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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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GEMINI 5 FLIGHT

The period August 21-29, 1965, will go down in history as the one in which the United States broke a number of existing manned space flight records — in fact, a period during which a number of manned space flight records were established.

During this period the Gemini 5 flight crew, Command Pilot L. Gordon Cooper, Jr., and Pilot Charles "Pete" Conrad, completed a space flight which covered 120 revolutions of the earth — a total of 3,312,993 miles in an elapsed time of 190 hours and 56 minutes.

The National Aeronautics and Space Administration had named Cooper and Conrad as the prime crew for this mission on February 8, 1965. Members of the backup crew were Command Pilot Neil A. Armstrong, and Pilot Elliot M. See, Jr.

Due to the large number of experiments scheduled for the flight, and the many activities accompanying the long-duration mission, the flight crew immediately entered an intensive training period.

In addition to refresher training in a number of fields covered by the astronaut training program, it was necessary that they receive specific instruction on the 17 experiments which were scheduled. The Gemini 5 spacecraft was the first to use the fuel cell as well as

THE RADAR EVALUATION POD test was one of the prime objectives of the Gemini 5 mission. The REP is shown above in an artist's concept as the spacecraft approached the target. To produce this effect the REP is superimposed on an earth-sky photo taken on a previous Gemini mission.

the first to carry rendezvous radar equipment and the use of these two items required much added time in preparation.

The two crew members completed their preflight physical examinations successfully several days before the mission and on flight day were reported "ready to charge."

They were awakened at 4:30 a.m. on the morning of the flight, showered and shaved for the last time for eight days, underwent a final physical examination, and, at 5:20 a.m., sat down for breakfast with Dr. Howard Minners, Dr. Eugene Tubbs, and Astronauts Walter Schirra, Thomas Stafford and Donald Slayton. The "going away meal" consisted of orange juice, filet mignon, scrambled eggs, toast, coffee, and grape jelly.

The crew departed the crew quarters on Merritt Island at 5:55 a.m. for the short ride to the suit-up area at Cape Kennedy. There the medical sensors were attached, they were suited up, and then transferred to Launch Complex 19 where their Gemini-Titan vehicle awaited them. The crew had gone through this same routine two days before the flight. That time, difficulties with loading the cryogenic fuels for the fuel cell and with weather resulted in a postponement of the mission.

On this day, however, the countdown progressed with no difficulty and the Gemini 5 lifted off the pad exactly on schedule at 9:00 a.m., EST.

FLIGHT OBJECTIVES

Major objectives of the Gemini 5 flight were:

- To demonstrate and evaluate the performance of the Gemini spacecraft for a period of eight days.
- To evaluate the performance of the rendezvous

THE GEMINI 5 FLIGHT CREW, Cooper in the foreground, and Conrad, are shown in their spacecraft during the latter phases of the final countdown. A NASA suit technician is shown as he checks the various connections of Cooper's suit.

guidance and navigation system, using the radar evaluation pod.

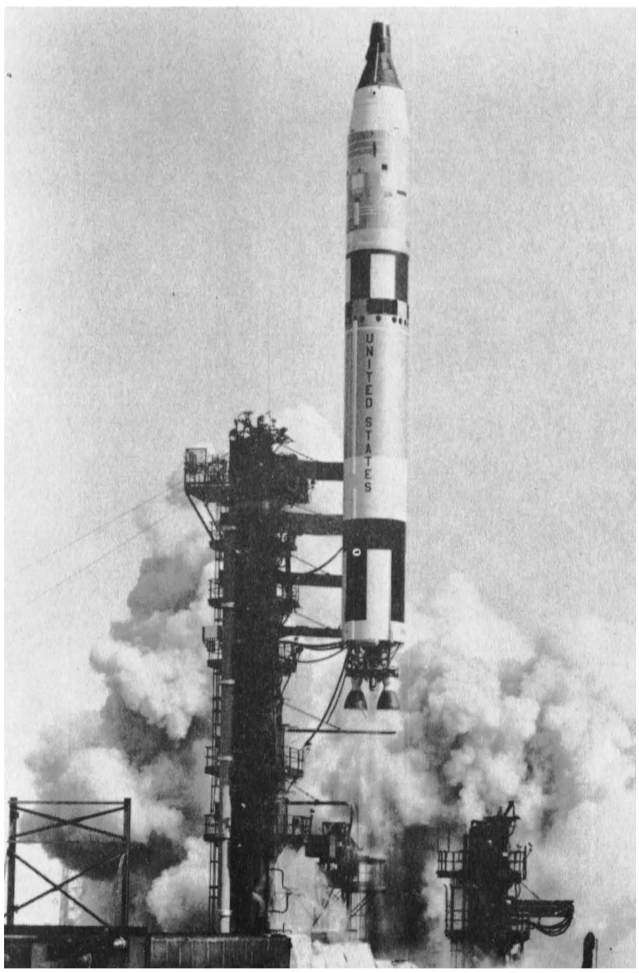
• To evaluate the effects of prolonged exposure of the two-man crew to the space environment.

There were other objectives assigned to the flight, including conducting a total of 17 experiments. Five of these were medical, six were scientific, and six were for the Department of Defense. A description of these experiments and preliminary results are covered in a later section.

THE FLIGHT

The flight progressed very closely to that planned during the launch and insertion stages. The pilots did report that the launch vehicle underwent more than expected longitudinal oscillation.

It is not uncommon that problems should develop during flight tests of anything as complex as the Gemini spacecraft. The Gemini 5 mission was no exception. The fuel cell is operated by the chemical reaction of hydrogen and oxygen and requires that high pressure be maintained in these cryogenic storage tanks so that sufficient amounts of the fuel may be forced into the fuel cell and maintain a high electrical output. Early in the mission the pressure of the oxygen tank started to decrease steadily and this precluded accomplishment of some of the tasks included in the flight plan.

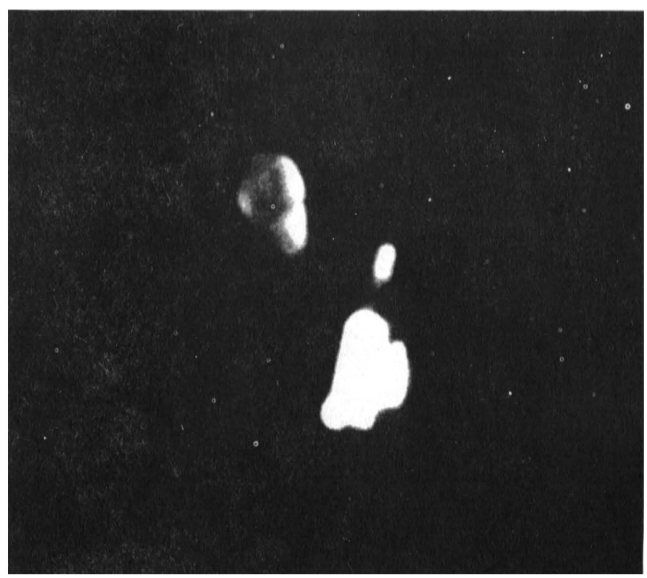


THE GEMINI 5 lifted off the launch pad at Cape Kennedy at 9 a.m. EST, August 21, 1965.

