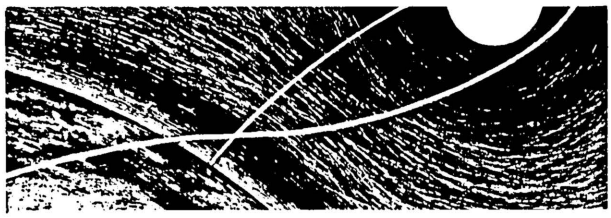


MANNED SPACECRAFT CENTER
HOUSTON, TEXAS
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GEMINI IX-A

RENDEZVOUS MISSION

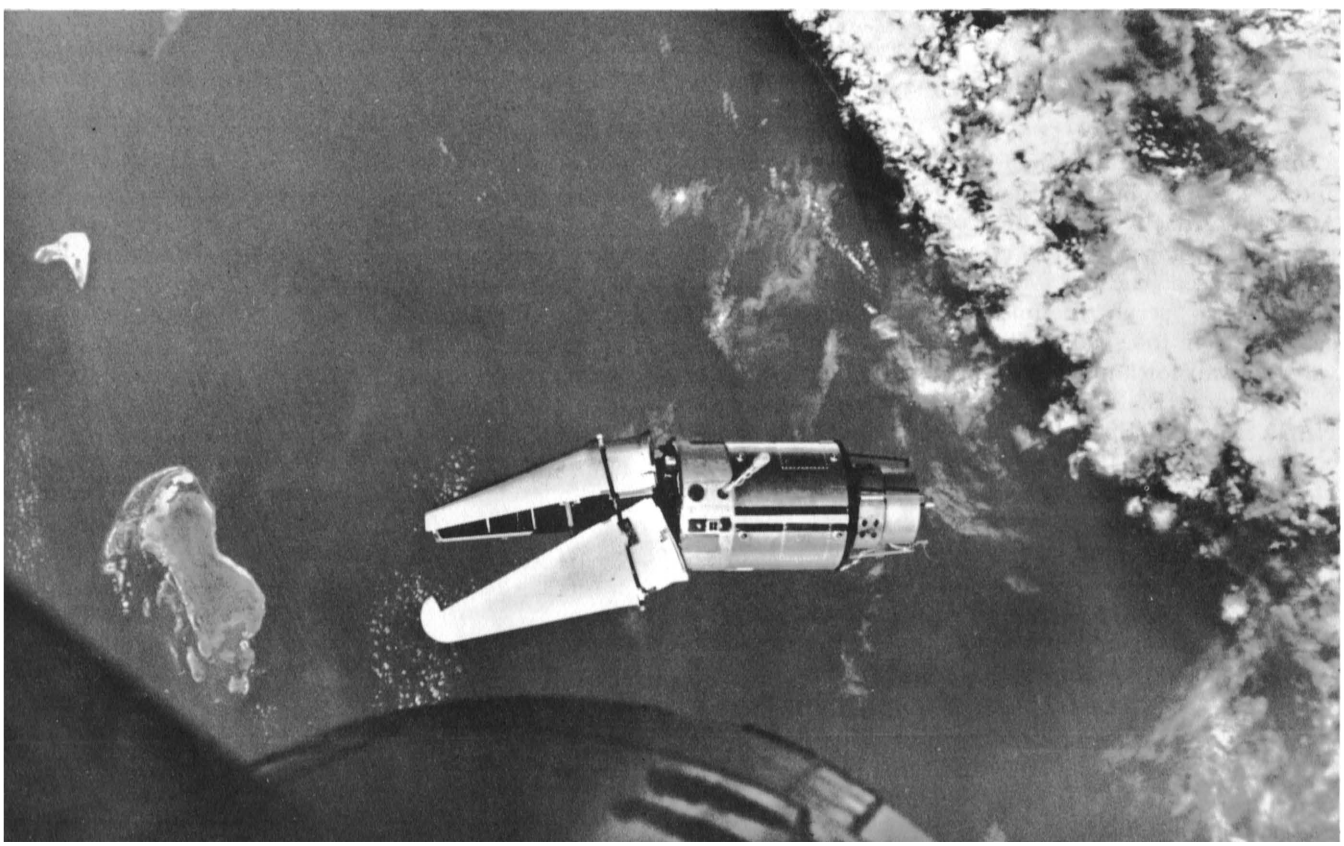
Fact Sheet 291-F
August 1966

Gemini IX-A, the seventh manned flight in the Gemini program, was conducted on June 3-6, 1966, following launch of Atlas-Agena on June 1, 1966. Two scheduled launch dates — May 17 and June 1 — were to pass before Astronauts Thomas P. Stafford, command pilot, and Eugene A. Cernan, pilot, and their Gemini IX spacecraft would attain orbital flight.

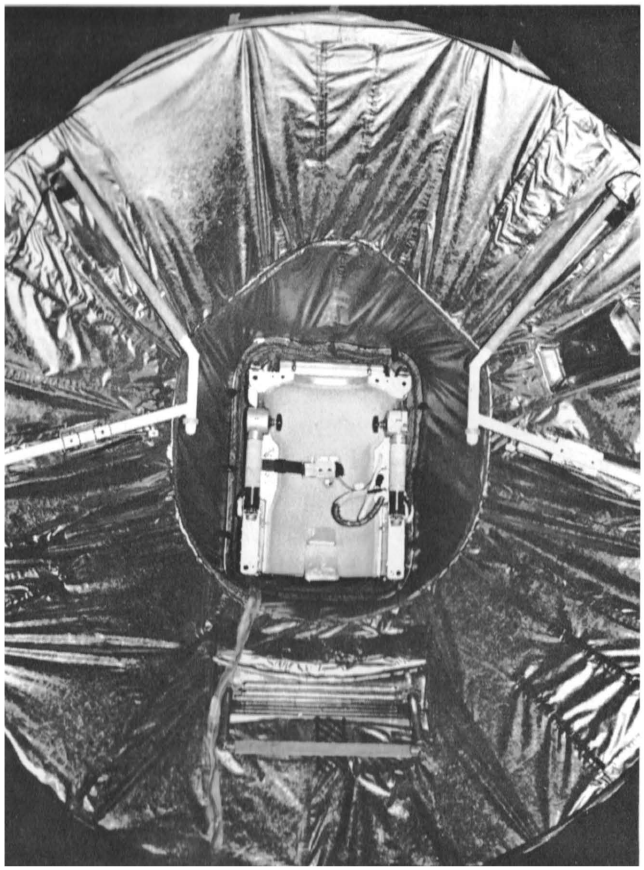
Astronauts Elliott M. See, Jr., and Charles A. Bassett, II, originally had been named as command pilot and pilot, respectively, with Stafford and Cernan as their backup crew. See and Bassett died when their airplane crashed at St. Louis, Missouri, February 28, 1966, while en route to the McDonnell Aircraft Corporation plant for specialized mission training. Subsequently, Stafford and Cernan were selected as the prime crew (the first time that a backup team, or backup astronaut, had been so utilized in America's manned space flight program). Astronauts James A. Lovell, Jr., and Edwin E. Aldrin, Jr., were chosen as the new Gemini IX backup crew.

