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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546
TELS WO 2-4155
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FOR RELEASE: FRIDAY A.M.
MARCH 11, 1966

RELEASE NO. 66-52

PRESS KIT

PROJECT: GEMINI 8

(To be launched no earlier than March 15, 1966)

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NEWS NASA
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FOR RELEASE: FRIDAY A.M.
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GEMINI 8
LAUNCH SET
FOR MARCH 15

The National Aeronautics and Space Administration will attempt to achieve the first rendezvous and docking of two spacecraft in Earth orbit during the Gemini 8 mission scheduled for launch no earlier than March 15 from Cape Kennedy, Fla.

The Gemini 8 is scheduled to be launched at 11:40 a.m. EST, 100 minutes after the Gemini Agena Target Vehicle (GATV), a modified Agena D, lifts off the pad at Cape Kennedy at 10 a.m.

Flight crew for the three-day mission is Neil A. Armstrong, command pilot, and David R. Scott, pilot. Armstrong is a civilian and Scott is an Air Force major. Backup crew is Navy Comdr. Charles "Pete" Conrad, command pilot; and Lt. Comdr. Richard F. Gordon, pilot.

Gemini 8 will be boosted into orbit by the two-stage Titan II Gemini Launch Vehicle which generates 430,000 pounds of thrust. The Gemini Agena Target Vehicle will be launched by an Atlas booster which develops 390,000 pounds thrust at liftoff.

The Agena will be launched into a 185-statute-mile circular orbit by an Atlas Standardized Launch Vehicle approximately 100 minutes before Gemini 8 liftoff.

Gemini 8 will go into a 100 by 168-statute mile elliptical orbit and rendezvous as planned during the fourth revolution, approximately five and one-half hours after liftoff.

After rendezvous the command pilot will perform the first of four dockings with the Agena, in which the Gemini will be physically connected to the Agena.

Several operational tests will be conducted, and the two spacecraft will remain docked during a 7½-hour-sleep period and until after extravehicular activity begins.

Scott is scheduled to open the hatch at 20 hours and 25 minutes into the mission and spend one and a half revolutions, about two hours and 40 minutes, outside the spacecraft. Total elapsed time from hatch-opening to hatch-closing will be two hours and 51 minutes.

In the first daylight segment, he will remain on a 25-foot umbilical tether, with oxygen supplied from the spacecraft. He will retrieve a nuclear emulsion radiation experiment from the spacecraft adapter, activate a micrometeoroid experiment on the Agena and use the minimum reaction power tool to loosen and tighten bolts on a work panel on the adapter.

During the night, Scott will don a backpack contained in the spacecraft adapter. With the backpack is a 75-foot tether which he will attach to the original 25-foot tether. He will remain in the adapter section of the spacecraft until daylight before continuing the extravehicular activities. (Gemini 8's adapter section, which is jettisoned before reentry, is an unpressurized, instrumented ring at the aft end of the spacecraft.)

At second daylight, Armstrong will undock the spacecraft and fly formation on the Agena at distances up to 60 feet.

Scott will then use a hand-held maneuvering unit which fires bursts of freon gas to control his movements. This unit is similar to the one used by Astronaut Edward H. White during the Gemini 4 mission.

Approximately four hours after the completion of extravehicular activity, the Gemini 8 will maneuver into a different orbit from that of Agena and then attempt to re-rendezvous with the target vehicle.

Five scientific, four technological and one medical experiment will be carried on Gemini 8. Technological experiments include mass determination, UHF/VHF polarization, night image intensification, and power tool evaluation. Scientific experiments are zodiacal light photography, frog egg growth, cloud top spectrometer, nuclear emulsion, and micrometeorite collection.

Primary objectives of the mission are rendezvous and docking with a Gemini Agena Target Vehicle and extravehicular activity by the pilot in the 13th through 15th revolutions.

Secondary objectives are:

1. Rendezvous and docking during the fourth revolution

2. Perform a docked maneuver with Agena secondary propulsion system

3. Conduct systems tests on both spacecraft and target vehicle

4. To conduct assigned experiments

5. To conduct separation and docking practices

6. To perform a passive-type re-rendezvous

7. To evaluate the performance of the auxiliary tape memory unit

8. To demonstrate the capability of the reentry guidance system

9. To maneuver the Agena into a parking orbit as a target for a later Gemini flight

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The medical experiment is the bio-assays of body fluids.

Landing of the spacecraft is scheduled in the West Atlantic Recovery Zone at the beginning of the 45th revolution after approximately 71 hours of flight.

(END OF GENERAL RELEASE

BACKGROUND INFORMATION FOLLOWS)

I PREFLIGHT ACTIVITIES AND INTEGRATED COUNTDOWN

NASA's John F. Kennedy Space Center has the overall responsibility for pre-flight testing, checkout and launching of the Gemini and Atlas/Agena vehicles for the Gemini 8 mission.

The Gemini launch vehicle was shipped to KSC by aircraft with the first stage arriving Jan. 4 and the second stage on Jan. 6. The stages were erected at launch complex 19, Cape Kennedy Jan. 13. The Gemini 8 spacecraft was flown to KSC from St. Louis, Jan. 8. It was taken to the pyrotechnic installation building, Merritt Island, for receiving inspection, ordnance installation and assembly checks. The rendezvous and recovery section and reentry control section of the spacecraft were mated, and the "premate buildup" was completed with installation of the pilot ejection seats, seat pyrotechnics and parachutes.

The modified Atlas booster for the target vehicle, known as a standard launch vehicle (SLV), first arrived at the Cape in Aug. 11 of last year.

The Agena and its docking adapter were shipped to the Kennedy Center Jan. 21. These two components and the Gemini spacecraft were mounted atop a 50-foot "Timber Tower" at KSC's Radio Frequency Test Systems site Jan. 27-28. The prime Gemini 8 crew and their backups boarded the spacecraft on the tower to conduct a series of Radio Frequency Capability Tests between Gemini 8 and the Agena target. Docking compatibility checks also were made between the two vehicles. The spacecraft was transported to launch complex 19 Jan. 31 and hoisted above the launch vehicle. Following a series of premate verifications tests, that included a simulated flight to verify spacecraft systems, the Gemini 8 was electrically mated to its Titan II rocket Feb. 10.

The launch crew then conducted some two weeks of individual and combined tests of the spacecraft and launch vehicle to insure that all systems of both were ready for flight. The spacecraft was removed for installation of fresh batteries and remated for final systems and simulated flight testing. The pilots participated in their space suits. Mechanical mating of the Atlas booster and the Agena was performed March 1. Combined interface and joint systems tests were conducted with the complete vehicle. A simultaneous launch countdown -- a complete dress rehearsal -- was scheduled to be completed March 9.

The Gemini 8 count actually is a combination of 11 different countdowns, mostly running simultaneously. The different counts are associated with the two launch vehicles, the two spacecraft, Houston Mission Control and the world-wide tracking network, the Eastern Test Range and the Radio-Command Guidance System.

Timing is critical in this count in order to complete the rendezvous. In the so-called final countdown on launch day the Atlas Agena count starts at T-530 minutes, the spacecraft at T-360 minutes, and the Gemini launch vehicle joins the combined count at 240 minutes (all these times are set in relation to the GLV liftoff).

Liftoff for the target vehicle is scheduled for the 95-minute mark in the simultaneous count. The Gemini spacecraft will be launched approximately 101 minutes later, depending on the exact location and performance of the orbiting Agena. If necessary, a built-in hold will be called at T-3 minutes to adjust the Gemini liftoff time to coincide with the Agena target's first pass over the Cape. After the launch sequence adjustments are computed, the count will resume.

LAUNCH VEHICLE COUNTDOWN

TIME	GEMINI	ATLAS-AGENA
F-3 days	Start pre-count	Countdown
F-1 day	Start mid-count	
T-720 minutes	GLV propellant loading	
T-530 minutes		Begin terminal count
T-420 minutes	Back-up flight crew reports to the 100-foot level of the White Room to participate in final flight preparations	
T-390 minutes	Complete propellant loading	
T-300 minutes	Begin terminal countdown Pilots' ready room, 100-foot level of White Room and crew quarters manned and made ready for prime crew	
T-270 minutes	Primary crew awakened	
T-240 minutes	Medical examination	
T-235 minutes		Start tower removal
T-220 minutes	Breakfast	
T-195 minutes	Crew leaves quarters	
T-185 minutes	Crew arrives at ready room on Pad 16	
T-135 minutes	Purging of suit begins	
T-124 minutes	Crew leaves ready room	
T-120 minutes	Flight Crew to Complex 19	

TIME	GEMINI	ATLAS-AGENA
T-119 minutes	Crew arrives at 100-foot level	
T-115 minutes	Crew enters spacecraft	
T-100 minutes	Close spacecraft hatches	
T-95 minutes		Lift off
T-86 minutes		Insertion into orbit
T-70 minutes	White Room evacuation	
T-55 minutes	Begin erector lowering	
T-20 minutes	Spacecraft OAMS static firing	
T-04 seconds	GLV ignition	
T-0 seconds	Lift off	
T+2 minutes 36 seconds	Booster engine cutoff (BECO)	
T+5:41	Second stage engine cutoff (SECO)	
T+5:57	Spacecraft-launch vehicle separation	
T+6:07	Insertion into orbit	

REENTRY

(Elapsed Time from Gemini Lift-Off)

70:12:33	Retrofire
70:13:18	Jettison retrograde section
70:34:34	400,000 feet altitude

70:37:58	Communications blackout
70:40:58	Initiate guidance
70:42:26	Blackout ended
70:44:09	Drogue chute deployed (50,000 feet)
70:46:00	Main chute fully deployed (9,800 feet)
70:52:04	Spacecraft landing

II. MISSION DESCRIPTION
(All Miles are Statute)

Mission information presented in this press kit is based on a normal mission. Plans may be altered prior to or during flight to meet changing conditions.

Simultaneous Countdown -- Countdowns of all vehicles involved are coordinated so that if a hold is encountered in one, the others may be held also.

LAUNCH

Launch Times -- Atlas-Agena - 10 a.m. EST, Launch Complex 14.

Gemini 8 - 11:40:52 a.m. EST, Launch Complex 19.

Launch Window -- Begins approximately 101 minutes after the Agena launch and lasts for six and a quarter minutes on the first day. If the Gemini launch is not accomplished during this window on the first day, rendezvous may be achieved by launching during varying windows on the following four days. The windows on these days vary according to the Agena orbit but under planned conditions they last for approximately 47 minutes.

Azimuth -- Atlas-Agena biased from 83.7 to about 84.4 to provide for yaw steering during Atlas sustainer burn to shift orbital equatorial nodes or crossings .2 degrees to east. Gemini launch vehicle azimuth will be 98.8 degrees, but will be biased slightly so that a small amount of yaw steering in second stage will place the spacecraft in Agena's plane.

Out-of-Plane Capability -- Fuel budget allows spacecraft to burn five-tenths of one degree out-of-plane if necessary if booster yaw steering does not place Gemini in Agena's plane. Corrections of greater magnitude must be performed by the Agena, capable of 10 degrees out-of-plane maneuvering.

Inclination -- 28.87 degrees for both Agena and Gemini Launch Vehicle (GLV).

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RENDEZVOUS

Orbits -- Agena at near-circular 185 miles (298 kilometers). Gemini initially in elliptic 100-168 miles (161-270 kilometers).

Incremental Velocity Adjustment Routine -- At spacecraft insertion a burn will be made if the insertion parameters do not match the actual velocity desired. It will be made at insertion if the spacecraft is underspeed no more than 30 feet per second. If the spacecraft is overspeed or if the velocity difference is more than 30 feet per second, the IVAR will not be performed, but a separation maneuver of at least five fps will be done. Aft firing thrusters are used.

Height Adjustment -- Because of drag during initial spacecraft orbit, a one foot-per-second posigrade burn is scheduled at first perigee at a ground elapsed time of 1:35:01 to raise apogee about .58 miles (.93 kilometers). Insertion dispersions may necessitate a larger maneuver. The object is to achieve a 168-mile (270 kilometers) apogee, or 17 miles below Agena orbit.

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Phase Adjustment -- Near spacecraft second apogee at a time of 2 hours, 18 minutes, 52 seconds (2:18:52) ground elapsed time. Posigrade horizontal velocity addition of 53.3 feet per second will raise perigee to about 134 miles (198 kilometers). It will reduce the catchup rate from about 6.68 degrees to 4.51 degrees per orbit and provide necessary phase relation at third apogee.

Co-elliptical Maneuver -- Near the third spacecraft apogee at 3:48:11, the crew will circularize orbit to 168 miles (270 kilometers). This will be achieved by a posigrade maneuver of 52.8 fps with spacecraft pitched up 4.5 degrees. At this time, spacecraft trails Agena by about 171 miles (275 kilometers) and should have on-board radar lock-on.

Terminal Phase Maneuver -- At 3:52:34, crew will switch computer to rendezvous mode and begin terminal phase systems checkout and procedures. At 5:03:47, about one minute after entering darkness, crew will perform a burn of 33 fps along line-of-sight of Agena. Range to Agena will be about 38 miles (63 kilometers), and spacecraft will be 130 degrees of angular travel from point of rendezvous. Spacecraft will be pitched up 27 degrees for the posigrade maneuver with aft thrusters.

Intermediate Corrections -- Twelve minutes after initial impulse, computer displays first correction to be applied by the crew. Twelve minutes later, at 5:28:06 another correction is applied. Range is then about four miles (seven kilometers) and crew begins a semi-optical approach to Agena. The crew will use radar information directly to read out range and range rate.

Velocity Matching Maneuver -- The magnitude of a theoretical velocity-matching maneuver at 5:35:54 is about 42 fps. However, since the command pilot will be controlling final approach by semi-optical techniques, he will make real-time decisions.

DOCKING CHECKS

When the spacecraft comes within 50 feet of the Agena, it will stop its relative motion and fly formation with the target vehicle for approximately 45 minutes before the first docking. Then a platform parallelism check will be performed to determine if the guidance system of the spacecraft retains its accuracy while two vehicles are joined.

Then a stored program command, which is loaded into the Agena memory, is activated to perform a yaw maneuver using Agena attitude control system. The first bending test is done at 7:35. The Gemini propulsion systems are used to set up rates and check the bending moment or rates on the docking cone interface. Then the Gemini crew will command the Agena secondary propulsion system in a 20-foot per second out-of-plane burn. The crew will then power down the spacecraft for a 7½ hour rest period.