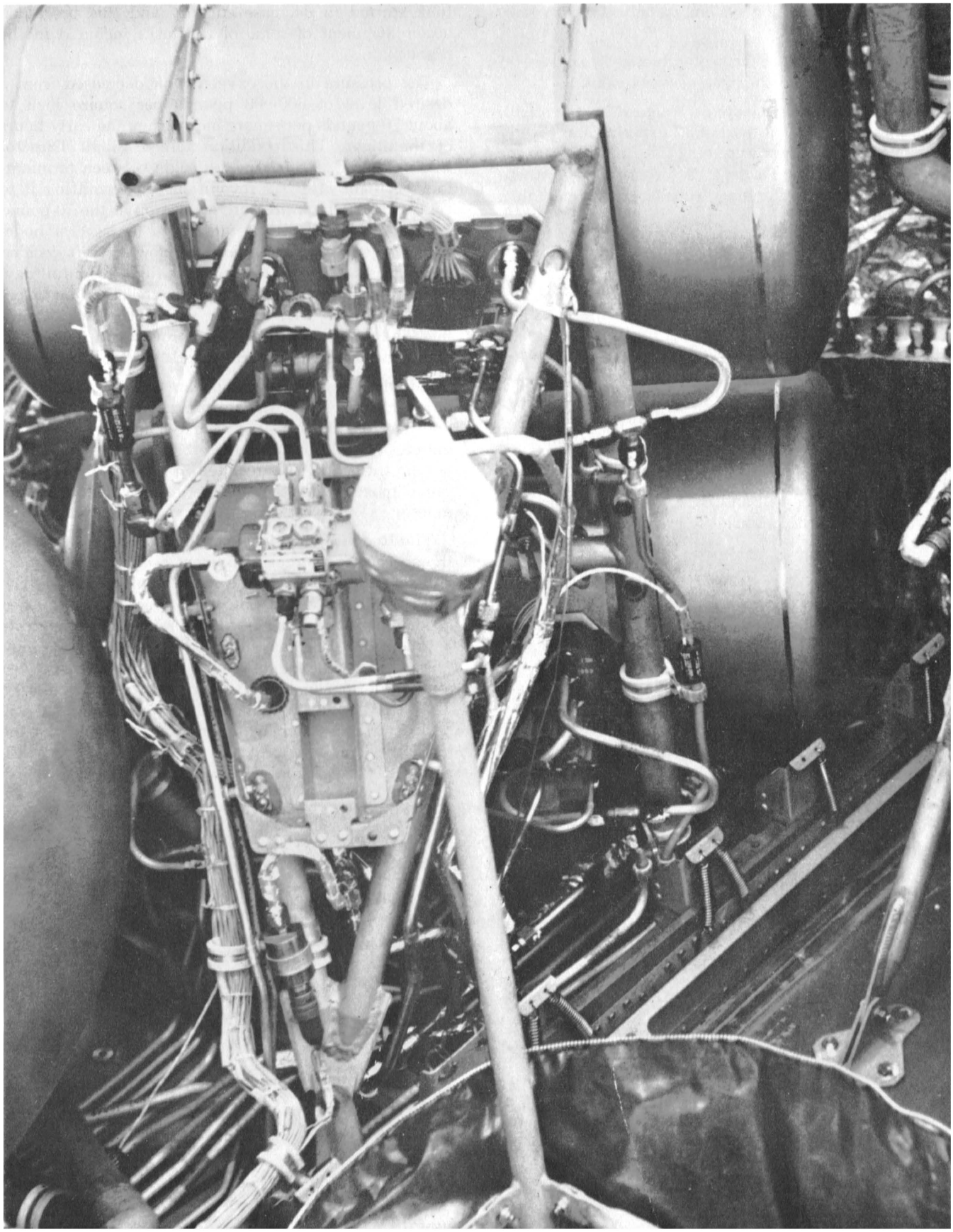
The pressure in the oxygen tank decreased from a desired level of 800-900 pounds per square inch to about 70 pounds per square inch during the early hours of the flight. This condition forced Flight Director Christopher C. Kraft, Jr., to decide between terminating the flight after six revolutions or permitting it to continue. The tank pressure leveled off at the 70-pound figure and remained constant there for several hours while the spacecraft was powered down. Kraft decided on the basis of this to continue the flight for a full day, while continuing to closely monitor the situation. From that time on, a "GO" decision was reached each morning. The situation gradually improved and late in the flight, the astronauts literally had "power to burn."

Initially, the Gemini 5 had an orbit of 216 statute miles at apogee and 100 statute miles at perigee. The flight crew performed its first major maneuver after 56 minutes of flight by firing the orbital attitude maneuver system thrusters. This resulted in a new orbit with the same apogee with the perigee raised to 106 statute miles.

The Radar Evaluation Pod (REP) was ejected from the spacecraft adapter equipment section at two hours and seven minutes into the flight as programmed. The onboard radar locked onto the target and furnished good information concerning the range and range rate between the spacecraft and the REP for about 40 minutes. This part of the test of the equipment was deleted after that time in order to conserve electrical power. The REP stayed in sight of the spacecraft for a long period of time. After five hours and 42 minutes of the mission, Conrad reported that the REP was an estimated 2,000 feet from the spacecraft. After nine and a



PHOTOS OF THE REP in space were taken shortly after the package was ejected from the equipment section of the spacecraft adapter. The bright object in the center of the picture is the pod; the other object is the thermal blanket which covered the REP until its ejection.



THE TOTAL CONFIGURATION of the fuel cell, used on Gemini 5 as a primary source of power for the first time, presents an interesting study of wires, connections and components. The fuel storage tanks for the unit are shown in the background.

half hours, Cooper still had it in sight and reported that it had been as close as 1,000 feet.

The original plan for the spacecraft to track the REP and rendezvous with it during the fourth and fifth revolutions was cancelled because of the oxygen pressure problem. The REP was equipped with instrumentation similar to that to be used on the Agena target. It contained a rendezvous radar transponder, batteries, antenna, and a flashing light.

