The Covered Wagon

Although NASA Headquarters refused to allow nicknames for Gemini spacecraft, Cooper was not so easily put off. Conrad's father-in-law had whittled a model covered wagon, which inspired Cooper with the idea of a patch using that motif and the motto: "Eight days or bust." A personal appeal to NASA Administrator Webb led, after much discussion, to approval of the "Cooper patch." But Webb heartily disliked the motto - if the mission did not go the full eight days, for whatever reason, many would say it had "busted" - and turned it down.[71]

On Saturday, 21 August, Guenter F. Wendt, the McDonnell pad leader, hustled Cooper and Conrad into their couches. Precisely at 9:00 a.m., they felt the modified Titan II start them on a far longer journey than any made by a bygone, continent-crossing covered wagon. The start was smooth enough but then came the bumps of Pogo.* A few seconds before staging, the bouncing stopped. *Gemini V* cut loose from the booster's second stage at 163 kilometers altitude, with an orbital apogee of 349 kilometers.[72]

Because of the mission's length, the supply of oxygen and hydrogen for the fuel cell was a concern. Cooper intended to operate the cells at the lowest possible pressure. But Conrad suddenly noticed that the pressure had upped too low. Flight Control told him to switch on the oxygen heater to raise the pressure. To his surprise, the needle continued to drop. [257] At 2 hours 13 minutes, Cooper yawed the spacecraft 90 degrees and ejected the rendezvous pod.[73]

Cooper turned the spacecraft to the rear, flipped on the radar, and got an immediate signal. The radar scale showed the pod moving off at a relative speed of two meters per second. Conrad had expected it to drift away and trail behind the spacecraft, but to his astonishment it went out to the side. Finally it started to follow them as they thought it should.

The heater had still not raised the pressure in the cells. *Gemini V* was out of communications range, so Cooper had to make a decision without help from the ground stations, as the pressure had fallen below 138 newtons per square centimeter (200 pounds per square inch). Never having seen a fuel cell working at a pressure that low, he was afraid it might stop entirely, and he reluctantly elected to power down. Without electrical power, rendezvous with the pod was out of the question. *Gemini V's* crew now wondered if, as Administrator Webb had feared, the mission had "busted." Would Mission Director Christensen continue the flight or have them come home?[74]

Flight Director Kraft now had his first major problem at the new Mission Control Center. He knew the spacecraft had enough battery power for reentry even if the fuel cell failed completely, but he needed to know if there would be time enough to reach a good reentry zone, such as the mid-Pacific near Hawaii on the sixth revolution. While Kraft waited for an answer, the fuel cell pressure dropped to 83 newtons (120 pounds). McDonnell set up a test in St. Louis to find out the lowest working pressure for a fuel cell. During the fourth revolution, the oxygen pressure stabilized at 49 newtons (71 pounds). About this time, Kraft was assured that the batteries were good for 13 hours. Mission Control Center learned that the low-pressure tests in St. Louis were going well. With these facts in hand, Kraft decided Cooper and Conrad could fly for at least one day.[75]

Kranz and his crew then came on duty. While he and his problem solvers wrestled with the heater, Edwin E. Aldrin worked with a Mission Planning and Analysis Division team to design maneuvers for some sort of practice rendezvous now that the pod was out of the picture - just in case the electrical supply should be salvaged. Kranz's team thought it would be safe to go ahead and operate the cells. When Hodge arrived, the three Flight Directors agreed to tell Cooper to turn the electricity back on. They were relieved when the pressure remained stable as the stacks were brought back on the line. Hodge's flight planners gave the crew some experiments and systems checks to perform, which required more and more power.[76]

Thinking they might have to land early, the crew had begun to put things away. Now that they were back in business, the cabin was soon full of loose gear again. Then it was time for some rest.[77] [258] It had been a long, cliff-hanging first day for Cooper and Conrad in their "Covered Wagon."

