

## GEMINI XI MISSION

### High Altitude, Tethered Flight

Fact Sheet 291-H  
October 1966

Gemini XI, the ninth manned space flight of the Gemini program, was launched September 12, 1966. The mission was ended September 15. Primary objective of the mission—to rendezvous and dock with the target vehicle during the first revolution—was accomplished.

There were seven secondary objectives assigned to the flight:

- To conduct docking practice
- To conduct extravehicular activity
- To conduct 11 experiments
- To conduct docked maneuvers which included a high-apogee excursion
- To conduct a tethered vehicle test
- To demonstrate an automatic reentry, and
- To park the Agena target vehicle.

Gemini XI had been scheduled by the National

Aeronautics and Space Administration for launch September 9, 1966. During the early stages of the countdown on that day, a small leak was discovered in the first stage oxidizer tank of the Gemini launch vehicle following completion of the propellant loading. The twin launches for the Gemini XI mission were later re-scheduled for the following day.

On September 10, Astronauts Charles Conrad, Jr. and Richard F. Gordon, Jr., command pilot and pilot of Gemini XI, respectively, were awakened early and after a physical examination, they had breakfast, suited up, and arrived at the White Room at the launch pad about 6:23 a.m., EST.

On arriving there, they were advised that the count was being held and were asked to hold up on being inserted into the spacecraft. This hold had become effective during the few minutes it took them



THE GEMINI XI SPACECRAFT, lower left, and target vehicle, center, are shown during tethered flight. This photo was taken as the spacecraft passed above the Gulf of California and Baja California.

to travel from the Ready Room to the launch pad and ascend to the 100-foot level on the elevator. Some 35 minutes later Conrad and Gordon were advised to return to the Ready Room. At 7:19 a.m., almost an hour after the hold had gone into effect, Mission Director William C. Schneider of NASA Headquarters announced that the flight had been scrubbed and would be recycled to occur 48 hours later. This hold was caused by a suspected malfunction of the autopilot on the launch vehicle for the Agena target.

### Launch Day

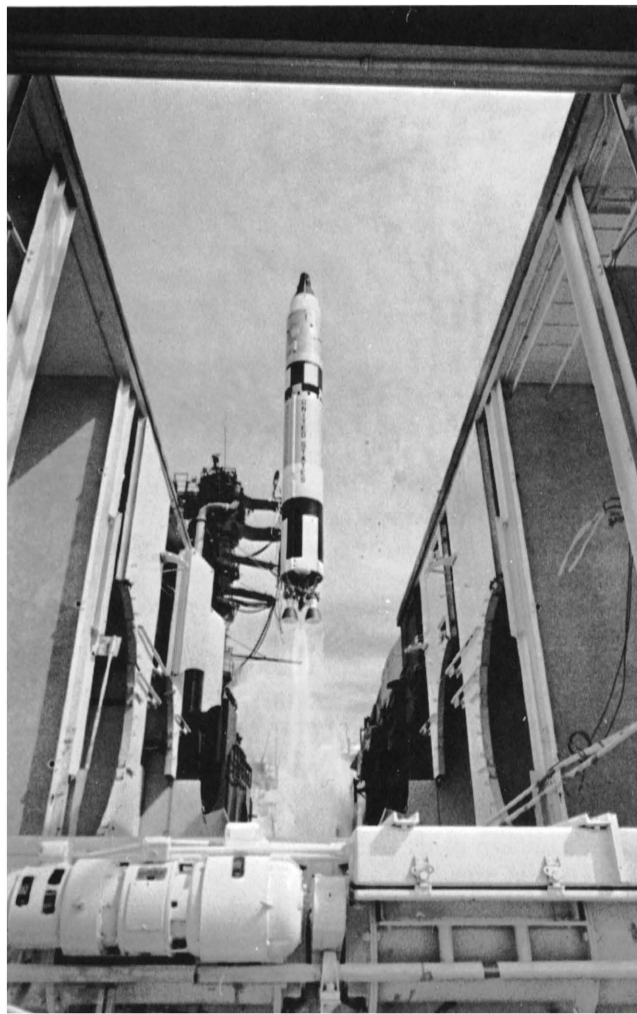
Finally, on September 12, the third time proved the charm for Gemini XI crew. They again went through the familiar preflight preparations including the physical examination, breakfast, suiting up, final briefings, and the trip to the White Room atop the gantry. On this morning they had Astronaut Alan B. Shepard Jr., as a breakfast guest and the menu varied from that which has come to be considered the normal preflight breakfast by substituting sirloin strip steaks for filets. The rest of the breakfast consisted of juice, scrambled eggs, toast, and coffee.