MAY 17 ATTEMPT

On the May 17 mission attempt, the Atlas-Agena lift-off occurred at 10:15 a.m., EST, following a short delay during the countdown caused by a slight problem in loading the Agena to capacity. During this time,



THE AUGMENTED TARGET DOCKING ADAPTER as seen by the Gemini IX spacecraft after the rendezvous in space. Command pilot Tom Stafford referred to the ATDA and its still attached shroud as an "angry alligator."



THE ADAPTER EQUIPMENT SECTION of the Gemini IX spacecraft shows the installation of the Astronaut Manuevering Unit back pack in place prior to the mission.

a simultaneous countdown of the Gemini IX spacecraft and its launch vehicle had proceeded without incident. After the Atlas-Agena launch only two minutes and ten seconds elapsed before all contact with the target vehicle ceased, causing Mission Director William C. Schneider to "scrub" the mission. Stafford and Cernan egressed from the spacecraft and descended on the elevator to wait for another try on another day.

Dr. George E. Mueller, Associate Administrator of NASA Manned Space Flight, announced at a news conference shortly thereafter that work was proceeding at the pad to complete launch preparations as quickly as possible and that an Augmented Target Docking Adapter (ATDA) would be used as the target vehicle for the Gemini IX mission.

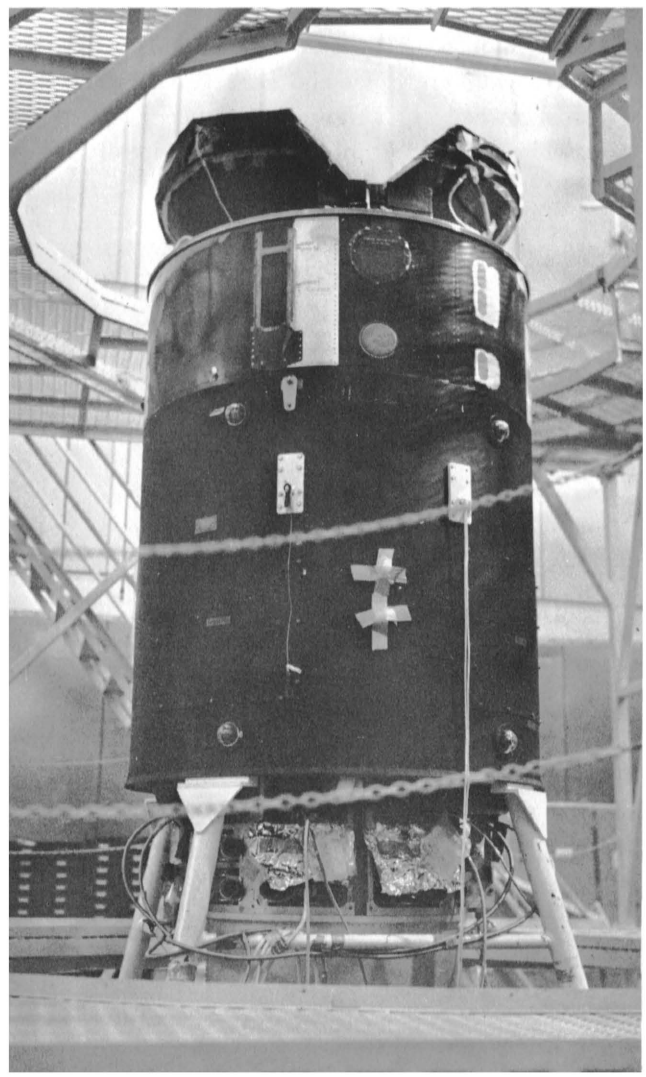
THE ATDA

The Augmented Target Docking Adapter is a rendezvous target vehicle designed for launch by an Atlas should an Agena target vehicle fail to achieve orbit or should one not be available for other reasons. The ATDA used on the Gemini mission had also been designated as a backup target for the Gemini VIII mission while the Agena was undergoing a reevaluation of its propulsion system.

The ATDA is 12 feet long (28.33 feet long with the nose shroud and Atlas adapter), is five feet in diameter, and weighs 2400 pounds at launch and 1748 pounds in orbit. It has no propulsion system for translation maneuvers and is fabricated mainly from Gemini off-the-shelf items.

Docking equipment installed is a Gemini Target Docking Adapter (TDA) The C-band beacons and antennas, the digital command system, the L-band radar transponder, telemetry system, stabilization system, shaped charge separators, batteries, wire bundles, relays, and connectors which make up the ATDA systems are all standard Gemini parts.

Lighting on the ATDA is identical to that of the Agena. There are two acquisition lights on the outer edge of the adapter structure that produce a flashing light reference of 55 pulses per minute and that can be seen for several miles.