The Flight Director decided to program a rendezvous with a "Phantom Agena" on the third day of the mission. In order to accomplish this, he placed the theoretical target into an orbit with a 141 statute mile perigee and an apogee of 210 statute miles, and relayed instructions to the flight crew to perform a series of four maneuvers during a period of two revolutions. Just how successful this operation was can be seen by the results.

The rendezvous exercise was designed to place the spacecraft in an orbit with a perigee of 124.2 statute miles and an apogee of 193.2 statute miles. At the end of the exercise the actual orbit had a perigee of 124.0 statute miles and an apogee of 192.6 statute miles.

In another valuable test of the onboard radar capability during the mission, the computer was turned on during the second day of the flight. The spacecraft radar locked on to an L-band transponder at Cape Kennedy and made some actual measurements that were very good. One of the figures obtained by this test indicated the accuracy of the equipment. When the equipment in the spacecraft read 167 miles, the radar at the Cape was reading 170. This was at the point of closest approach to the Cape on that revolution.

Another first was recorded as a result of this flight. An Air Rescue Service C-54 aircraft sighted a 17-foot piece of the first stage of the Titan II launch vehicle floating in the water. The destroyer USS DuPont was not too far from the area and successfully retrieved this piece of hardware several hours later.

The remainder of the flight was taken up largely with work on the various experiments, eating, sleeping and performing "housekeeping" chores.

As the flight neared its completion, on August 29, Cooper and Conrad were ready. The pre-reentry tasks were completed and all was in readiness, both in space and on the ground, for the final phases of the mission.

A MISSION CONTROL "SUMMIT CONFERENCE" was the result of the problem with the fuel cell oxygen pressure early in the flight. Seen left to right, clockwise, are Astronaut James McDivitt, spacecraft communicator; Richard D. Glover and John W. Aaron, electrical environmental and communications officers; Astronaut Elliot M. See Jr., backup pilot for the GT-5 flight; Christopher C. Kraft Jr., flight director; Eugene F. Kranz, flight director; and John D. Hodge, flight director, who is seated to the right of Kraft.

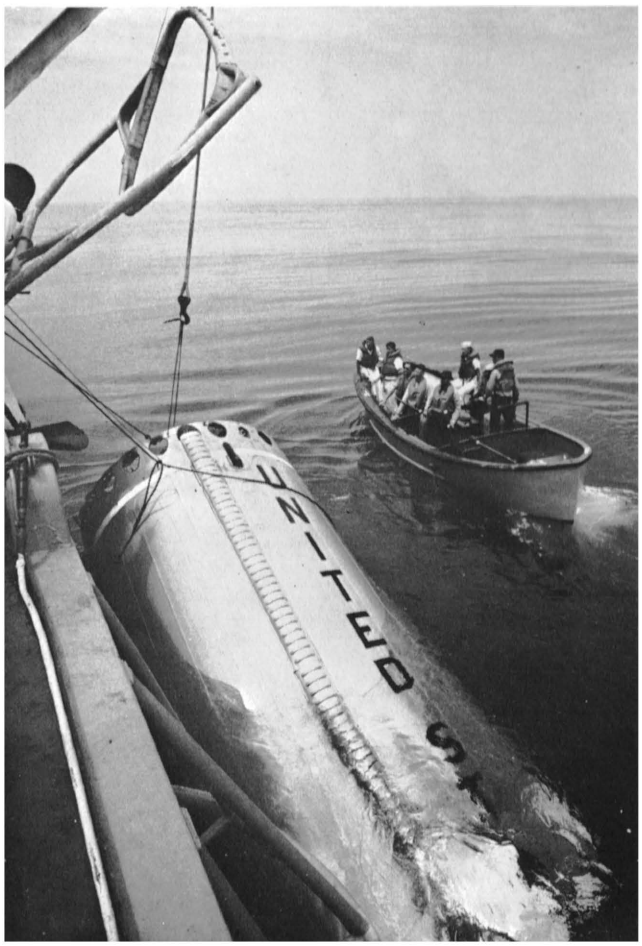
The retrorockets were fired while the spacecraft was near Hawaii on its 120th revolution of the earth at 7:27:43 a.m. EST. A little more than 28 minutes later, the spacecraft touched down in the Atlantic Ocean about 103 statute miles from the prime recovery vessel, the aircraft carrier USS Champlain. The time was 7:56 a.m.

Swimmers from the Champlain were in the water and preparing to attach the flotation collar at 8:39 a.m. At 8:56 a.m. the pilots were in the helicopter and started a much slower but equally safe journey to the deck of the carrier. They landed on the carrier at 9:25 a.m. and, following brief welcoming ceremonies, walked down to the sick bay where the first of a series of medical and technical debriefings began.

The medical debriefing was halted for a few minutes, shortly after 10:00 a.m., in order that Cooper and Conrad might receive the personal congratulations of President Johnson. Immediately following that call, they talked briefly with their wives.

POSTFLIGHT NEWS CONFERENCE

A postflight news conference was held in Houston several hours after the recovery operation was completed. The conference was opened by introductory remarks by Dr. George E. Mueller, Associate Administrator of NASA for Manned Space Flight; Dr. Robert R. Gilruth, Director of Manned Spacecraft Center; Charles W. Mathews, Gemini Program Manager, MSC; and Air Force Lt. Gen. Leighton I. Davis, Department of Defense Manager of Manned Space Flight Support Operations.



RECOVERY of 17 feet of the first stage of the Gemini 5 launch vehicle was accomplished by personnel of the destroyer U.S.S. DuPont. This action occurred about 450 miles northeast of Cape Kennedy.

Dr. Mueller said, "It is, as always, a tremendous pleasure, and a tremendous relief from pressure to congratulate the flight crew, the flight operations crew, the Program Office, the manufacturers, and the Department of Defense support team. It was a perfectly wonderful example of man going into space."

Dr. Gilruth said in part, "... I think the way some of the headlines come out tends to over-emphasize some of the difficulties that occur and don't give any credit to all the literally hundreds of systems that work perfectly. An eight day flight of a device that has to be as complex as this spacecraft is really a great tribute to an outfit that can make something that will work in a tough environment for all that time, and still come up on retrofire like this did and have all the separations clean ..."

Mathews said he thought this was the most interesting flight made to date in the Gemini Program. He said, in part, "We've done some things on this flight like flying the fuel cells — which incidently worked perfectly under some very unusual circumstances — but, nevertheless, they could probably go for another 30 days the way they were looking. We flew cryogenics on this spacecraft, cryogenic hydrogen ... We also, of course, flew a radar system. I was very pleased that it survived the launch environment. We turned it on. We did track the REP before we had to break off activities. I was even more surprised that we tracked the ground target with it ..."

General Davis indicated that he was most pleased with the performance of the DOD forces and stressed the excellence of the tracking network during the complete eight day mission.