Conrad and Gordon arrived at the White Room at 7:25 a.m., EST, and "checked signals" with the backup crew before being inserted into the spacecraft. That crew, with Neil Armstrong and William Anders serving as command pilot and pilot, respectively, had been participating in the countdown activities for about five and a half hours.

A hold was initiated at T minus 97 minutes and five seconds due to suspected leakage around the command pilot's hatch. The hatch was reopened, the sealant checked, and the hatch closed again. The countdown was then recycled to T minus 103 minutes. This hold lasted about 10 minutes plus a 6-minute recycle for a total of 16 minutes delay.

The countdown was resumed and the Atlas-Agena target vehicle liftoff occurred at 8:05:02 a.m., EST. Shortly after liftoff preliminary orbital figures for the Agena indicated that it would be in an orbit with an apogee of 165 miles and a perigee of 156.6 miles (all mileage figures quoted in this Fact Sheet are in nautical miles—one nautical mile is equal to 1.15 statute miles).

A postflight examination of data determined that the Agena was in an orbit with an apogee of 163 miles and a perigee of 153 miles. During the remainder of the Gemini countdown, Conrad asked for an estimated launch time, the length of the launch window and the length of the T minus three-minute hold. He was told that the estimated ignition time was 9:42:23 a.m. with liftoff to occur at 9:42:26 a.m., the launch window would be two seconds in duration, and that the hold was anticipated to last two minutes 21 seconds. This information was accurate. Gemini XI liftoff was clocked at 9:42:26.5, and its initial orbit had an apogee of 151 miles and a perigee of 87 miles.



AN UNUSUAL ANGLE shows Gemini XI scant seconds after lift-off.

In achieving the first-orbit rendezvous, Gemini XI performed a minor plane change to the left shortly after 29 minutes of the flight had elapsed, then made a terminal phase burn maneuver after 49 minutes and 58 seconds of the mission had been flown. The latter maneuver with minor midcourse corrections placed the spacecraft in position to initiate the braking maneuver after about one hour and 18 minutes of the flight had elapsed.

During the next several hours the crew performed various sequences of the Ion-Wake Measurement experiment, including one undocking and redocking. After four hours and 28 minutes of flight the first docked maneuver was initiated using the Agena's primary propulsion system. Each crewman performed an additional docking practice before entering the first sleep period which was scheduled to start about eight hours after liftoff.

At 24 hours and two minutes after liftoff, Gordon opened his hatch and began the umbilical extra-vehicular (EVA) activity. He set up a camera, retrieved an experiment package, then moved to the nose of the spacecraft and attached a tether from

the Gemini Agena Target Vehicle to the docking bar. This operation proved very difficult and tiring. As a result, Conrad and Gordon decided to terminate this phase of EVA because of pilot fatigue. The hatch was open 33 minutes.

After 25 hours and 37 minutes, ground elapsed time, the pilot opened the hatch and jettisoned the equipment no longer needed for the mission. The other major activity during the second day of the flight was spent performing various sequences of the Airglow Horizon Photography experiment, and the second sleep period started after 31 hours and 30 minutes of flight. That period terminated at 39 hours.

### High Altitude

The following day the Agena primary propulsion system was used to place the docked Gemini-Agena configuration into an elliptical orbit which had an apogee of 741.5 miles and a perigee of 156.3 miles. This maneuver was initiated after 40 hours, 30 minutes and 15 seconds of flight. During the ensuing two revolutions the crew was busy taking photographs required for the Synoptic Terrain Photography, Synoptic Weather Photography, and the Air-

glow Horizon Photography experiments. After 43 hours, 52 minutes, and 55 seconds of flight, a retrograde maneuver was performed which lowered the apogee of the docked vehicles to 164.2 miles while the perigee remained at 156.0 miles.

Conrad and Gordon then started preparation for the standup EVA activity and the pilot opened his hatch after an elapsed flight time of 46 hours and seven minutes. During the two hours and eight minutes of standup EVA both night passes were spent taking photographs for the Astronomical Camera experiment.

### Tethered Operation

The spacecraft was undocked about 49 hours and 55 minutes after liftoff and the successful tether operation began at that time. About 17 minutes later the crew initiated a rotational rate to the tethered vehicles. The initial rate achieved was 38 degrees per minute. Later the Gemini XI crew increased the rotational rate to about 55 degrees per minute and again encountered oscillations. Oscillations were reduced more rapidly by maneuvering the spacecraft and after about 20 minutes the rotating combination became very stable.