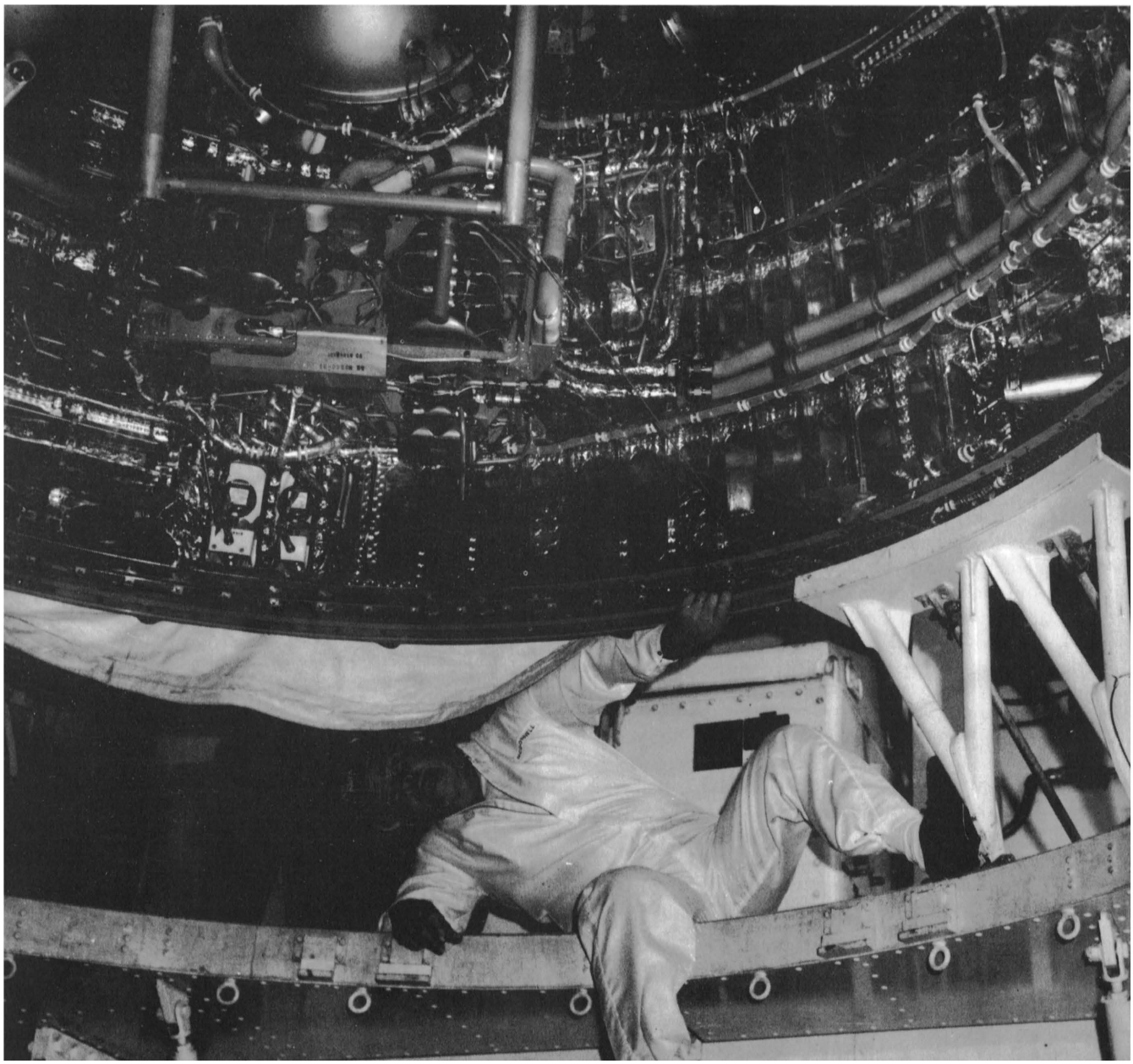
A CLOSE-UP of the Gemini Augmented Target Docking Adapter (ATDA) as it underwent a pre-flight checkout at Cape Kennedy, Fla.

JUNE 1 ATTEMPT

The Gemini IX mission was redesignated Gemini IX-A and on the morning of June 1, 1966, countdowns proceeded simultaneously for the Atlas-ATDA and for the Gemini spacecraft and its launch vehicle. Following an uneventful countdown, the Atlas-ATDA lifted off from the Cape Kennedy Pad 14 at four seconds after 10:00 a.m., EST, with the Gemini spacecraft expected to be launched about 98 minutes later.

After launch, the Atlas-ATDA followed a nominal trajectory and attained a near circular orbit with an apogee of 161 nautical miles and a perigee of 159 nautical miles. The shroud housing the ATDA was commanded to separate 10 seconds after the launch vehicle's vernier engine cutoff, but telemetry signals did not confirm this.

The usual planned hold of four minutes duration was instituted in the Gemini countdown at Pad 19 at the T minus 3-minute mark. The count then resumed and continued until T minus one minute and 40 seconds. At this point the count was recycled to T minus three minutes and holding. From Launch Control the announcement came that the MOD III guidance system update of the spacecraft computer could not be transferred through the ground equipment to the spacecraft.



MC DONNELL AIRCRAFT CORPORATION technician Don Black inspects the Gemini IX spacecraft in the white room atop Pad 19 prior to positioning it over the Gemini launch vehicle and cabling up.

Shortly thereafter the countdown was resumed but a second update attempt also could not be transferred. Later, a third failure of the ground equipment to transfer the launch-azimuth update to the command transmitter for transmission to the spacecraft was recorded.

By this time the launch window had been violated and Mission Director Schneider called for the launch attempt to be rescheduled for the third of June — a day on which two panes in the launch window would be available.

LAUNCH AT LAST

On June 3, Stafford and Cernan were awakened at 3:11 a.m. They underwent the usual preflight physical examination, and then ate the traditional astronaut breakfast consisting of fruit juice, filet mignon, scrambled eggs, toast and coffee. One guest joined them for breakfast — Donald K. Slayton, MSC's Director for Flight Crew Operations.

At 4:21 a.m., the flight crew left the crew quarters at Merritt Island and proceeded to the ready room at Pad 16 to don their suits and make final preparations for the mission.

Over at Pad 19, the countdown of the spacecraft and its launch vehicle proceeded smoothly. Because of the difficulty encountered two days earlier, the computer at the Mission Control Center, Houston, was programmed to transmit the update information directly to the Gemini IX spacecraft computer at the T minus 60-minute, the T minus 30-minute, and the T minus 15-minute marks. This would permit the launch to go on time using the latest data entered into the computer, if the T minus 3-minute update information could not be transferred by the ground equipment to the command transmitter.

Stafford and Cernan completed preparations, made the trip from the ready room to Pad 19, entered the elevator, and went up to the launch pad white room, arriving about two hours before the scheduled launch time. They were briefed by the backup crew on the status of the countdown, as Lovell and Aldrin had been participating in these activities since about 2:00 a.m.

Technicians closed Stafford's hatch at T minus 105 minutes and Cernan's about 10 seconds later. The count continued on schedule. As launch time approached, following a planned hold at T minus three minutes, the ground equipment again failed to transfer update information; however, satisfactory information had been transmitted at T minus 15 minutes from MCC-Houston, and lift-off occurred precisely on schedule at 8:39:33 a.m., EST.

With the final minutes of countdown ticking by, and during a communications check, Command Pilot Stafford used the term Walter M. Schirra, Jr., his command pilot on Gemini VI-A, had used, "For the third time, Go." History had repeated itself as far as Stafford was concerned. On his first space trip, he was launched on the third try and it had taken three efforts for his second space mission.

The primary objectives of the Gemini IX-A mission were rendezvous and docking of the Gemini spacecraft with the ATDA, and the extravehicular activity of Pilot Eugene Cernan.