While *Gemini V* drifted, the cabin got cold. The crew turned the airflow on low but continued to shiver. This was different from Mercury flights, where the capsule had tended to overheat. The suit coolant circuit seemed cold, too, so they took the hoses off and stopped the flow inside the suits. As the spacecraft tumbled through space, the sight of the stars spinning around outside the window bothered them until Cooper covered the windows and blocked out the view.[78]

Cooper and Conrad had no better luck sleeping than McDivitt and White. At first they tried sleeping alternately, but the dozer was soon disturbed by the ground calling, "Gemini 5, Gemini 5, Gemini 5." As long as one of them was awake, there would be radio transmissions, and they decided this sleep schedule would not work. So they tried, not altogether successfully, to sleep, eat, and work together.[79]

Cooper and Conrad considered the third day the high point of the flight. They worked steadily on experiments and did a series of maneuvers for a "phantom rendezvous." Setting up their calculations on the assumption that they were tracking an Agena in a different orbit than the spacecraft, the flight controllers would pass information to the crew, just as though the target vehicle really existed. Using both ground and spacecraft computations, Cooper would then maneuver *Gemini V* to a rendezvous with this moving point in space, giving him a chance to check out the complete maneuvering system. Such precise moves were new to manned space flight, but Cooper came through like a champion, bringing his spacecraft to the exact position Kraft had asked for. Doubts about being able to accomplish rendezvous faded, and the mission planners were confident and ready for Gemini VI.[80]

The crew powered the electrical systems down again and resigned themselves to drifting in space, performing experiments when possible. Since the inertial guidance platform was not working, they had little success, although they did some experiments, performed radar tests, and made vision tests. They saw smoke at Laredo, Texas, for example, but did not see a checkerboard pattern that had been laid out for them on a field. In the evening, Cooper asked for some uninterrupted sleep and got it.

Cooper slept seven hours and Conrad five, so their work day began at a more normal time. It was to be the last busy shift. First, they saw a rocket sled test as they flew over Holloman Air Force Base, New Mexico. Over Vandenberg, on the next pass, they sighted the contrail of a chase plane just before they glimpsed the ignition of a Minuteman missile. In the Atlantic, they observed their prime recovery carrier, *Lake Champlain*, with a destroyer astern. But, down below in Mission Control Center, a new problem was causing fresh worries.

Since there was no way to dump the fuel cell's product water overboard, [259] its storage tank had been partitioned by a bladder wall; one side held drinking water, the other stored the acidic liquid. As the crew drank, more room for the fuel-cell discharge was provided. But the cells were producing 20 percent more fluid than had been foreseen. When an analysis by Kranz' team disclosed that, even at the high rate of production, there would be some room left at the end of the mission, everyone sighed in relief. Then still another problem arose to plague the mission controllers.

Late in the fifth day, the orbital attitude and maneuvering system (OAMS) grew sluggish, and one thruster quit. Kraft canceled all experiments that required fuel, and the crew turned off the electrical system to help reduce the water buildup. Although several possible solutions to the thruster problem were worked out, none was successful. So Cooper and Conrad again drifted through their rest and sleep period, awakening only to find that the whole OAMS had become erratic. Two thrusters had now stopped. The spacecraft drifted for the rest of the mission, with Cooper only turning on the system occasionally to stop excessive tumbling. When things had been working right, the crew had been busy. Now Conrad mentally kicked himself for not bringing a book.[81]

Despite all the problems, the crew did a creditable job on the experiments. Only one of the 17 had to be scrubbed - D-2, Nearby Object Photography - since it depended on rendezvous with the pod. Two complementary Department of Defense experiments were successful. Experiment D-1, Basic Object Photography, proved that the crew could acquire, track, and photograph celestial bodies. Weather conditions somewhat hampered D-6, Surface Photography, but Cooper and Conrad did obtain photographs of Merritt Island, Florida; Tampico, Mexico; Rocas Island, Brazil; and Love Field, Dallas, Texas.

Defense experiments D-4/D-7, Celestial Radiometry and Space Object Photography, were combined to make irradiance measurements on celestial and terrestrial backgrounds and on rocket plumes. The final defense experiment - S-8/D-13, Visual Acuity/Astronaut Visibility - combined use of an inflight vision tester and the observation of rectangular marks in fields near Laredo, Texas, and Carnarvon, Australia. Weather and operational problems made ground observations difficult - they never were able to see the Carnarvon field, but the Laredo pattern was partially read in the 48th revolution. The tester showed that the crew's vision did not change during the eight-day flight.[82]

Gemini V carried the same medical experiments as *Gemini IV*, plus M-1, Cardiovascular Conditioning, and M-9, Human Otolith Function, to see if the ability to perceive the horizontal deteriorated during flight. Postflight responses were not significantly different from those reported before the mission. Conrad wore inflatable leg cuffs for M-1. [260] When activated, the cuffs pressurized automatically for two minutes out of six. They could be run continuously throughout the flight or be turned off. Conrad had some problems with the equipment but he felt the cuffs might be useful for extremely long missions. His pulse rate returned to normal faster than Cooper's after the flight, and he lost four percent less plasma volume. But this could not be conclusively traced to the use of the cuffs, since individual responses differ. Principal investigator Pauline Beery Mack found that both had lost more calcium than the *Gemini IV* crew, but she was unwilling to predict a trend since "a form of physiological adaptation may occur in longer space flight."[83]

