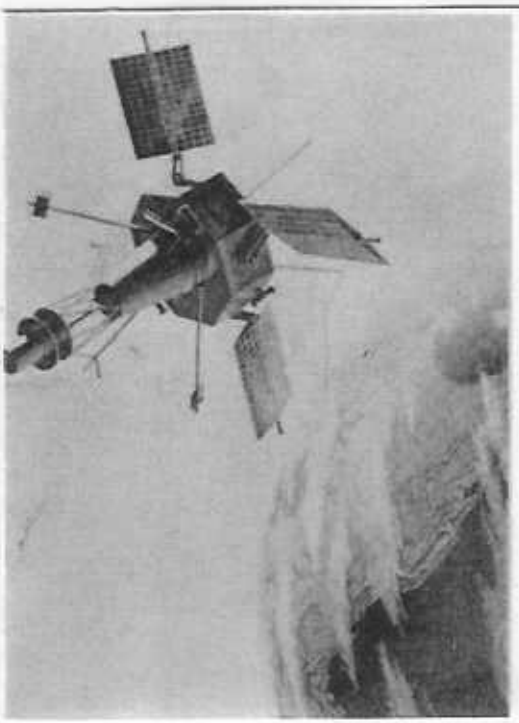

IMP-C ( EXPLORER 28 ) mission. MAY 29, 1965. Cape Canaveral manual cancel on the date and time of launch. It was a solar-cell and chemical-battery powered spacecraft instrumented for interplanetary and distant magnetospheric studies of energetic particles, cosmic rays, magnetic field, and plasmas. After every third normal telemetry sequence there was an 81.9 s interval of rubidium vapor magnetometer analog data transmission. Performance was essentially normal until late April 1967.

# SPACE PHYSICS : THE EXPLORER 31 AND 34


DME-A ( EXPLORER 31 ) mission. NOVEMBER 28, 1965. Vandenberg AFB machine cancel. Launched on November 29 by a Thrust Augmented Thor-Agena B. It was a small ionospheric observatory instrumented to make direct measurements of selected ionospheric parameters at the spacecraft. It carried seven experiments. Some difficulties were encountered in obtaining attitude information that was necessary for the reduction of the experiment observations.


IMP-F ( EXPLORER 34 ) mission. MAY 24, 1967. Vandenberg AFB machine cancel on the date and time of launch. The spin-stabilized spacecraft was placed into a high-inclination, highly eccentric Earth orbit. Like the earlier IMPs, this spacecraft was instrumented to study interplanetary magnetic fields, energetic particles, and plasma. The spacecraft optical aspect system failed on 4 March, 1969. Otherwise, useful data were acquired until just before spacecraft reentry, which occurred on 3 May, 1969.

# SPACE PHYSICS : THE EXPLORER 41 AND 50



VANDENBERG AFB, CA 93437
JUN 21
AM
1969

6c
FRANKLIN D. ROOSEVELT
U.S. POSTAGE

INTERPLANETARY MONITORING PLATFORM (IMP-G) DESIGNATED EXPLORER 41 CARRIES 12 INDIVIDUAL EXPERIMENTS DESIGNED TO STUDY SOLAR PLASMA MAGNETIC FIELDS AND COSMIC RAYS.

C. SARZIN
PORT WASHINGTON
L. I., NEW YORK

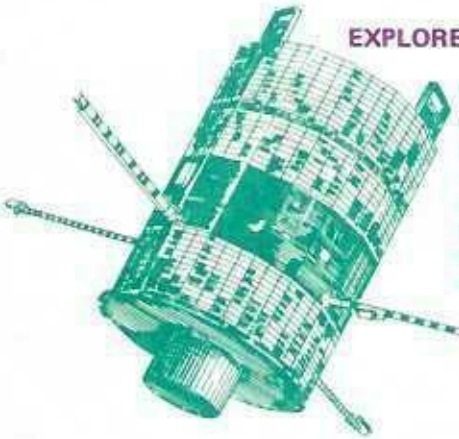
IMP-G ( EXPLORER 41 ) mission. JUNE 21, 1969. Vandenberg AFB machine cancel on the date and time of launch. It was a spin-stabilized spacecraft placed into a high-inclination, highly elliptic orbit to measure energetic particles, magnetic fields, and plasma in cislunar space. The spacecraft functioned very well from launch until it decayed from orbit on December 23, 1972. Data transmission was nearly 100% for the spacecraft life, except for the interval from November 15, 1971, to February 1, 1972.

# IMP-J

INTERPLANETARY MONITORING PLATFORM
WEIGHT: 371 KG(818 LBS)/PROJECTED LIFE: 2 YEARS

EXPLORER 50

KENNEDY SPACE CENTER, FL
OCT 25
PM
1973



WILL STUDY CISLUNAR RADIATION ENVIRONMENT, INTERPLANETARY MAGNETIC FIELD, EARTH'S MAGNETOSPHERE.

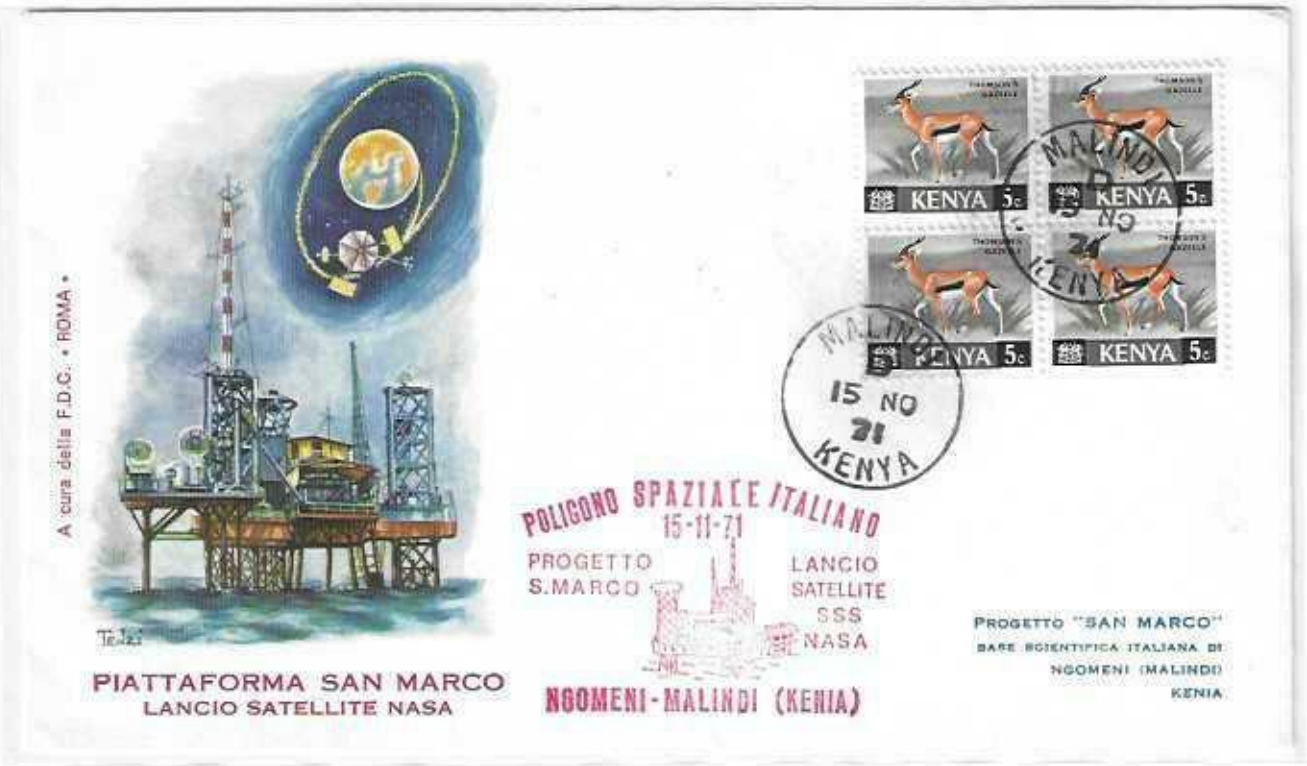

DEVELOP SOLAR-FLARE PREDICTION CAPABILITY AND DETERMINE RADIATION HAZARD FOR MANNED MISSIONS TO THE PLANETS

LAUNCHED BY DELTA, OCTOBER 25, 10:26 P.M.

Sec. 73/15 No. 29

IMP-J ( EXPLORER 50 ). OCTOBER 25, 1973. KSC machine cancel. Launched on October 26. It was the last satellite of the IMP series, instrumented for interplanetary and magnetotail studies of cosmic rays, energetic solar particles, plasma, and electric and magnetic fields. Telemetry acquisition resumed after about three months at Canberra only ( 30-50% coverage ), as an adjunct to the Voyager and Ulysses missions. The last useful science data from IMP-J was acquired on October 7, 2006.