The Gemini IX spacecraft was inserted into an initial orbit with an apogee of 144 miles and a perigee of 86 miles (all mileage quoted in this report is in terms of nautical miles, and each nautical mile is 1.15 statute miles). According to the mission plan, the spacecraft would rendezvous with the ATDA during the third revolution; to accomplish this event, seven maneuvers were scheduled.

The first maneuver involved a phase adjustment initiated at 49 minutes and three seconds after lift-off

ASTRONAUT EUGENE A. CERNAN, Gemini IX pilot, has his suit adjusted by suit technician Al Rochford in preparation for a test. The Gemini IX extravehicular suit weighed 35 pounds and the leg cover layer was qualified to withstand surface temperatures of 1200 degrees Fahrenheit while maintaining the suit internal temperature to no more than 110 degrees Fahrenheit.

to attain the correct orbital catch-up rate for rendezvous with the ATDA in the third revolution of the spacecraft. Following the completion of this maneuver, the Gemini IX spacecraft now orbited the earth with an apogee of 147 miles and a perigee of 124 miles.

Stafford executed a corrective combination maneuver beginning one hour and 55 minutes, 17 seconds into the mission. This action adjusted the catch-up rate and the plane of the spacecraft orbit to bring it closer to the ATDA's orbital plane.

An additional maneuver was performed as the Gemini spacecraft neared its apogee on the second revolution. Termed a coelliptic maneuver, the objective was to place the spacecraft in a circular orbit. Initiated two hours, 24 minutes, and 51 seconds into the flight, this action resulted in the spacecraft being within 109 miles of the target with a closure rate of about 126 feet per second and about 12 miles below the target orbit. Pilot Cernan related that the spacecraft was about one mile from the target as they passed over New Guinea during the third revolution, at about four hours and 11 minutes of mission elapsed time.

As the spacecraft moved across the Pacific Ocean, the tracking station at Hawaii picked up the voice communication, and at this time Stafford revealed that the shroud on the nose of the ATDA had not separated. In describing the situation, Stafford said, "We have a weird looking machine here . . . both the clam shells of the nose cone are still on but they are open wide. The front release has let go and the back explosive bolts attached to the ATDA have both fired. . . . The jaws are like an alligator's jaw that's open at about 25 to 30 degrees and both the piston springs look like they are fully extended. . . . It looks like an angry alligator out here rotating around."

During the rest of that pass over Hawaii and continuing across the United States, flight controllers studied the situation and considered several possible means of breaking the shroud loose from the target. They determined that one possibility would be to have the ground transmit several commands to the target, first to "rigidize," the second to "unrigidize" the docking cone. These actions were carried out after the crew had backed away to a safe distance to observe the activity. The commands resulted in the shroud moving, and the "alligator's jaw" partially closing.

After it was suspected that the shroud had not jettisoned an alternate plan was worked out in Houston. At a time when docking had been planned, the Mission Control Center, Houston, gave Stafford instructions to align his spacecraft and to perform a maneuver which would place the spacecraft into an orbit about two and a half miles above and 11 miles behind the target. About an hour and 30 minutes later, Stafford completed the equi-period rendezvous which had originally been programmed for the 28th hour of the flight. This maneuver, a completely onboard operation, used the computer and a handheld sextant to obtain a guidance.

Stafford executed a separation maneuver at an elapsed flight time of seven hours and 14 minutes. He later reported satisfaction with the results after tracking the ATDA on radar. Following this maneuver, the Gemini IX spacecraft orbited the earth at an apogee of 160 miles and a perigee of 156 miles; the ATDA remained in an orbit with an apogee of 161 miles and a perigee of 159 miles. Mission Control Center, Houston, predicted that during the sleep period scheduled for the crew before the final rendezvous attempt, the spacecraft would move about 60 miles ahead of the target.

The third rendezvous, designed to simulate a lunar module rendezvous (rendezvous from above), would undertake to investigate possible conditions of a lunar rendezvous which might take place if the lunar excursion module had descended to the 50,000-foot level above the moon's surface. With the spacecraft about 80 miles ahead of the target, the first maneuver toward affecting the rendezvous was initiated at 18 hours, 23 minutes into the flight to adjust the spacecraft altitude. About two hours and 39 minutes later, the crew was preparing for the terminal phase initiate maneuver of this rendezvous. Stafford and Cernan then reported difficulty in visually acquiring the target using this mode of rendezvous but stated they had a solid radar lock-on. This difficulty resulted when they attempted to visually sight the target against the background of the Atlantic Ocean and the sand dunes of the Sahara Desert. The crew was not able to see the ATDA until they were within three miles of it. They said during a debriefing later that even after they had visual acquisition it would be intermittently lost to sight against various terrain features.

During this final rendezvous with the ATDA, the crew maneuvered to about three inches from the shroud to take closeup pictures of the shroud wires. Speaking of this activity, Stafford graphically described it by saying, "We kept clear of the dipole antenna, rolled the Gemini on its side, and rolled right up to where the X axis of the Gemini was 90 degrees to the X axis of the ATDA, and rolled right into it, and snapped the pictures. Making sure the alligator wouldn't bite us that way."

Stafford and Cernan reviewed the situation after the rendezvous. Stafford requested that any extravehicular activity be postponed until the following day due to crew fatigue. They had completed three rendezvous events in less than a day, all being by different modes, and the crew was quite fatigued by the close attention demanded. Permission was granted and the flight controllers on the ground started immediately to revise the flight plan.

After completing their station-keeping operation with the ATDA, Stafford and Cernan performed a separation maneuver high above the African continent. Several hours later after another scheduled rest period, the crew began work to accomplish several experiments. These consisted of zodiacal light photography, airglow horizon photography, and a communications system experiment to check operations through the ionosphere.

GEMINI IX-A EXTRAVEHICULAR PHOTOGRAPH — Astronaut Eugene A. Cernan during the time he was outside his spacecraft during the long period of extravehicular activity. The photo was taken by command pilot Thomas P. Stafford.

EVA

About 5:30 a.m., EST, the following day, some 45 hours into the flight, Stafford and Cernan began precise preparations for the EVA activity. According to the plan, this operation would commence at the 49-hour, 26-minute point, just as the Gemini IX spacecraft entered the daylight portion of an orbital circuit. During the "making ready" period, ground stations held their communications with the spacecraft to a minimum, collecting only the essentials of information, and the crew advised on the status of the preparations. Stafford said, near the 47-hour point, ". . . we've got the big snake out of the black box," meaning thay had removed the 25-foot umbilical from its stowage place. A few minutes later, Stafford reported a problem with the number three thruster which was causing the spacecraft to build up a roll. During this same time period, the command pilot also reported that the needles indicating attitude of the spacecraft appeared to be in reverse logic. James Walker of McDonnell suggested that perhaps the crew had inadvertently knocked the scanner heater circuit breaker to the off position during their EVA preparations. Stafford checked; Walker was right. The command pilot switched the circuit breaker to the on position, the needles again indicated proper spacecraft attitude. At the same time the roll control problem with the number three thruster cleared up.