THIS EVA ACTIVITY of Astronaut Richard Gordon prompted command pilot Charles Conrad to yell "Ride 'em Cowboy!" The action took place 160 miles above the Atlantic Ocean.

As a result of this operational experiment the tethered system appears to be an economical and feasible method of unattended station keeping. This activity was ended after about 53 hours of flight.

The next day, a series of maneuvers was initiated, starting at 65 hours and 27 minutes of flight, to achieve a re-rendezvous with the target vehicle. Conrad and Gordon were station keeping with that target one hour and 13 minutes later.

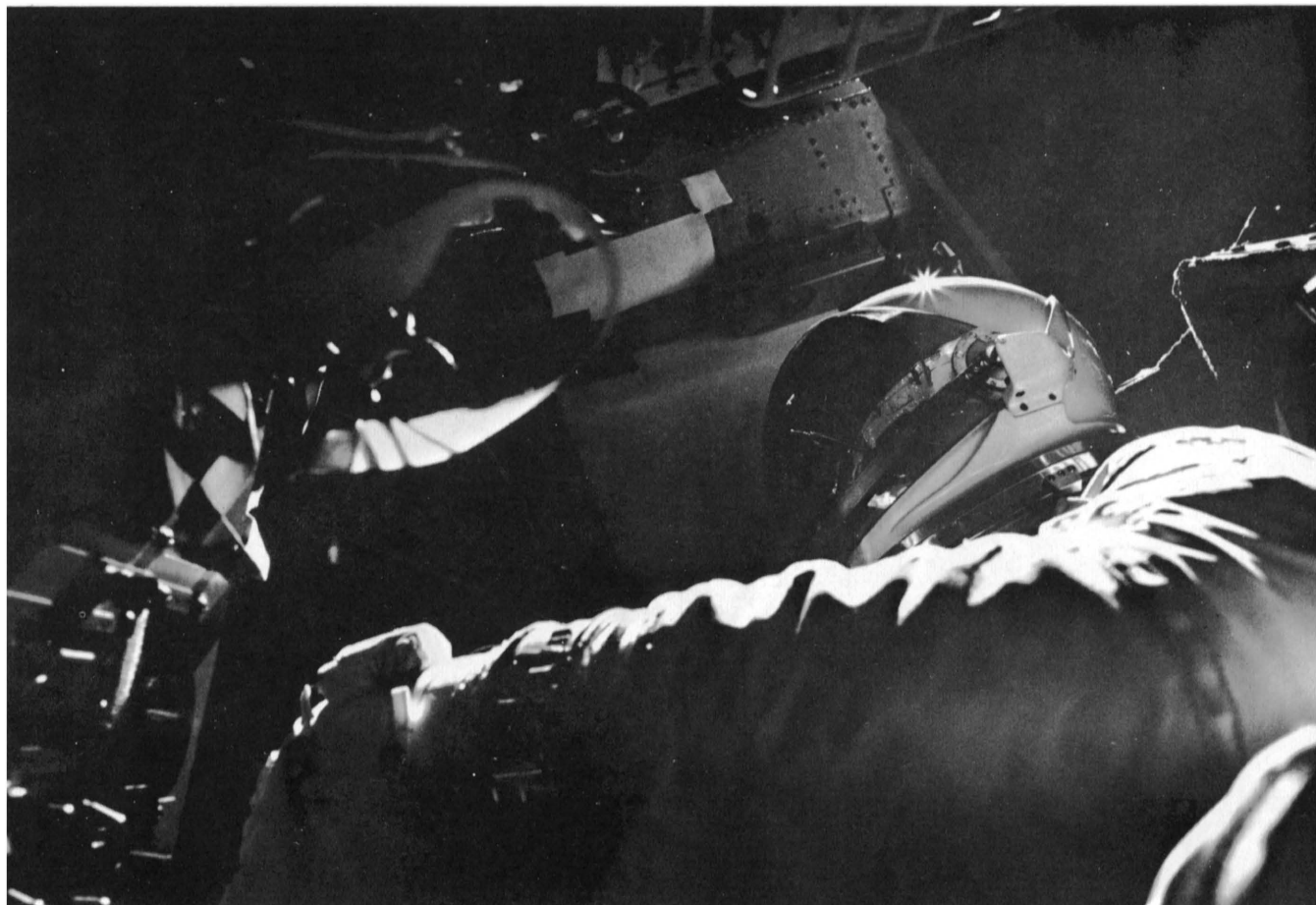
Retrofire occurred over the Canton Island tracking station at an elapsed time of 70 hours, 41 minutes and 36 seconds. The crew performed all manual functions to prepare the spacecraft for reentry. At 400,000 feet Conrad rolled the spacecraft to a backup bank angle of 44 degrees, and the computer commanded a bank angle for full lift and a right roll to recover from the backup bank angle. At this time the crew agreed that the computer was operating properly and switched control to the automatic mode. Conrad followed all commands for control of the spacecraft with the attitude hand controller deactivated so that, if a problem occurred, manual control of the reentry could have been initiated in a minimum time.