Cooper obtained the first photographs of the light of the moonless sky (zodiacal light and the gegenschein), experiment S-1. He made a series of stepped exposures and took two pictures of the gegenschein, a faint nebulous light opposite the Sun. Like their predecessors, Cooper and Conrad took synoptic terrain and weather photographs. Pictures of the Zagros Mountains showed more detail than the official Geologic Map of Iran. The crew also provided pictorial cloud studies, including tropical storm Doreen. S-7, Cloud-Top Spectrometer, the other science experiment, proved the feasibility of making cloud altitude measurements from spacecraft.[84]

During the mission, Hurricane Betsy moved relentlessly toward the planned landing area. The landing area sea-state constraints for Gemini were considerably relaxed from those of Mercury. For Mercury, the limits were winds no more than 34 kilometers per hour (18 knots), waves no more than one and a half meters (five feet); for Gemini, winds up to 47 kilometers (25 knots) and waves up to two and a half meters (eight feet) were acceptable. Weather for Mercury in all of the recovery areas - primary secondary, or contingency - had to be good. No such restraints were ever placed against Gemini - but it certainly could not be expected to touch down in a hurricane area. The Weather Bureau recommended that *Gemini V* be brought down early to avoid landing too near the storm. Kranz agreed in plenty of time for the *Lake Champlain* to reach the new recovery zone.[85]

Because of the erratic, and sometimes inoperable, OAMS, Kraft allowed the crew to use one of the two rings of the reentry control system to position the spacecraft properly more than one revolution before coming back to Earth. During the 120th pass, Cooper told McDivitt (CapCom in Houston for reentry) that *Gemini V* was ready for retrofire.[86]

In the darkness near Hawaii, on the morning of 29 August, at 190 hours 27 minutes 43 seconds, the first retrorocket went off followed by the second and third. After what seemed like an eternity, the fourth fired. Cooper peeked out the window and felt as if he were sitting "in the middle of a fire." With the control system thrusters spewing [262] flame in front and the retrorockets firing behind, a nighttime reentry had to rely strictly on instruments, Cooper discovered. There was absolutely no way of seeing the horizon or a landmark. He and Conrad stayed on instruments until they had passed over the Mississippi in the morning light.[87]

[Page 261 consisted of photographs from *Gemini V*, 21 August 1965]

Cooper held the spacecraft at full lift until it reached the 120,000-meter altitude and then tilled it to a planned bank angle of 53 degrees. The reentry gauge con indicated that they were high; there might be an overshoot the landing point. Cooper, responding to the instrument, slewed to 90 degrees left instead of 53 to create more drag and reduce the landing error. The g-loads quickly shot from 2 1/2 to 7 1/2.[88]

At 20,000 meters, Cooper punched the drogue parachute button. *Gemini V*, unlike *Gemini 1* did not oscillate - it was completely stable on the drogue. Cooper then cut in the second control ring thrusters to discard the fuel as the spacecraft came straight down. He and Conrad watched the main parachute as it unfurled and felt the expected jolt at two-point suspension. In contrast to the McDivitt-White landing, impact was very, very soft.

Gemini V landed 190 hours 55 minutes 14 seconds after launch, 130 kilometers short of the planned landing point. The computer had worked as it should in this case - the error had been human. Earth's rotation rate is 360.98 degrees per day. But, in programming the computer, someone had left off the two decimal-place numbers and fed the machine just the 360 degrees. Cooper's efforts to compensate for what he recognized as an erroneous reading had brought them down closer to the ship than they would otherwise have been.