As the 49th hour drew near, Stafford told the ground stations that they were slightly ahead of schedule in their EVA preparations and that they were in the process of drinking a lot of water as the flight surgeon in the Houston Control Center had advised. Shortly thereafter, Flight Director Eugene F. Kranz told the Carnarvon station to relay the word to them that they were "Go" for cabin depressurization; this activity took place between Canton Island and Hawaii. Stafford reported depressurization complete at 49 hours and 19 minutes, and three minutes later the crew started opening the hatch. With the hatch opened Cernan stood in the seat, retrieved the S-12 micrometeorite impact package, deployed the handrails, attached the docking bar mirror, and set up his EVA 16mm camera. All the while he seemed enthralled with the space view. He also noted that the tasks were somewhat difficult to accomplish in this weightless, suit-pressurized environment where the objects he worked with all tried to float away.

At the 49-hour, 43-minute elapsed-time point, Cernan moved outside the Gemini IX spacecraft. He saw Los Angeles, he thought, and mentioned seeing Edwards Air Force Base. Cernan remarked about the difficulty in getting to desired vantage positions with the "snake" seemingly all over him, but he gradually worked his way toward the spacecraft's adapter section. He then returned to the hatch area so that he and Stafford could change the film in the EVA camera and illuminate the EVA lights for the night orbital period. After this, Cernan returned to the adapter vicinity and reported there were no streamers or hanging straps as there had been in the case of the VI and VII spacecraft.

As IX came into the sunlight over Africa, Cernan moved into the adapter area where the Astronaut Maneuvering Unit (AMU) was stowed. As he began to plug into the AMU circuits, Cernan noted that the exertion caused some fogging of his helmet visor. He also encountered difficulty in deploying the attitude control arms on the AMU, which ". . . presented far more difficulty to us in zero g than they did in the simulation," Stafford said. In addition to problems in connecting the oxygen hoses and electrical circuits, Stafford described Cernan's communications through the AMU transreceiver as having a "log of garble." The command pilot stated that Cernan's tasks seemed to be about four or five times harder to accomplish than had been anticipated, and they were about ready to give a "no go" on the AMU if the visor continued in its fogged condition. Although Cernan rested, the fogging condition did not improve significantly. Stafford and Cernan evaluated the situation after sunrise. They felt continued fogging constituted a flight safety hazard and, after ground concurrence, the AMU experiment was scrubbed. Cernan continued to rest and gradually gained about 25 percent vision through the visor. After he had switched to the umbilical communications lead, voice contact immediately improved between the command pilot and pilot. Looking through a clear spot near the point of his nose, Cernan facetiously remarked to Stafford, "Hey, Tom, what's that guy doing with the Texas driver's license out there on the California highway?" After more rest the fogging reduced to about 40 percent, but as he began to retrieve the docking bar mirror the fogging grew worse. Cernan also became quite warm. According to the flight plan he was scheduled to take photographs of the sunset but Stafford decided that Cernan should get back in the spacecraft before then.

At 51 hours and nine minutes Stafford helped Cernan back into the seat and they spent the next 17 minutes stowing the umbilical. They secured the hatch at 51 hours and 30 minutes elapsed time. The crew had been in extravehicular conditions for two hours and five minutes and had accomplished cabin repressurization without incident.

LANDING AND RECOVERY

Following the rather strenuous EVA operation the crew stowed equipment and settled down to rest and eat. At 53 hours and 10 minutes Houston Control Center passed data for Stafford to use in bringing IX's apogee down about 10 to 12 miles. This would make retrofire less sensitive to dispersions and allow better control during reentry. Stafford effected the maneuver and also tracked the ATDA at a distance of 165 miles behind the spacecraft. Over Hawaii during IX's 35th revolution, Cernan loaded the computer with the reentry equations and math flow. In the 36th revolution they received information on the 46-1 landing area from the *Coastal Sentry* in the western Pacific. With much of the preparatory work completed, they had their evening meal and began a sleep period. At the 67-hour point, Stafford responded to the Carnarvon communi-

cator's call. The crew received flight update information, attended to the flight-plan checklist, and stowed equipment in preparation for reentry. Shortly after the 70-hour mark, Stafford armed the Reentry Control System (RCS); the dual set of rings checked out well. Then he asked the Houston communicator if the captain of the prime recovery ship in the Atlantic would "guarantee that the big boat's going to be on the spot?"

Retrofire was initiated at 71 hours, 46 minutes, and 44 seconds. In less than a minute Cernan confirmed "4 good Retros" to the Canton station. Splashdown occurred at 72 hours, 20 minutes, and 50 seconds less than two miles from the U.S.S. *Wasp* and in full view of television cameras. In four minutes, recovery personnel had the spacecraft flotation collar attached. The crew asked to be hoisted aboard ship in the spacecraft — a precedent set by Schirra in Mercury-Atlas 8 in October 1962, and also followed by Schirra and Stafford in Gemini VI on December 16, 1965.

POSTRECOVERY BRIEFING

Dr. Mueller opened the conference by expressing his satisfaction with the development of controlled reentry. He pointed out that this had been the longest EVA period and that this experience had taught us "a great deal more about man's ability to work in space. . . ." Dr. Robert R. Gilruth, Director of the Manned Spacecraft Center in Houston, said that although this was the thirteenth manned flight in Mercury and Gemini, he had observed that "even though we get a lot more proficient, the flights don't get any easier." The reason for this is because we try to do more on each flight, he said. As an example, he recalled that just a year ago we had trouble stationkeeping with the launch vehicle's second stage; the IX had not only performed this task using the ATDA but had been able to rendezvous successfully three times. Since docking had not been accomplished and the AMU had not been used, Dr. Mueller was asked if these had become "secondary in the scheme of things?" Mueller replied, "Of course not. Literally we did not meet all of the objectives we had established for the mission. I think we had a quite ambitious set of objectives to meet. Our posture is one where we will try to do as much as we can on each of our Gemini flights. We won't always succeed in meeting all of the objectives."