EXTRAVEHICULAR ACTIVITY

At the 18th hour after liftoff, the crew will prepare for the pilot's extravehicular activity. The ELSS chest pack (see Crew Provisions Section for details of EVA equipment) will be unstowed, along with the 25-foot umbilical tether and "Y" connectors. The command pilot will lower cabin pressure to 3.5 psi for systems check and then completely depressurize the cabin. The pilot is scheduled to open the hatch at 20:30 GET, and at sunrise at the end of the 13th revolution, the pilot will emerge from the spacecraft at 20:41 GET.

On the first daylight pass over the United States, the pilot will perform the following tasks. While standing on the seat, he will mount the extravehicular camera facing forward, then retrieve the S-9 experiment on the retro adapter directly behind his seat. Then he will move to the target docking adapter and open the S-10 micrometeroid experiment mounted there. He will return to the spacecraft, change film in the camera and face it aft, then clean and sample the spacecraft windows. The pilot then moves to the rear of the adapter section to check the ESP equipment. He returns to the retro adapter and performs the D-16 power tool experiment. Prior to sunset, he moves to the rear of the adapter section to don the ESP.

During the night pass (45 minutes) the pilot will stay in the adapter section, donning the extravehicular equipment. At second sunrise, the command pilot will undock the Gemini from the Agena and translate 60 feet out-of-plane to fly formation with the Agena. He will then separate the back pack from the adapter section and the pilot will move to the nose of the Gemini.

The EVA pilot will then evaluate the 75-foot tether and the HHMU. He will move out from the spacecraft to the 15-foot point on the tether. The pilot will then translate below the Agena by ten feet, and the command pilot will maneuver the spacecraft to null any angular motion between the spacecraft and EVA crewman. The EVA pilot will move successively to the 45-foot connect point and the 75-foot connect point on the tether. When he has finished HHMU maneuvers at 75 feet, the command pilot will maneuver the spacecraft to the pilot.

The command pilot will follow the pilot as he translates to the Agena. The pilot will then follow the spacecraft at 50 feet as the command pilot translates from the Agena. Ingress will be in the 15th revolution while flying formation with the Agena at 250 feet. Total time of EVA will be two hours, 10 minutes.

RE-RENDEZVOUS

After EVA is completed, the command pilot will re-dock with the Agena. Another bending test will be performed, followed by two more docking and undocking maneuvers. At 27 hours into the flight the crew will begin the re-rendezvous maneuver. It will be a completely onboard operation using the computer, and a hand held sextant to obtain guidance information. The purpose of the re-rendezvous is to simulate the terminal phase of a passive target rendezvous, which will be performed on a later Gemini mission. The radar will not be used except as a backup if visual contact is lost with the target.

At 27:27:55 GET, an upward radial translation of 20 feet per second will be made. The new orbit will be equi-period with the Agena orbit, i.e. the perigees and apogees of the orbits do not coincide, but the orbital period is the same. Gemini will have a perigee of 181.5 miles and an apogee of 188.5 miles.

The spacecraft will travel above and behind the GATV into sunset. The maximum separation distance will be 13 miles behind the GATV. A mid course correction may be made, if necessary.

At 28:40:09 GET, the terminal phase initiation will begin. A 1.8 foot per second burn retrograde will be made to put the spacecraft on an 80 degree intercept, i.e. rendez-vous will occur 80 degrees around the earth from that point. The pilots will be in heads down attitude to shield the spacecraft windows from direct sunlight. The target must be visually acquired to perform terminal phase maneuvers. Line of sight elevation and sun-angle time histories will be scaled for a passive rendezvous, so that the side of the GATV toward the spacecraft is illuminated. Range and range rate will be scaled at 40 per cent.

At 29:00:23 the velocity match maneuver of 16 feet per second is made to bring the spacecraft back to a 185 mile orbit. Docking should be completed over the Rose Knot Victor at 29:05:00 GET.

FINAL SEPARATION

At approximately 29:50:00 GET, the Gemini will separate from the Agena in an out-of-plane maneuver which will place the spacecraft about 1,500 feet to the side of the GATV about 19 minutes later for the Primary Propulsion System plume photography.

AGENA ACTIVITIES FOLLOWING RENDEZVOUS

After final undocking, an Agena maneuver will be commanded by the crew of Gemini 8. They will also observe and photograph the plume produced by rocket exhaust as the engine is fired. Eight more maneuvers will be ground commanded at later times during the mission. See Table III this section for details of these burns. After fuel depletion, the Agena will be in a 253-mile circular orbit, where it will be left as a passive target vehicle for possible future rendezvous. It is expected that the orbit will decay to 230 miles in four months. The purpose of the out-of-plane maneuvers with the Agena will demonstrate the rocket's ability to make these maneuvers for a late rendezvous situation and will also evaluate the restart performance of the Agena primary propulsion system.

RETROFIRE

Retrofire will occur at about 70:12:30 GET during the spacecraft's 44th revolution. Splashdown will occur in the west Atlantic recovery area (26N69W) at 70:48:00 GET.

ORBITS - REVOLUTIONS

The spacecraft's course is measured in revolutions around the Earth. A revolution is completed each time the spacecraft passes over 80 degrees west longitude, or at Gemini altitudes about once every 96 minutes.

Orbits are space referenced and in Gemini take about 90 minutes.

The longer time for revolutions is caused by the Earth's rotation. As the spacecraft circles the Earth, the Earth moves about 22.5 degrees in the same direction. Although the spacecraft completes an orbit in about 90 minutes, it takes another six minutes for the spacecraft to reach 80 degrees west longitude and complete a revolution.

Gemini completes 16 orbits per day, but in 24 hours crosses the 80th meridian of longitude 15 times -- hence 15 revolutions per day.

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GEMINI 8 MANEUVERS

Maneuver	Spacecraft Revolution number	Spacecraft G.e.t. Begin: hr:min:sec End: hr:min:sec	Total ΔV, fps	Thruster	Resultant perigee/apogee altitude above spherical earth statute miles	Geodetic latitude, deg	Longitude deg	Lighting conditions
IVAR	1	00:05:56 00:06:08	10.0	AFT	100/168	26.7	-69.8	Daylight
Height adjustment	1	01:35:01 01:35:02	1.1	AFT	100/168	26.4	-91.1	Daylight
Phase adjustment	2	02:18:52 02:19:59	53.3	AFT	134/168	-26.3	77.9	Darkness
Co-elliptical maneuver	3	03:48:11 03:49:17	52.8	AFT	168/168	-26.2	55.9	Darkness
Terminal phase initiation	4	05:03:47 05:04:25	33.0	AFT	167/187	-24.1	-27.4	Darkness
Velocity match (TPF)	4	05:35:54 05:37:01	42.1	FWD	185/185	3.3	96.6	Darkness
Re-rendezvous radial separation	18	27:27:55 27:28:18	20.0	AFT	181/188	-9.1	-48.2	Daylight
Re-rendezvous terminal phase initiation	18	28:40:09 28:40:49	1.8	FWD	181/187	22.6	-132.0	Daylight
Re-rendezvous velocity match	19	29:00:23 29:00:48	16.2	FWD	185/185	-12.9	-64.3	Daylight
S/C - Agena separation	19	29:50:00 29:50:01	1.0	FWD	185/185	20.3	120.3	Daylight
Retrofire	44	70:12:30 70:12:52	(180° yaw, -20° pitch)	RETROS		-3	175	Darkness

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AGENA MANEUVERS

GATV Maneuver No. Site/Agena Rev.	GMT (day:hr:min)	Delta V fps	Yaw deg	Purpose Resultant apogee/ perigee
Hawaii/20	1:22:49	103.5	0.	Plume photo 220/185
Canarvon/28	2:11:34	1600.	-91.8°	Plane Change 220/185
Canarvon/31	2:16:22	104.	0.	Circularize 220/220
Hawaii/33	2:20:07	100.	-90.	GPO_1 Test Firing
Guaymas/33	2:20:17	100.	-90.	GPO_2 Test Firing
Rose Knot/34	2:20:37	100.	-90.	GPO_3 Test Firing
Hawaii/34	2:21:40	100.	-90.	GPO_4 Test Firing
Canton/58	4:13:17	~590.	-90.7	Inclination Adjust
Hawaii/61	4:18:18	~800	-90.9	Fuel Depletion

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III. EXPERIMENTS

Ten experiments will be carried on Gemini 8. Seven are being flown for the first time, three have been performed on previous flights. They are divided into three categories: technological, four experiments; scientific, five experiments; medical, one.

SCIENTIFIC

S-1 Zodiacal Light Photography

Purpose - To obtain photographs of zodiacal light, airglow layer, and other dim light phenomena, including day sky brightness from orbital altitude. Flown on Gemini 5.

Equipment - Widelux camera, Model F. VI. Field of view 50 degrees by 130 degrees. Lens speed f/1. Focal length 26 mm. Weight 3.5 lbs. Film - Eastman Tri-X 35 mm ASA 400 b&w 20 exposures.

Procedure - Camera and bracket is mounted in pilot's window prior to sunset. Spacecraft is oriented to place sunset in field of view. At sunset plus 10 seconds camera is switched on. It will operate automatically for five minutes making 15 second exposures with 30 seconds interval between exposures. For remainder of night pass, an exposure is made every four minutes with S/C in orbital plane. At the earth terminator, camera left on for five minutes.

Experimenter - Dr. E. P. Ney and Mr. W. F. Huch, University of Minnesota.

S-3 Frog Egg Experiment

Purpose - To study the effects of subgravity on development in a biological system which is gravity oriented.

Equipment - Two units, one mounted on each hatch sill structure. Each unit has four two celled chambers, one for frog eggs of the species rana pippens and one for fixitive. (Formalin). Weight of each unit is four lbs.

Procedure - The pilot will arrest egg development by turning lever which allows formalin to flow into egg cells and stop egg growth on unit at T-15 minutes for chambers 1 and 2, and T plus 210 minutes for chambers 3 and 4. The command pilot will arrest development in chambers 1 and 2 on his unit at 27 hours after launch. Chambers 3 and 4 will be activated just prior to reentry or returned alive (no activation). After recovery, eggs will be examined for any effects of zero gravity on their development.

Experimenter - Dr. Richard Young, Ames Research Center, California.

S-7 Cloud Top Spectrograph

Purpose - To determine the feasibility of measuring cloud-top altitudes from orbiting spacecraft using a hand-held spectrograph.

Equipment - Spectrograph fitted with 35 mm Leica camera body. Camera has 75 mm focal length, shutter speed of f/11; and exposure time of 1/100th. Spectrograph is 25 mm focal length, shutter speed of f/8, exposure time of 1/4 and 1/8. Resolution is 5 Angstroms with a special bandwith of 7500-7800 Angstroms.

Procedure - Film is Kodak high speed IR. U.S. Weather Bureau will determine cloud targets in southern U.S., Dakar, Africa, Guam, and Hawaii areas, using ground stations and ESSA satellite reports. Crew members will photograph the cloud twice, at two exposure times. Ground based aircraft will measure cloud altitude at the same time. The film records the amount of absorption by oxygen in the path of the reflected solar ray between cloud and spacecraft. Altitude can be determined since oxygen has a constant mixing ratio in the atmosphere below 62 miles or 100 kilometers. This experiment was flown on Gemini 5.

Experimenter - Dr. Faud Saiedy, U.S. Weather Bureau, Washington, D. C.

S-9 Nuclear Emulsion

Purpose - to study cosmic radiation at orbital altitudes

Equipment - A rectangular package, 8½"x6"x3", mounted in a cold well in the retro adapter behind the right hatch.

Procedure - At orbital insertion, a spring loaded fairing will jettison exposing the experiment. Spacecraft will fly in heads-up attitude as much as possible before EVA, to give maxium exposure time to cosmic rays. Particles striking the emulsion will leave a track on the negative. The first task after hatch opening will be to retrieve the experiment and hand it to the command pilot. It will be stowed on the centerline storage compartment door.

Experimenter - Dr. Carl Fichtell, Goddard Space Flight Center, and Dr. Maurice Shapiro, Naval Research Laboratory, Washington, D. C.

S-10 Micrometeorite Cratering

Purpose - To collect samples of micrometeoroids and their impacts and return them uncontaminated to earth for laboratory analysis.

Equipment - Micrometeorite collection package mounted on the target docking adapter of the Agena. The rectangular package is hinged to fold open and expose eight plates of highly polished surfaces such as metal, plastic, glass, etc.

Procedure - The package will be launched onboard the Agena in the closed position. The pilot, after leaving the spacecraft on EVA, will move to the Agena and open the package. It would be retrieved on a later rendezvous flight.

Experimenter - Dr. Curtis Hemenway and Royce Coon, Dudley Observatory, Albany, New York.

TECHNOLOGICAL

D-3 Mass Determination

Purpose - To determine the technique and accuracy of a direct contact method of measuring the mass of an orbiting object.

Procedure - Before docking, the aft firing thrusters are calibrated by computing thrust needed to produce desired velocity change during phase adjustment. While docked a 25 second burn is made with aft thrusters. The first 17 seconds stabilizes propellants in the Agena, the last eight seconds is for computation purposes. The mass of both vehicles can be determined by dividing the sum of the thrust times the thrust time by the delta velocity obtained. By subtracting the known weight of the spacecraft, the weight of the Agena is obtained.

Experimenter - Deputy for Technology, Air Force Space Systems Division, Los Angeles, Calif.

D-14 UHF/VHF Polarization

Purpose - To obtain information on communication systems operating through the ionosphere.

Equipment - An UHF/VHF transmitter with 8-ft. extendable antenna mounted on the top centerline of the spacecraft on the retro adapter section.

Procedure - When the spacecraft is over tracking stations at Hawaii and Antigua, the system will be turned on to broadcast a signal at two wavelengths. A 30 foot antenna dish on the ground would pick up the signal and be recorded on audio tape on a chart recorder and signal visual characteristics will be recorded by motion picture from an oscilloscope. The experiment is designed to provide information on regular and irregular fading of radar and radio signals coming through the ionosphere.

Experimenter - Robert Ellis, Naval Research Laboratory Washington, D. C.

D-15 Night Image Intensification

Purpose - To determine whether a low light level television system can be used for night observation of sea and land features.

Equipment - An image-orthicon television camera with 20^{o} field of view and 4-inch square portable viewing monitor. A recording monitor and 16 mm photographic camera, a TV camera control unit, and equipment control unit.

Procedure - The camera is located in the adapter behind and below the crew on the centerline of the spacecraft. A six inch diameter reflecting mirror is deployed so the camera will be scanning along the longtitudinal axis of the spacecraft, and the camera will view the same area which the pilot can see out the window. The system will be warmed up and checked out and beginning with orbital night on the 30th revolution the crew will point the spacecraft at different land and sea objects and observe whether they can be picked up by the camera. The crew will perform both sweeping and tracking tasks on the areas selected. Areas scanned by the video camera will also be recorded on motion picture film for later analysis.

Experimenter - U.S. Naval Air Development Center, Johnsville, Pa.