Many of the questions which followed the introductory remarks concerned the medical findings during the flight and the post-recovery condition of the crew.

Dr. Charles Berry, Chief of Manned Spacecraft Center Medical Program, discussed this aspect. He said that, during the flight, rates observed in both crew members showed an adaptation to weightless condition. He also said that both crew members had achieved lower heart rates than they had shown in pre-flight tests and were running in the 50's and 60's after the first three or four days of flight. Berry added, however, that, during the retrofire phase they ended up with rates of about 180. Berry said that one blood pressure was obtained at that time and this blood pressure was elevated, as expected, and that this showed the capacity of the heart to respond to a given demand.

TWO BEARDED TRAVELERS, above, smile broadly after the recovery phase of Gemini 5 on the deck of the aircraft carrier. Below, a few minutes later, they paused during their medical debriefing to receive the congratulations of President Johnson.

There were no early indications that either crew member suffered from vertigo, or from nausea, and the first report from flight surgeons aboard the carrier said both pilots were "healthy, happy, and aware."

In answer to another question about the condition of the crew following recovery, Berry pointed out that a flight surgeon had been aboard the helicopter and required the crew to do deep knee bends. The surgeon reported that both pilots were perfectly capable of doing this as well as standing and walking around in the helicopter with no difficulty.

Chris Kraft was asked to evaluate the overall performance of the spacecraft. Kraft emphasized that the performance of the spacecraft was extremely good. He said there were some problems they had to contend with but that had to be expected in any research program where you are dealing with new systems.

Kraft was also asked if the successful phantom rendezvous provided much information for the Gemini 6 flight which is to provide the first attempt to rendezvous and dock with an Agena target. Kraft replied, "There's no question about it.... What we proved was that we could hit the right altitude within probably a tenth of a mile or so; and we hit the mid-point of darkness we were aiming for within a couple of minutes. That's very significant."

ASTRONAUT NEWS CONFERENCE

The astronaut news conference was held in Houston on September 9. This event followed 11 days of intensive medical and technical debriefings — four days on board the carrier and at Cape Kennedy, followed by seven days at Manned Spacecraft Center.

Following brief introductory remarks by Dr. Robert C. Seamans, Jr., Associate Administrator of the National Aeronautics and Space Administration, and Dr. Gilruth, Cooper and Conrad discussed their flight in some detail.

Cooper described the activities during the first few orbits. He said that the liftoff was very smooth and positive and that the trajectory was almost as perfect as a trajectory could be. Cooper said the Titan II launch vehicle was considerably smoother and more solid than the Atlas he had ridden on his Mercury flight. Cooper said, "The Gemini launch vehicle was really a Cadillac."

Speaking of events surrounding the ejection of the REP, he said in part, "... it was ejected nominally, and very shortly after we ejected it we were getting into the second night side, and as we began to turn around — yaw to the left — to get the REP in sight, we could see the light flashing very brightly on the nose of the spacecraft. It was quite near us and moving out in the scheduled manner away from us. We succeeded in getting a few pictures of it as it moved on out.... We got radar lock on. The radar behaved ideally.... We got radar range and range rates, and we got a great deal of data as the REP passed on out in this out-of-plane fashion in which we had ejected it..."

Cooper also praised the behavior of the fuel cells. He said that they worked perfectly and were better than anyone had hoped they would be. He pointed out that they had powered one section of the cell down for long periods of time and it came back on strong and provided all the electrical power needed.

In speaking about the work completed on the experiment, Conrad pointed out that the crew had taken about 350 photographs in addition to some 16-mm film. He added that he felt this material would provide "some pretty useful geological information."

He also noted that the Gemini 5 crew got credited with positioning tropical storm "Doreen" on two successive days. The Gemini 5 crew observed hurricane "Betsy" during its early stages off the coast of Brazil. Photos were obtained of other storms noted by the crew during their flight.

Cooper said that stowage presented the crew with one of their greatest problems, just as they had anticipated, and that they had found out just how important good housekeeping can be. In describing the problem, he said, "Very shortly, if you didn't keep things stowed properly and put away you discovered that you were practically getting crowded out. The footwells filled up very rapidly and it was vitally necessary ... to have a housecleaning session every day." He pointed out that after each series of passes over the United States, each crew member would have several cameras and lenses plus numerous other pieces of equipment in their lap, stowed on velcro along the side, and stowed in the footwell. All this equipment had to be disassembled and put away in a proper fashion. This activity, he said, took one of their sleep periods each day.

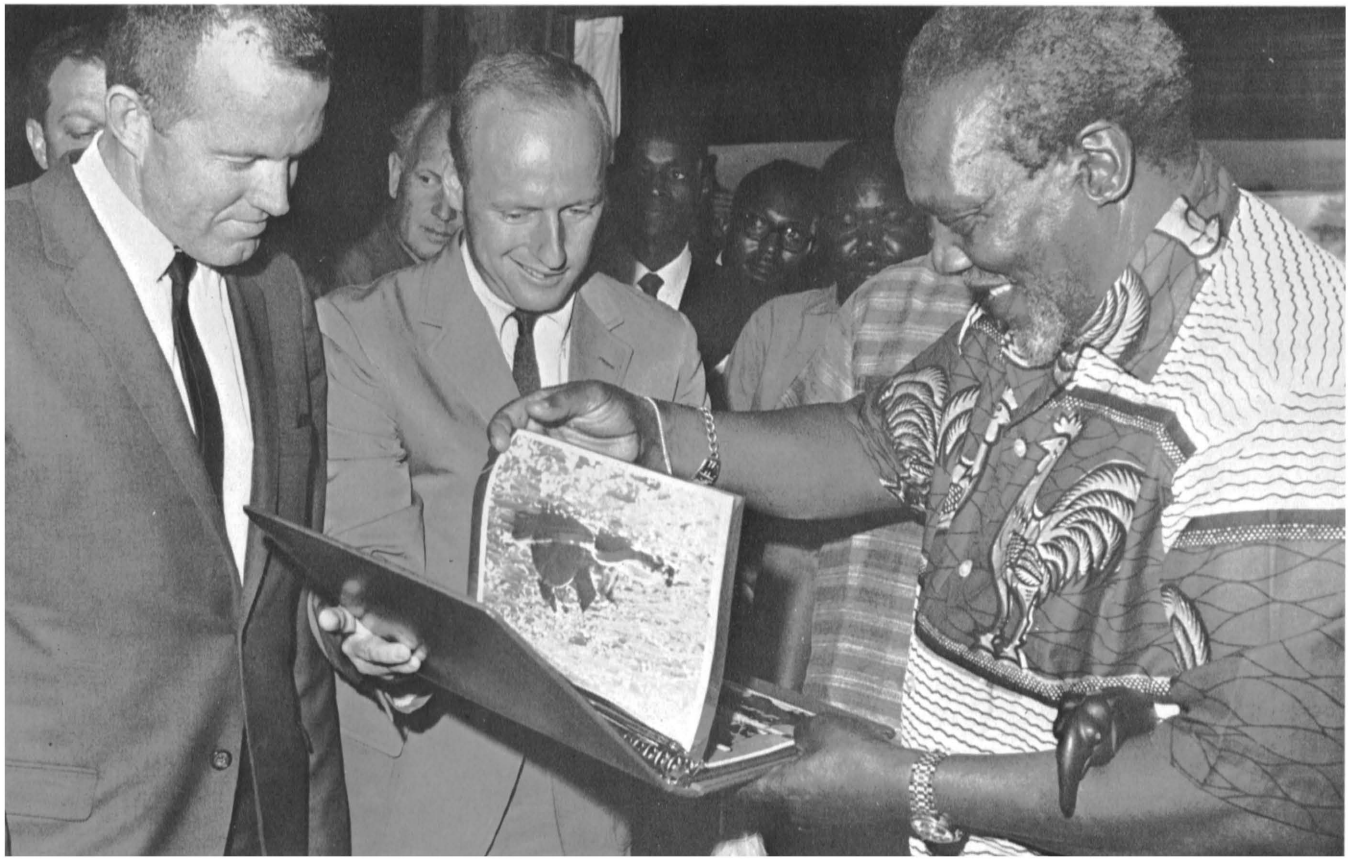
Both pilots agreed that one of the changes in the flight plans for future missions should be to program both crew members for concurrent sleep periods. They felt that there was sufficient evidence of the reliability of the spacecraft systems to permit both pilots to sleep at the same time, and pointed out that during this time the ground stations could read out the telemetry and call them on the radio if there seemed to be any problem developing.