PILOTS' REPORT CONFERENCE

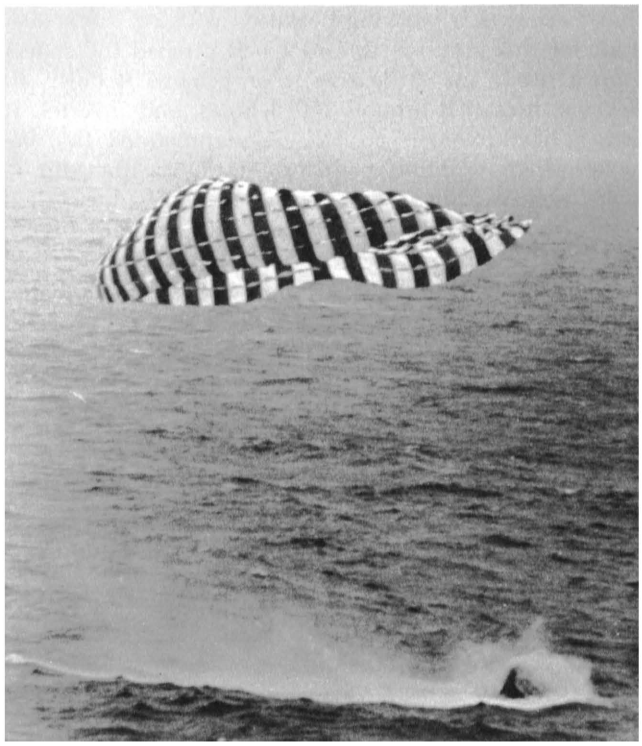
On June 17, after almost two weeks of technical debriefings, the pilots appeared before the news media to present a firsthand report of their mission experiences. NASA's Deputy Administrator, Dr. Robert C. Seamans, Jr., opened the conference by announcing that both astronauts and Colonel Richard C. Dineen of the Air Force's Space Systems Division had been awarded the NASA Exceptional Service Medal. Colonel Dineen had been responsible for the Gemini launch vehicle. Seamans then remarked that the Gemini IX spacecraft had been launched almost flawlessly and had landed with almost pinpoint precision. He added that some unforeseen difficulties had cropped up; some were procedural such as the shroud that failed to clear the ATDA docking adapter, and some were operational and could only be learned in space such as Cernan's saturated suit environment. These problem areas pointed up a factor quite often forgotten. ". . . . the Gemini program is experimental," Seamans said, and "As an experimental program, we try on each flight to advance to a maximum extent our understanding of space and how to operate in it." He added, ". . . there is still a good deal to learn in some . . . areas, as for example operation in docked mode and in manned operation outside the spacecraft." Much experience was still needed, he continued, in preparation for the Apollo missions.

Dr. Gilruth then introduced the Gemini IX-A crew, and Stafford led off the discussion with several allusions to his "elevator time" during VI and IX, facetiously remarking that he believed he had been jinxed by Schirra and Cernan. Then Stafford talked seriously of what had been gained from the May 17 failure of the Atlas to put the Agena into orbit. The crew had returned to Houston and met with Christopher C. Kraft, Jr., MSC's Director of Flight Operations, and his flight planning group to outline a Gemini IX-A mission which might achieve all the major objectives of the original flight plan. This included three rendezvous, which they believed to be important "to feed over into the latter Gemini flights and also the Apollo flights." Within about two days, he said, they had completed the analysis and had come up with the trajectories. On June 1 the computer update could not be transferred by ground equipment and the mission was again postponed. Stafford explained that these data were very sensitive to accomplishing rendezvous at the apogee of the third orbit.

Following the orbital insertion of the ATDA and another trip by the crew from the spacecraft to the now quite familiar elevator, there were suspicions that the ATDA shroud had not jettisoned. On the following day they went over to the hangar to study Gemini X's shroud in minute detail until they knew every piece and what to expect once they were in flight.

On June 3 the Gemini launch vehicle put them in orbit about 570 miles behind the target, and they began their catching maneuvers. When the target became visible they could see its docking adapter in reflected sunlight; in darkness they could see its flashing light. Stafford and Cernan thought ". . . . we were home free because we couldn't see a flashing blue [light] if the shroud was on." Even at a half-mile distance they had the same impression, Stafford said. At about 1,000 feet, however, they saw the shroud in its "open-jawed-alligator" position.

Stafford pointed out that their second rendezvous with the ATDA was the first pure optical space rendezvous that had ever been performed. Cernan made all of the computations; they did not use the computer and employed the radar only as a monitor. He added that whereas the shroud had been a curse to docking with the ATDA, it was a blessing to the visual sighting of



THE GEMINI IX spacecraft is seen as it touches down in the Atlantic Ocean on June 6, 1966, at the conclusion of its three-day space voyage.

the target due to its reflectivity in the sunlight, ". . . . in fact we might have missed it completely if we hadn't had the shroud on it." The command pilot stated that optical rendezvous from short distances was feasible but costly in fuel expenditure; radar was best and more economical in fuel usage.

The third rendezvous, which simulated a lunar module positioned in front of and below the Apollo command module, forcefully made the crew realize the value of their radar. To the command pilot the docking adapter against the background of the Sahara Desert ". . . . looked like a period on a piece of typing paper." Without radar they would never have found the target and would have completely missed the rendezvous.