The landing point achieved by the automatic reentry was about one and a half miles from the prime

recovery ship, the USS *Guam*, after 71 hours, 17 minutes and eight seconds of flight. After landing, Conrad and Gordon decided to be retrieved by helicopter and they were on the deck of the *Guam* 24 minutes after landing. The spacecraft was picked up by the *Guam* 35 minutes later.

George E. Mueller, Associate Administrator of NASA for Manned Space Flight, listed the major accomplishments of the Gemini XI flight at the post recovery news conference, conducted in Houston September 15. They were:

- The first-orbit rendezvous and docking—probably the most difficult to achieve of all rendezvous attempted to date.
- A perfect re-rendezvous from a standoff position of about 25 miles.
- Achieving an orbit with a 741.5 mile apogee and verification of the radiation levels at that altitude—a new altitude record for manned flight.
- Docking practice successfully carried out—two dockings performed by the command pilot, two by the pilot.
- Gemini XI achieved the greatest total time engaged in extravehicular activity for a single flight—a total of 161 minutes.
- Gemini XI carried out the tethered vehicle exer-



THIS UNUSUAL PHOTO shows Gemini XI pilot Richard Gordon preparing for the umbilical extravehicular activity. Conrad took the picture.



cises. It reached a spin rate of 55 degrees per minute, thus providing the first, although very small, artificial gravity field in space.

- Maneuvers with the Agena and Gemini spacecraft in a docked configuration and using the Agena propulsion unit for power were conducted. This activity resulted in attaining an elliptical orbit with an apogee of 741.5 miles.
- Ten out of 11 scheduled experiments for the mission were accomplished.
- The automatic reentry—attempted for the first time in the Gemini program—was successful and the spacecraft landed within several miles of the primary recovery ship.

In addition to Mueller, those participating in the post recovery news conference included: MSC Director Robert R. Gilruth, Lt. Gen. Leighton I. Davis, DOD Manager of Manned Space Flight Support Operations; Charles W. Mathews, Gemini Program Manager, MSC; and Flight Surgeon Charles A. Berry.

In his remarks, Gilruth pointed out that he found the results of the tether experiment to be most fascinating and said that the resultant stability and the low rotation rates achieved was probably an indica-

tion that a number of vehicles can be fastened together in space in this or similar ways. He also pointed up the fact that there is still much to be learned about extravehicular activity. Gilruth said we have worked hard on this phase of activity and each time felt we have learned from the preceding flight and still the problems of EVA have not yielded to solution as have other technical problems.

In answer to a question as to whether the workload encountered during EVA on Gemini XI had come as a surprise, Mathews said the design of the equipment was based on a reasonable workload one might expect a man to do. He added that one of the major difficulties is the fact that it is impossible to simulate weightlessness for extended periods of time on earth, and that up to this time no technique for this training has been developed which does not have great limitations.

General Davis said the recovery force had a very easy job due to the fact that the people responsible had developed the equipment and techniques which led to such a precise operation.

Dr. Berry, in response to a question as to whether Gordon had any reaction of any kind after his extreme exertion, said that there was no reaction other than the fact he was tired.



THE NORTHWEST COAST OF AUSTRALIA as seen from the Gemini XI spacecraft at an altitude of 740 miles. This is the most impressive view of the curvature of the earth yet taken by man.



THE GEMINI XI SPACECRAFT, containing Astronauts Charles Conrad and Richard Gordon, is shown just before it touched down in the Atlantic Ocean about 700 miles east of Cape Kennedy, Florida. This photo was taken from a helicopter which was hovering in the vicinity of the impact point.

## PILOT'S REPORT

The postflight Pilots' Report was conducted at Houston, September 26. Following brief introductory remarks by George Low, Deputy Director of Manned Spacecraft Center, Conrad and Gordon described their experiences at length.

In talking about the first orbit rendezvous, Conrad said, "I think probably the most significant factor of the rendezvous is that although we had good information from the ground we accomplished the rendezvous totally with information contained within the spacecraft."