D-16 Power Tool Evaluation

Purpose - To determine man's ability to perform work tasks in pressurized suit under zero gravity.

Equipment - A minimum reaction power tool - battery powered, 12 amp hours lifetime, weight 7.6 pounds, 10.7 inches long, impacting mode - rachet hand tool, work plate with seven non-detachable bolts, four on face and three on reverse side, a knee tether.

Procedure - The pilot goes to the experiment hardware location on the right side of the retro adapter directly below and behind the S-9 experiment location. He pulls out the work panel and opens it. Then he attaches the knee tether to his suit by velcro and clamps the other end to the handrail. He unstows the power tool from its housing and uses it to loosen four bolts on the work panel. He turns the work panel over and reattaches it to the experiment package. Then he tightens a separate instrumented bolt with the rachet hand tool. After tethered operation is completed, he repeats the same operations without the knee tether.

Experimenter - Propulsion Laboratory, Wright Patterson AFB, Ohio.

Medical

M-5 Bioassay of Body Fluids

Purpose - To collect body fluids before, during, and immediately after flight for analysis of hormones, electrolytes, proteins, amino acids and enzymes which might result from space flight.

Method - Urine will be collected in a special bag for each elimination. A specified amount of tritiated water will be added automatically. The water has a tracer amount of radioactive tritium. By comparing the amount of tritium in the sample with the known amount of tritium placed in it, biochemists can measure the total volume. Sixteen 75 cc capacity sample bags will be carried. A sample will be drawn for each elimination. The remaining urine will be transferred into the urine dump system of the spacecraft.

OPERATIONAL TASKS

In addition to the experiments, the crew will carry out a number of operational tasks which involve spacecraft or evaluation of equipment which will be flown on later spacecraft.

Apollo Landmarks Evaluation - The crew will obtain photographs of earth landmarks which could be used as orbit navigational references in the Apollo guidance system. They will take an oblique photograph at acquisition of the landmark and comment on the ease of acquisition and the weather conditions.

Auxiliary Tape Memory - A new subsystem in the Gemini Inertial Guidance System (IGS) is being tested on the upcoming Gemini 8 Mission. This subsystem, called the Auxiliary Tape Memory (ATM), provides additional onboard memory capacity.

The ATM will allow the further development of onboard capabilities in the future Gemini Missions. The incorporation of the ATM did not require any modifications to the present Gemini computer system.

The ATM is a fifteen-track magnetic tape recorder which stores 835,000 bits on each track resulting in a total storage of 12,500,000 bits. Data parity, clocking, and computer processing bits are recorded in triplicate. The ATM provides triple redundant storage for approximately 1,170,000 bits that can be used for external storage of computer programs. The present computer has provided onboard computer program capability for launch, rendezvous, and reentry and has 156,000 bits of program storage.

The ATM is a hermetically-sealed unit which contains a mechanical transport assembly mounted on vibration isolators, and an electronic assembly containing the power supply, control logic, record logic, and playback logic.

The tape transport is a flangeless reel, peripheral drive unit which contains 525 feet of one-inch wide magnetic tape. The magnetic tape is driven by an endless, seamless three-quarter inch wide mylar belt called the peripheral drive belt. The peripheral drive belt is in turn driven by two drive capstans which are coupled by smaller endless, seamless mylar belts. By not exposing the magnetic tape to drive stresses, its useful life is extended.

The unit weighs twenty-six pounds, contains 700 cubic inches, and uses approximately eighteen watts. The ATM is built by Raymond Engineering Laboratories of Middletown, Connecticut, under contract to the International Business Machines, Electronics Systems Division, Owego, New York, who was contracted to the National Aeronautics and Space Administration, Manned Spacecraft Center's prime Gemini contractor, the McDonnell Aircraft Corporation.

IV. CREW PROVISIONS AND TRAINING

CREW TRAINING BACKGROUND

In addition to the extensive general training received prior to flight assignment and the training received for the Gemini 8 mission, the following preparations have or will be accomplished prior to launch:

1. Launch abort training in the Gemini Mission Simulator and the Dynamic Crew Procedures Simulator.

2. Egress and recovery activities using a spacecraft boilerplate model and actual recovery equipment and personnel. Pad emergency egress training using elevator and slide wire.

3. Celestial pattern recognition in the Morehead Planetarium, Chapel Hill, N. C.

4. Zero gravity training in KC-135 aircraft and a heavy trainer to practice EVA. Stowage and donning of EVA equipment is done in aircraft. HHMU firing is done on Beta trainer. Additional EVA training is performed in 20 foot chamber at vacuum conditions.

5. Suit, seat, and harness fittings.

6. Training sessions totaling approximately 20 hours per crew member on the Gemini translation and docking simulator.

7. Detailed systems briefing; detailed experiment briefings; flight plans and mission rules reviews.

8. Participation in mock-up reviews, systems review, subsystem tests, and spacecraft acceptance review.

During final preparation for flight, the crew participates in network launch abort simulations, joint combined systems test, wet mock simulated launch, and the final simulated flight tests. At T-2 days, the major flight crew medical examinations will be administered to confirm readiness for flight and obtain data for comparison with post flight medical examination results.

GEMINI 8 SUIT

The pressure suit worn by the Gemini 8 crew is identical to the Gemini 4 extravehicular suit with the following two exceptions.

1. No extravehicular thermal over gloves will be worn. Thermal protection for the hands is now integrated in a basic suit glove.
2. The material is now a layer-up of neophrene-coated Nylon, the same material as the pressure retention layer.

The Gemini extravehicular suit has seven layers:

1. White cotton constant wear undergarment with pockets around the waist to hold biomedical instrumentation equipment.

2. Blue nylon comfort layer
3. Black neoprene-coated nylon pressure garment
4. Restraint layer of dacron and teflon link net to restrain pressure garment and maintain its shape.
5. Thermal protective layer of seven layers of aluminized mylar with spacers between each layer.
6. Micrometeoroid protective layer
7. White HT-1 nylon outer layer

For extravehicular activity, the pilot will carry a detachable overvisor which has attach points on both sides of the helmet and can be swiveled into position over the faceplate. The inner visor is a polycarbonate material which provides impact and micrometeoroid protection. The outer visor is gold-coated and provides protection for the eyes from solar glare.

When the cabin is depressurized, and the pilot is outside the spacecraft, the suit automatically pressurizes to 3.7 pounds per square inch to provide pressure and breathing oxygen for both crew members. The extravehicular suit weighs 33 pounds.

EXTRAVEHICULAR LIFE SUPPORT SYSTEM (ELSS)

A 42-pound rectangular box which is worn on the chest. It provides electrical, mechanical, and life support connections between the EVA astronaut and the spacecraft. System is 18 inches high, 10 inches wide and six inches deep. It contains ejector pump for circulation, a heat exchanger for cooling air, a 30 minute emergency oxygen supply. Controls and a warning system for the emergency oxygen supply are mounted on the top of the unit. Used in combination with the ESP, the ELSS functions as a suit pressurization and air supply system during EVA.

EXTRAVEHICULAR SUPPORT PACK (ESP)

A 92-pound backpack worn by the astronaut during extended EVA. Before use, the unit is mounted in the center rear of the adapter section. It supplies the EVA astronaut with oxygen for extended operation in space independently from the spacecraft oxygen supply and with fuel for the Hand Held Maneuvering Unit. The major components of the unit include two high pressure gas storage bottles. The container on the astronauts left side as he wears the unit holds seven pounds of breathing oxygen, sufficient for 79 minutes normal useage. The right container has 18 pounds of Freon 14, the fuel supply for the Hand Held Maneuvering Unit.

Extravehicular crewman will back into pack, seat himself in the cradle, and secure himself to the unit by a nylon strap on the ESP which fastens in front of the ELSS. The ESP is similar in shape to the Astronaut Maneuvering Unit, a self-contained maneuvering pack which will be used on later Gemini flights. The ESP is 26 inches high, 21 inches wide, and 17 inches deep. It was fabricated in-house at the Manned Spacecraft Center. In addition to the oxygen and freon containers, it carries a 28-volt battery for instrumentation and communications. A UHF transceiver and wedge antenna is mounted in the top of the unit for radio voice communications between the extravehicular crewman and the spacecraft.

UMBILICAL TETHER

There are two tether lines which the astronaut will use outside the spacecraft. The 25-foot umbilical is carried inside the cabin and attached to the ELSS and the parachute harness. It contains an oxygen supply line, 1000-pound test nylon tether, and electrical hardline for communications and bioinstrumentation. The oxygen line is protected from temperature extremes by layers of aluminized mylar wrapped around it. The whole unit is encased in a white nylon sleeve. The umbilical is attached to the nose of the spacecraft during portions of EVA. A nylon strap with hook is used to attach the umbilical to eye in spacecraft nose. The strap is secured around the umbilical. This attach point prevents the umbilical near the spacecraft from looping or drifting near thrusters or other external equipment.

The 75-foot umbilical is composed of nylon cord, 1000-pound test, with 13 hardline connections in an electrical wire for communications and bioinstrumentation information. It is also covered with a close-fitting high-temperature white nylon sleeve. Total length is 75 feet, with intermediate metal snap hook attachment points at 15 feet, 45 feet, and 75 feet. The long tether is stored in a nylon bag fixed in place on top of the ESP by the astronauts. The bag allows the tether to pay out on both sides. One side is attached to the parachute harness ring, the other to the 25-foot tether. When the tether is completely out, the bag can be jettisoned.

HAND-HELD MANEUVERING UNIT

This unit is similar to the unit used by Ed White on Gemini IV, except that the oxygen bottles have been removed from the frame. The freon fuel is stored in the ESP. The unit is used to provide the extravehicular astronaut with positive control of his attitude and to propel him from point to point in the zero gravity environment of free space. The major components of the gun include the handle, two spring-loaded poppet valves, foldable tubes, two one-pound nozzles, and one two-pound nozzle. It weighs 3.4 pounds and is stored on top of the ESP in the adapter section during launch. The unit is 12 inches long by 4½ inches high. The distance between the tractor nozzles extended is 28 inches, and 15 inches retracted. Tractor and braking thrust ranges up to 2 pounds, and the total delta velocity of the gun is 54 feet per second as compared with 6 feet per second on Gemini IV.

70MM HASSELBLAD CAMERA

I. Camera

A. Equipment

1. Camera (Inboard)
   80 MM lens
   f2.8 to f22.0 aperture
   Time exposures and speeds up to 1/500 seconds
   Resolution: approximately 125 lines/mm
   Approximately 1.5X magnification
   General Purpose - EVA

2. EVA Camera
   70MM superwide angle Hasselblad
   90° field of view
   38 MM lens
   All other details same as inboard camera

3. 70 MM Mauer
   F=2.8
   80MM Lens
   Purpose: General development and evaluation. To be used in later flight for scientific experiments.

16MM MAURER MOVIE CAMERA

I. Camera

1. Outboard Camera
   5 mm lens
   160° field of view
   5.4 inches focal length

2. Inboard Camera
   18 mm and 75 lenses
   All other characteristics are the same as outboard camera except for field of view.

II. Film

A. Eleven magazines each containing approximately 80 feet of film

B. Kodak S.O. 217 color film

III. Purpose

Agena and rendezvous photographs
Extravehicular activity
General Purposes

WATER MEASURING SYSTEM

A mechanical measuring system has been added to water gun. It consists of a neoprene bellows housed in a small metal cylinder mounted at base of gun. The bellows holds one-half ounce of water. When plunger of gun is depressed, a spring pushes water out of bellows and through gun. A counter in right side of gun registers number of times bellows is activated. Each crewman will record how much he drinks by noting numbers at beginning and end of each use of gun.

FOOD

Number of Meals -- Three per day per astronaut for three days.

Type -- Bite-sized and rehydratable. Water is placed in rehydratables with special gun. Bite-sized items need no re-hydration.

Storage -- Meals individually wrapped in aluminum foil and polyethelene, polyamide laminate. All meals are stored in the right aft food box over the pilot's right shoulder.

GEMINI 8 FLIGHT MENU

DAY 1:

Meal B

		Calories
(R)	Chicken & Gravy	92
(R)	Apricot Pudding	300
(B)	Toasted Bread Cubes (6)	161
(B)	Brownies (6)	241
(R)	Orange Drink	83
(R)	Grapefruit Drink	83
		960

Meal C

		CP	P
(R)	Tuna Salad	214	214
(B)	Cheese Sandwiches (6)	---	324
(B)	Peanut Cubes (6)	297	222
(B)	Cinnamon Toast (6)	99	99
(R)	Butterscotch Pudding	312	312
(R)	Grapefruit Drink	83	83
(R)	Orange-Grapefruit Drink	83	83
		1088	(1115)

DAY 1 TOTAL 2048 (2075)

DAY 2:

Meal A

		Calories	
		CP	P
(R)	Sausage Patties	223	---
(R)	Beef & Gravy	---	160
(B)	Strawberry Cereal Cubes (6)	169	---
(B)	Beef Sandwiches (6)	---	298
(B)	Toasted Bread Cubes (6)	161	161
(R)	Peaches	98	98
(R)	Grapefruit Drink	83	83
(R)	Orange Drink	83	83
		817	(853)

DAY 2 (Contd)

Meal B

		Calories
(R)	Beef Pot Roast	119
(R)	Potato Salad	143
(B)	Cinnamon Toast (6)	99
(R)	Chocolate Pudding	307
(B)	Brownies (6)	241
(R)	Orange Grapefruit Drink	83
		992

Meal C

(R)	Spaghetti & Meat	70
(R)	Applesauce	165
(B)	Cheese Sandwiches (6)	324
(B)	Fruitcake (Date) (4)	262
(R)	Orange Drink	83
(R)	Grapefruit Drink	83
		987

DAY 2 TOTAL 2796 (2832)

THREE DAY AVERAGE CP 2748
P 2787

DAY 3

Meal A

		CP	P
(B)	Bacon Squares (8)	180	180
(R)	Frosted Flakes	---	140
(B)	Apricot Cereal Cubes (6)	171	---
(B)	Cinnamon Toast (6)	99	99
(R)	Applesauce	165	165
(R)	Cocoa	190	190
		888	(857)

-more-

DAY 3 (Contd)

Meal B

		CP	P
(R)	Shrimp Cocktail	119	119
(R)	Beef & Vegetables	98	98
(B)	Strawberry Cereal Cubes (6)	169	---
(B)	Toasted Bread Cubes	---	161
(B)	Fruitcake (Pineapple) (4)	253	253
(R)	Grapefruit Drink	83	83
(R)	Orange Grapefruit Drink	83	83
		805	(797)

Meal C

(R)	Chicken Salad	237
(B)	Toasted Bread Cubes (6)	161
(B)	Gingerbread (6)	183
(R)	Banana Pudding	282
(R)	Orange Drink	83
(R)	Grapefruit Drink	83
		1029

DAY 3 TOTAL 2722 (2683)

ONE SNACK PACK PER CREW MEMBER

(R)	Choc. Pudding	307
(R)	Peaches	98
(R)	Salmon Salad	246
		641

MEDICAL CHECKS

At least one medical check a day will be made by each crew member. Performed over a convenient ground station, a check will consist of: Oral temperature, blood pressure measurement, food and water intake evaluation.