Cooper said that after they got the "Go" for one day, they removed their helmets and gloves and stowed them in the footwells until just before retrofire. They put the neckdam around the collar of the suit and put on wrist bands to keep the suit circuit functioning as it should and used a lightweight head set with a little boom microphone during this period.

POSTFLIGHT ACTIVITIES

On September 15, the astronauts and their families along with Dr. Berry and his family went to Washington, D. C. There, they had a full day of activities, beginning at the White House. President Johnson, in his office, awarded the NASA Exceptional Service Medal

CONRAD AND COOPER EXPLAIN THE INTRICACIES OF A SPACE HELMET TO Emperor Haile Selassie during their visit to Ethiopia, as U. S. Ambassador Edward Korry looks on. Below, the two astronauts are shown with Nigerian Prime Minister Sir Abubakar Balewa at Lagos.



PRESIDENT JOMO KENYATTA of Kenya examines an album of Gemini 5 photographs presented to him by the astronauts at the village of Keekorok, above. Below, the astronauts are shown with the Premier of Northern Nigeria, Sir Ahmadu Bello, after an exchange of gifts in which Cooper and Conrad received native dress and fans. The astronauts presented a spacecraft model to the premier.

to Cooper, Conrad and Berry. He also announced that he had forwarded recommendations to Congress for Cooper's promotion to Air Force Colonel and Conrad's promotion to Navy Commander.

The President also announced that he was sending the astronauts on a good will trip to Greece, Turkey, Ethiopia, Malagasy, Kenya, and Nigeria.

After the White House ceremony, the group went to the National Academy of Sciences, accompanied by Vice President Humphrey and Administrator Webb. While there, Cooper described the activities of the flight; Conrad told the group about the conduct of the experiments; and Berry discussed the medical aspects of the mission. The group remained for lunch as guests of the Academy.

Later in the day there was a motorcade to the Capitol. Cooper and Conrad were introduced to both Houses and spoke briefly.

The following day, the group flew to Athens. Highlights of the stay there included a presentation of the results of the Gemini 5 flight to the 16th International Astronautical Congress by the pilots and Dr. Berry, and a dinner given by King Constantine II and Queen Mother Frederica.

Cooper and Conrad had several meetings with Russian cosmonauts Pavel Belyayev and Alexei Leonov while in Athens. At a dinner at the Congress, Cooper and Belyayev traded the wrist watches they had worn on their space flights. The four spacemen also got together for breakfast in Cooper's room and exchanged further amenities. On this occasion, Conrad and Leonov exchanged the special pens they had used in space. Also, while in Greece, the party visited the Acropolis and made a side trip to Thessaloniki. They visited the United States Pavilion at a Fair in progress there.

Three stops were made in Turkey. The first was at Izmir where the astronauts laid a wreath at the base of the Ataturk Statue. In Istanbul the group had lunch with Governor Aki, and at Ankara they met the heads of a number of universities.

Enroute from Turkey to Ethiopia, the plane flew over the Nile, the great pyramids and the Suez Canal. On arrival at Addis Ababa they were greeted by members of the Imperial Household, then proceeded to the Palace where Cooper, Conrad, Berry and their wives were presented to Emperor Haile Selassie. They spent about an hour and a half with the Emperor and showed him the Gemini pressure suit and a film of the Gemini 5 flight. Later the group visited the City Hall and Cooper, Conrad and Berry were presented with keys to the city.

The next stop on the trip was at Tananarive, Malagasy. While there they visited the tracking station located in that area; called on President Philibert Tsiranana; paid a courtesy call to City Hall; and visited the Queen's Palace.

At Nairobi, Kenya, they visited Parliament and Mayor Rubia. The two astronauts then flew to Keekorok. While there they called on President Jomo Kenyatta, were introduced to Masai warriors, and were presented spears. They gave the President a photo album which included a picture of the Rift Valley taken from space. On their return to Nairobi, they met with a group of students and science teachers.

The last country visited on their tour was Nigeria and they made five brief stops there. After landing in Lagos, they called on government officials and presented a spacecraft model to Prime Minister Sir Abubakar Balewa. They also visited the tracking station at Kano, and called on Ado Bayero, Emir of Kano, at his palace. Other stops were made at Benin, Enugu, and Kaduna. At the latter, they exchanged gifts with the Premier of Northern Nigeria, Sir Ahmadu Bello. They received gifts of native dress, and, in turn, presented the Premier with a model of the Gemini spacecraft.

Enroute to the United States, the aircraft landed in the Canary Islands and the group was welcomed by representatives of the Spanish government who had flown in from Madrid to greet them.

EXPERIMENTS

Due to the long period of the Gemini 5 flight, a greater number of experiments were carried than on previous missions. Following is a brief description of each of the 17 experiments and preliminary results.