A little later Conrad added, "Due to our late lift-off time we came upon the Agena in daylight a little bit sooner than we expected. I think I shot two or three per cent of the fuel fussing around getting used to seeing the bright Agena when I couldn't see the instruments. I fumbled for my sunglasses and didn't get them. On the re-rendezvous I was ready for it and got the sunglasses on in time and I could both read the instruments and track the Agena."

Gordon threw a little sidelight into the report at that time. He said, "I want to mention something about insertion that Pete and I had talked about a great deal. This was our own ability to shut out the outside world and confine our activities to the vicinity of the spacecraft . . . [in my case] to the manual data insertion unit, the computer and the readouts. We had sustainer engine cutoff at about five min-

utes and 40 seconds with spacecraft separation at six minutes. Well, when Pete separated from that booster I couldn't help myself. I really had to look outside and I got the biggest shock of my life because floating all around the spacecraft was all kind of garbage. I said, 'Hey, look at all that junk out there.' And the next words I got from him were 'Hey, get to work.' . . . but I couldn't resist. I must admit that I had talked to myself for days, but I just couldn't resist that first quick look."

In discussing the umbilical EVA problems, Gordon said he felt that he and Conrad had practiced this phase of activity so frequently that they got into trouble. The flight plan allowed about four hours for the EVA preparation and the Gemini XI crew was ready approximately two hours before they were scheduled to be. This resulted in Gordon becoming overheated and the crew decided to go back to the spacecraft's environmental control system. About a half hour before start of EVA Gordon again pressurized his suit, then had difficulty putting on the gold-plated EVA visor. This task was so difficult that Gordon became extremely tired and developed a high heart rate.

Gordon said, "The hatch was opened on time, I stood up in the seat, or rather flew out of the spacecraft, because as soon as we opened the hatch all the debris and junk that we found in the spacecraft went floating out the window—or out the door



POST-LANDING RECOVERY ACTIVITY—Command pilot Conrad stands in the life raft and talks to a Navy pararescueman while pilot Gordon emerges from the Gemini XI spacecraft. This action took place only several minutes after the landing.



really. And I was right along with the rest of the debris."

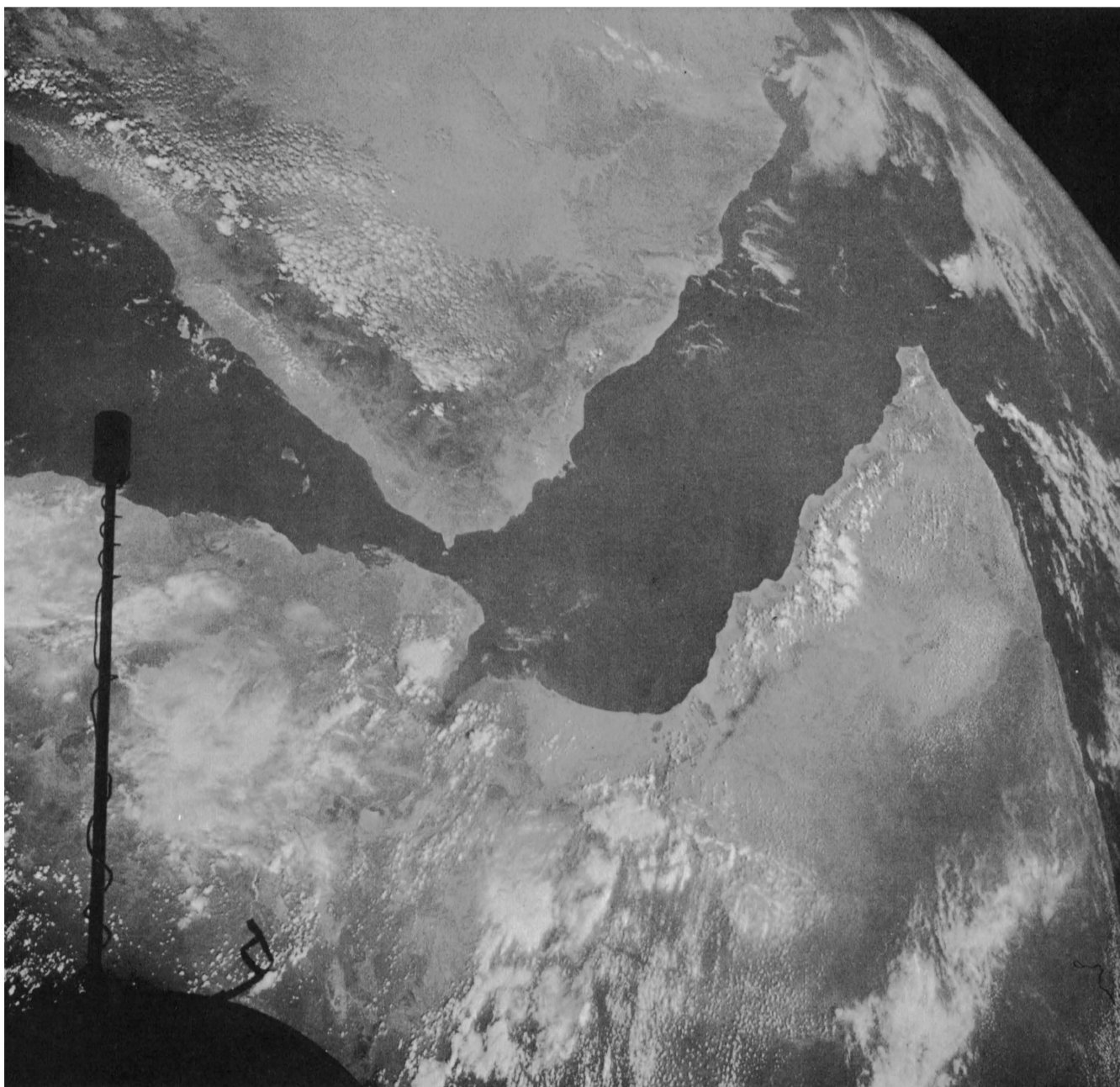
Conrad interjected, "I remember that. The only thing I saw was his feet going out of the hatch."