BODY WASTE DISPOSAL

Solid Wastes -- Plastic bag with adhesive lip to provide secure attachment to body. Contains germicide which prevents formation of bacteria and gas. Adhesive lip also used to form seal for bag after use and bag is stowed in empty food container and brought back for analysis.

Urine -- Excreted into fitted receptacle connected by hose to either a collection device or overboard dump.

V. MANNED SPACE FLIGHT TRACKING NETWORK GEMINI 8 MISSION REQUIREMENTS

NASA operates the Manned Space Flight Tracking Network by using its own facilities and those of the Department of Defense for mission information and control.

For Gemini 8 the network will provide flight controllers:

(1) Continuous tracking, command and telemetry data from launch through orbital insertion of the Agena Target Vehicle and the Gemini spacecraft.

(2) Verification of the proper operation of the systems onboard the Gemini and Agena target.

The network also will update via the control center, the spacecraft computer to provide ephemeris (computed space position) and reentry displays for the astronauts.

Immediate computing support will be provided from launch through impact by the Real-Time Computer Complex (RTCC) at the Manned Spacecraft Center. During powered flight, the RTCC will receive launch trajectory data from Bermuda and Air Force Eastern Test Range (AFETR) radars via the Cape Kennedy CDC-3600 computing complex.

TRACKING

The Gemini mission will require separate tracking of four space vehicles: the Gemini spacecraft, the Agena Target Vehicle (ATV), Titan II which is the Gemini Launch Vehicle (GLV), and as required, the Atlas Booster called SLV-3. The Gemini Target Vehicle will carry one C-band and one S-band beacon. Skin tracking (radar signal bounce) of the spacecraft, Agena target vehicle, and Gemini launch vehicle throughout orbital lifetime is a mission requirement. The MSFN Wallops Station (WLP) Space Range Radar (SPANDAR) and various facilities of the North American Air Defense Command (NORAD) will be used for this mission. However, NORAD will not track during the rendezvous phase.

For Gemini 8, various combinations of spacecraft tracking assignments will be carried out according to individual station capability. Some sites have radar systems capable of providing space position information on both the Gemini and Agena vehicles simultaneously through their Verlort (S-band) and FPS-16 (C-band) antennas. Data transmission links, however, have only a single system capability, therefore, priority will be established by the Mission Director or Flight Dynamics Officer according to their needs.

After Titan II launch, the spacecraft will be the prime target for C-band tracking.

Manned Space Flight Tracking Network Configuration

Cape Kennedy	Grand Canary Island
Merritt Island	Pt. Arguello, California
Patrick AFB	White Sands, N. M
Grand Bahama Island	Kauai, Hawaii
Ascension Island	USNS Rose Knot
Antigua Island	USNS Coastal Sentry
Bermuda Island, BWI	USNS Range Tracker
	Canton Island
Pretoria, South Africa	Grand Turk Island
Kano, Nigeria	Tannanarive, Malagasy
Carnarvon, Australia	Eglin, Fla.
	Corpus Christi, Texas

Stations Capable of C-Band Tracking are:

Merritt Island	White Sands, N. M.
Patrick AFB	USNS Range Tracker
Grand Bahama Island	Eglin, Fla.
Antigua Island	Grand Turk Island
Ascension Island	Grand Canary Island
Carnarvon, Australia	Pt. Arguello, Calif.
Bermuda Island, BWI	Kauai, Hawaii
Pretoria, South Africa	

-more-

Stations Capable of S-Band Tracking are:

Cape Kennedy	Carnarvon, Australia
Bermuda Island, BWI	Kauai, Hawaii
Grand Canary Island	Guaymas, Mexico
Pt. Arguello, Calif.	Corpus Christi, Texas

Stations Capable of Skin (radar signal bounce) Tracking the Gemini Launch Vehicle, Spacecraft, and the Agena Target Vehicle are:

Merritt Island	Carnarvon, Australia
Patrick AFB	White Sands, N. M.
Grand Bahama Island	
Antigua Island	Eglin, Fla.
Ascension Island	Grand Turk Island

Skin tracking procedures will be used as needed as mission priorities permit.

Other Computer Support

The Goddard Space Flight Center realtime computing support for Gemini 8 includes the processing of realtime tracking information obtained from the Titan II and Agena systems beginning with mission simulations through Gemini spacecraft recovery and Agena lifetime.

Goddard's computer also will certify the worldwide network's readiness to support Gemini 8 through a system-by-system, station-by-station, computer-programmed checkout method called CADFISS tests. CADFISS (Computation and Data Flow Integrated Subsystem) checkout of network facilities also will be performed by Goddard during postlaunch periods when the spacecraft are not electronically "visible" by some stations and continue until the vehicles are again within acquisition range.

Control of the entire Gemini 8 mission will be exercised by the Mission Control Center in Houston, Texas. As it did on the Gemini 7/6 missions, Houston's Realtime Complex will serve as the computer center.

Gemini Spacecraft

The spacecraft has two tracking beacons. The model ACF* beacon (spacecraft) will be installed in the reentry module and the DPN-66* model beacon (adapter) in the adapter package.

The ACF beacon will be prime for launch, insertion, and reentry phase, using the DPN-66 as a backup for these periods.

AGENA TARGET VEHICLE

The Agena Target Vehicle will contain one C-band and one S-band beacon. The C-band beacon will be a modified DPN-66. Each beacon will use one linearly polarized antenna. The C-band beacon will be prime for Agena Target Vehicle prior to the Gemini launch. The Gemini spacecraft will be the prime target for C-band tracking following launch.

ACQUISITION SYSTEMS

Sites with spacecraft aid systems capable of tracking the Agena and Gemini spacecraft simultaneously will provide radio frequency (RF) inputs and pointing data to their associated telemetry receivers and steerable antennas. Sites which do not have simultaneous-tracking capability will track the Gemini spacecraft only. All stations will track the Agena Target Vehicle until orbital insertion of the Gemini spacecraft.

MISSION MESSAGE REQUIREMENTS

Low speed telemetry data (on-site teletype summaries) from flight controller manned stations will be sent to the Houston Mission Control Center.

Bermuda and Corpus Christi transmit Gemini spacecraft or Agena Target Vehicle PCM telemetry via high-speed digital data to Houston Mission Control Center in computer format. MCC-K/TEL III, Grand Bahama Island, Grand Turk Island, and Antigua will remote Gemini spacecraft and Agena wide-band data to the Houston Mission Control Center in the same manner.

SPACECRAFT COMMAND SYSTEM

The prime ground system in effecting rendezvous is the Digital Command System (DCS) located at key stations throughout the worldwide network. Command control of the mission from launch through recovery will as always be provided by the Flight Director at Houston Mission Control Center. Maximum command coverage is required throughout the mission.

Grand Canary Island; Carnarvon, Australia; Hawaii; and the two ships, USNS Coastal Sentry and USNS Rose Knot; are DCS equipped and manned by flight controllers who will initiate all uplink data command transmissions.

Following astronaut recovery, further commands will be required for the Agena Target Vehicle. Network Digital Command System support will be continued throughout the Agena Target Vehicle battery lifetime.

The Texas, Cape Kennedy, Grand Bahama, Grand Turk, Antigua, and Bermuda sites will not be manned by flight controllers. All uplink data command transmissions through these sites will be remoted in real time from Houston Mission Control Center.

In addition to real-time commands and on-board clock update commands, the following digital instructions may be sent:

a. Gemini spacecraft

1. Preretro with maneuver
2. Preretro without maneuver
3. Orbital navigation
4. Maneuver
5. Rendezvous
6. Accelerometer error corrections

b. Agena Target Vehicle

1. Maneuver
2. Ephemeris
3. Engine burn time

SPACECRAFT COMMUNICATIONS

All MSFN stations having both HF and UHF spacecraft communications can be controlled either by the station or by remote (tone) keying from Houston Mission Control Center and Goddard.

The following sites are not scheduled to have a command communicator (Cap Com) and will be remoted to Houston Mission Control Center:

Cape Kennedy, Grand Bahama Island; Tananarive, Malagasy Republic; Kano, Nigeria; Bermuda; Grand Turk Island; Pt. Arguello, California; Antigua Island; Ascension Island; Canton Island; USNS Range Tracker, and the voice relay aircraft.

SPACECRAFT SYSTEMS SUPPORT

The Gemini spacecraft communications system (antennas, beacons, voice communications, telemetry transmitters, recovery light, and digital command system) allows radar tracking of the spacecraft, two-way voice communications between the ground and the spacecraft and from astronaut to astronaut; ground command of the spacecraft, instrumentation systems data transmission, and postlanding and recovery data transmission. The sole link between the ground and the Gemini spacecraft is provided by these systems.

The Agena Target Vehicle communications system (antennas, beacons, telemetry transmitters, and digital command system) allows radar tracking of the vehicle from both the ground and the Gemini spacecraft. Ground station and Gemini spacecraft command to the Agena also are accomplished through this sytem.

Agena Target Vehicle On-Board Systems supported by Network Stations

Table #1

Telemetry (Real Time)
Telemetry (Dump)
L-Band Transponder
S-Band Transponder
C-Band Transponder
Command Receiver (Range Safety)
Command Receiver (Command Control)

Gemini Spacecraft On-Board Systems Supported by Network Stations

Table #2

Reentry Module	UHF(voice)xmit-Rcv
Reentry Module	HF(voice)xmit-Rcv
Reentry Module	Telemetry(Real Time)
Reentry Module	Telemetry(Dump)
Reentry Module	Telemetry(Backup)
Adapter Package	L-Band Radar
Reentry Module	C-Band Transponder
Adapter Package	C-Band Transponder
Adapter Package	Acquisition Aid Beacon
Adapter Package	Digital Command System
Reentry Module	UHF Recovery Beacon

GROUND COMMUNICATIONS

The NASA Communications network (NASCOM) used for Gemini 7/6 will be used for Gemini 8. Shore stations for USNS Rose Knot and USNS Coastal Sentry Ship support will be based upon the mission-designated ship positions and predicted HF radio propagation conditions.

NETWORK RESPONSIBILITY

Manned Spacecraft Center (MSC). The MSC has the overall management responsibility of the Gemini program. The direction and mission control of the Network immediately preceding and during a mission simulation or an actual mission is responsibility of the MSC.

Goddard Space Flight Center. The NASA Office of Tracking and Data Acquisition has centralized the responsibility for the planning, implementation, and technical operations of manned space flight tracking and data acquisition at the Goddard Space Flight Center. Technical operation is defined as the operation, maintenance, modification, and augmentation of tracking and data acquisition facilities to function as an instrumentation network in response to mission requirements. About 370 persons directly support the network at Goddard; contractor personnel bring the total network level to some 1500.

Department of Supply, Australia. The Department of Supply, Commonwealth of Australia, is responsible for the maintenance and operation of the NASA station at Carnarvon, Australia. Contractual arrangements and agreements define this cooperative effort.

Department of Defense (DOD). The DOD is responsible for the maintenance and operational control of those DOD assets and facilities required to support Project Gemini. These include network stations at the Eastern Test Range, Western Test Range, White Sands Missile Range, the Air Proving Ground Center, and the tracking and telemetry ships.

NETWORK CONFIGURATION

WLP	A/C	RTK	RKV	CSQ	ASC	ANT	EGL	WHS	TEX	CAL	GYM	HAW	CTN	CRO	PRE	TAN	KNO	CYI	BDA	GTK	GBI	PAT	CNV	MLA	MCC-K	MCC-H	Stations / Systems
		X			X	X	X	X		X		X		X	X			X	X	X	X	X	X	X			C-band Radar
									X	X	X	X		X				X	X				X				S-band Radar
	X	X	X	X	X	X			X	X	X	X	X	X		X	X	X	X	X	X		X		X		Telemetry Receive & Record
			X	X							X	X		X				X								X	Telemetry Real Time Display
			X	X					X		X	X		X				X									Low Speed (TTY) Telemetry Data Transmission
						X														X	X				X		Wide Band Data
						X			X										X	X	X				X		High Speed Data
			X	X							X	X		X				X								X	On Site Data Process & Summary
																							X		X		Gemini Launch Vehicle Telemetry
																							X		X		Gemini Launch Vehicle Command
			X	X								X		X				X							X	X	Digital Command System
			X	X		X			X			X		X				X	X	X	X		X				Radio Frequency Command System
		X	X	X	X				X	X	X	X	X	X		X	X	X	X	X	X				X	X	Voice - Transmit & Receive
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	Teletype-Transmit & Receive
			X	X							X	X		X				X								X	Flight Control Team Manned
X		X	X	X	X	X			X	X	X	X	X	X		X	X	X	X	X	X				X		Spacecraft Acquisition Aid System
			X	X							X	X		X				X								X	Flight Controller Air & Group Voice
	X	X			X	X			X	X			X			X	X		X	X	X		X			X	MCC-H-Air to Ground Remote Voice

VI ABORT AND RECOVERY

CREW SAFETY

Every Gemini system affecting crew safety has a redundant (backup) feature. The Malfunction Detection System aboard the launch vehicle monitors subsystem performance and warns the crew of a potentially catastrophic malfunction in time for escape.

There are three modes of escape:

MODE I	Ejection seats, and personal parachutes, used at ground level and during first 50 seconds of powered flight, or during descent after reentry.
MODE II (Delayed)	Retrorockets used between 50 and 100 seconds, allowing crew to salvo fire all four solid retrorockets five seconds after engine shutdown is commanded.
MODE III	Normal separation from launch vehicle, using OAMS thrusters, then making normal reentry, using computer.

Except for Mode I, spacecraft separates from Gemini Launch Vehicle, turns blunt-end forward, then completes reentry and landing with crew aboard.

Survival package

Survival gear, mounted on each ejection seat and attached to the astronaut's parachute harnesses by nylon line, weighs 23 pounds.

Each astronaut has:

3.5 pounds of drinking water.

Machete .

One-man life raft, 5½ by 3 feet, with CO_2 bottle for inflation, sea anchor, dye markers, nylon sun bonnet.

Survival light (strobe), with flashlight, signal mirror, compass, sewing kit, 14 feet of nylon line, cotton balls and striker, halazone tablets, a whistle, and batteries for power.

Survival radio, with homing beacon and voice reception.