The short landing caused no problems for the U.S. Navy recovery forces. A helicopter soon arrived over the spacecraft and three swimmers dropped into the water. Cooper and Conrad were very comfortable. With a calm sea, Cooper wanted to stay with the spacecraft on this pleasant summer morning (about 8:30, Cape time) until he learned that the carrier was still 120 kilometers away. Then he and Conrad rode the helicopter to the *Lake Champlain*.[89]

The admiral welcomed them aboard ship. Asked what they had been thinking about when it looked as though the fuel cell heater problem might cause the mission to end early, Conrad pointed out a picture he had drawn between the spacecraft seats of a covered wagon halfway over a cliff.[90]

Although the crew's worries were over, Berry's were not. His postflight concern was the trend in plasma volume and calcium losses, which were increasing on these longer missions. He was aware that the crew had been forced to drift through space the last three days, with little to do; but they should have exercised more. Two days later, to Berry's relief, both were physiologically almost back to normal.[91]

[263] A safe landing and healthy crew after an eight-day space voyage increased NASA's confidence in achieving its lunar-landing goal during the sixties. In a span of only three months in 1965 and after just two long-duration flights, medical fears of weightlessness began to subside. Hugh Dryden reflected this optimism in his report for the President:

> The primary objective of the Gemini V mission to demonstrate man's ability to function in the space environment for 8 days and to qualify the spacecraft systems under these conditions was met. This milestone duplicated the period required for the manned lunar exploration mission.
>
> Gemini V also demonstrated the capability of man to withstand prolonged periods of weightlessness. The adaptability of the human body was indicated by the performance of the astronauts. For example, their heartbeat rates gradually dropped to a level significantly lower than their preflight normal rates, but by the fourth day, adapted to the weightless condition and leveled off. Upon return to Earth, the heartbeat rates were slightly higher than normal, as expected, but returned to normal rate during the second day. This has assured us of man's capability to travel to the Moon and return.[92]

Postflight activities for Cooper and Conrad included a six-nation goodwill tour assigned to them by President Johnson. During the trip, they attended the International Astronautical Federation Congress in [264] Athens, where they talked with the crew of *Voskhod II*, Russian Cosmonauts Aleksey Leonov and Pavel Belyayev.[93]

NASA now turned to plans for the rendezvous and docking mission and for the final long-duration flight, both scheduled before the end of the year. The goal of five manned flights in a single year seemed phenomenal, compared with the experience of Project Mercury. But *Gemini IV* and *Gemini V* had indeed proved to be pillars of confidence, a solid base from which to build.

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* Pogo oscillations reached +0.38g during stage 1 flight, exceeding the permitted +0.25g for a total of about 13 seconds. Within three days after the launch, analysis of flight data showed that the oxidizer standpipes had been charged with only 10 percent of the required volume of nitrogen. The fault was quickly traced to prelaunch procedures, which were corrected. This was the only Pogo anomaly to mar a Gemini mission.

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71 Memo, Webb to Donald K. Slayton, 14 Aug. 1965.

72 "Gemini V Technical Debriefing," Part I, 1 Sept. 1965, pp. 1, 6, 10-12, "Gemini V Mission Report," pp. 1-1, 4-18, -19, 5-117; Wambolt and Anderson, "Launch Systems Final Report," p. II.G-5; Gemini 5 mission commentary transcript, 21 Aug. 1965, tape 10, p. 1; memo, John J. Turner to Mgr., GPO, "Oxidizer charging equipment and procedures," GV-66231, 8 Oct. 1965.

73 "Gemini V Air-to-Ground Transcription," 5 Oct. 1965, pp. 22, 25, 27; "Gemini V Debriefing," Part I, p. 48.

74 "Gemini V Air-to-Ground," pp. 24, 26-33; "Gemini V Debriefing," Part I, pp. 56-61, 63, 65; "Gemini V Mission Report," pp. 4-2, 7-7; John D. Hodge and Jones W. Roach, "Flight Control Operations," in *Gemini Midprogram Conference*, p. 184; briefing, first shift change, 4:00 p.m., 21 Aug. 1965, pp. 1-2, 4-5, 8.

75 "Gemini V Air-to-Ground," p. 54; Kranz interview; Hodge and Roach, "Flight Control Operations," p. 184; "Gemini V Debriefing," Part I, pp. 65-66; "Gemini V Mission Report," pp. 5-68, - 69; first shift briefing, pp. 1, 5-7.

76 "Gemini V Air-to-Ground," pp. 64-65, 67; Kranz interview; "Gemini V Mission Report," pp. 4-2, -3; Gemini 5 mission commentary, tape 61, p. 1, tape 63, p. 1, tape 86, pp. 1, 2; shift change conference No. 2, 11:30 pan., 21 Aug. 1965, pp. 1, 3-4.

77 "Gemini V Debriefing," Part I, pp. 65, 72; "Gemini V Mission Report," pp. 4-2, 7-9; Gemini 5 mission commentary, tape 81, p. 1.

78 "Gemini V Debriefing," Part I, pp. 80-82; "Gemini V Mission Report," pp. 5-19, 7-47; "Gemini V Air-to-Ground," p. 155.