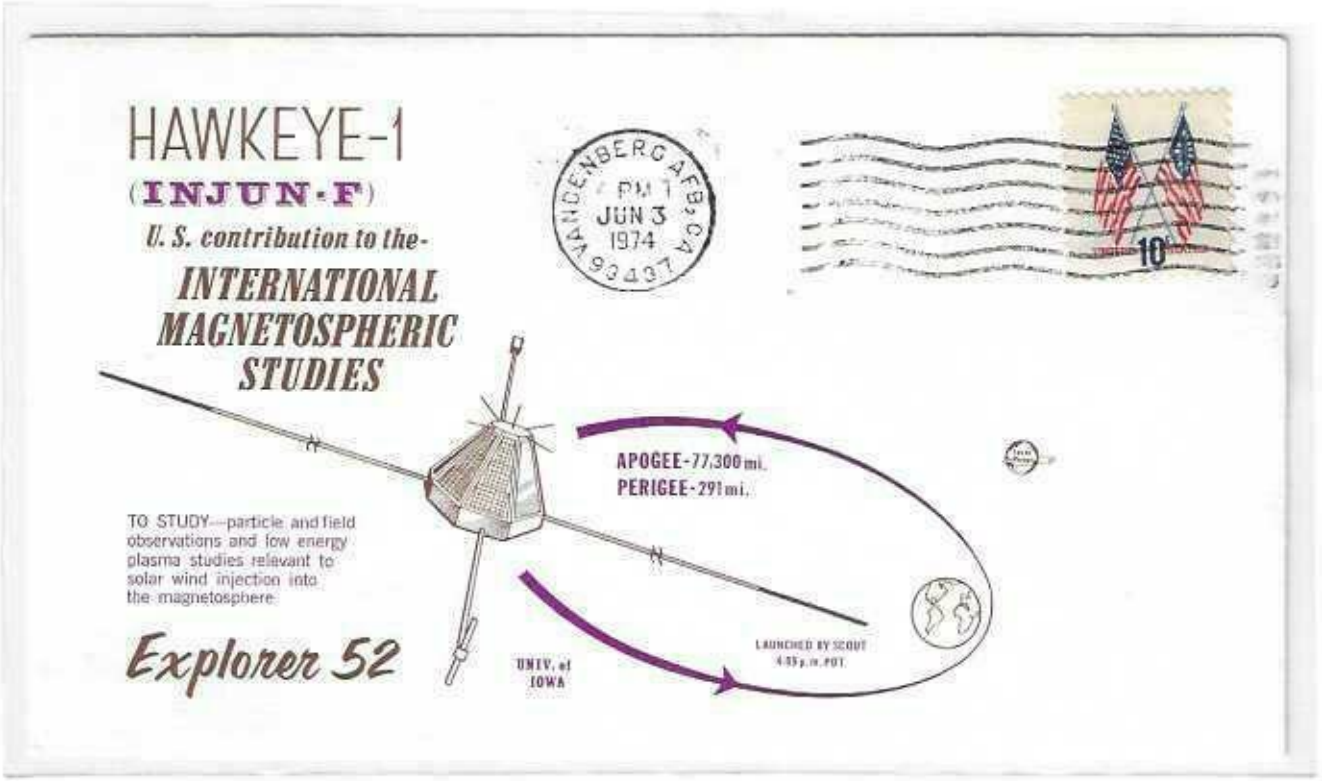
# SPACE PHYSICS : THE EXPLORER 45



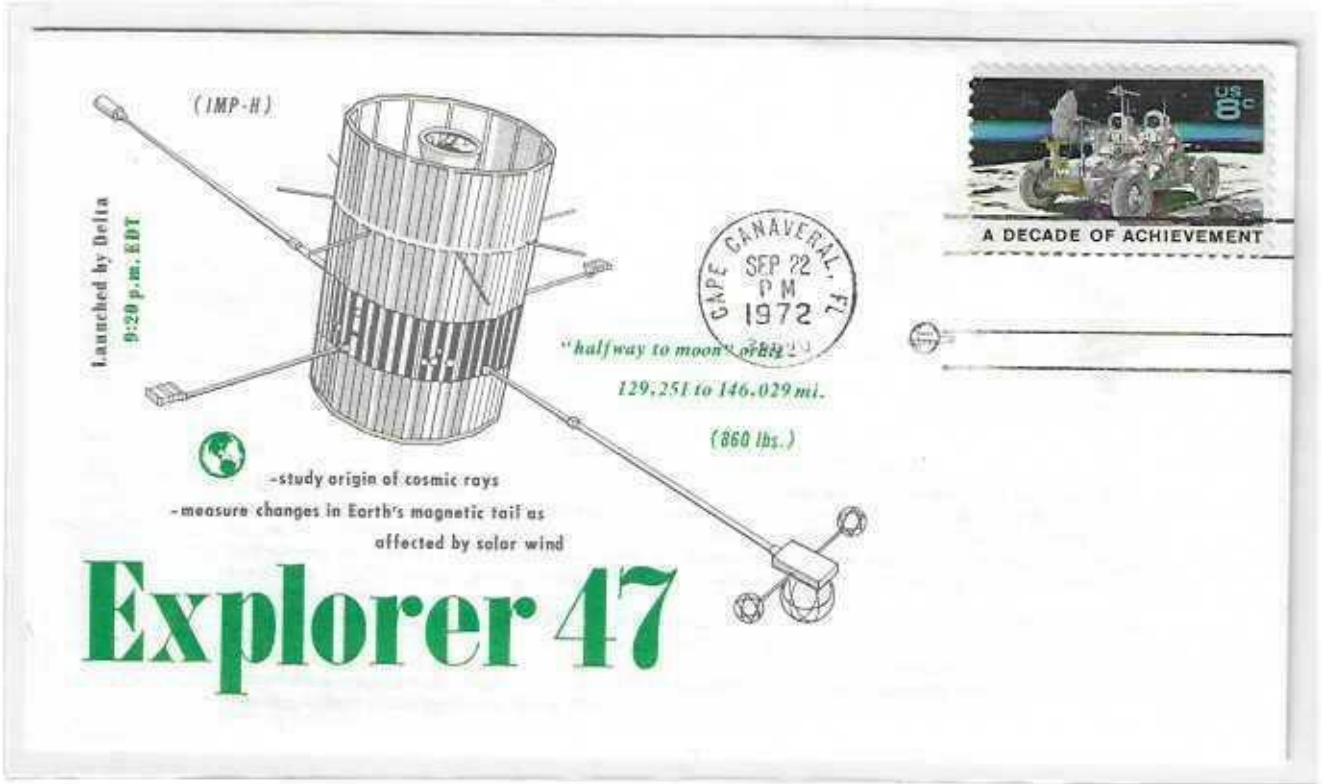

S-Cubed A mission ( EXPLORER 45 ). NOVEMBER 15, 1971. Malindi manual cancel on the date of launch. Launched by a Scout rocket, Explorer 45 was designed to perform a wide variety of investigations within the magnetosphere with regards to particle fluxes, electric fields, and magnetic fields. Its primary scientific objectives were to : study the characteristics and origin of the Earth's ring current and development of the main-phase magnetic storms; study the relations between magnetic storms, substorms, and the acceleration of charged particles within the inner magnetosphere.


S-Cubed A mission ( EXPLORER 45 ). NOVEMBER 15, 1971. Mombasa machine cancel on the date and time of launch. The satellite contained two transmitters. The antenna system consisted of four dipole antennas spaced 90 deg. apart on the surface of the spacecraft cover. The satellite power system consisted of a rechargeable battery and an array of solar cells.

SPACE PHYSICS : THE EXPLORER 52
SOLAR PHYSICS, SPACE PHYSICS : THE EXPLORER 47

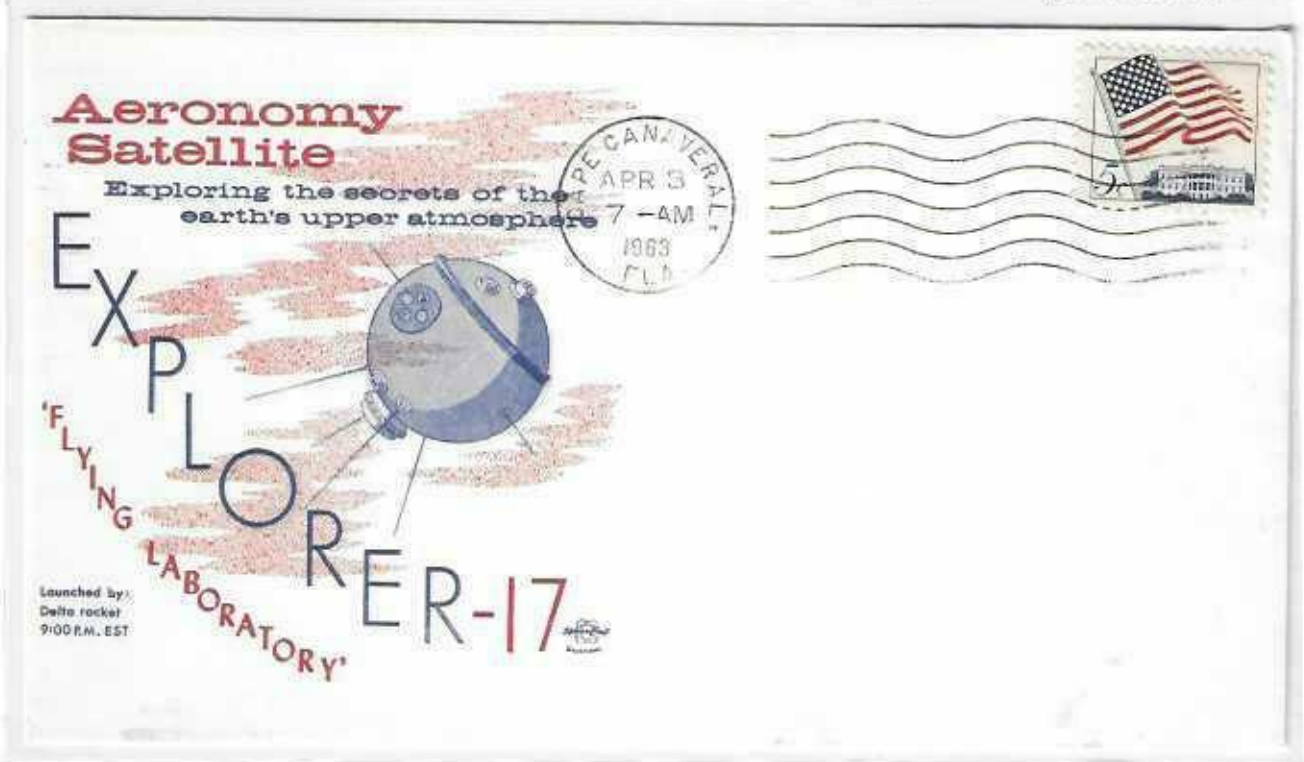



HAWKEYE ( EXPLORER 52 ) mission. JUNE 3, 1974. Vandenberg AFB machine cancel on the date and time of launch. The primary mission objective was to conduct particles and fields investigations of the polar magnetosphere of the Earth out to 21 Earth radii. The mission participated in the International Magnetospheric Study ( IMS ), and during the first half of 1977 data acquisition was confined to IMS.




IMP-H ( EXPLORER 47 ) mission. SEPTEMBER 22, 1972. Cape Canaveral machine cancel. Launched on September 23. IMP-H continued the study begun by earlier IMP spacecraft of the interplanetary and magnetotail regions from a nearly circular orbit, near 37 Earth radii. It was designed to measure energetic particles, plasma, and electric and magnetic fields. The spacecraft was turned off on October 31, 1978.


Explorer 7 mission. OCTOBER 13, 1959. Port Canaveral manual cancel on the date and time of launch. The mission was designed to measure solar x-ray and Lyman alpha flux, trapped energetic particles, and heavy primary cosmic rays. The spacecraft was powered by approximately 3,000 solar cells mounted on both the upper and lower shells. Additional power was provided by 15 nickel-cadmium batteries. Useful real-time data were transmitted from launch through February 1961, and intermittently until August 24, 1961.




AE-A ( EXPLORER 17 ) mission. APRIL 3, 1963. Cape Canaveral machine cancel on the date and time of launch. Explorer 17 carried four pressure gauges for the measurement of total neutral particle density, two mass spectrometers for the measurement of certain neutral particle concentrations, and two electrostatic probes for ion concentration and electron temperature measurements. Battery power failed on July 10, 1963. One spectrometer malfunctioned , and the other operated intermittently.

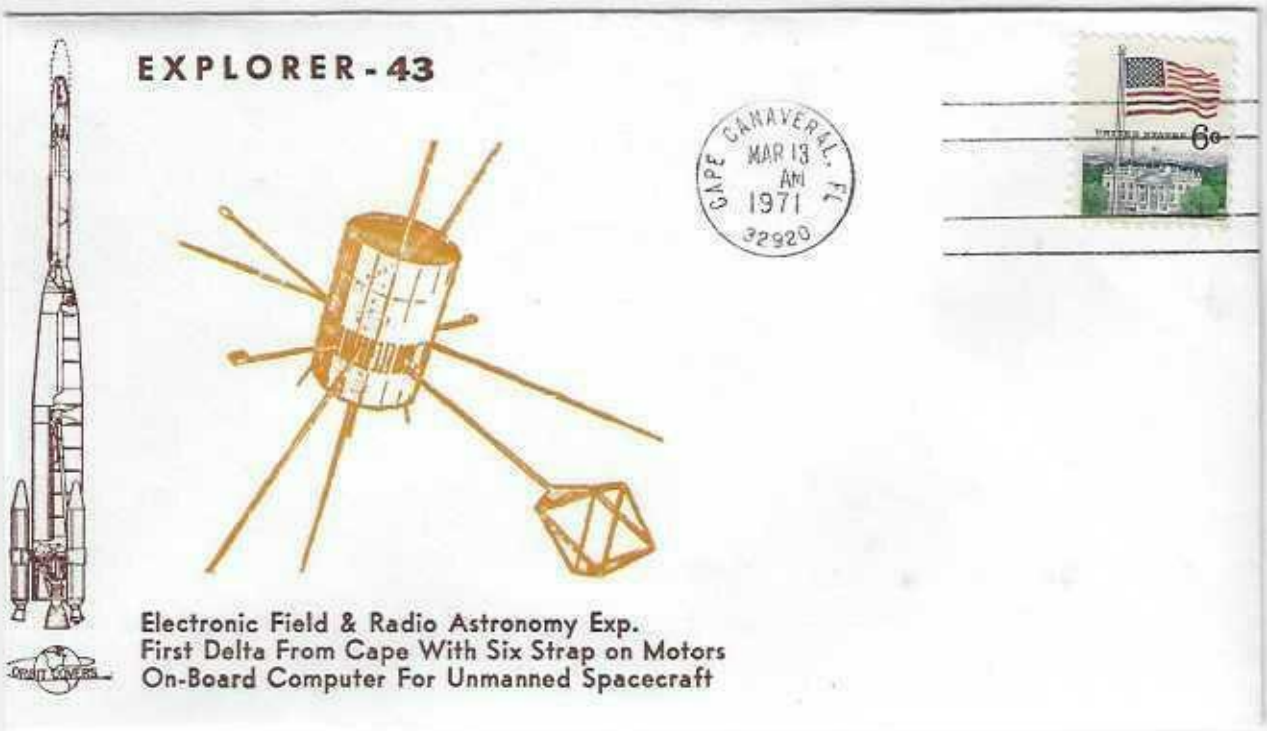
## ASTRONOMY, SPACE PHYSICS : THE EXPLORER 20


IE-A ( EXPLORER 20 ) mission. AUGUST 25, 1964. Vandenberg AFB machine cancel on the date and time of launch. The satellite was designed to measure electron distribution, ion density and temperature, and to estimate cosmic noise levels between 2 and 7 Mhz. The satellite was a small ionospheric observatory instrumented with a six-frequency ionospheric sounder and a ion probe. Telemetry stations were located to provide primary data coverage near 80 deg.W plus areas near Hawaii, Singapore, the UK, Australia, Africa.