Sunglasses.

Desalter kit, with brickettes enough to desalt eight pints of seawater.

Medical kit, containing stimulant, pain, motion sickness and antibiotic tablets and aspirin, plus injectors for pain and motion sickness.

PLANNED AND CONTINGENCY LANDING AREAS

There are two types of landing areas for Gemini 8, planned and contingency. Planned areas are those where recovery forces are pre-positioned to recover spacecraft and crew within a short time. All other areas under the orbital track are contingency areas, requiring special search and rescue techniques and a longer recovery period.

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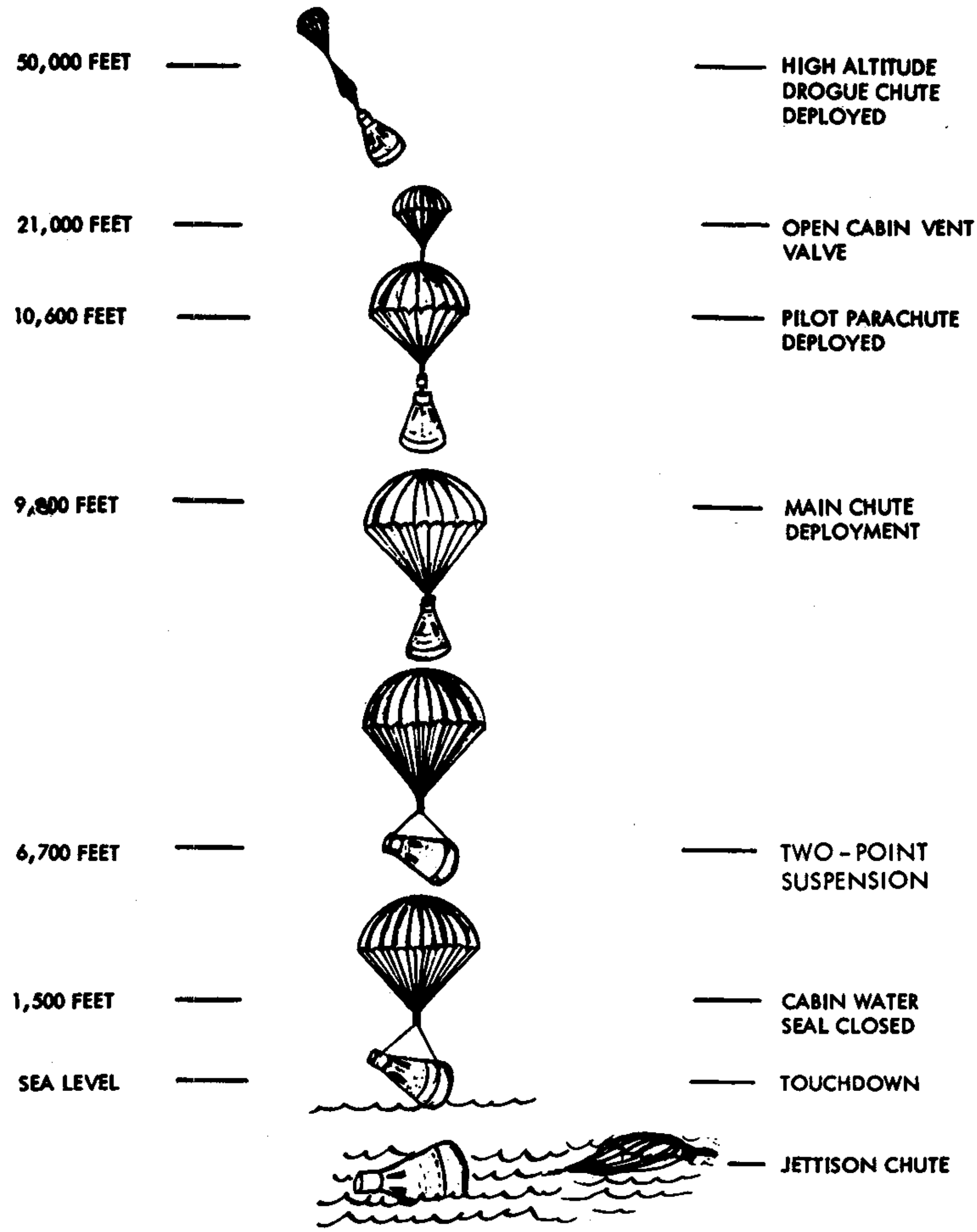
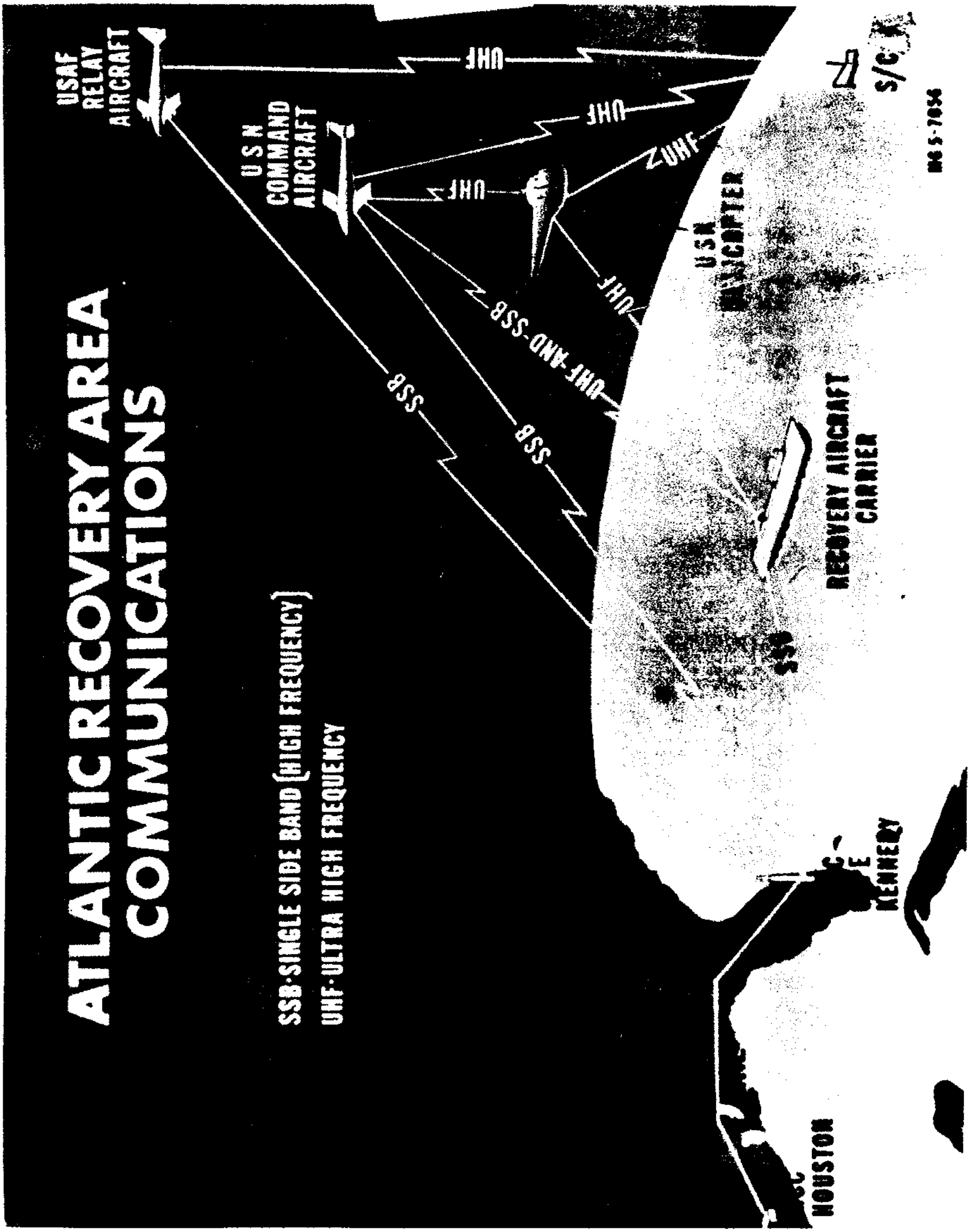
GEMINI PARACHUTE LANDING SEQUENCE




ATLANTIC RECOVERY AREA COMMUNICATIONS
SSB-SINGLE SIDE BAND (HIGH FREQUENCY)
UHF-ULTRA HIGH FREQUENCY
USAF RELAY AIRCRAFT
USN COMMAND AIRCRAFT
UHF
UHF
UHF
UHF
UHF
UHF-AND-SSB
SSB
SSB
SSB
USN
RECOVERY AIRCRAFT CARRIER
S/C
KENNEDY
HOUSTON

Planned Landing Areas

PRIMARY	Landing in the West Atlantic (45-1) where the primary recovery vessel, an aircraft carrier, is pre-positioned.
SECONDARY	Landing in East Atlantic, West Pacific and Mid-Pacific areas where ships are deployed.
LAUNCH SITE	Landing in the event of off-the-pad abort or abort during early phase of flight, includes an area about 47 miles seaward from Cape Kennedy, 3½ miles toward Banana River from Complex 19.
LAUNCH ABORT	Landing in the event of abort during powered flight, extending from 47 miles at sea from Cape Kennedy to west coast of Africa.

Contingency Landing Areas

All the area beneath the spacecraft's ground track except those designated Planned Landing Areas are Contingency Landing Areas, requiring aircraft and pararescue support for recovery within a period of 18 hours from splashdown.

Recovery forces will be provided by the military services, and during mission time will be under the operational control of the Department of Defense Manager for Manned Space Flight Support Operations.

VII. SPACECRAFT AND LAUNCH VEHICLES

GEMINI SPACECRAFT

The Gemini spacecraft is conical, 18 feet, 5 inches long, 10 feet in diameter at its base and 39 inches in diameter at the top. Its two major sections are the reentry module and the adapter section.

Reentry Module

The reentry module is 11 feet high and 7½ feet in diameter at its base. It has three main sections: (1) rendezvous and recovery (R&R), (2) reentry control (RCS), and (3) cabin.

Rendezvous and recovery section is the forward (small) end of the spacecraft, containing drogue, pilot and main parachutes and radar.

Reentry control section between R&R and cabin sections contains fuel and oxidizer tanks, valves, tubing and two rings of eight attitude control thrusters each for control during reentry. A parachute adapter assembly is included for main parachute attachment.

Cabin section between RCS and adapter section, houses the crew seated side-by-side, their instruments and controls. Above each seat is a hatch. Crew compartment is pressurized titanium hull. Equipment not requiring pressurized environment is located between pressure hull and outer beryllium shell which is corrugated and shingled to provide aerodynamic and heat protection. Dish-shaped heat shield forms the large end of cabin section.

Adapter Section

The adapter is 7½ feet high and 10 feet in diameter at its base, containing retrograde and equipment sections.

Retrograde section contains four solid retrograde rockets and part of the radiator for the cooling system.

Equipment section contains fuel cells for electrical power, fuel for the orbit attitude and maneuver system (OAMS), primary oxygen for the environmental control system (ECS), cryogenic oxygen and hydrogen for fuel cell system. It also serves as a radiator for the cooling system, also contained in the equipment section.

NOTE: The equipment section is jettisoned immediately before retrorockets are fired for reentry. The retrograde section is jettisoned after retros are fired.

ELECTRICAL POWER SYSTEM

Gemini 8 will carry two fuel cells for the primary power supply during launch and orbit. The cells consist of three stacks of 32 individual cells. Cryogenic liquid oxygen and hydrogen are used as reactants to produce electrical energy by the process of electrolysis which combines hydrogen and oxygen in a controlled reaction to produce water as a by-product.

Four 45 amp/hour batteries will also be carried in the spacecraft to insure a continuous power supply during reentry and landing. They will also be used during prelaunch and launch, in conjunction with the fuel cells.

Three 15 amp/hour squib batteries will be used in the reentry section for all squib-actuated pyrotechnic separating during the mission.

PROPELLANT

Total Useable -- 678.6 pounds

Mission Propellant budget with No Dispersions -- 534.25 pounds

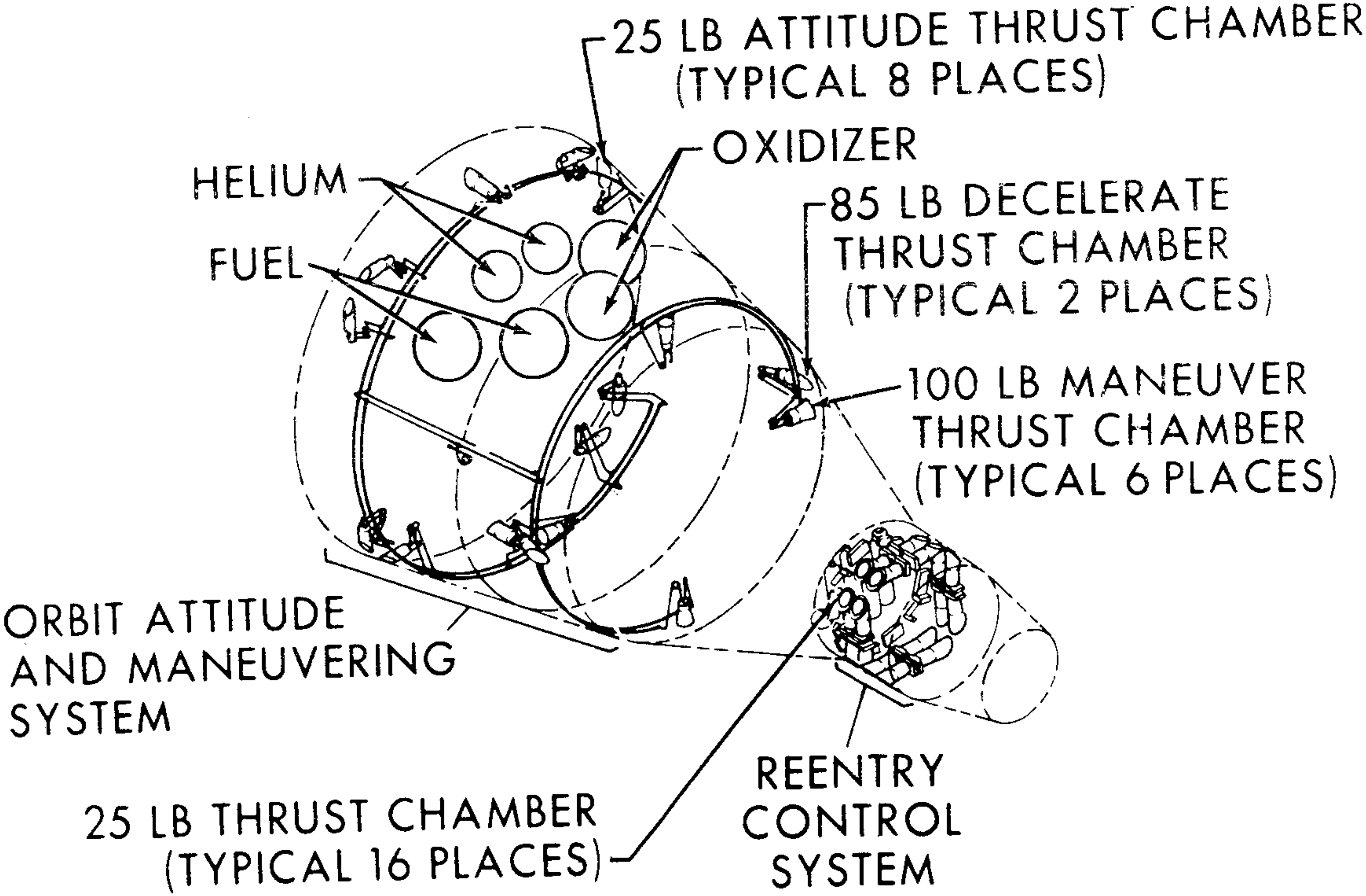
RENDEZVOUS RADAR

Purpose -- Enables crew to measure range, range rate, and bearing angle to Agena. Supplies data to Inertial Guidance System computer so crew can determine maneuvers necessary for rendezvous.