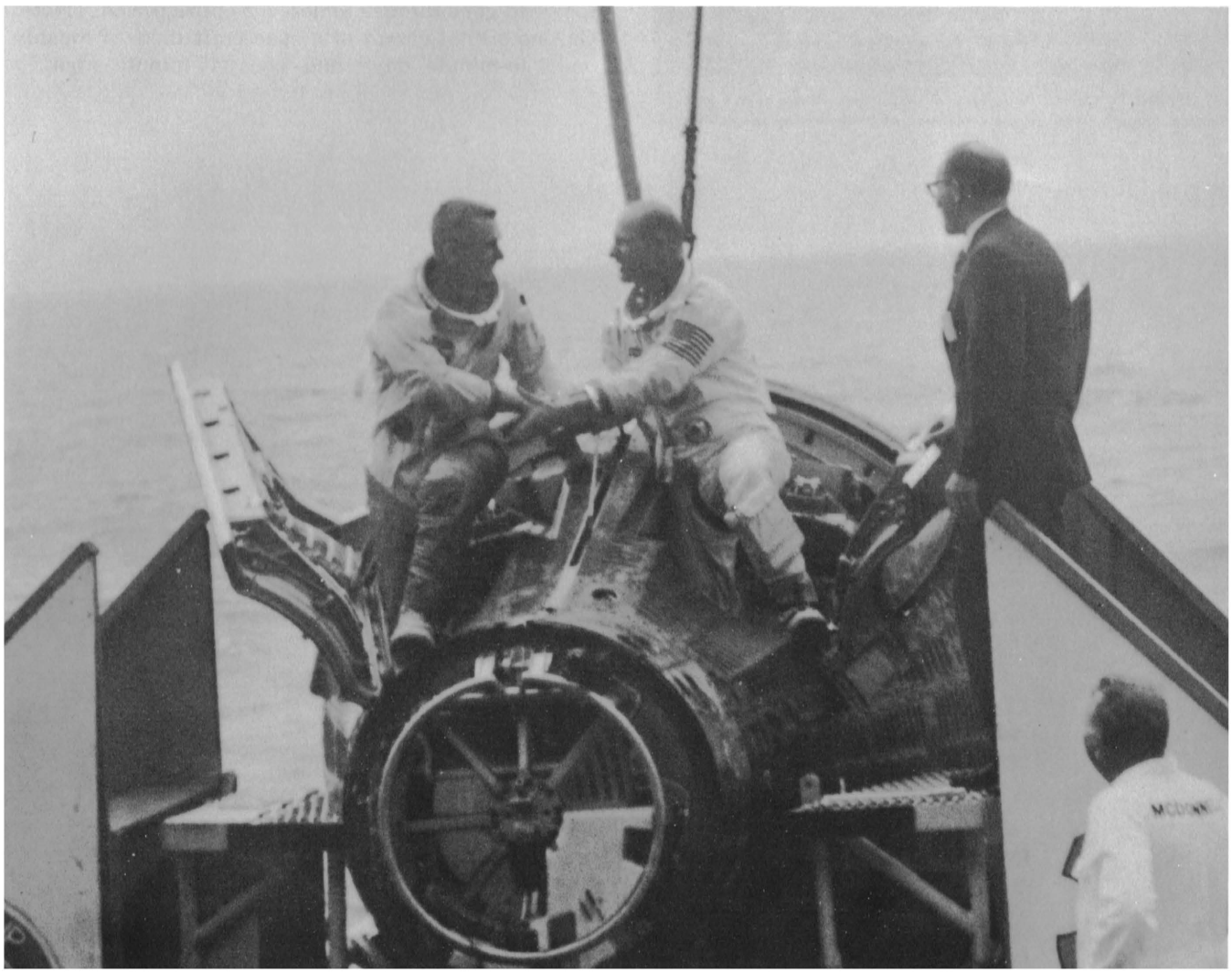
Speaking of EVA activities, Cernan said he had ". . . . been over it about 30 times in the technical debriefings . . .," and he intended only to summarize the problem areas encountered in the actual flight situation. He opened the discussion by saying that a two-day and one-night EVA had been planned, and they had gone through almost the entire period. (Note: On one orbital circuit of a spacecraft there is roughly one "45-minute day" and one "45-minute night.")

GEMINI IX CREWMEN Eugene A. Cernan, left, and Thomas P. Stafford relax aboard their spacecraft as they await the arrival of the aircraft carrier USS Wasp and recovery helicopters hover nearby.

Cernan said that at the outset of EVA he sought to evaluate the tether dynamics control and with the 25-foot umbilical, test the use of handholds and Velcro or sticky type pads to assist in "walking around the spacecraft, and investigating the operation of the new Extravehicular Life Support System (the chest pack or ELSS)". Cernan said the ELSS operated satisfactorily on its medium flow providing comfort in terms of temperature control, total oxgen supply, and suit integrity. His suit pressure, he added, never varied from the chamber runs he had seen in Houston during the flight-training period.

While "walking" around the spacecraft, Cernan met with some difficulty in attaining the exact position he desired — a means of bracing himself against the drift encountered in zero gravity was needed in order to free his hands to accomplish the scheduled tasks. At this point Stafford injected that he could easily tell that Cernan was working because, in using the spacecraft for this purpose, the pilot had pitched the spacecraft attitude up 30 degrees, then pitched it down 40 degrees, turned it around 150 degrees, and inverted it into a head-to-earth position. Cernan added that he experienced absolutely no disorientation, neither did he ever feel lost. During this period Cernan had installed cameras, made film pack changes with Stafford's help, and attached rearview mirrors so that the command pilot could see him while he was in the aft area of the spacecraft. All of these tasks were accomplished with little physical exertion.

Near the 50-hour point, as scheduled, the crew began to partially close the hatch, leaving it open about two inches. Cernan said, "We didn't lock it for a number of reasons, not that I didn't trust Tom, but we did have an umbilical coming out of the hatch . . ." The main reason for this action was thermal control to pro-



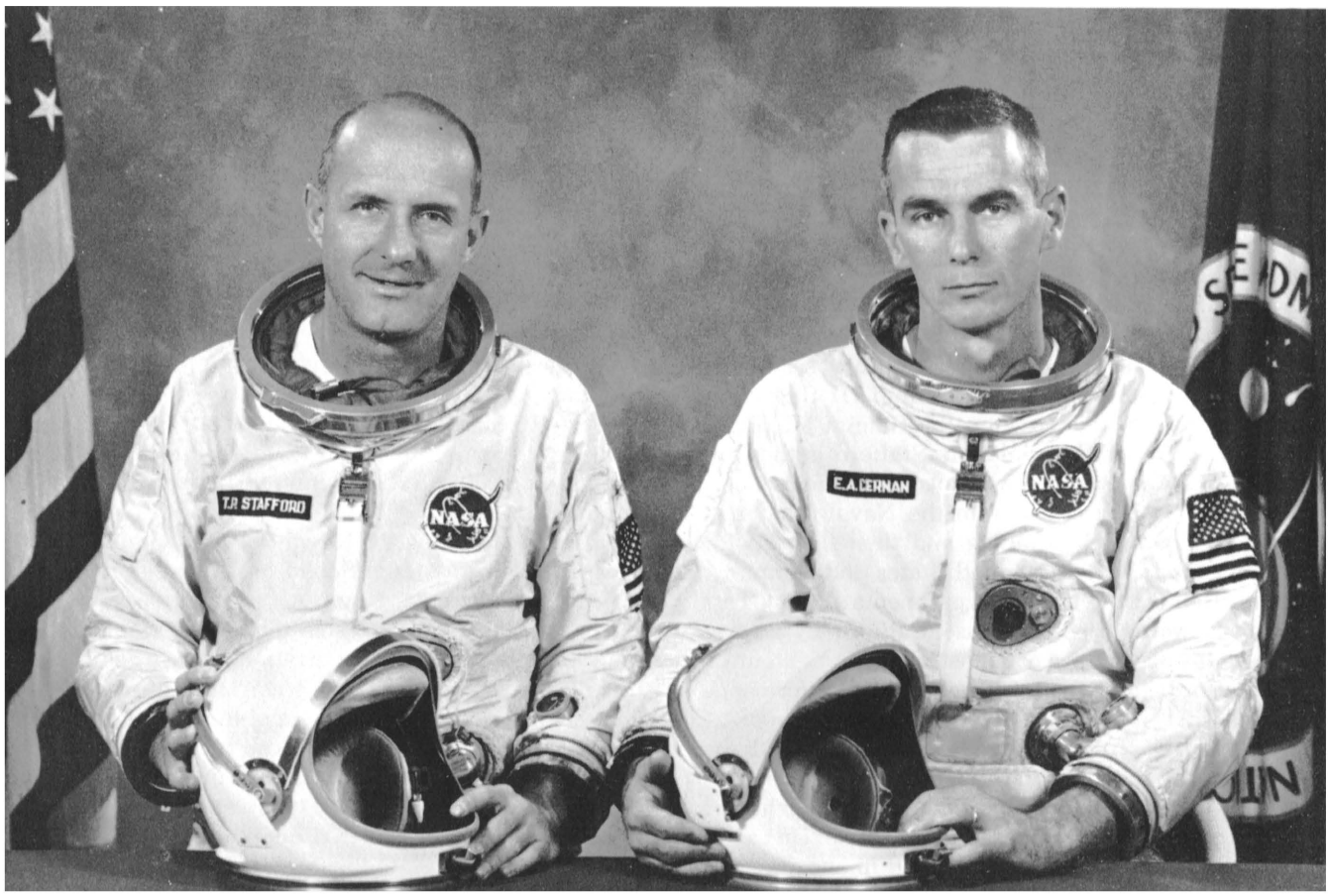
SPACE BUDDIES Cernan, left, and Stafford exchange congratulations on completing their mission shortly after the spacecraft with the crew inside was picked up by the carrier USS WASP. On hand to greet them was John C. Stonesifer of Manned Spacecraft Center's Landing and Recovery Division.