## SPACE PHYSICS, SOLAR PHYSICS, EARTH SCIENCE : THE EXPLORER 55


AE-E ( EXPLORER 55 ) mission. NOVEMBER 19, 1975. KSC machine cancel on the date and time of launch. The purpose of the Atmospheric Explorer-E mission was to investigate the chemical processes and energy transfer mechanisms that control the structure and behavior of the Earth's atmosphere and ionosphere in the region of high absorption of solar energy at low and equatorial latitudes.

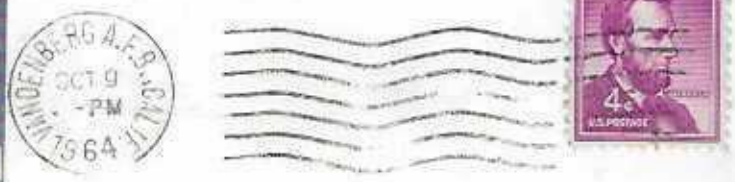
# ASTRONOMY, SPACE PHYSICS : THE EXPLORER 43 AND 56




IMP-I ( EXPLORER 43 ) mission. MARCH 13, 1971. Cape Canaveral machine cancel on the date and time of launch. IMP-I continued the study of the interplanetary and outer magnetospheric regions. A radio astronomy experiment was also included in the payload. Three orthogonal pairs of dipole antennas were used for the electric fields experiments. The members of the pair used in both the electric field and radio astronomy experiments extended 45.5 m.


ISEE 1 ( EXPLORER 56 ) mission. OCTOBER 22, 1977. Cape Canaveral machine cancel on the date and time of launch. The Explorer-class mother spacecraft, International Sun-Earth Explorer 1, was part of the mother/daughter/heliocentric mission. The mother/daughter portion of the mission consisted of two spacecraft ( ISEE 1 and 2 ) with stationkeeping capability in the same highly eccentric geocentric orbit with an apogee of 23 Earth radii. Both ISEE 1 and ISEE 2 reentered the Earth's atmosphere during orbit 1,518, on September 26, 1987.

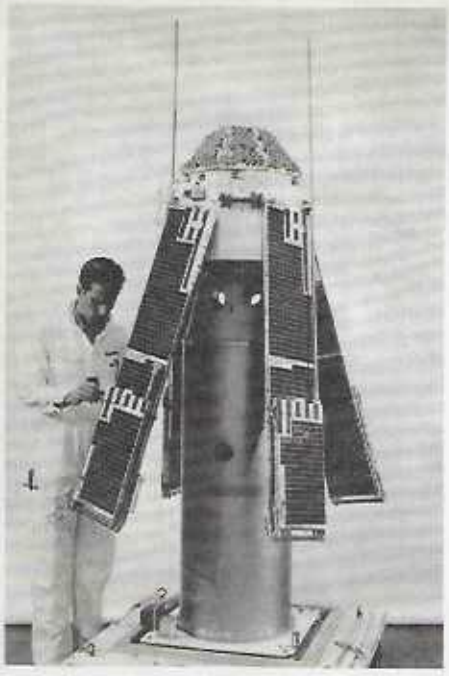
# EARTH SCIENCE, SPACE PHYSICS : THE EXPLORER 22 AND 27




EXPLORER 22

S - 66 Ionosphere Laser Ray
Beacon Satellite, Vandenberg
Air Force Base, California
October 9, 1964

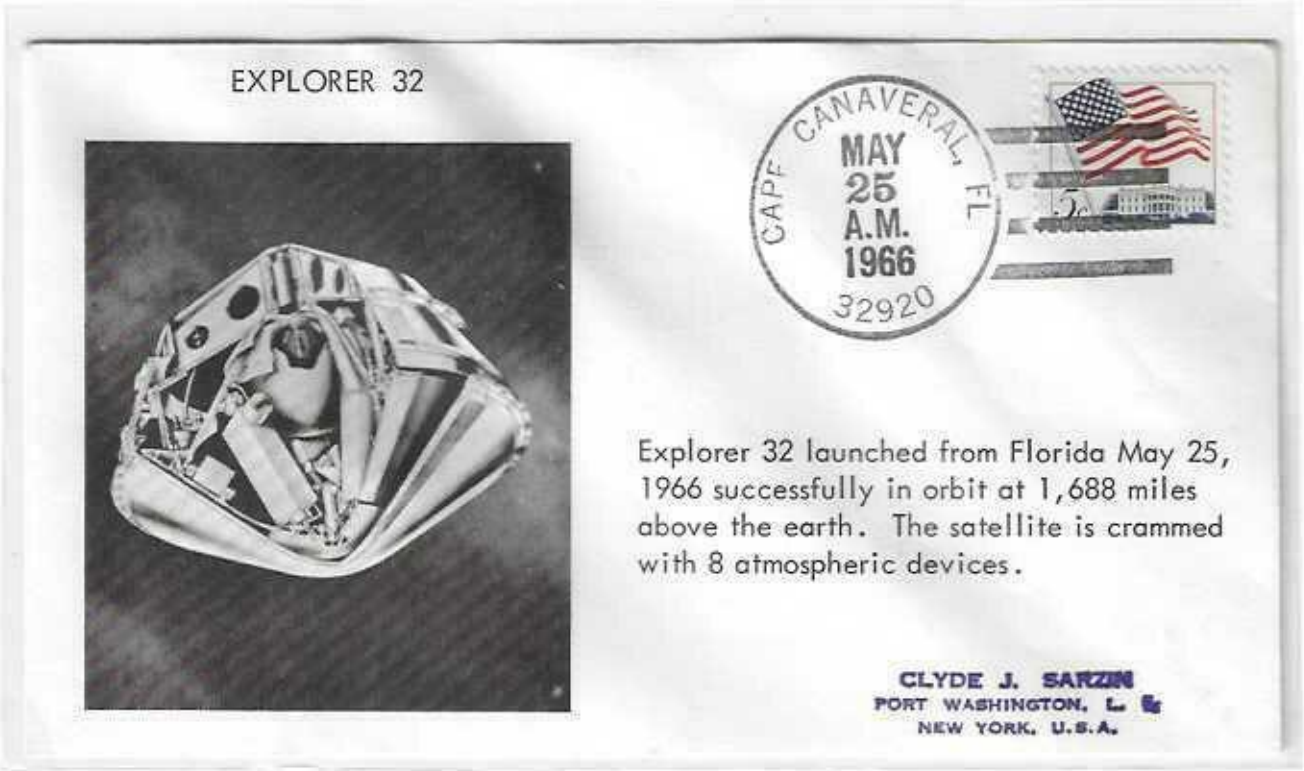
BE-B ( EXPLORER 22 ) mission. OCTOBER 9, 1964. Vandenberg AFB machine cancel. Launched on October 10, 1964, by a Scout rocket. Its objective was to obtain worldwide observations of total electron content between the spacecraft and the Earth. There was not tape recorder aboard so that satellite. Performance data and electrostatic probe data could be observed only when the satellite was within range of a ground telemetry station.



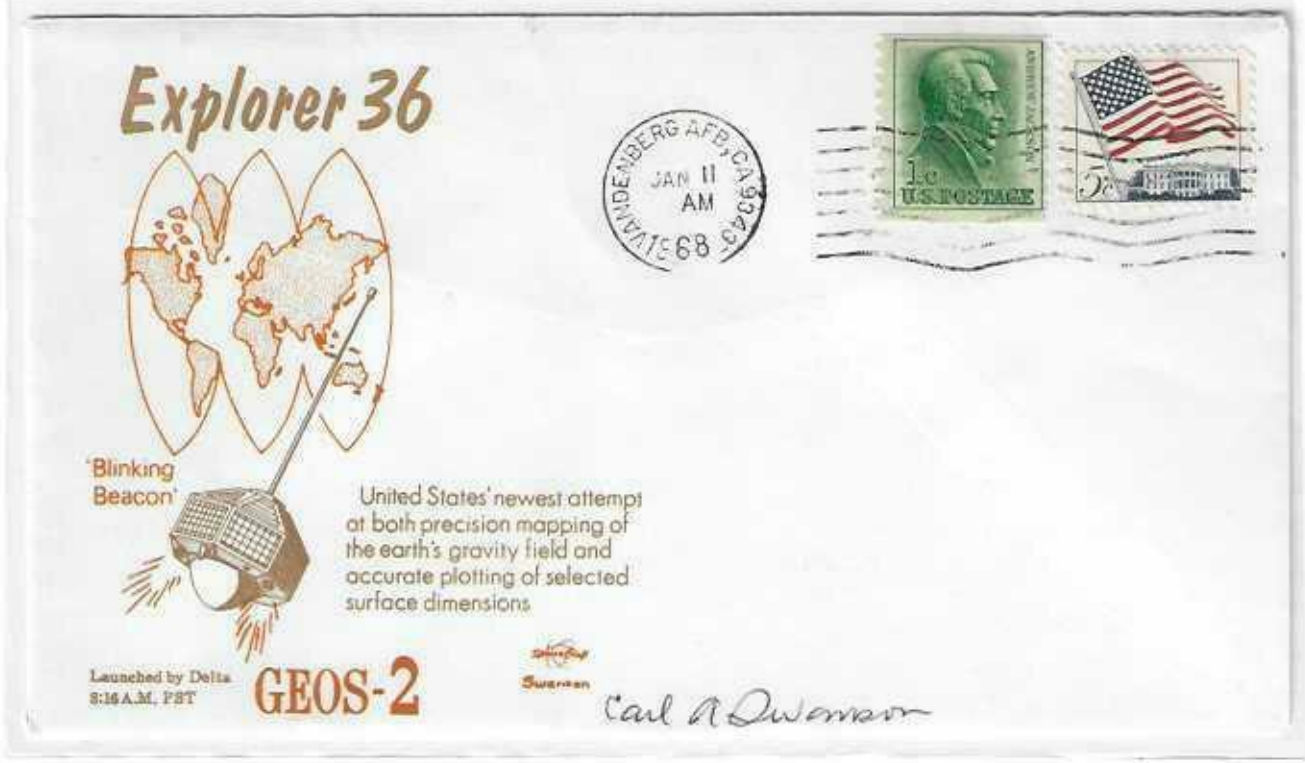

BEACON EXPLORER SATELLITE
LAUNCHED TODAY BY NASA

Purpose - To map irregularities
in the Earth's Gravitational field.

BE-C ( EXPLORER 27 ) mission. APRIL 29, 1965. Wallops Island machine cancel on the date and time of launch. The satellite was turned on in order to partially replace use made of BE-B beacon experiment. Explorer 27 was a small ionospheric satellite instrumented with an electrostatic probe, radio beacons, a passive laser tracking reflector and a Doppler navigation experiment. Its primary objective was to obtain worldwide observation of total electron content between the spacecraft and the Earth.