Operation -- Transponder on Agena receives radar impulses and returns them to spacecraft at a specific frequency and pulse width. Radar accepts only signals processed by transponder.

Location -- small end of spacecraft on forward face of rendezvous and recovery section.

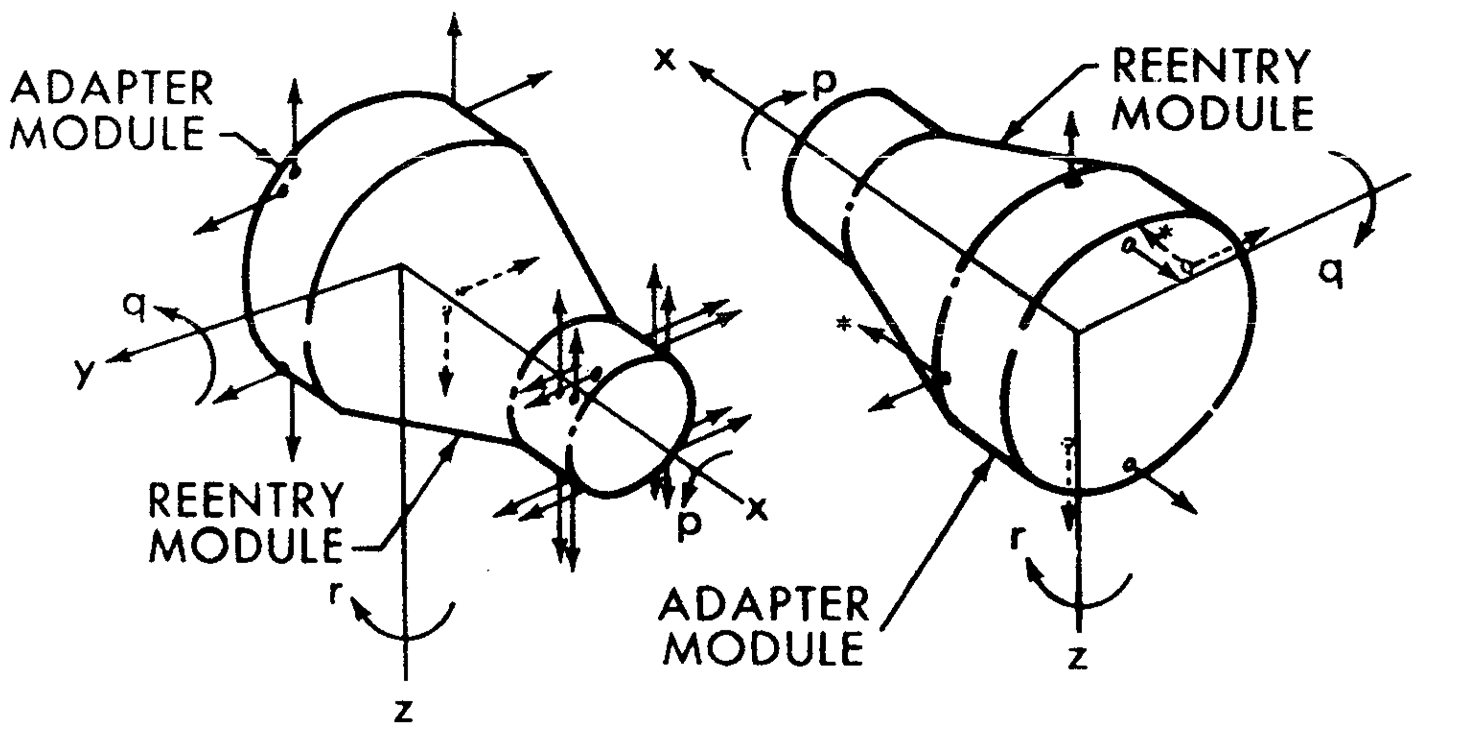
LIQUID ROCKET SYSTEMS GENERAL ARRANGEMENT

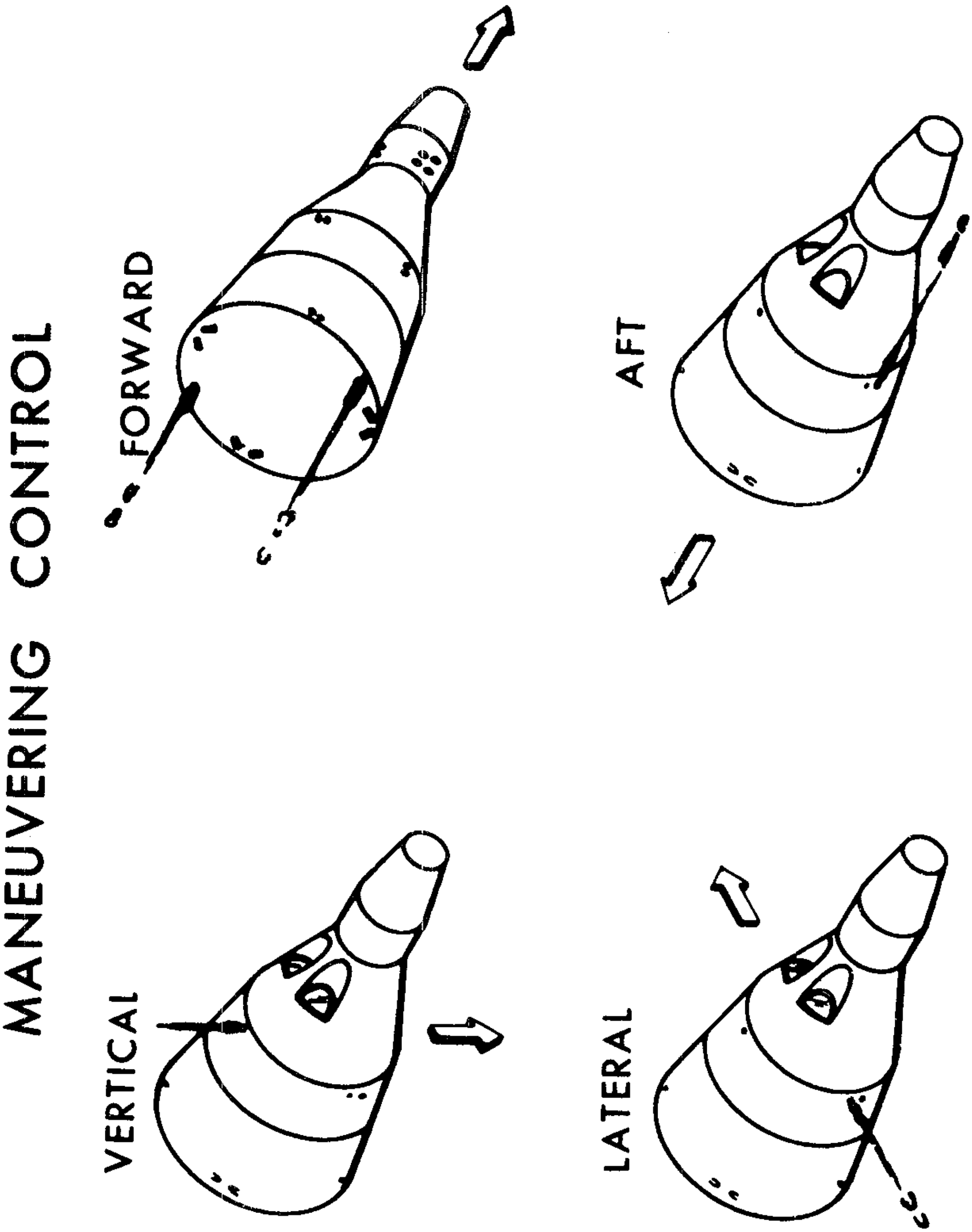


THRUST CHAMBER ARRANGEMENT

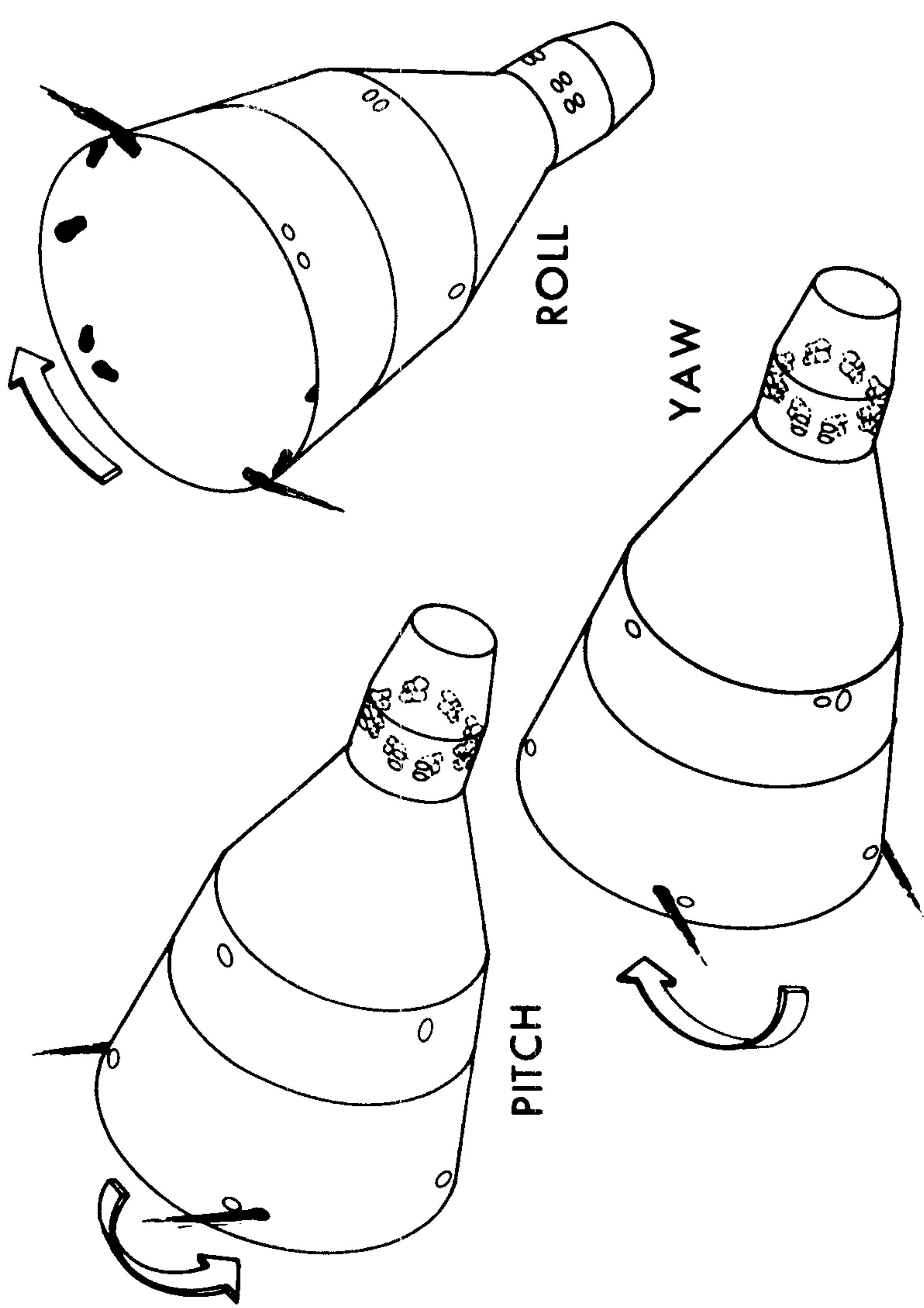
ATTITUDE CONTROL
25 LBS. THRUST PER UNIT