There were five medical experiments:

• In-flight Exerciser — the in-flight exerciser was designed to measure the capability of the astronauts to perform physical tasks under weightless conditions. The exerciser used was a bungee cord which requires 60 pounds of pressure to pull it to its limit of 12 inches. During each scheduled exercise period the astronauts pulled this cord once a second for 30 seconds. The pulse rate was monitored during these periods and a close check kept on the rate of return of the pulse level to what it was prior to the exercise. Both crew members felt that exercise was essential on long duration flights. In addition to using the exerciser during medical passes three times each day, both crew members used the bungee cord frequently after the fourth day of the flight.

• In-flight Phonocardiogram — the in-flight phonocardiogram is designed to measure the fatigue state of an astronaut's heart muscle. Heart sounds of the astronauts were picked up by a miniature microphone attached to their chests and recorded on a medical recorder. Information obtained from this experiment will provide some insight into the functional cardiac status of crew members during prolonged flight. The system functioned well during the Gemini 5 mission.

• Bone Demineralization — in the bone demineralization experiment, X-rays taken before the flight, immediately following the flight, and at set intervals following the flight were compared to determine the loss

of calcium from the bones as a result of weightlessness and inactivity. Bones studied in this experiment are the heel bone and the end bone of the little finger. A quick-look at the results of this experiment indicates some actual X-ray absorbency changes occurred in the heel of both Cooper and Conrad. The last X-rays taken during the postflight examinations indicate a decrease in the absorbency but they had not yet returned to preflight levels.

• Cardiovascular Reflex Conditioning — this experiment was performed to determine the effectiveness of pneumatic cuffs in preventing deterioration of an astronaut's blood distribution system. On this experiment, the cuffs were applied to Conrad and Cooper was used as a control. The cuffs were applied to the upper thighs and were automatically pressurized for two minutes out of every six the first four days of the flight. The experimenter concluded that this experiment did accomplish its objectives.

• Human Otolith Function — this experiment was designed to measure any changes in otolith (gravity sensors in the inner ear) functions. The item used to test this activity was a pair of special light-proof goggles, one eye piece of which contained a light source in the form of a movable white line. One astronaut positioned the white line to what he judged the pitch axis of the spacecraft to be, while the second astronaut recorded the results. The preflight, in-flight and postflight data from one crewman showed no change in otolith activity. The in-flight data from the other crewman shows only a relatively minor change in the otolith function.

Six experiments were included on the Gemini 5 mission for the Department of Defense.

• Nearby Object Photography — the object of this experiment was to test man's proficiency in obtaining high-resolution photographs of an orbiting object while maneuvering, station keeping, and observing in a manual control mode. This experiment was not conducted due to the trouble encountered with the fuel cell oxygen pressure system.

• Space Object Radiometry — the objectives of this experiment were to determine the threshold of sensitivity values for earth objects and sky background radiation of various objects in space and on the ground. The Gemini 5 astronauts were to attempt to observe the second stage of the Titan II launch vehicle, exhaust plumes of rockets fired from the Eastern and Western Test Ranges, and rocket sled exhausts at Holloman Air Force Base, as well as other targets. Twenty-three of the planned 28 runs were completed, and one of the four target-of-opportunity runs was completed. Man's capability to observe and track rocket launches and space objects such as the REP is considered to be of significance.

• Celestial Radiometry Experiment — the purpose of this experiment was to provide information on spectral analysis of regions of interest supplied in the star fields, principal planets, earth and the moon. Measurements of two of the three selected stars were successful. Measurements of the Milky Way and the Sun were not made due to the loss of attitude control of the spacecraft in the powered-down flight.

• Surface Photography — this experiment was performed to identify the problems associated with the crew's ability to acquire, track, and photograph terrestrial objects. Some of the planned activities concerning this experiment were cancelled during the powered-down phase of the flight. Only one of the five planned acquisition and tracking modes — visual acquisition and visual tracking — was used. Results indicate that this combination was highly successful in obtaining photographs of pre-selected terrestrial objects.

• Basic Object Photography — the objectives of this experiment were to investigate man's ability to acquire, track, and photograph space-borne objects such as the REP, natural celestial bodies, and other objects of opportunity. Photographs of celestial bodies were made with Cooper sighting through the optical sight in the left window, and Conrad passing over corrections in attitudes from his observations in the periscope.

The sixth experiment for the Department of Defense, the visual acuity experiment, was conducted in conjunction with a similar test conducted for NASA.

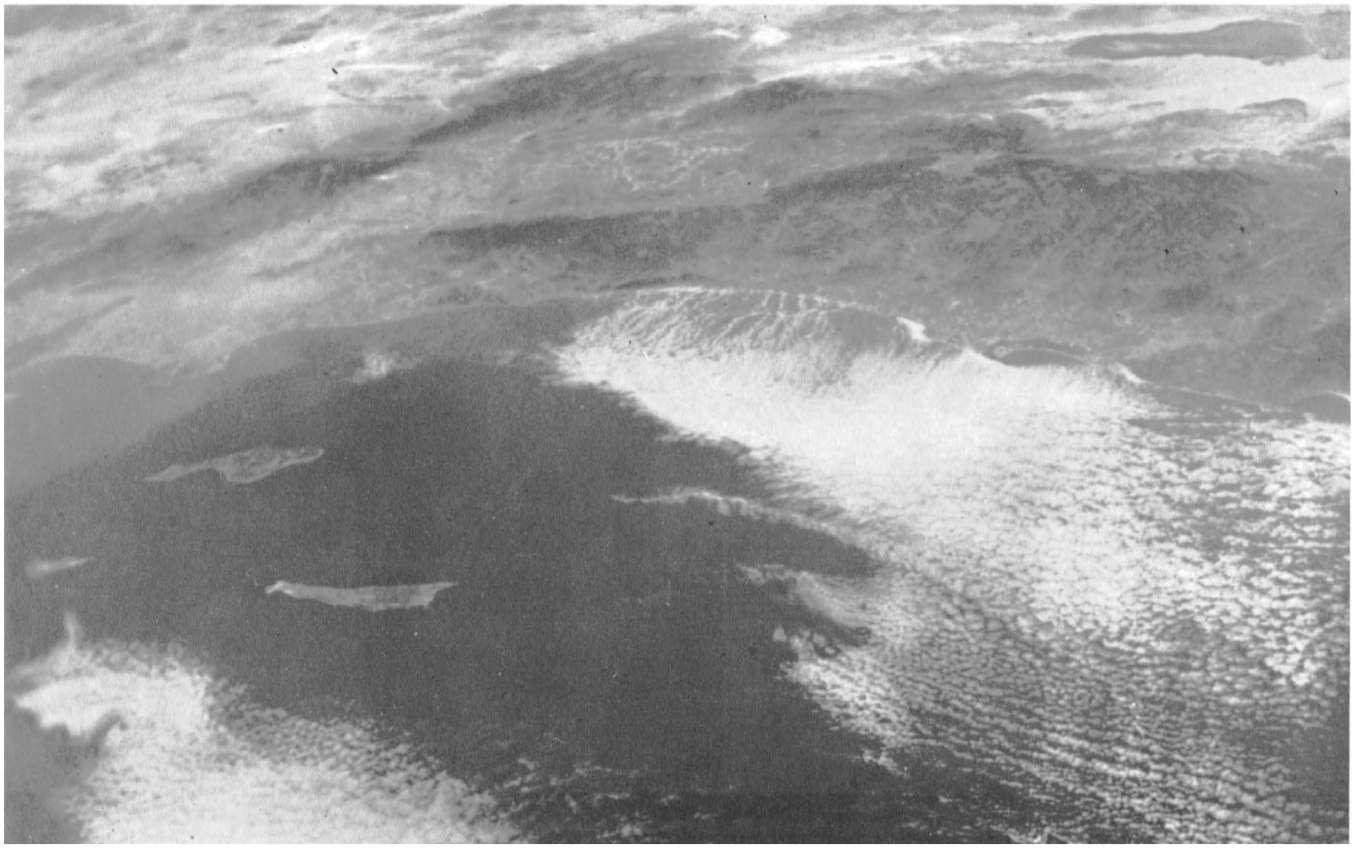
The six scientific experiments were:

• Zodiacal Light — this experiment was designed in an effort to determine the origin of this natural phenomenon. Zodiacal light appears as a cloudy, hazy light seen in the west after twilight and in the east before sunrise. The experiment was primarily to photograph the zodiacal light but was also used to photograph the Gegenschein. The Gegenschein is believed to be a dim illumination approximately in the anti-Sun direction. No photographs of it ever existed. Results show that the zodiacal light can be recorded at elongation angles as small as 16 degrees and that the Gegenschein has no measurable westerly displacement.

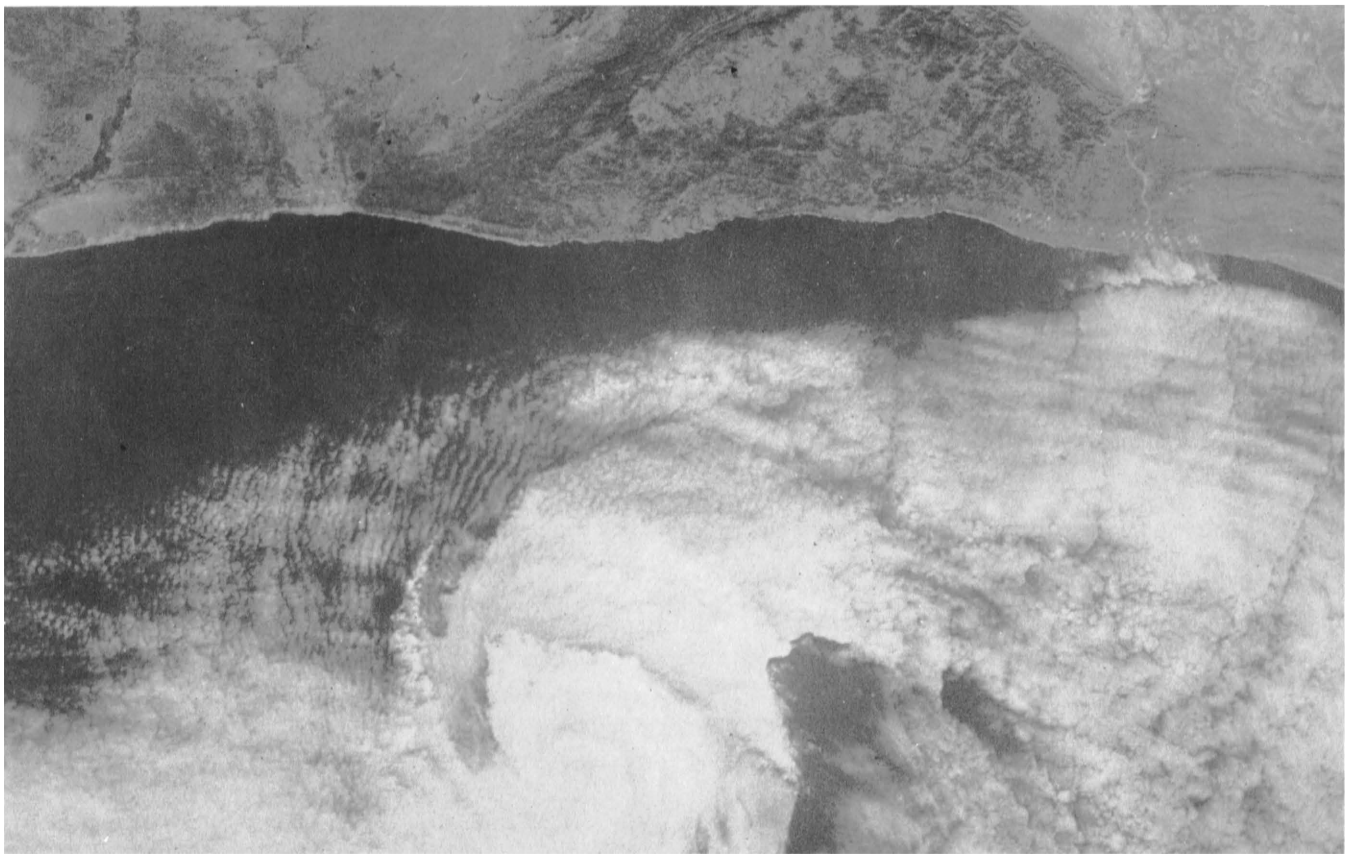
• Cloud Spectrometer — in this test, photographs were to be taken of various types of cloud formations. Results of the experiment were expected to be valuable in aiding scientists in the design of weather satellites. Twenty-seven of 30 planned observations were obtained by the Gemini 5 crew. Of great significance was the stratus off California; a tropical storm, hurricane Doreen; and the stratus off the Philippine Islands, Guam and Florida. Data from more than 50 observations of direct measurements of cloud heights from civilian and military aircraft have been received and this data is being correlated with that obtained during the flight.

• Visual Acuity — the purpose of this experiment was to measure man's visual acuity before, throughout and after the long duration flight to ascertain the effects of prolonged spacecraft environment on vision. Another objective was to test the use of basic visual acuity data to predict the limiting naked-eye visual

THE SALTON SEA and Imperial Valley of California as seen from the Gemini 5 spacecraft is shown in the picture above. Below is another view of the western coast of the United States. An interesting cloud mass is shown in the foreground.