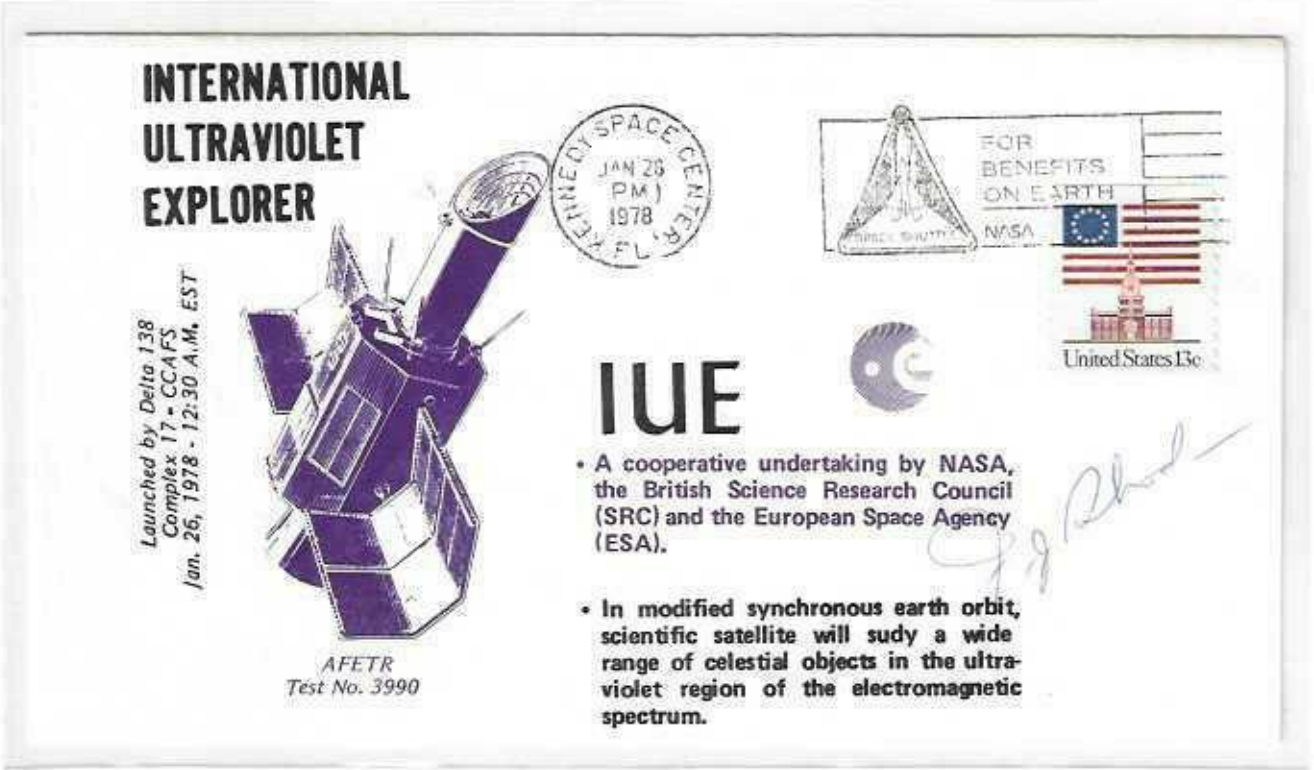



AE-B ( EXPLORER 32 ) mission. MAY 25, 1966. Cape Canaveral manual cancel on the date and time of launch. It was an aeronomy satellite which was designed to directly measure temperatures, composition, densities, and pressures in the upper atmosphere on a global basis. The two neutral particle mass spectrometers failed about 6 days after launch. The remaining experiments operated satisfactorily and provided useful data for most of the 10-month satellite lifetime.




GEOS 2 ( EXPLORER 36 ) mission. JANUARY 11, 1968. Vandenberg AFB machine cancel on the date and time of launch. The Geodetic Earth Orbiting Satellite was a gravity-gradient-stabilized, solar-cell-powered spacecraft that carried electronic and geodetic instrumentation. The objectives of the spacecraft were to optimize optical station visibility periods and to provide complementary data for inclination-dependent terms established by Explorer 29 ( GEOS 1 ) gravimetric studies.

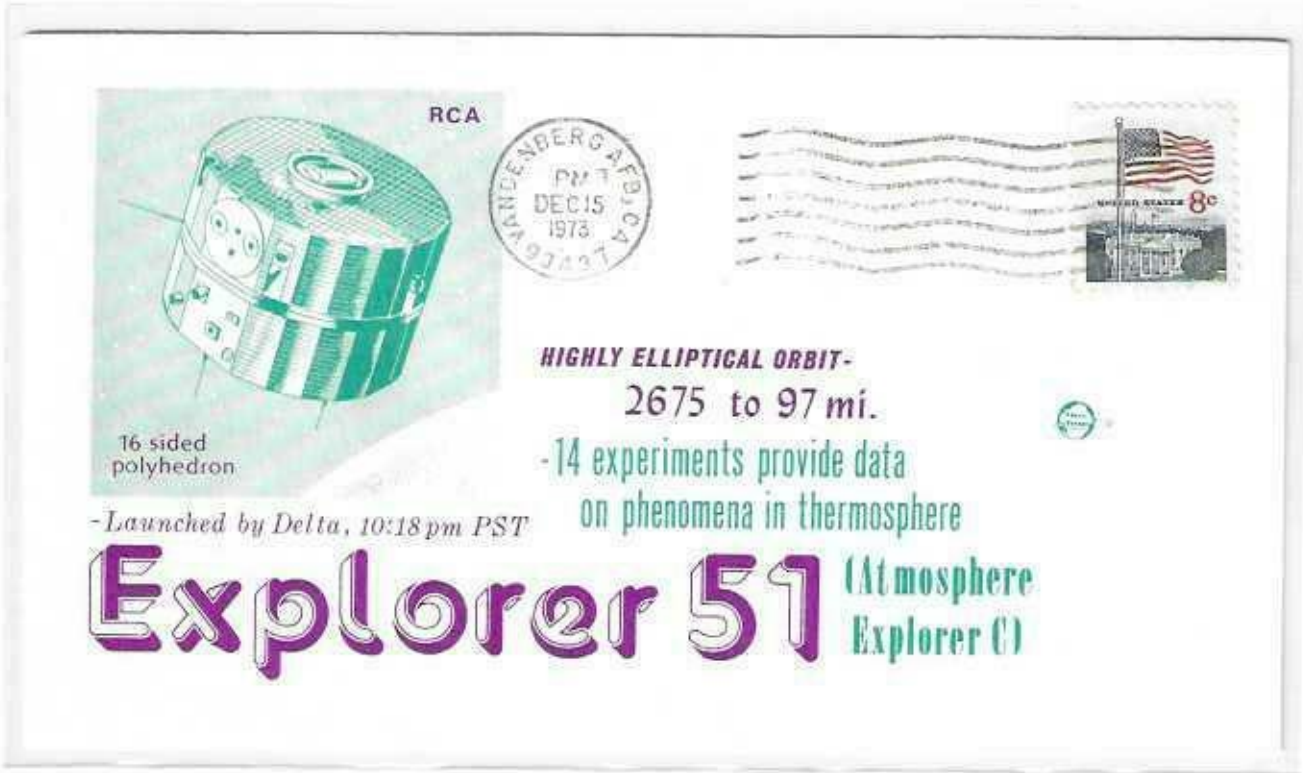
ASTRONOMY, PLANETARY SCIENCE, SPACE PHYSICS: THE EXPLORER 57
ASTRONOMY, SOLAR PHYSICS, SPACE PHYSICS: THE EXPLORER 38



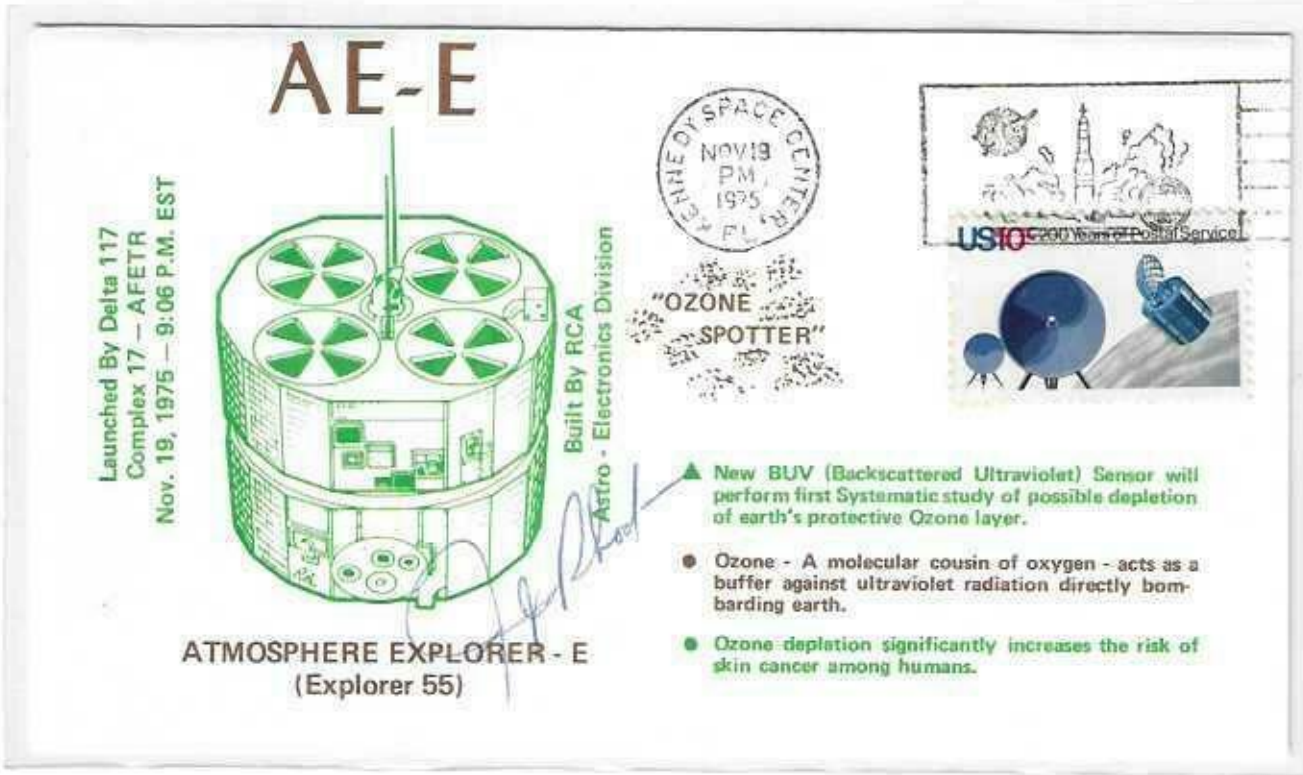

IUE ( EXPLORER 57 ) mission. JANUARY 26, 1978. KSC machine cancel on the date and time of launch. The International Ultraviolet Explorer satellite was a spaceborne ultraviolet astronomical observatory for use as an international facility. The satellite and optical instrumentation were provided by the Goddard Space Flight Center. The ESA supplied solar paddles for the satellite and a European Control Center.


RAE-A ( EXPLORER 38 ) mission. JULY 4, 1968. Vandenberg AFB machine cancel on the date and time of launch. The Radio Astronomy Explorer-1 spacecraft measured the intensity of celestial radio resources, particularly the Sun, as a function of time, direction, and frequency. It was designed for a 1-year minimum operating lifetime. The tape recorder performance began to demonstrate after 2 months in orbit. In spite of several cases of instrument malfunction, good data were obtained on all three antenna systems.

# EARTH SCIENCE, SOLAR PHYSICS, SPACE PHYSICS : THE EXPLORER 51 AND 55.




AE-C ( EXPLORER 51 ) mission. DECEMBER 15, 1973. Vandenberg AFB machine cancel. Launched on December 16 from Cape Canaveral, the payload included instrumentation for the measurement of solar UV, composition of positive ions and neutral particles , density and temperature of neutral particles, positive ions and electrons, airglow emissions, photoelectron energy spectra, and proton and electron fluxes .