Gordon continued, "The only thing I could say to Pete was 'Hey, grab me, I'm leaving you.' So Pete actually had to hold me in the craft."

The crew continued the description of the EVA and told of the difficult nature of the activities which led to their decision to terminate the EVA after 33 minutes because of the exhaustion of the pilot and the fact that perspiration was gathering in Gordon's right eye and impairing his eyesight.

At a later point in the discussion Conrad was talking about activities during the standup EVA. He said after their experience with the umbilical EVA they knew they had an excellent hatch. When they jettisoned the umbilical equipment it was apparent that the right hand hatch was like your front door. He said, "We could open and close it any time we wanted to."

Conrad added, "Houston advised us that the weather there was going to be clear and suggested that we might get some pictures out of the hatch. We hadn't been able to do this before. So, Dick was going to hang out of the hatch and grab some pic-



THIS VIEW FROM ABOUT 400 miles high presents a view of Ethiopia and Somali in northeast Africa. Also seen in this photo are the Red Sea and the Gulf of Aden.



tures of Houston with the Hasselblad . . . we came out of the night side and it was 7:00 a.m. in Houston, local time. It only took us about four minutes to go from Houston to Florida and we had the whole rest of the Atlantic to go with nothing to do. So, lo and behold, I fell sound asleep in my hard suit with my arms extended and all of a sudden I woke up and realized that not only was I asleep on the job but I was asleep while we were depressurized. I said, 'Hey, Dick, would you believe I fell asleep?' And all I got out of him was, 'Huh, what?' So there we were out over the Atlantic. He was asleep hanging out of the hatch on his tether and I was sitting asleep inside

the spacecraft. So I think you can see that standup EVA was an entirely different operation than umbilical EVA."