Above, THE GRAND BAHAMA BANK, southeast of Andres Island, as it was photographed from the Gemini 5. Below is a photo showing the coast line of Africa in the Morocco area. A storm is shown in the foreground.



capability to identify small objects on the surface of the earth in daylight. Equipment used in this experiment consisted of an in-flight device for testing visual acuity, a photometer to monitor the window of the spacecraft, two ground test sites, instruments to monitor atmospheric and light conditions at each site, and a training van. The experiment started several months before the flight and both pilots completed six sessions in the training van during this period. During the flight, in-flight vision tests were conducted each day by the crew. Ground patterns were laid out near Laredo, Texas, and near Carnarvon, Australia. At the Laredo site 12 background test areas were used with markings made of white gypsum. In Australia the markings were made of white shells. Use of these materials permitted persons concerned with the experiment to change the ground patterns as they desired. Preliminary results show that visual performance was not degraded during the mission. A quantitative reading of the ground markings at Laredo was achieved once during the mission.

• Electrostatic Charge — the object of this experiment was to detect and measure any accumulated charge on the surface of the spacecraft. Data obtained was telemetered to the ground. Results indicate that the electrostatic charge is not great enough to present a hazard during rendezvous missions.

• Terrain Photography — the primary objective of this experiment was to obtain high-quality pictures of large land areas for use in research in geology, geophysics, geography, and oceanography. Such photographs can serve as a standard for interpretation of pictures of unknown areas on earth, the moon and other planets. The Gemini 5 crew obtained 172 photos which will be useable for terrain studies. Of special interest are the pictures of near-shore areas. Much bottom photography and current structure is visible, making the pictures valuable in planning studies in oceanography and marine geology.

• Weather Photography — the objective was to obtain high-quality color photographs of a variety of cloud systems for comparison with pictures obtained from unmanned meteorological satellites. In many areas these satellites provide information where few or no other observations exist. Unfortunately, satellite pictures are essentially television views of large areas taken from an altitude of 400 miles or more. They lack the details which can be obtained in pictures taken by astronauts at 100 miles. During the Gemini 5 mission, about 175 high-quality pictures containing cloud formations were obtained. These include photographs of tropical storm Doreen, typhoon Lucy near Japan and thunderstorm activities over Florida and the adjacent water area.

GEMINI 5 FLIGHT CONTROL

The Mission Control Center at Houston exercised control of the flight from lift-off through the recovery phases. This was the second manned space flight to be controlled from that location.

The most hectic part of the flight occurred early in the mission when Flight Director Chris Kraft had to decide whether to terminate the mission during the sixth revolution or to permit it to go for a full day. This decision was made necessary by the troubles encountered in the oxygen system which feeds the fuel cell. Kraft made the decision to go for one day; then made additional "GO" decision on a day-to-day basis.

Although there were several other minor operational problems during the flight, how well these problems were handled is attested to by the success of the mission.

THE PILOTS

Command pilot L. Gordon Cooper, Jr., was born in Shawnee, Oklahoma, March 6, 1927. He is five feet, eight inches tall; has brown hair and blue eyes, and weighs 155 pounds.

He received an Army commission after completing three years of college at the University of Hawaii. He transferred that commission to the Air Force and was placed on extended active duty by that service in 1959 and given flight training.

Following four years service in Germany, he returned to the United States and was assigned as a student at the Air Force Institute of Technology at Wright-Patterson Air Force Base, Ohio. He received a bachelor of science degree in aeronautical engineering after completing two years work there.

Cooper then attended the Air Force Experimental Flight Test School at Edwards Air Force Base, California. He was graduated from this school in 1957 and assigned to duty in the Performance Engineering Branch of the Flight Test Division at Edwards. He participated in flight testing experimental fighter aircraft, working both as an aeronautical engineer and as a test pilot.

Cooper was one of the seven Mercury astronauts named by NASA in April 1959 and flew the last and longest Mercury mission on May 15-16, 1953. That flight lasted 34 hours, 19 minutes and 49 seconds. He was awarded the NASA Distinguished Service Medal and the Air Force Astronaut Wings. He has logged more than 3,400 hours flying time, including more than 2,300 hours in jet aircraft.

He is married to the former Trudy Olson of Seattle, Washington. They have two daughters — Camala, 16, and Janita, 15. Cooper's mother, Mrs. Hattie Cooper, resides at Tecumseh, Oklahoma.

Pilot Charles Conrad, Jr., was born in Philadelphia, Pennsylvania, June 2, 1930. He is five feet, six inches tall, weighs 142 pounds, and has blonde hair and blue eyes.

Conrad was graduated from Princeton University in 1953 with a bachelor of science degree in aeronautical engineering. Following his graduation he entered the Navy and received flight training.

He attended the Navy Test Pilot School at Patuxent

UNITED STATES SPACE FLIGHT LOG

MISSION	PILOTS(S)	DATE(S)	ELAPSED TIME	TOTAL U. S. MANNED HOURS IN SPACE
Mercury-Redstone 3	Shepard	May 5, '61	00:15:22	00:15:22
Mercury-Redstone 4	Grissom	July 21, '61	00:15:37	00:30:59
Mercury-Atlas 6	Glenn	Feb. 20, '62	04:55:23	05:26:22
Mercury-Atlas 7	Carpenter	May 24, '62	04:56:05	10:22:27
Mercury-Atlas 8	Schirra	Oct. 3, '62	09:13:11	19:35:38
Mercury-Atlas 9	Cooper	May 15-16, '63	34:19:49	53:55:27
Gemini-Titan 3	Grissom-Young	Mar. 23, '65	04:53:00	63:41:27
Gemini-Titan 4	McDivitt-White	June 3-7, '65	97:56:11	259:33:49
Gemini-Titan 5	Cooper-Conrad	Aug. 21-29, '65	190:56:00	641:25:49

River, Maryland, and upon the completion of that training was a project test pilot in the Armaments Test Division there. He also served at Patuxent as a flight instructor and performance engineer.

Conrad was selected for the astronaut program by NASA in September 1962. He has logged more than 3,200 hours flying time, including more than 2,400 hours in jet aircraft.

He is a member of the American Institute of Aeronautics and Astronautics, and an associate member of the Society of Experimental Test Pilots.

Conrad is married to the former Jane DuBose of Uvalde, Texas. They have four sons — Peter, 10; Thomas, 8 Andrew, 6; and Christopher, 4.

THE GEMINI 5 FLIGHT CREW — pilot Charles Conrad Jr. and command pilot L. Gordon Cooper Jr.