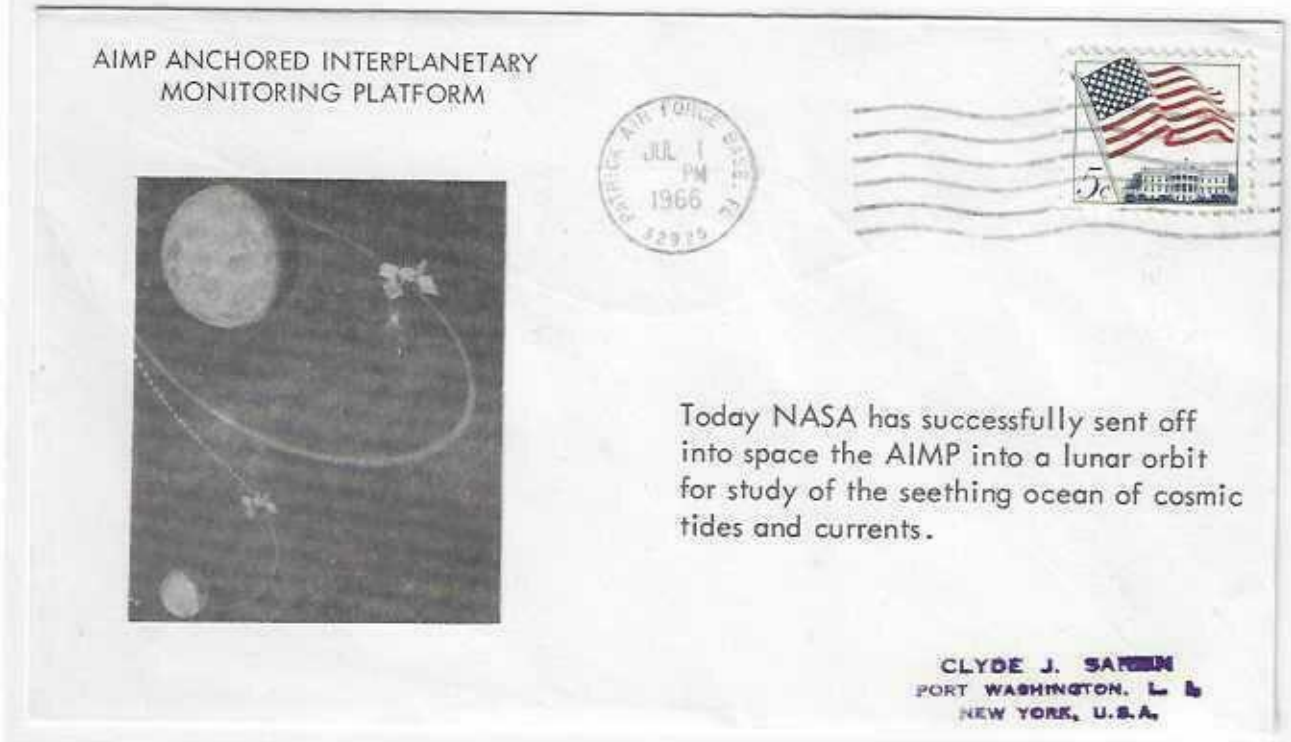

AE-E ( EXPLORER 55 ) mission. NOVEMBER 19, 1975. KSC machine cancel. Launched on November 20, the purpose of the mission was similar to AE-D ( Explorer 54 ) mission. The simultaneous sampling at higher latitudes was carried out by the AE-D spacecraft until its failure, and then by AE-C, until it reentered on December 12, 1978.

# EARTH AND PLANETARY SCIENCE, SPACE PHYSICS : THE EXPLORER 8
# PLANETARY SCIENCE, SOLAR AND SPACE PHYSICS : THE EXPLORER 35

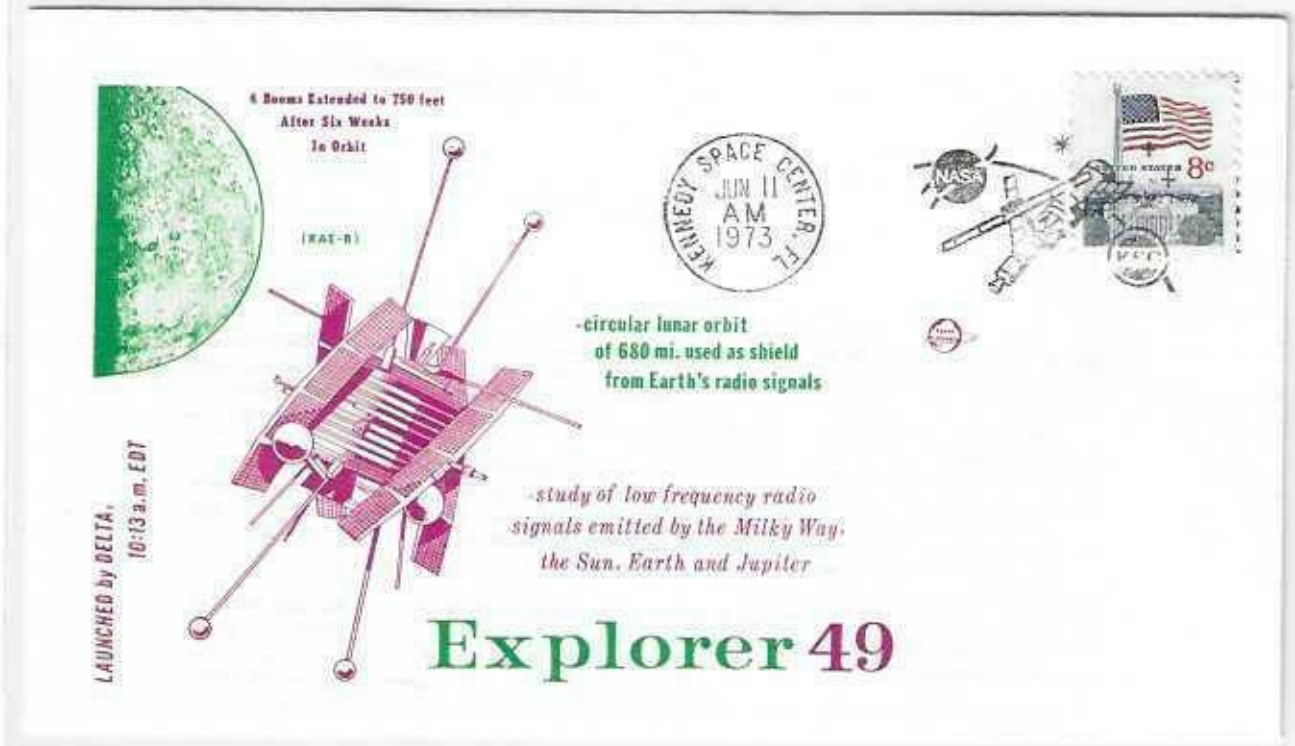

Explorer 8 mission. NOVEMBER 3, 1960. Port Canaveral manual cancel on the date and time of launch.It was an Earth-orbiting satellite designed to obtain measurements of the electron density, the electron temperature, the ion concentration, the ion mass, the micrometeorite distribution, and the micrometeorite mass in the ionosphere at altitudes between 400 and 1,600 km. As a result of considerable difficulties, the data were mostly processed by hand. Considerable new knowledge about the ionosphere was gained.


IMP-E ( EXPLORER 35 ). JULY 19, 1967. Cape Canaveral machine cancel on the date and time of launch. It was instrumented for interplanetary studies, at lunar distances, of the interplanetary plasma, magnetic field, energetic particles, and solar x-rays. It was launched with a Delta rocket into an elliptical lunar orbit. After successful operation for 6 years, the spacecraft was turned off on June 24, 1973.

# ASTRONOMY, PLANETARY SCIENCE, SOLAR AND SPACE PHYSICS : THE EXPLORER 33 AND 49




IMP-D ( EXPLORER 33 ) mission. JULY 1, 1966. Patrick AFB machine cancel on the date and time of launch. It was a spin-stabilized spacecraft instrumented for studies of interplanetary plasma, energetic charged particles ( electrons, protons, and alphas ), magnetic fields, and solar x-rays at lunar distances. The spacecraft failed to achieve lunar orbit but did achieve mission objectives.




RAE-B ( EXPLORER 49 ) mission. JUNE 11, 1973. KSC machine pictorial cancel. Launched on June 10, the satellite was placed into lunar orbit to provide radio astronomical measurements of the planets, the Sun, and the galaxy, over the frequency range of 25 KHz to 13.1 MHz. The lunar orbit and position af the Earth as a radio source, imposed periodicities on the observations of 29.5 days ( the lunar synodic month ) and 24.8 hours ( the interval between consecutive sweeps of a given Earth geographic position past the Moon.

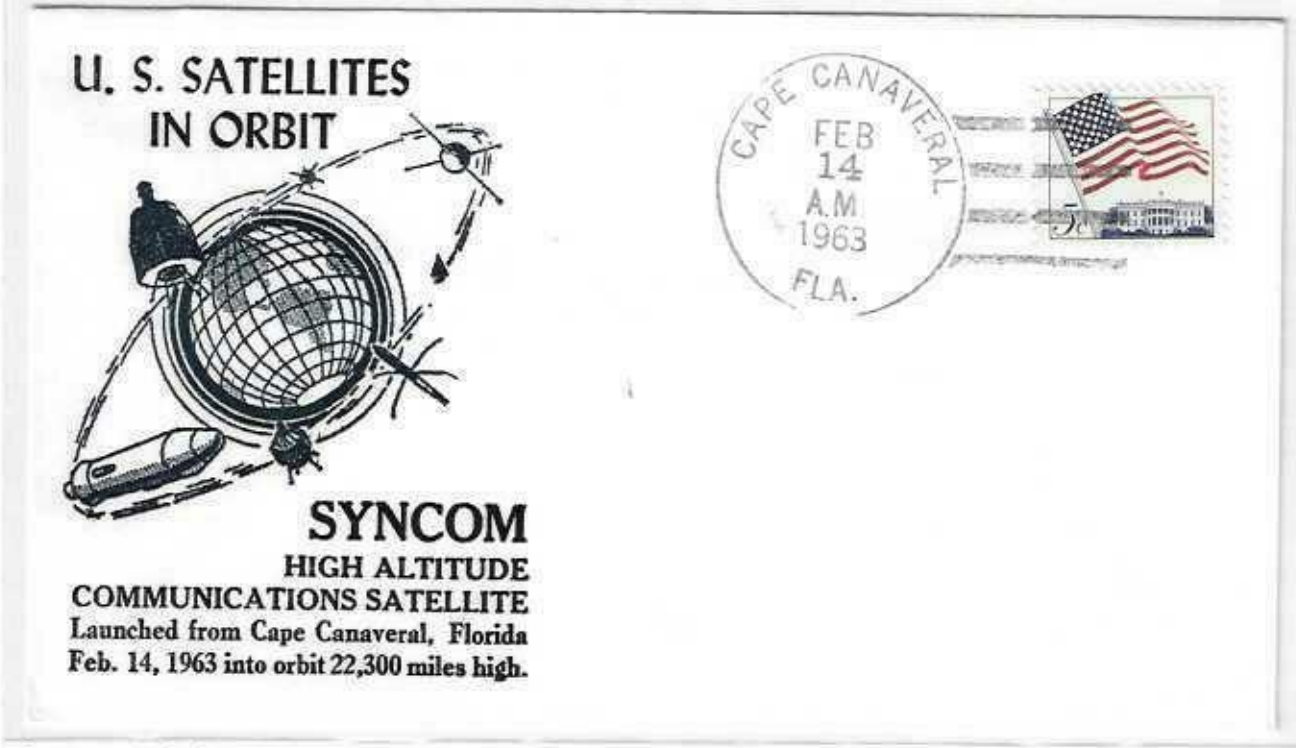
# ASTRONOMY, PLANETARY SCIENCE, SOLAR AND SPACE PHYSICS:THE EXPLORER 59
# ENGINEERING, EARTH SCIENCE, SOLAR AND SPACE PHYSICS : THE EXPLORER 54


ISEE 3 ( EXPLORER 59 ) mission. AUGUST 14, 1978. KSC machine cancel. Launched on August 12, it was the first spacecraft to use halo orbit. The Explorer-class heliocentric spacecraft, international Sun-Earth Explorer 3, was part of the mother/daughter/heliocentric mission ( ISEE 1, 2 and 3 ). In conjunction with the mother and daughter spacecraft, which had eccentric geocentrics orbit, this mission explored the coupling and energy transfer processes between the incident solar wind and the Earth's magnetosphere.