tect the hatch seals from the day-night temperature extremes. The pilot stated that the hatch closing proved to be the first real physical task he had encountered up to that point.

At the June 17 conference he used a full-sized spacecraft adapter with the AMU properly installed to demonstrate the second phase of his EVA experiences. He showed that the first objectives were to get his feet in the stirrups to prevent him from floating away; the stirrups allowed him the use of both hands to accomplish the electrical and oxygen connections. As it turned out, he said, his feet tended to float out of the stirrups and it became a problem to maintain his position. Thus, he was involved in an expenditure of effort that had not been anticipated in preparing the AMU for operation. Since he was in total sunlight at this time, he began to feel warm at a point in the small of his back. Postflight analysis showed that part of the superinsulation had ripped away from the stitching and allowed the radiation to penetrate the suit at that point. So he stopped and rested until sunset. When he resumed the tasks of donning the AMU, he noted that his visor began to fog with moisture collecting on both the visor and the suit pressure gauge. When he had felt the heat from the sun, he had increased the oxygen flow rate to maximum for better cooling and then left it in the increased flow position to try to eliminate fogging (in a similar manner to a defroster on an automobile).

Even after his vision became obscured Cernan continued to work for as Stafford said ". . . . he had been through it so many times he could do it blindfolded. Actually Cernan reached the point where he had only to connect the restraint harness (similar to an automobile safety belt) and the oxygen hose and for Stafford to throw the switch to cut the AMU loose. The question now was how long the fogging would continue; the crew decided to hold up on the terminal action to see. Since little improvement in vision resulted during the wait, they decided they were "no go" for the AMU. Cernan said that he rated the condition of the AMU ". . . in top notch shape . . ." when he left it. ". . . I'm convinced it was a flyable machine, "the pilot reported.

The crew learned several lessons during the EVA experience. They determined that work was possible in daylight and darkness; work could be accomplished in temperature extremes; there were absolutely no problems in disorientation in the two-hour period and no feeling of vertigo. Cernan stated that he had to expend an estimated 50 percent of his effort just to maintain the desired position while he was in the adapter area.



GEMINI IX FLIGHT CREW — Command Pilot Thomas P. Stafford and Pilot Eugene A. Cernan.

UNITED STATES SPACE FLIGHT LOG

MISSION	PILOTS	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 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

This effort, in addition to the required work, overtaxed the suit environmental circuit.

THE CREW

Thomas P. Stafford

The command pilot for the Gemini IX-A mission, Lt. Colonel Thomas P. Stafford, was born in Weatherford, Oklahoma, September 17, 1930. He was graduated from the United States Naval Academy in 1952.

Prior to the Gemini IX flight, Stafford served as pilot of the backup crew for the Gemini III flight and was pilot of the prime crew on the Gemini VI flight, the first space rendezvous mission. Stafford is the first astronaut to fly in two Gemini program missions.

Following his graduation from the Naval Academy, Stafford received flight training and then flew fighter interceptor aircraft in the United States and Germany. He later attended the USAF Experimental Flight Test School at Edwards Air Force Base, California.

Prior to his acceptance as an astronaut in September 1962, Stafford served as Chief of the Performance Branch, USAF Aerospace Research Pilot School at Edwards and was responsible for supervision and administration of the flying curriculum for student test pilots. He also served as an instructor in both flight test training and in specialized academic subjects. He established basic textbooks and participated in and directed the writing of flight test manuals for use by the staff and students.

Stafford is married to the former Faye L. Shoemaker, also of Weatherford; they have two daughters, Dianne and Karin.

Eugene A. Cernan

The pilot of Gemini IX, Commander Eugene A. Cernan, is a native of Chicago, Illinois, born March 14, 1934. Cernan received a bachelor of science degree in electrical engineering from Purdue University and a master of science degree in aeronautical engineering from the United States Naval Postgraduate School at Monterey, California.

Cernan received a commission in the Navy as a result of his participation in the Naval Reserve Officer Training Corps at Purdue and entered flight training upon graduation.

Prior to attending the Naval Postgraduate School, he was assigned to Attack Squadrons 126 and 113 at the Miramar, California, Naval Air Station.

In October 1963 he was selected by the National Aeronautics and Space Administration for astronaut training. Since his selection, Cernan has monitored the spacecraft propulsion systems and the Agena D. Cernan was named as pilot of the backup crew for Gemini IX on November 8, 1965; as pilot of the prime crew for Gemini IX on March 21, 1966; and as pilot of the backup crew for Gemini XII on June 17, 1966.

Cernan is married to the former Barbara J. Atchley of Houston, Texas, and they have one daughter, Teresa Dawn.