79 "Gemini V Air-to-Ground," p. 187; "Gemini V Debriefing," Part I, pp. 74-75; "Gemini V Mission Report," pp. 7-9. -48.

80 "Gemini V Mission Report," pp. 4-3, 6-4, 7-7, -8; "Gemini V Debriefing," Part I, p. 102; Tindall interview; change of shift press briefing No. 4, 2:40 p.m., 22 Aug. 1965; change of shift press briefing, 2:45 p.m., 23 Aug. 1965, pp. 2-4.

81 Memo, John A. Edwards to dist., "Gemini 5 24-hour report for 1500 August 24 to 1500 August 25," 26 Aug.1965, with enclosure; "Gemini V Mission Report," p. 4-5; "Gemini V Debriefing," Part I, p. 117; Charles Conrad, Jr., interview, Houston, 31 March 1967.

82 "Gemini V Mission Report," pp. 7-8, 8-1, -4 through -10, -53, -54, -55; Col. D. McKee, "Experiments D-1, D-2, and D-6, Basic Object, Nearby Object, and Surface Photography," in "Manned Space Flight Experiments Interim Report, Gemini V Mission," presented in Washington, 6 Jan. 1966, pp. 169-81; Burden Brentnall, "Experiment D4/D7, Celestial Radiometry and Space-Object Radiometry," in *Gemini Midprogram Conference*, pp. 356-77; Seibert Q. Duntley et al., "Experiments S-8/D-13, Visual Acuity and Astronaut Visibility," ibid., pp. 329-46.

83 "Gemini V Mission Report," pp. 8-11 through -15; Lawrence F. Dietlein and William V. Judy, "Experiment M-1, Cardiovascular Conditioning," in *Gemini Midprogram Conference*, pp. 381-92; Earl Miller, "Experiment M9, Human Otolith Function," ibid., pp. 431-36; Mack et al., "Experiment M-6, Bone Demineralization," ibid., pp. 413-14.

84 E. P. Ney and W. F. Huch, "Experiment S-1, Zodiacal Light Photography," in "Gemini V Experiments Interim Report," pp. 1-8; Paul D. Lowman, Jr., "Experiment S-5, Synoptic Terrain Photography," ibid., pp.9-17; Kenneth M. Nagler and Stanley D. Soules, "Experiment S-6, Synoptic Weather Photography," ibid., pp. 19-30; F. Saiedy, D. Q. Wark, and W. A. Morgan, "Experiment S-7, Cloud-Top Spectrometer," ibid., pp. 31-44; *Earth Photographs from Gemini III, IV, and V*, pp. 111-255, esp. p. 201.

85 Amman interview; "Gemini V Mission Directive," NASA Program Gemini working paper No. 5028, 21 July 1965, pp. 3-6, -7; Edward F. Mitros, telephone comment on draft chapter, 29 July 1969; Gemini 5 mission commentary, tape 413, p. 1.

86 Gemini 5 mission commentary, tape 426, pp. 4-6; "Gemini V Air-to-Ground," pp. 642, 646; "Gemini V Debriefing," Part I, p. 170.

87 "Gemini V Mission Report," p. 4-6; "Gemini V Debriefing," Part I, pp. 173-78.

88 "Gemini V Mission Report," p. 4-6; "Gemini V Debriefing," Part I, pp. 184-86; Tindall interview.

89 "Gemini V Mission Report," pp. 6-14, -15, 7-10,-11; "Gemini V Debriefing," Part I, pp. 197- 99, 203-204, 206, 213-14; Gemini 5 mission commentary, tape 454, p. 1, tape 455, p. 1, tape 458, p. 1, tape 459, p. 1, tape 461, p. 1; Tindall interview.

90 James interview.

91 Berry interview.

92 Memo, Hugh L. Dryden, Cabinet Report to the President, "Significance of Gemini V Accomplishments," 11 Sept. 1965.

93 "Washington Ceremonies Honor Gemini V Crew, Dr. Berry; Thirteen-Day Goodwill Tour of Six Foreign Nations Begins," MSC *Space News Roundup*, 17 Sept.1965; Neocosmos Tzallas, "Russian Cosmonaut Greets Cooper and Conrad in Athens," *The Washington Post*, 18 Sept. 1965; photo, *The Evening Bulletin*, Philadelphia, 18 Sept. 1965, captioned, "Soviet, American Spacemen meet prior to a dinner in their honor last night. . . ."

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