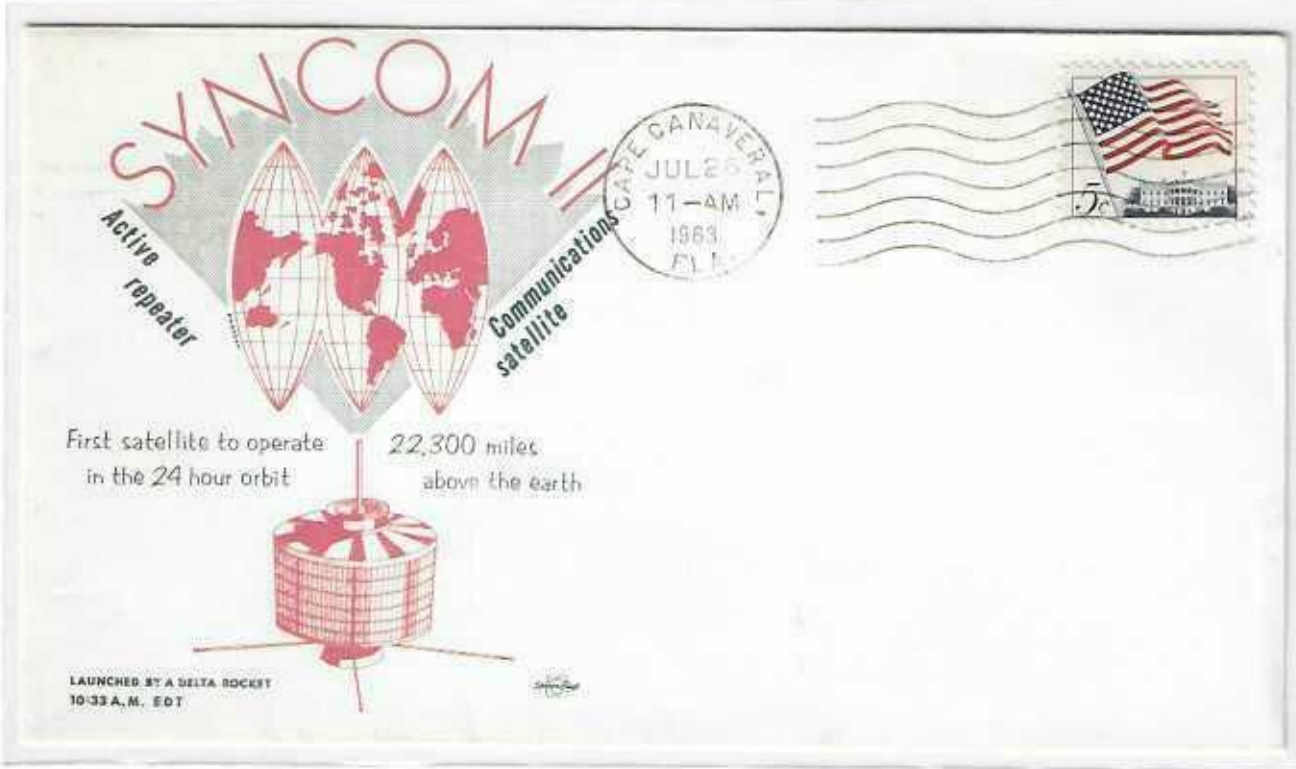

AE-D ( EXPLORER 54 ) mission. OCTOBER 6, 1975. Vandenberg AFB machine cancel on the date and time of launch. The purpose of the mission was to continue the investigations begun by AE-C ( Explorer 51 ) mission of the chemical processes and energy transfer mechanisms that control the structure and behavior of the Earth's atmosphere and ionosphere in the region of high absorption of solar energy. This mission was planned to sample the high latitude regions at the same time that AE-E ( Explorer 55 ) mission was sampling the equatorial and low latitude regions.

# VARIOUS SATELLITES

## COMMUNICATIONS : THE SYNCOM 1 AND 2




Syncom 1 mission. FEBRUARY 14, 1963. Cape Canaveral manual cancel on the date and time of launch.Syncom ( for " Synchronous Communications Satellite " ) started as a 1961 NASA Program for active geosynchronous satellite, all of which were developed and manufactured by Hughes Space and Communications. Syncom 1 was lost on the way due to an electronics failure.




Syncom 2 mission. JULY 26, 1963. Cape Canaveral machine cancel on the date and time of launch. During the first year, NASA conducted voice, teletype, and facsimile tests, as well as 110 public demonstrations to show the capabilities of this satellite and invite feedback. In August 1963, President J. F. Kennedy in Washington, D.C., telephoned Nigerian Prime Minister Abubakar Tafawa Balewa aboard Template USNS docked in Lagos Harbor, the first live two-way call between heads of government by satellite. Syncom 2 also relayed a number of test low-quality television transmission.

# COMMUNICATIONS : THE SYNCOM 3 AND WESTAR 1


Syncom 3 mission. AUGUST 19, 1964. Cape Canaveral machine cancel on the date and time of launch. It was the first geostationary communication satellite. The satellite, in orbit near the International Data Line, had the addition of a wideband channel for television, and was used to telecast the 1964 Summer Olympics in Tokyo to the United States. Although Syncom 3 is sometimes credited with the first television program to cross the Pacific Ocean.


Westar 1 mission. APRIL 13, 1974. Cape Canaveral manual cancel on the date and time of launch. Launch vehicle for Westar was the three-stage Delta, with nine strap-on motors. The launchings were conducted by the NASA under a contract from Western Union. Three Westar satellites were purchased by Western Union, one of the first applicants in the U.S. to win approval from the Federal Communications Commission to operate a domestic satellite.

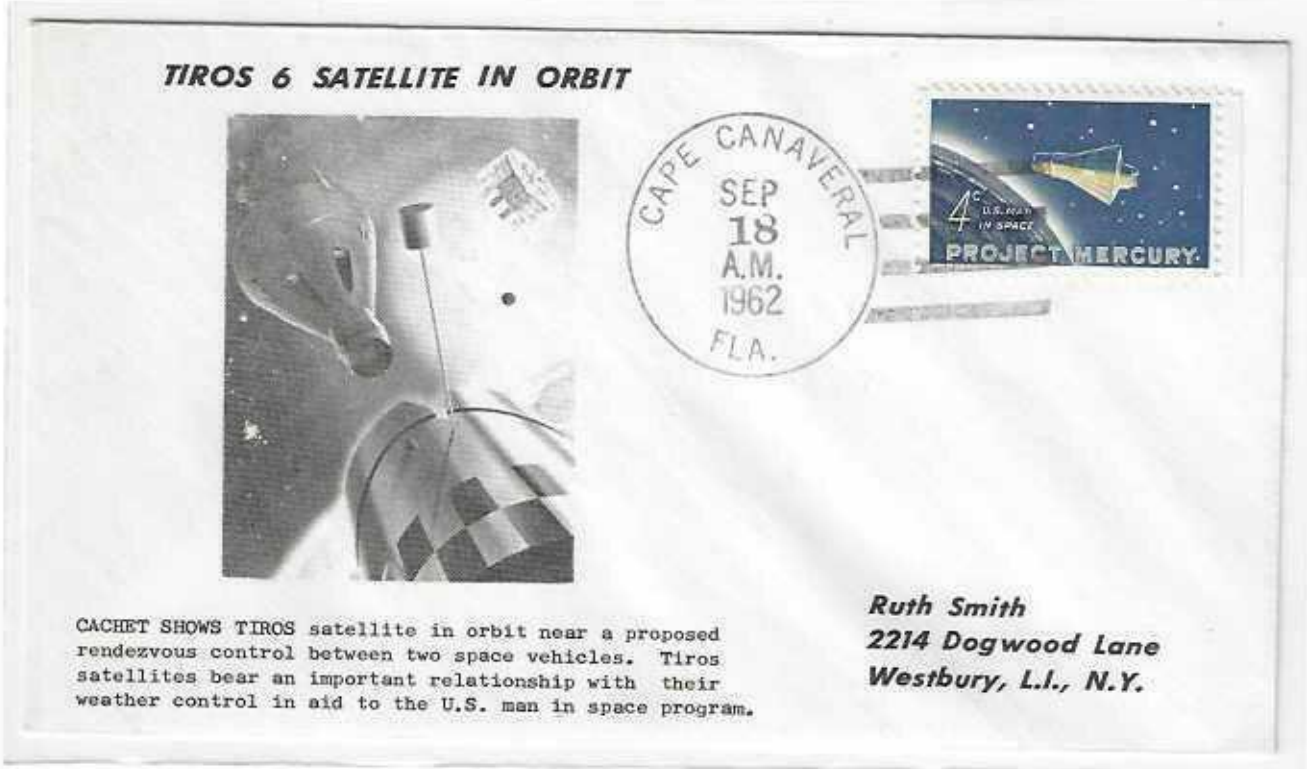
# COMMUNICATIONS : THE WESTAR 2 AND 3


Westar 2 mission. OCTOBER 10, 1974. KSC machine cancel on the date and time of launch. The successful launch of Westar 1, America's first domestic communications satellite, signaled the start of a new era of communications in the USA. Westar, built by Hughes Aircraft Company, today know as Boeing Satellite Development Center, is similar to the Anik satellites Hughes designed and built for Canada's domestic system, and the Palapa satellites built for Indonesia.


Westar 3 mission. AUGUST 9, 1979. Greenbelt manual cancel. Launched on August 10, operating in synchronous orbit, 22,300 miles above the Equator, the satellite relay voice, video, and data communications to the continental U.S. as well as Alaska, Hawaii, and Puerto Rico. Western Union's primary Earth station is in Glenwood, New Jersey, near New York city. Additional Earth station in the Westar system are located near Atlanta, Chicago, Dallas, and Los Angeles. Design lifetime in orbit for each satellite is 7 years.

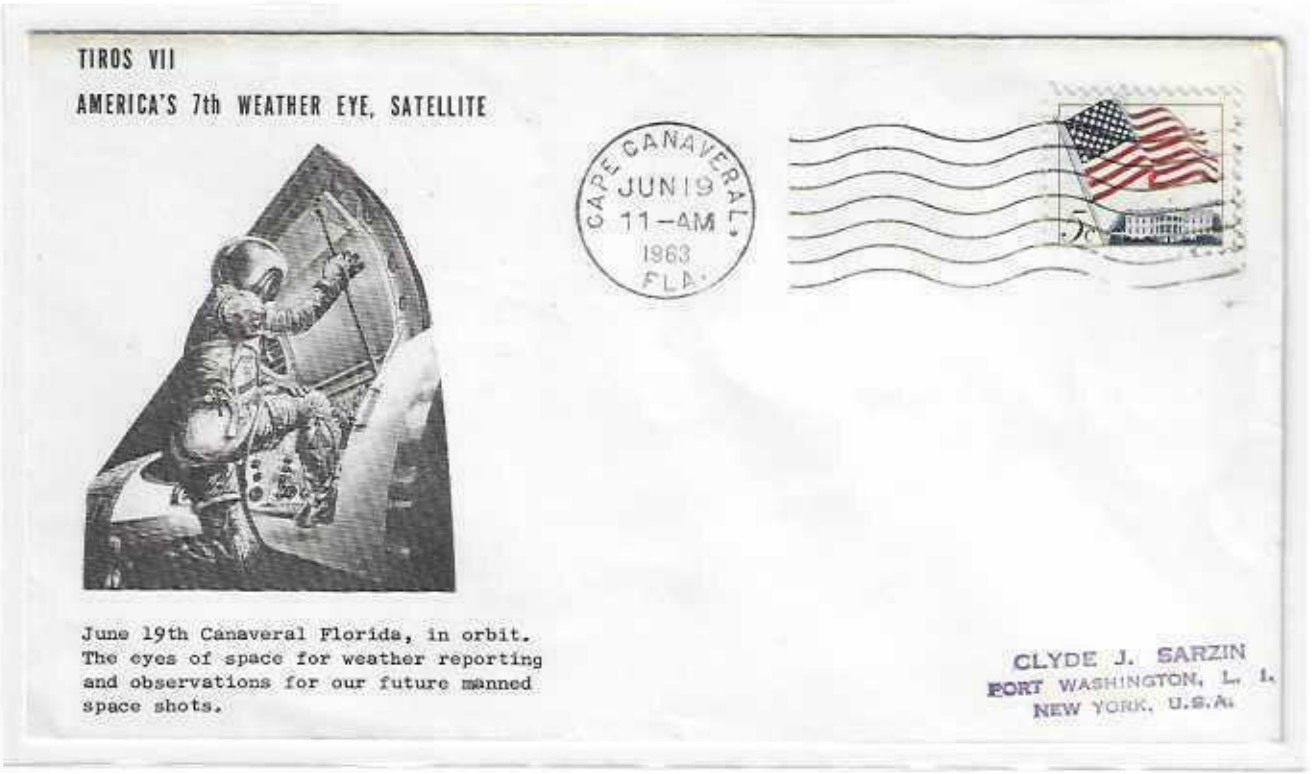
# EARTH SCIENCE : THE TIROS 4 AND 6


Tiros 4 mission. FEBRUARY 8, 1962. Patrick AFB machine cancel on the date and time of launch. Mission's objectives were to continue research into and development of the meteorological satellite information system. This mission was designed to maintain an operational Tiros in orbit for an extended period of time, and to obtain improved data for operational use in weather forecasting during the northern hemisphere hurricane season.




Tiros 6 mission. SEPTEMBER 18, 1962. Cape Canaveral manual cancel on the date and time of launch. Mission's objectives were to continue research and development of the meteorological satellite information system, prove Tiros could stay in orbit for an extended period of time, obtain improved data for use in weather forecasting during hurricane season, provide operational support for the Mercury-Atlas 8 launch on October 3, 1962.