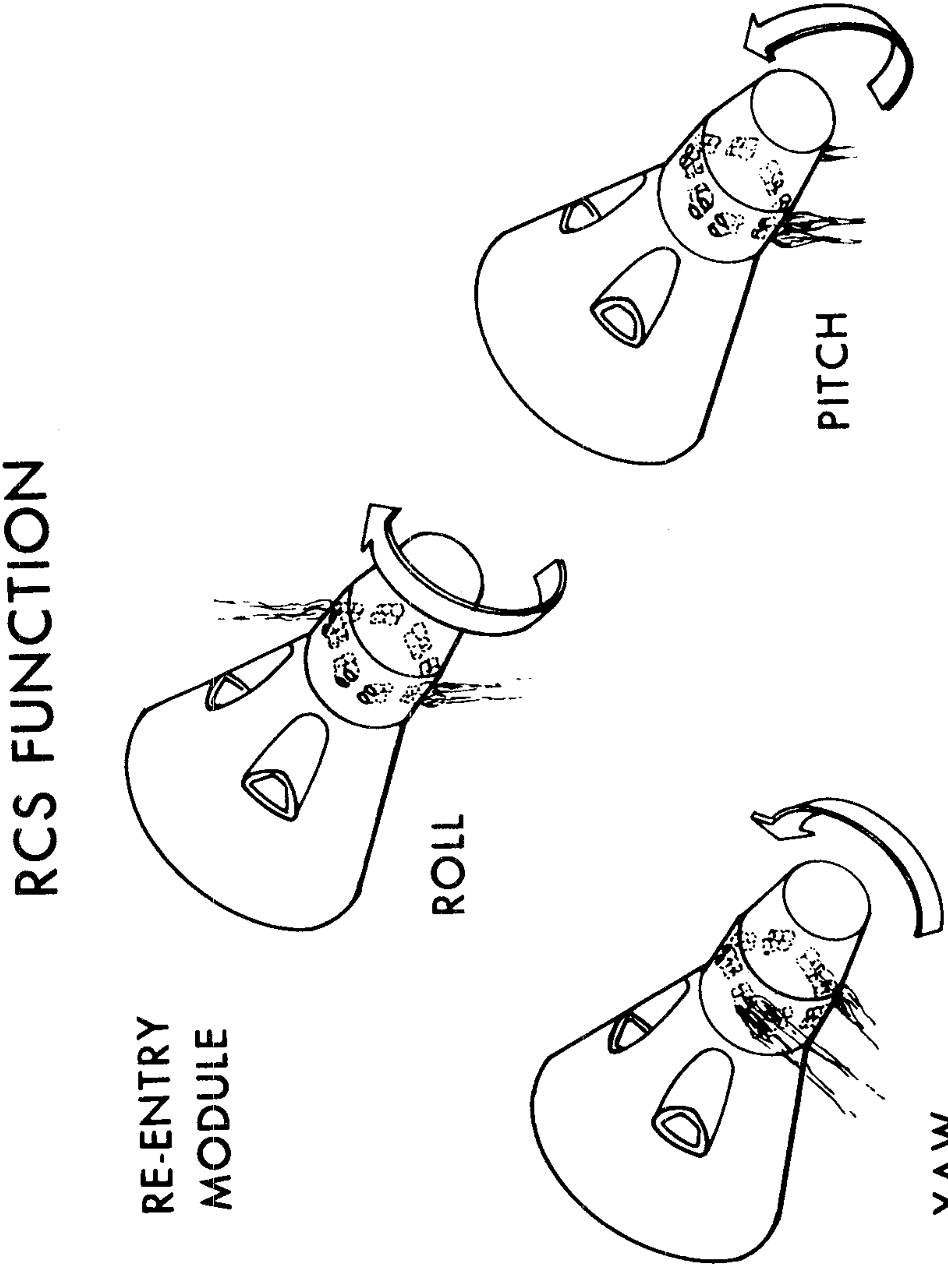
MANEUVER CONTROL
100 LBS. THRUST PER UNIT
* 85 LBS. THRUST PER UNIT AFT




MANEUVERING CONTROL
FORWARD
AFT
VERTICAL
LATERAL

SPACECRAFT RESPONSES TO ORBIT ATTITUDE CONTROL THRUST




RCS FUNCTION
RE-ENTRY MODULE
ROLL
PITCH
YAW

Size -- less than two cubic feet.

Weight -- less than 70 pounds.

Power Requirement -- less than 80 watts.

STATUS CHARGE DEVICE

Experiments on Gemini 4 and 5 indicated there is no problem of a static charge between the spacecraft and the Agena during docking, but these experiments cannot be considered conclusive. Therefore, three protruding flexible copper fingers are installed on the Agena docking cone to make first contact with the spacecraft. Any charge will be carried to a ground in the Agena and dissipated at a controlled rate.

GEMINI LAUNCH VEHICLE

The Gemini Launch Vehicle (GLV-8) is a modified U.S. Air Force Titan II intercontinental ballistic missile consisting of two stages, identical to the launch vehicles used in previous Gemini flights.

	FIRST STAGE	SECOND STAGE
HEIGHT	63 feet	27 feet
DIAMETER	10 feet	10 feet
THRUST	430,000 pounds (two engines)	100,000 pounds (one engine)
FUEL	50-50 blend of monomethyl hydrazine and unsymmetrical-dimethyl hydrazine	
OXIDIZER	Nitrogen tetroxide (Fuel in hypergolic, ignites spontaneously upon contact with oxidizer.)	

Overall height of launch vehicle and spacecraft is 109 feet. Combined weight is about 340,000 pounds.

Modifications to Titan II for use as the Gemini Launch Vehicle include: (NOTE: GLV 8 same as GLV 1 through 5)

1. Malfunction detection system added to detect and transmit booster performance information to the crew.

2. Back-up flight control system added to provide a secondary system if primary system fails.

3. Radio guidance substituted for inertial guidance.

4. Retro and vernier rockets deleted.

5. New second stage equipment truss added.

6. New second stage forward oxidizer skirt assembly added.

7. Trajectory tracking requirements simplified.

8. Electrical hydraulic and instrument systems modified.

Gemini Launch Vehicle program management for NASA is under the direction of the Space Systems Division of the Air Force System Command.

AGENA TARGET VEHICLE

The Agena target vehicle for Gemini 8 is a modification of the U.S. Air Force Agena D upper stage, similar to the space vehicles which helped propel Ranger and Mariner spacecraft to the Moon and planets.

It acts as a separate stage of the Atlas/Agena launch vehicle, placing itself into orbit with its main propulsion, and can be maneuvered either by ground control or the Gemini 8 crew, using two propulsion systems.

HEIGHT (liftoff)	36.3 feet	Including shroud
LENGTH (orbit)	26 feet	Minus shroud and adapter
DIAMETER	5 feet	
WEIGHT	7,000 pounds	In orbit, fueled
THRUST	16,000 pounds 400 pounds 32 pounds	Primary Propulsion Secondary Engines, Unit II Secondary Engines, Unit I
FUEL	UDMH (Unsymmetrical Dimethyl Hydrazine)	
OXIDIZER	IRFNA (Inhibited Red Fuming Nitric Acid) in primary propulsion system; MON (Mixed Oxides of Nitrogen) in secondary propulsion system	
COMBUSTION	IRFNA and UDMH are hypergolic, ignite on contact	

Primary and secondary propulsion systems are restartable. Main engine places Agena into orbit and is used for large orbital changes. Secondary system, two 200-pound-thrust, aft-firing engines, are for small velocity changes. Two 16-pound-thrust, aft-firing thrusters are for ullage orientation and vernier adjustments. Attitude control (roll, pitch, yaw) is accomplished by six nitrogen jets mounted on Agena aft end.

Modifications to Agena for use as Gemini rendezvous spacecraft include:

1. Docking collar and equipment to permit mechanical connection with Gemini during flight.

2. Radar transponder compatible with Gemini radar.

3. Displays and instrumentation, plus strobe lights for visually locating and inspecting Agena before docking.

4. Secondary propulsion system for small orbital changes.

5. Auxiliary equipment rack for special rendezvous equipment and telemetry.

6. Command control equipment to allow control by Gemini 8 crew or ground controllers.

7. Multi-restartable engine to provide in-orbit maneuver capability.

Agena program management for NASA is under the direction of the Space Systems Division of the Air Force Systems Command.

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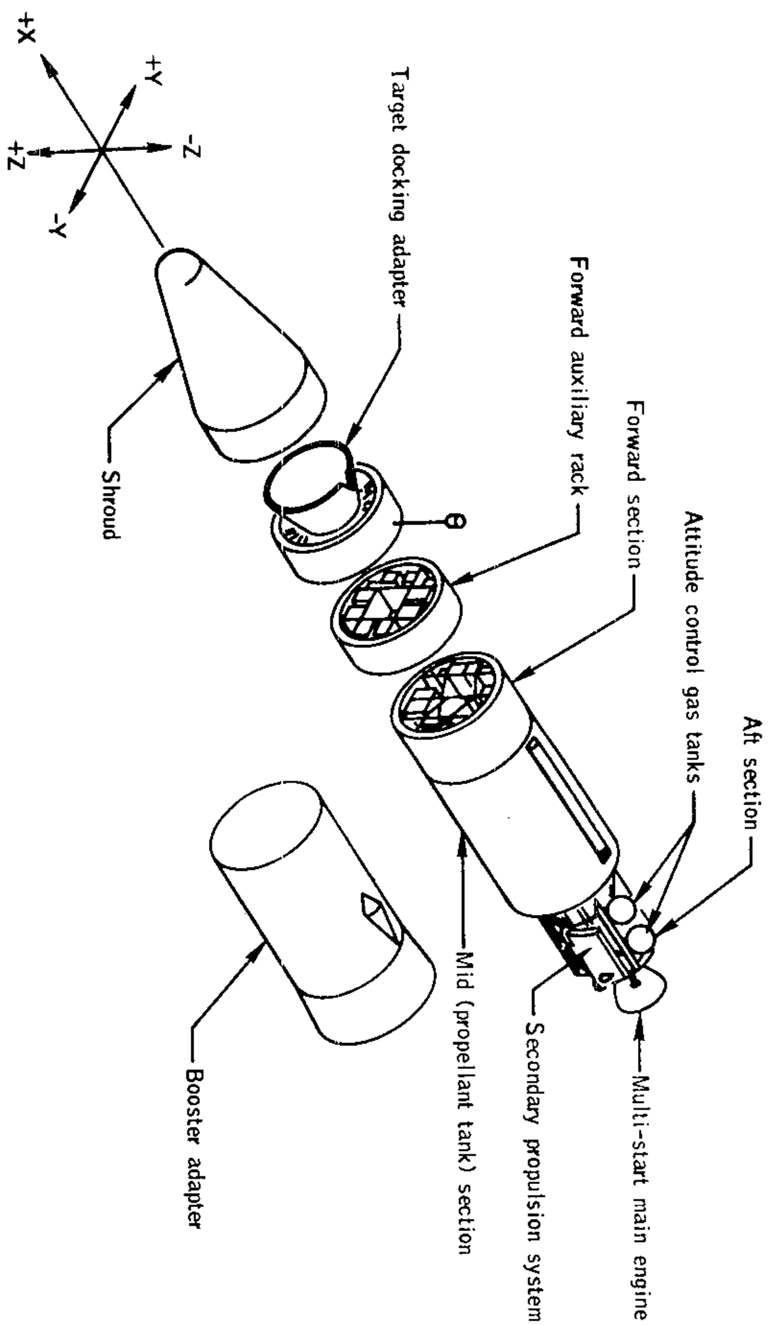

AGENA TARGET VEHICLE

ATLAS LAUNCH VEHICLE

The Atlas Standard Launch Vehicle (SLV-3) is a refinement of the modified U.S. Air Force Atlas intercontinental ballistic missile, similar to the launch vehicle which placed Project Mercury Astronauts into orbit.

Atlas is a one-and-a-half stage vehicle, igniting all three main engines on the pad, then dropping off the outboard booster engines at staging, allowing the single sustainer engine to continue thrusting at altitude, aided by two small vernier engines.

HEIGHT	66 Feet	Minus Agena Payload
DIAMETER	16 Feet	Lower Booster Section
	10 Feet	Tank Sections
	5 Feet, 10 inches	Tapered Upper End
WEIGHT	260,000 pounds	Fully fueled, minus Agena payload
THRUST	390,000 pounds	Total at liftoff
	330,000 pounds	Two booster (outer engines)
	57,000 pounds	One Sustainer (center) engine
	Balance	Two small vernier engines for trajectory and final velocity control
FUEL	RP-1, a hydrocarbon resembling kerosene	
OXIDIZER	Liquid oxygen at -297 degrees F.	

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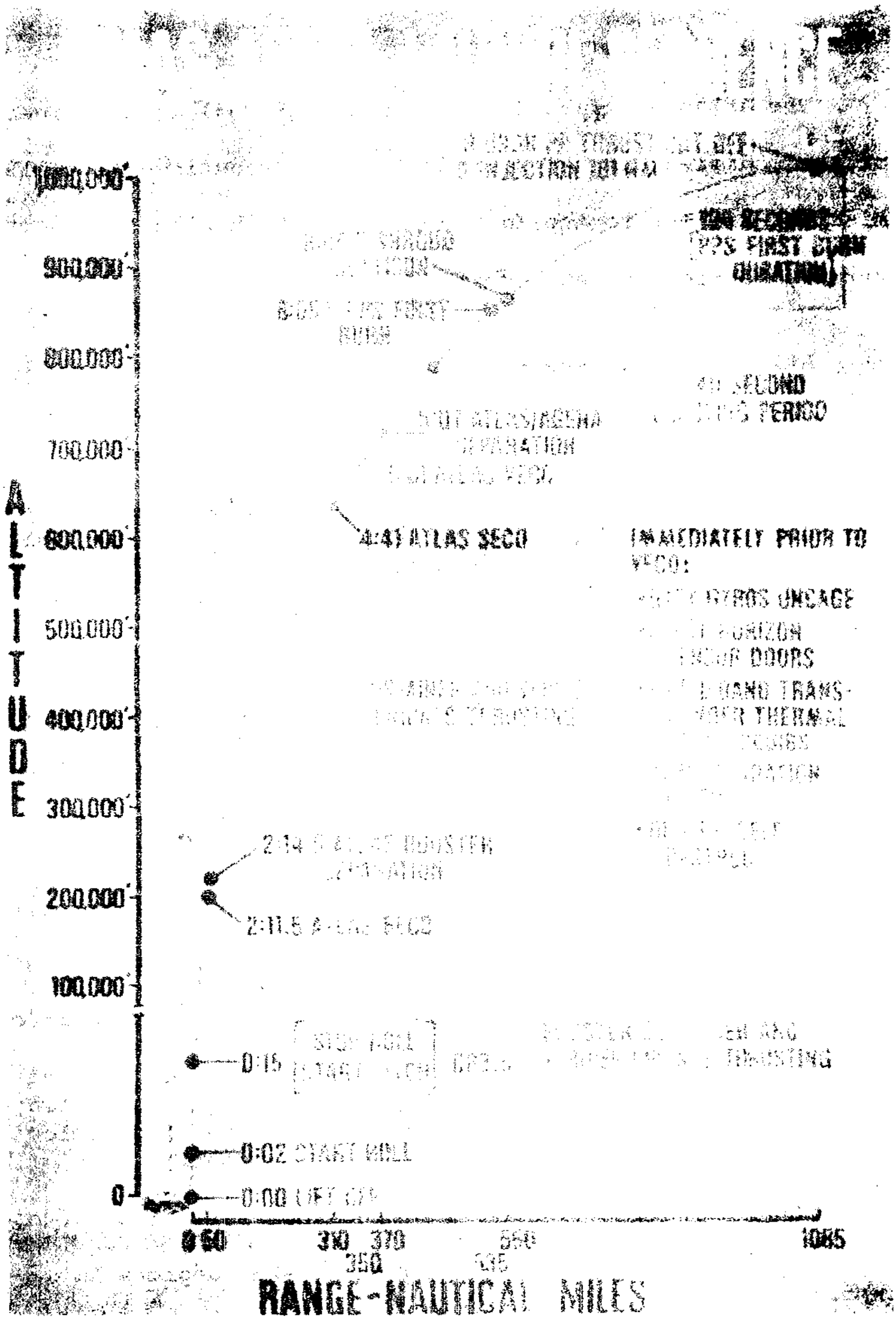
1,000,000'
900,000'
800,000'
700,000'
600,000'
500,000'
400,000'
300,000'
200,000'
100,000'
0
ALTITUDE
0:00 LIFT OFF
0:02 START ROLL
0:15
2:11.5
4:41 ATLAS SECO
IMMEDIATELY PRIOR TO
GYROS UNCAGE
DOORS
THERMAL
40 SECOND
PERIOD
THRUSTING
0 60
310 370
350
1085
RANGE-NAUTICAL MILES

COMBUSTION — Unlike Titan's hypergolic, spontaneous ignition, Atlas combustion is achieved by forcing propellants to chambers under pressure, burning them in gas generators which drive propellant pump turbines.