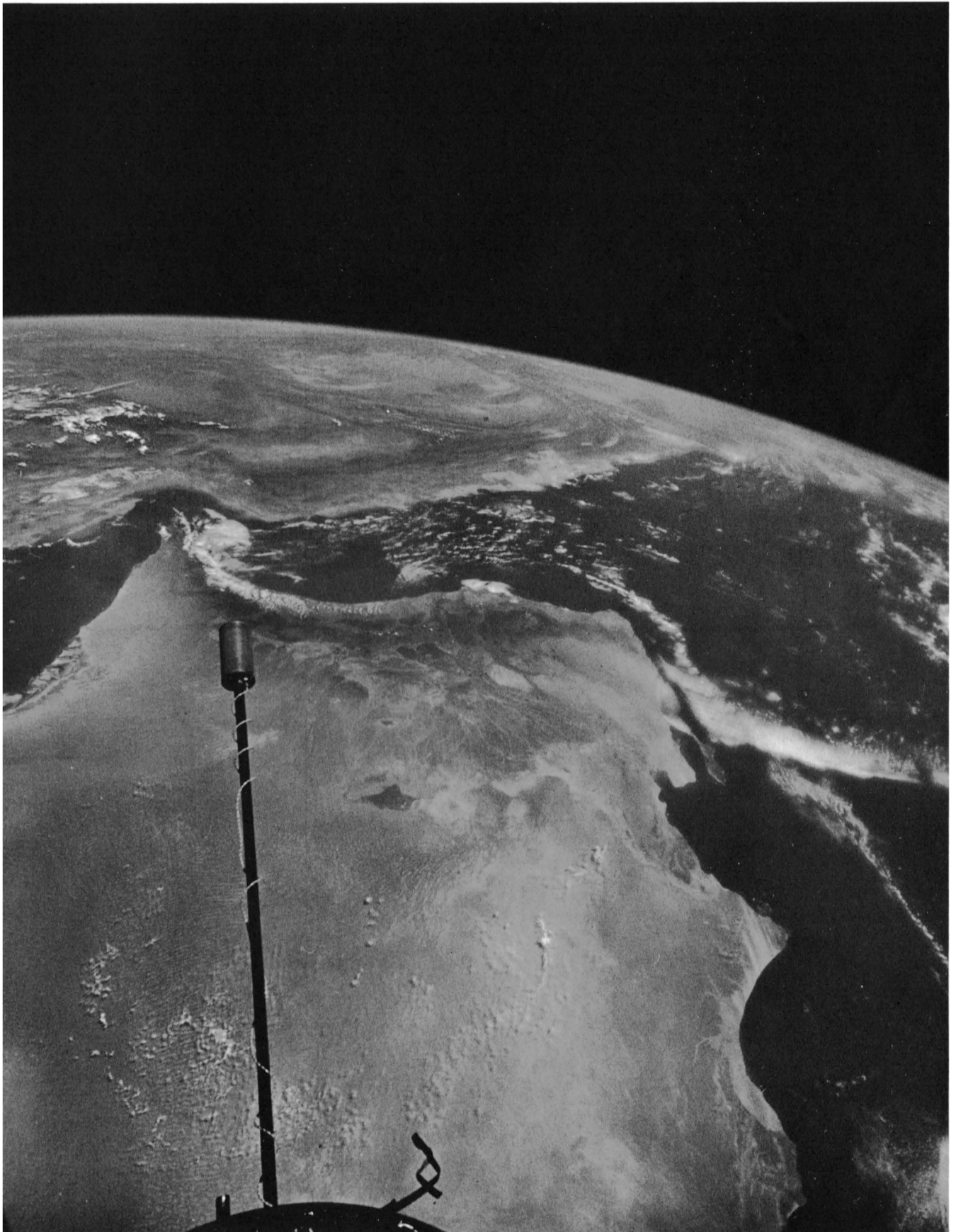
The crew talked at length about their experience during the high-altitude orbits. Conrad said, "Passing India it became apparent to us that we were climbing at a fantastic rate. I don't know what the exact numbers were but they were extremely high . . . we just had the impression that we were looking down at the ground going straight up."

At this point, Gordon interrupted, "We were wondering if we were going to stop."

"We were worried about the orbital mechanics,"



THE NEAR EAST as seen from the Gemini XI spacecraft. The United Arab Republic is seen in the foreground. The triangular-shaped area is the Sinai Peninsula. The Gulf of Aqaba, right center, separates the Sinai Peninsula and the Arabian Peninsula.



THIS PHOTO WAS TAKEN while Gemini XI was 270 miles above the earth. On the Peninsula are Trucial Oman, Muscat and Oman, and Saudi Arabia. Pakistan and India are in the top center background. The body of water at the right is the Arabian Sea.

Conrad continued. "We did this for two revolutions and we saw some of the most amazing sights that man has ever seen . . . the photographs, I think, do some justice to what we saw, but you can't do justice to what you actually see with your eyes."

The crew spent considerable time in describing the tethered maneuvers with the Agena target vehicle. Conrad said that it took longer to get the tether deployed than they had expected. They had placed the tether on several strips of Velcro before they stowed it. When they deployed it and reached the point where the tether was attached to the Velcro the spacecraft was pulled toward the target vehicle a bit.

Conrad stated, "We somehow got a little rotation velocity in the tether . . . and I can't tell you how I got it stopped spinning to where we finally had the tether completely straightened out . . . We went to the end of the tether and it became obvious to us that we actually had the whole system rotating, so we watched it about 20 minutes and the attitude excursions damped down to about 30 degrees per minute . . . We told the ground we would go ahead and ride it into the night side . . . as we went into the night side we had our docking light on the tether and we could see that it stayed taut. We had the running lights on the Agena and could tell that it was still oscillating . . . our biggest surprise as we came out into the daylight was when we discovered that the rotation of both vehicles was down to less than 10 degrees per minute."