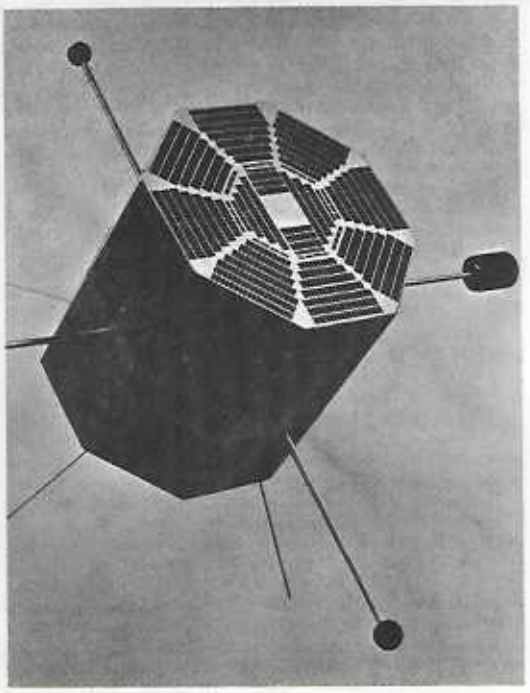
# EARTH SCIENCE : THE TIROS 7 AND 8




Tiros 7 mission. JUNE 19, 1963. Cape Canaveral machine cancel on the date and time of launch. Objectives: continue research and development of the meteorological satellite information system, obtain improbe data for use in weather forecasting, especially during hurricane season. The electron density and temperature probes were the same as the ones flown on board Explorer 17. Tiros 7 was deactivated after furnishing over 30,000 cloud photographs; it lasted the longest of the Tiros series thus far, 1,809 days.


Tiros 8 mission. DECEMBER 21, 1963. Cape Canaveral machine cancel on the date and time of launch. Objectives : continue research and development of the meteorological satellite information system, flight test the Automatic Picture Transmission ( APT ) camera system and ground stations. Tiros 8's APT system exceeded its 90-days expected lifetime. True space-based study of the Earth had begun. Forty-seven ground station around the world were able to ingest satellite images, forming the first body of wide-angle imagery ever assembled.

# EARTH SCIENCE : THE ESSA 1 AND 2



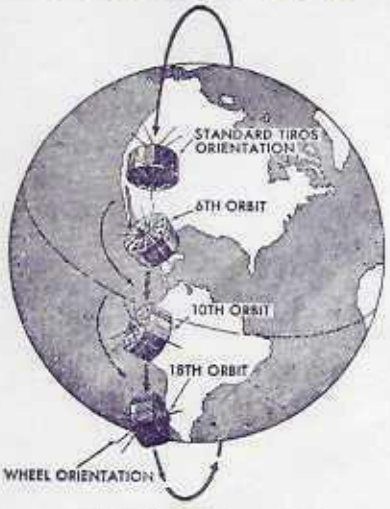

ESSA 1

World's first pioneering weather eye operational space platform satellite. Designed to routinely scan the globe's weather. Is now whirling around the earth at 17,000 mph in a polar orbit ranging from 433 to 523 miles high.

Mr. Ronald Williamson
5689, Washington Street
Sherry Hills, N.J. 08034

Essa 1 mission. FEBRUARY 3, 1966. Cape Canaveral manual cancel on the date and time of launch. It was a spin-stabilized operational meteorological spacecraft designed to take and record daytime cloudcover pictures on a global basis for subsequent playback to a ground acquisition station. The satellite had essentially the same configuration as that of the Tiros series. The satellite was placed in a cartwheel orbital mode, with its spin axis normal to the orbital plane. On October 6, 1966, the camera system failed.

TIROS XII





ESSA II

*Polar Orbit Transit From Cape Kennedy*

Essa 2 mission. FEBRUARY 28, 1966. Cape Canaveral manual cancel on the date and time of launch. It was a Sun-synchronous operational meteorological satellite designed to provide real-time Earth cloudcover TV pictures to properly equipped ground receiving station for use in weather analysis and forecasting. Over 4 yr of useful cloudcover pictures were obtained before the camera systems were placed in a standby mode on March 20, 1970, owing to a telemetry conflict with Itos 1. Essa 2 was deactivated on October 16, 1970.

# EARTH SCIENCE : THE NIMBUS 2 AND ESSA 3

NIMBUS - II



NASA

Launched Cape Kennedy 3.56 A.M. The 912-pound is the biggest U. S. Weather Satellite, its 725 miles high orbit is designed to take about 3,000 pictures day and night and send to Transmission Stations in 26 Foreign countries.

Nimbus 2 mission. MAY 15, 1966. Vandenberg AFB machine cancel on the date and time of launch. The spacecraft carried : an Advanced Vidicon Camera System ( AVCS ), an Automatic Picture Transmission ( APT ) camera for providing real-time cloudcover pictures, and both High-and-Medium-resolution Infrared Radiometers ( HRIR and MRIR ) for measuring the intensity and distribution of electromagnetic radiation emitted by and reflected from the Earth and its atmosphere.

ESSA-3

U. S. WEATHER SATELLITE PROJECT
The Television Satellite orbits the Earth near the Pole. Launched by Thor-Delta Rocket.



Essa 3 mission. OCTOBER 2, 1966. Vandenberg AFB machine cancel on the date and time of launch. Essa 3 was a Sun-synchronous operational meteorological satellite designed to take and record daytime Earth cloudcover pictures on a global basis for subsequent playback to a ground acquisition facility. The spacecraft was also capable of providing worldwide measurements of reflected solar and long-wave radiation leaving the Earth. Essa 3 performed normally until January 20, 1967, when the radiometer experiment failed.

# EARTH SCIENCE : THE ESSA 4 AND 5

ESSA 4

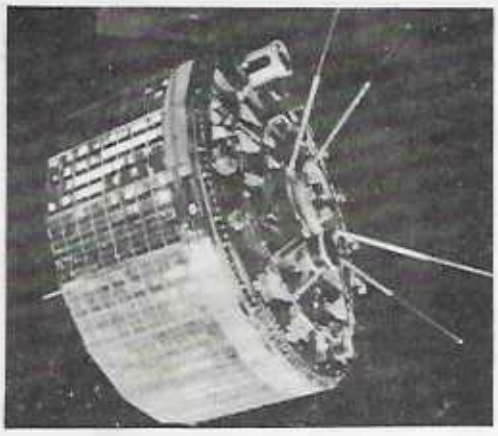
Today launched at Vandenberg Air Force Base, California.



Weather (eye-in-the-sky) operational Tiros satellite replaces Essa 2. Its 2 cameras will photograph the earth's cloud cover daily and send pictures immediately to ground stations around the world.

Essa 4 mission. JANUARY 26, 1967. Vandenberg AFB machine cancel on the date and time of launch. It was a Sun-synchronous operational meteorological satellite designed to provide real-time Earth cloudcover TV pictures to properly equipped ground receiving stations for use in weather analysis and forecasting. The satellite had essentially the same configuration as that of the Tiros spacecraft. It was turned operationally off on December 6, 1967, and was finally deactivated on May 5, 1968.

ESSA 5 WEATHER SATELLITE

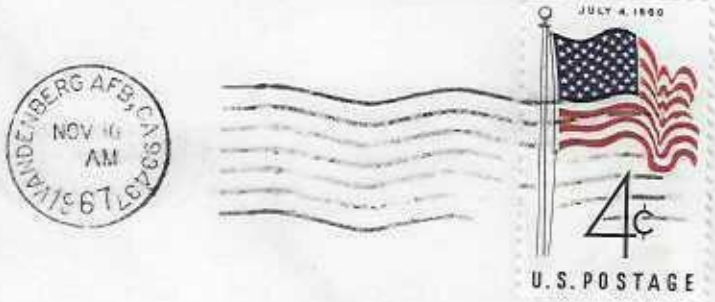



NOW IN ORBIT

U.S. Essa 5 Observation Satellite of the Weather Bureau branch of U.S. Government sucessfully launched into perfect orbit from Vandenberg AFB California, April 20th, 1967.

Essa 5 mission. APRIL 20, 1967. Vandenberg AFB machine cancel on the date and time of launch. It was a Sun-synchronous operational meteorological satellite designed to take and record daytime Earth cloudcover pictures on a global basis for subsequent playback to a ground acquisition facility. The spacecraft was also capable of providing worldwide measurements of reflected solar and long-range radiation leaving the Earth. The spacecraft performed normally until September 22, 1967, when the radiometer experiment failed.

# EARTH SCIENCE : THE ESSA 6 AND 7




ESSA 6
Weather Bureau Observation satellite.
Launched into Polar Orbit by Thor Delta
Booster. Tiros Operational Satellite.

Essa 6 mission. NOVEMBER 10, 1967. Vandenberg AFB machine cancel on the date and time of launch. Essa 6 was a Sun-synchronous operational meteorological satellite designed to provide real-time Earth cloudcover TV pictures to properly equipped ground receiving stations for use in weather analysis and forecasting. The satellite performed normally after launch. The ATP system was turned operationally off on July 25, 1969, and reactivated on September 11, 1969. The spacecraft was deactivated on November 4, 1969.

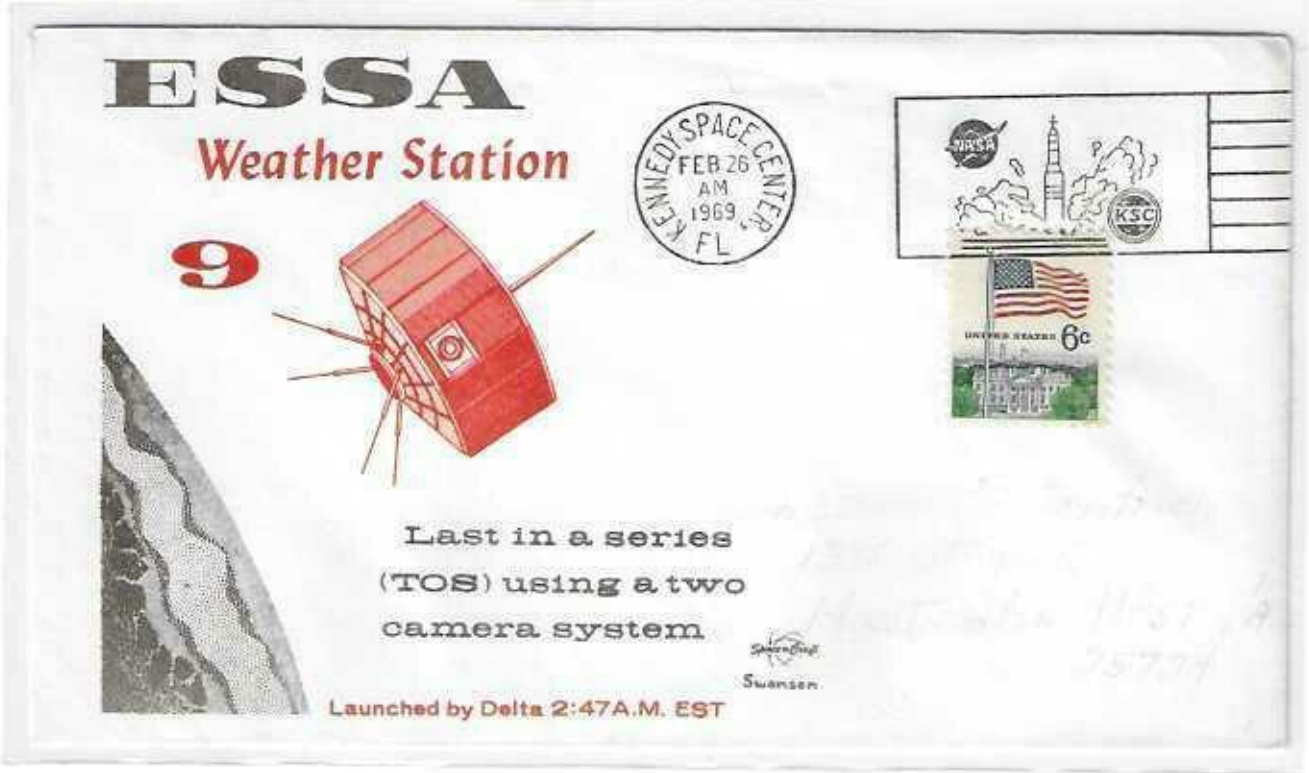


ESSA 7 hurricane hunter environmental surveyor satellite in orbit. Total payload 2,750 pounds. This new weather eye is timed for the approaching hurricane season.

Essa 7 mission. AUGUST 16, 1968. Vandenberg AFB machine cancel on the date and time of launch. Essa 7 was a Sun-synchronous operational meteorological satellite designed to take and record daytime Earth-cloud pictures on a global basis for subsequent playback to a ground acquisition facility. The radiometer experiment failed on June 23, 1969, and the remaining camera system failed on July 19, 1969. The spacecraft was deactivated on March 10, 1970, after being left on for an additional time period of engineering purposes.

# EARTH SCIENCE : THE ESSA 8 AND 9


Essa 8 mission. DECEMBER 15, 1968. Vandenberg AFB machine cancel on the date and time of launch. It was a Sun-synchronous operational meteorological satellite designed to provide real-time Earth cloudcover TV pictures to properly equipped ground receiving stations for use in weather analysis and forecasting.




Essa 9 mission. FEBRUARY 26, 1969. KSC machine cancel on the date and time of launch. Essa 9 was a Sun-synchronous meteorological satellite designed to take and record daytime Earth cloudcover pictures on a global basis for subsequent playback. The spacecraft was also capable of providing worldwide measurements of reflected solar and long-range radiation leaving the Earth. Following the successful launch of Itos 1, Essa 9 was temporarily deactivated. It was reactivated after Itos 1 ended its operations. Essa 9 was again turned off in November 1972, with the launching of NOAA 2.

# EARTH SCIENCE : THE TIROS M AND NOAA 1


Tiros M ( ITOS 1 ) mission. JANUARY 23, 1970. Lompoc manual cancel on the date and time of launch. The ITOS ( Improved Tiros Operational Satellite ) series ( Tiros M was the prototype spacecraft ) were the second generation of operational Sun-synchronous meteorological spacecraft. Operational satellites were renamed NOAA. The primary objective of ITOS was to provide improved operational infrared and visual observations of Earth cloudcover for use weather analysis and forecasting.

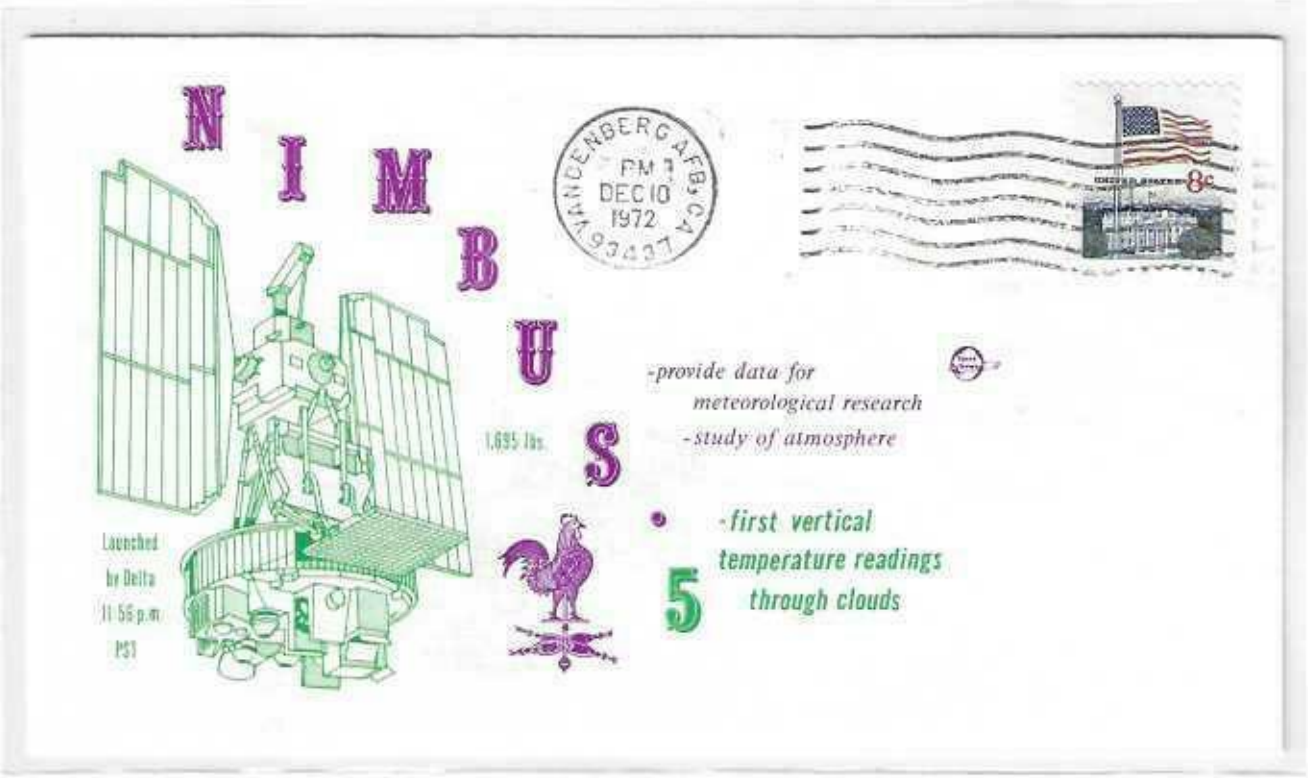

NOAA 1 ( ITOS A ) mission. DECEMBER 11, 1970. Vandenberg AFB machine cancel on the date and time of launch. The nearly cubical spacecraft measured 1 by 1 by 1.2 m. The satellite was equipped with three curved solar panels that were folded during launch and deployed after orbit was achieved. Each panel measured over 4.2 m in length when unfolded and was covered with 3,420 solar cells, each measuring 2 by 2 cm.

# EARTH SCIENCE : THE ITOS B AND NOAA 2


ITOS B mission. OCTOBER 21, 1971. Vandenberg AFB machine cancel on the date and time of launch. The TV cameras and infrared sensor were mounted on the satellite baseplate with their optical axes directed vertically earthward. The ITOS dynamics and attitude control system maintained desired spacecraft orientation through gyroscopic principles incorporated into the satellite design. Minor adjustments in attitude and orientation were made by means of magnetic coil and by varying the speed of the momentum flywheel.


NOAA 2 ( ITOS D ) mission. OCTOBER 15, 1972. Vandenberg AFB machine cancel on the date and time of launch. These were a series of reconfigures ITOS satellites launched with new meteorological sensors onboard to expand the operational capability of the ITOS system. NOAA was not equipped with conventional TV cameras. It was the first operational weather satellite to rely solely upon radiometric imaging to obtain cloudcover data.

# EARTH SCIENCE : THE NIMBUS 5 AND 6




Nimbus 5 mission. DECEMBER 10, 1972. Vandenberg AFB machine cancel. Launched on December 11 by a Delta rocket. There are six experiments onboard including : mapping the microwave radiation from the Earth's surface and atmosphere, obtaining vertical profiles of temperature and moisture, determining tropospheric temperature profiles, atmospheric water vapor abundances, and cloud liquid water contents. measuring the differences in the thermal emission and characteristics of the Earth's surface.

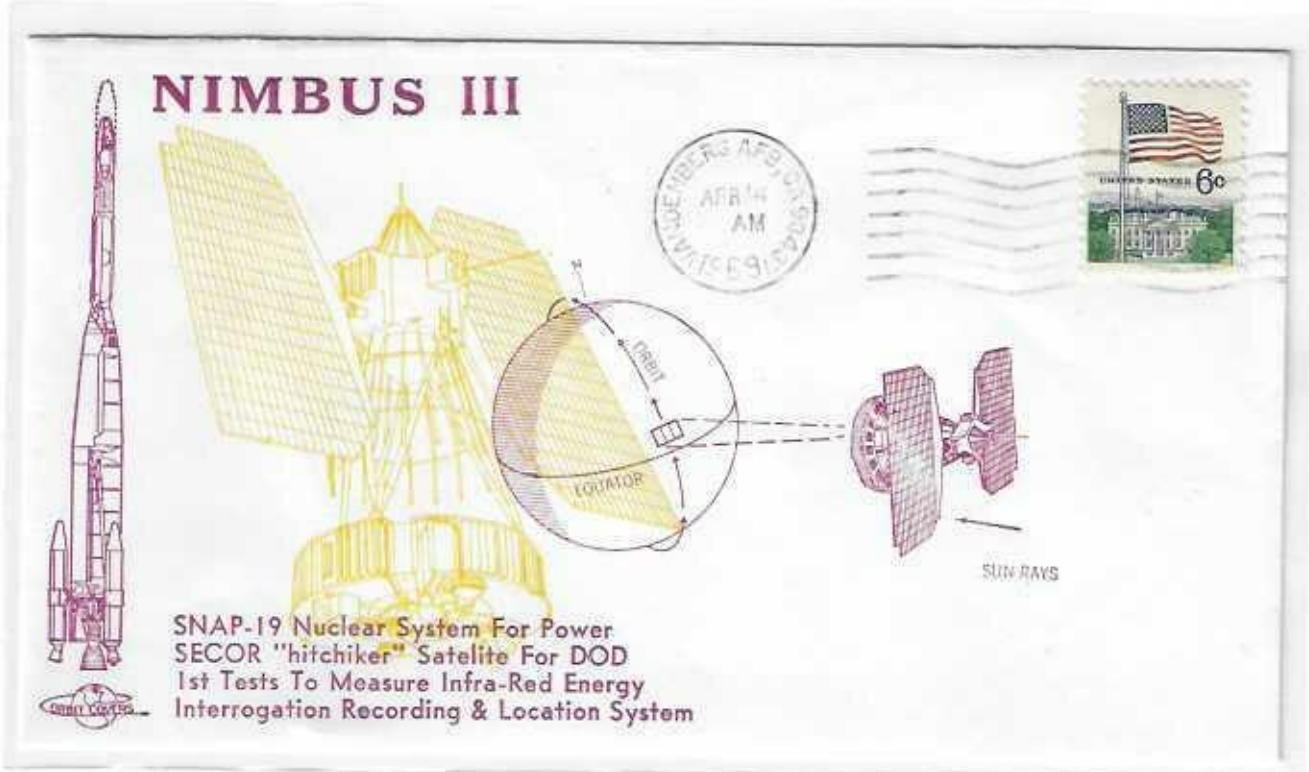

Nimbus 6 mission. JUNE 12, 1975. Vandenberg AFB machine cancel on the date and time of launch. There are nine experiments onboard. The complement of advanced sensors was capable of : mapping tropospheric temperature,water vapor abundances and cloud water content, providing vertical profiles of temperature, ozone and water vapor, transmitting real-time data to a geostationary spacecraft ( ATS 6 ), and yielding data on the Earth's radiation budget.

# EARTH SCIENCE : THE ITOS E AND NOAA 3


ITOS E mission. JULY 16, 1973. Greenbelt machine cancel on the date and time of launch. The primary sensors consisted of : Very High Resolution Radiometer ( VHRR ), Vertical Temperature Profile Radiometer ( VTPR ), and Scanning Radiometer ( SR ).


NOAA 3 ( ITOS F ) mission. NOVEMBER 6, 1973. Vandenberg AFB machine cancel on the date and time of launch. The primary objective of NOAA was to provide global daytime and nighttime direct readout real-time cloudcover data on a daily basis. The Sun-synchronous spacecraft was also capable of supplying global atmospheric temperature soundings and very high resolution infrared cloudcover data for selected areas in either a direct readout or a tape-recorder mode.

# LIFE SCIENCE, SOLAR PHYSICS, EARTH SCIENCE : THE NIMBUS 3
# SOLAR PHYSICS, EARTH SCIENCE : THE NIMBUS 4




Nimbus 3 mission. APRIL 14, 1969. Vandenberg machine cancel on the date and time of launch. There are seven experiments onboard including : detecting solar UV radiation, providing daytime cloudcover pictures in both real-time mode, assessing the operational capability of radioisotope power for space applications, measuring the emission spectra of the Earth-atmosphere system. On July 22, 1969, IRIS experiment failed.


Nimbus 4 mission. APRIL 8, 1970. Vandenberg AFB machine cancel on the date and time of launch. There are nine experiments onboard including : determining the vertical profiles of temperature and water vapor in the atmosphere, monitoring the vertical distribution and total amount of atmospheric ozone on a global scale, locating, interrogating, recording, and retransmitting meteorological and geophysical data from from remote collection stations.