Twelve scientific and technological experiments were originally planned for the Gemini XI. The three-day delay from the September 9th launch date resulted in cancellation of the Libration Regions Photography experiment because the earth-moon libration regions became obscured by the Milky Way, thereby preventing the experiment from meeting its basic objectives.

Only one of the eleven experiments scheduled during the mission was not attempted. This concerned the evaluation of a special power tool for use in space. That experiment was cancelled because of the premature termination of the umbilical extravehicular activity.

Another experiment—one concerning Dim Sky Photography/Orthicon—was only partially completed.

The following experiments were completed although a complete analysis of the results is not available: Mass Determination, Night Image Intensification, Radiation and Zero-G on Blood, Synoptic Terrain Photography, Synoptic Weather Photography, Nuclear Emulsion, Airglow Horizon, Ultraviolet Astronomical Camera, and Ion-Wake Measurement.

#### **THE CREW**

##### **Charles Conrad, Jr.**

Command pilot of the Gemini XI mission was Astronaut Charles Conrad, Jr. Conrad, born in

Philadelphia, Pennsylvania, June 2, 1930, was graduated from Princeton University with a bachelor of science degree in aeronautical engineering.

Conrad entered the Navy following his graduation and received flight training. He attended the Navy Test Pilot School at Patuxent River, Maryland, and upon completion of that training was a project test pilot in the Armaments Test Division there. He also served as a flight instructor and performance engineer at Patuxent.

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 was pilot of the Gemini V mission which lasted 190 hours and 56 minutes, during the period August 21-29, 1965. Command pilot on that mission was L. Gordon Cooper, Jr. Later, Conrad served as command pilot of the backup crew for the Gemini VIII flight. He was awarded the NASA Exceptional Service Medal in September 1965. Conrad is a member of the American Institute of Aeronautics and Astronautics, and an associate member of the Society of Experimental Test Pilots.

He is married to the former Jane DuBose of Uvalde, Texas. The Conrads have four sons: Peter, born December 25, 1954; Thomas, born May 3, 1957; Andrew, born April 30, 1959; and Christopher, born November 26, 1960.

##### **Richard F. Gordon, Jr.**

The Gemini XI pilot, Astronaut Richard F. Gordon, Jr., was born in Seattle, Washington, October 5, 1929. He was graduated from the University of Washington with a bachelor of science degree in chemistry.

Gordon joined the Navy and entered aviation training in 1951. He received his wings in 1953. Gordon attended the Navy Test Pilot School at Patuxent River, Maryland, in 1957, and served at that station until 1960. While there he performed flight test work on the F8U Crusader, F11F Tiger-cat, FJ Fury, A4D Skyhawk, and was the first project test pilot for the F4H Phantom II.

In May 1961, Gordon won the Bendix Trophy Race from Los Angeles, California, to New York City while establishing a new speed record of 869.74 miles per hour and a transcontinental speed record of two hours and 47 minutes.

At the time of his selection as a NASA astronaut in October 1963, Gordon was a student at the U.S. Naval Postgraduate School, Monterey, California. He has logged more than 3,000 hours flying time, including more than 2,500 hours in jet aircraft.

He is married to the former Barbara J. Field of Freeland, Washington. The Gordons have six children: Carleen, born July 8, 1954; Richard, born October 6, 1955; Lawrence, born December 18, 1957; Thomas, born March 25, 1959; James, born April 26, 1960; and Diane, born April 23, 1961.

# UNITED STATES SPACE FLIGHT LOG

TIME	ELAPSED	DATE(S)	MISSION PILOTS	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 III	Grissom-Young	Mar. 23, '65	04:53:00	63:41:27
Gemini-Titan IV	McDivitt-White	June 3-7, '65	97:56:11	259:33:49
Gemini-Titan V	Cooper-Conrad	Aug. 21-29, '65	190:55:14	641:24:17
Gemini-Titan VII	Borman-Lovell	Dec. 4-18, '65	330:35:31	1302:35:19
Gemini-Titan VI	Schirra-Stafford	Dec. 15-16, '65	25:51:24	1354:18:07
Gemini-Titan VIII	Armstrong-Scott	Mar. 16, '66	10:41:26	1375:40:59
Gemini-Titan IX	Stafford-Cernan	June 3-6, '66	72:21:00	1520:22:59
Gemini-Titan X	Young-Collins	July 18-21, '66	70:46:39	1661:56:17
Gemini-Titan XI	Conrad-Gordon	Sep. 12-15, '66	71:17:08	1804:30:33



THE GEMINI XI CREW—pilot Richard F. Gordon, Jr., left, and command pilot Charles Conrad, Jr.