Modifications to the Atlas Standard Launch Vehicle for the Gemini 8 mission include:

1. Special autopilot system for rendezvous mission.

2. Improved propellant utilization system to assure simultaneous depletion of both fuel oxidizers.

3. Increased thickness of Atlas structure for support of Agena upper stage.

4. Simplified pneumatic system.

5. Retrorockets moved from exterior equipment pods to upper interstage adapter section.

6. Uprated MA-5 propulsion system (used on later Mercury flights.)

7. Modular telemetry kit tailored for each mission.

Atlas Standard Launch Vehicle program management for NASA is under the direction of the Space Systems Division of the Air Force Systems Command.

VIII. HISTORY AND CONTRACTORS

CREW BIOGRAPHIES

Neil A. Armstrong, Gemini 8 command pilot

BORN: Wapakoneta, Ohio, August 5, 1930.

EDUCATION: Bachelor of Science degree in Aeronautical Engineering from Purdue University.

MARITAL STATUS: Married former Janet Shearon of Evanston, Illinois.

CHILDREN: Eric, June 30, 1957; Mark, April 8, 1963.

EXPERIENCE: Armstrong was a naval aviator from 1949 to 1952 and flew 78 combat missions during the Korean action.

He joined NASA's Lewis Research Center in 1955 (then NACA Lewis Flight Propulsion Laboratory) and later transferred to the NASA High Speed Flight Station at Edwards AFB, California, as an aeronautical research pilot for NACA and NASA. As an aeronautical research pilot, he was an X-15 project pilot, flying that aircraft to over 200,000 feet and approximately 4,000 mph. Other flight test work included piloting the X-1 rocket airplane, the F-100, F-101, F-102, F5D, B-47, and paraglider.

He has logged more than 3,400 hours flying time, including 1,900 hours in jet aircraft.

CURRENT ASSIGNMENT: Armstrong was selected as an astronaut by NASA in September 1962. In addition to participating in all phases of the astronaut training program, he served as command pilot of the backup crew for the Gemini 5 flight.

David R. Scott, Gemini 8 pilot

BORN: San Antonio, Texas, June 6, 1932.

EDUCATION: Bachelor of Science degree in science, United States Military Academy; Master of Science degree in aeronautics and astronautics from Massachusetts Institute of Technology.

MARITAL STATUS: Married to the former Ann Lurton Ott of San Antonio, Texas.

CHILDREN: Tracy L., March 25, 1961; Douglas W., October 8, 1963.

EXPERIENCE: Scott, a United States Air Force Major, finished fifth in a class of 633 at West Point.

His thesis at MIT concerned interplanetary navigation.

He is a graduate of the Air Force Experimental Test Pilot School and the Air Force Aerospace Research' Pilot School.

Scott has logged more than 3,000 hours flying time, including more than 2,800 hours in jet aircraft.

CURRENT ASSIGNMENT: Scott was among the third group of astronauts named by NASA in October 1963. In addition to participation in the astronaut training program, he is responsible for specific participation in the development of guidance and navigation.

Charles Conrad, Jr., Gemini 8 backup command pilot

BORN: Philadelphia, Pennsylvania, June 2, 1930.

EDUCATION: Bachelor of Science degree in aeronautical engineering from Princeton University.

MARITAL STATUS: Married to the former Jane DuBose of Uvalde, Texas.

Conrad Biography (Continued)

CHILDREN: Peter, December 25, 1954; Thomas, May 3, 1957; Andrew, April 30, 1959; Christopher, November 26, 1960.

EXPERIENCE: He entered the Navy following his graduation from Princeton University and became a naval aviator. He is now a Navy Commander.

Conrad attended the Navy Test Pilot School at Patuxent River, Maryland, and following completion of that course was a project test pilot in the armaments test division there. He also served at Patuxent as a flight instructor and performance engineer at the Test Pilot School.

He served as a F4H flight instructor and as a safety officer for Fighter Squadron 96 at the Miramar, California, Naval Air Station.

He was pilot on Gemini 5 flight which took place in August 1965.

He has logged more than 3,200 flying hours, including more than 2,500 hours in jet aircraft.

Richard F. Gordon, Jr., Gemini 8 backup pilot

BORN: Seattle, Washington, October 5, 1929.

EDUCATION: Bachelor of Science degree in chemistry, University of Washington.

MARITAL STATUS: Married to the former Barbara J. Field of Freeland, Washington.

CHILDREN: Carleen, July 8, 1954; Richard, October 6, 1955; Lawrence, December 18, 1957; Thomas, March 25, 1959; James, April 26, 1960; Diane, April 23, 1961.

Gordon Biography (continued)

EXPERIENCE: Gordon, a United States Navy Lieutenant Commander, entered aviation training in 1951. After receiving his wings as a Naval aviator in 1953, he attended All-Weather Flight School and received jet transitional training before reporting to an all-weather squadron at the Jacksonville, Florida, Naval Air Station.

He attended the Navy's Test Pilot School at Patuxent River, Maryland, in 1957, and served as a flight test pilot until 1960. During this tour of duty, he performed flight test work on the F8V Crusader, F11F Tigercat, FJ Fury, A4D Skyhawk, and was the first project test pilot for the F4H Phantom II.

He served with Fighter Squadron 121 at the Miramar, California, Naval Air Station as a flight instructor in the F4H and participated in the introduction of that aircraft tothe Atlantic and Pacific fleets.

He was flight safety officer, assistant operations officer, and ground training officer for Fighter Squadron 96 at Miramar.

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

He was a student at the U.S. Naval Postgraduate School at Monterey, California.

He has logged more than 3,000 hours flying time, including more than 2,500 hours in jet aircraft.

CURRENT ASSIGNMENT: In October 1963, Gordon was named as one of the third group of astronauts chosen by NASA. In addition to the regular astronaut training, he is responsible for monitoring cockpit layouts, instrument displays and pilot controls to insure that systems displays are appropriately integrated into cockpit panels.

U.S. MANNED SPACE FLIGHTS

MISSION	SPACECRAFT HRS.			REVS.	MANNED HOURS IN MISSION			TOTAL MANNED HRS CUMULATIVE		
	HRS.	MIN.	SEC.		HRS.	MIN.	SEC.	HRS.	MIN.	SEC.
MR-3 (Shepard)		15	22	S.O.		15	22		15	22
MR-4 (Grissom)		15	37	S.O.		15	37		30	59
MA-6 (Glenn)	4	55	23	3	4	55	23	5	26	22
MA-7 (Carpenter)	4	56	05	3	4	56	05	10	22	27
MA-8 (Schirra)	9	13	11	6	9	13	11	19	35	38
MA-9 (Cooper)	34	19	49	22	34	19	49	53	55	27
Gemini 3 (Grissom & Young)	4	53	00	3	9	46	00	63	41	27
Gemini 4 (McDivitt & White)	97	56	11	62	195	52	22	259	33	49
Gemini 5 (Cooper & Conrad)	190	56	01	120	381	52	02	641	25	57
Gemini 7 (Borman & Lovell)	330	35	00	206	661:10:00			1302	35	57
Gemini 6 (Schirra & Stafford)	25	51	24	15	51:41:48			1354	17	45

PREVIOUS GEMINI FLIGHTS

Gemini I, Apr. 8, 1964

Unmanned orbital flight, using first production spacecraft, to test Gemini launch vehicle performance and ability of launch vehicle and spacecraft to withstand launch environment. Spacecraft and second stage launch vehicle orbited for about four days. No recovery attempted.

Gemini II, Jan. 19, 1965

Unmanned ballistic flight to qualify spacecraft reentry heat protection and spacecraft systems. Delayed three times by adverse weather, including hurricanes Cleo and Dora. December launch attempt terminated after malfunction detection system shut engines down because of hydraulic component failure. Spacecraft recovered after ballistic reentry into Atlantic Ocean.

Gemini III, Mar. 23, 1965

First manned flight, with Astronauts Virgil I. Grissom and John W. Young as crew. Orbited earth three times in four hours, 53 minutes. Landed about 50 miles (81 kilometers) short of planned landing area in Atlantic because spacecraft did not provide expected lift during reentry. First manned spacecraft to maneuver out of plane, after its own orbit. Grissom, who made suborbital Mercury flight, is first man to fly into space twice.

Gemini IV, June 3-7, 1965

Second manned Gemini flight completed 62 revolutions and landed in primary Atlantic recovery area after 97 hours, 56 minutes of flight. Astronaut James A. McDivitt was command pilot. Astronaut Edward H. White II was pilot, accomplished 21 minutes of Extravehicular Activity (EVA), using a hand held maneuvering unit for first time in space. Near-rendezvous with GLV second stage was not accomplished after use of pre-planned amount of fuel for the maneuver. Malfunction in Inertial Guidance System required crew to perform zero-lift reentry.

Gemini V, Aug. 21-29, 1965

Astronauts L. Gordon Cooper and Charles (Pete) Conrad, Jr., circled the earth 120 times in seven days, 22 hours and 56 minutes. Cooper was first to make two orbital space flights. Failure of oxygen heating system in fuel cell supply system threatened mission during first day of flight, but careful use of electrical power, and excellent operational management of fuel cells by both crew and ground personnel, permitted crew to complete flight successfully. Spacecraft landed about 100 miles (161 kilometers) from primary Atlantic recovery vessel because of erroneous base-line information programmed into onboard computer, although computer itself performed as planned. Plan to rendezvous with a transponder-bearing pod carried aloft by Gemini 5 was cancelled because of problem with fuel cell oxygen supply.

Gemini VII, Dec. 4-18, 1965

Holds current world record for manned space flight as Command Pilot Frank Borman and Pilot James Lovell completed 206 revolutions of the earth in 13 days, 18 hours, and 35 minutes. On the 12th day of their flight, the Gemini VII served as target for the Gemini VI spacecraft on the first successful rendezvous in space. In proving man's ability to operate in space for period up to two weeks, the crew of Gemini VII carried out an ambitious list of twenty experiments including all medical experiments in the Gemini program, a test of laser communications from space, and visual acuity. The Gemini VII experienced continuous difficulty with the delta P light on the fuel cell system. However, the system performed for the entire mission. The only other problem encountered was the temporary malfunction of a yaw thruster on the spacecraft. Gemini VII landed in the Atlantic on Dec. 18, making a controlled reentry which brought them within 10 miles of the recovery carrier.

Gemini VI, Dec. 15-16, 1965

The first spacecraft to rendezvous with another spacecraft in orbit. Command Pilot Walter Schirra and Pilot Thomas Stafford flew their spacecraft from a 100 by 167 mile orbit into a 185 mile circular orbit, rendezvousing with Gemini VII over the Pacific Ocean at 5 hrs. 47 min. after liftoff. It demonstrated one of the major objectives of the program, and also paved the way for Apollo

Lunar Orbit Rendezvous in the accomplishment of the first manned landing on the moon.

Gemini VI was launched on its historic rendezvous mission on the third attempt. On the first try, Oct. 25, the Agena Target Vehicle was destroyed by a hard start of its propulsion engine. On Dec. 12, the Gemini Launch Vehicle failed to achieve liftoff when an electrical plug connecting the rocket with the pad electrical system dropped out prematurely.

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PROJECT OFFICIALS

George E. Mueller	Associate Administrator, Office of Manned Space Flight, NASA Headquarters Acting Director, Gemini Program.
Leroy E. Day	Acting Deputy Director, Gemini Program, Office of Manned Space Flight, NASA Headquarters
Charles W. Mathews	Gemini Program Manager, Manned Spacecraft Center, Houston.
Christopher C. Kraft	Assistant Director for Flight Operations, Manned Spacecraft Center, Houston
G. Merritt Preston	Deputy Mission Director for Launch Operations. JFK Space Center, Fla.
Lt. Gen. Leighton I. Davis	USAF, National Range Division Commander and DOD Manager of Manned Space Flight Support Operations.
Maj. Gen. V. G. Huston	USAF, Deputy DOD Manager
Col. Richard C. Dineen	Director, Directorate Gemini Launch Vehicles, Space Systems Division, Air Force Systems Command
Lt. Col. John G. Albert	Chief, Gemini Launch Division, 6555th Aerospace Test Wing, Air Force Missile Test Center, Cape Kennedy, Fla.
R. Admiral B. W. Sarver	USN, Commander Task Force 140
William C. Schneider	Deputy Director, Mission Operations Office of Manned Space Flight, NASA Headquarters, Gemini 8 Mission Director

SPACECRAFT CONTRACTORS

McDonnell Aircraft Corp., St. Louis, Mo., is prime contractor for the Gemini spacecraft. Others include:

AIResearch Manufacturing Co. Los Angeles, Calif.	Environment Control System
The Eagle Pitcher Co. Joplin, Mo.	Batteries
General Electric Co. West Lynn, Mass.	Fuel Cells
Northrop Corp. Newbury Park, Calif.	Parachutes
Rocketdyne Canoga Park, Calif.	OAMS, RCS
Thiokol Chemical Corp. Elkton, Md.	Retrorocket System
Weber Aircraft Corp. Burbank, Calif.	Ejection Seats
Westinghouse Electric Corp. Baltimore, Md.	Rendezvous Radar System

Atlas contractors include:

General Dynamics, Convair Div., San Diego, Calif.	Airframe and Systems Integration
Rocketdyne Div., North American Aviation, Inc. Canoga Park, Calif.	Propulsion Systems
General Electric Co. Syracuse, New York	Guidance

Titan II contractors include:

Martin Co., Baltimore Divisions, Baltimore, Md.	Airframe and Systems Integration
Aerojet-General Corp. Sacramento, Calif.	Propulsion System
General Electric Co. Syracuse, N. Y.	Radio Command Guidance System
Burroughs Corp. Paoli, Pa.	Ground Guidance Computer
Aerospace Corp. El Segundo, Calif.	Systems Engineering and Technical Direction

Agena D contractors include:

Lockheed Missiles and Space Co., Sunnyvale, Calif.	Airframe and Systems Integration
Bell Aerosystems Co. Niagara Falls, N. Y.	Propulsion Systems
McDonnell Aircraft Co. St. Louis, Mo.	Target Docking Adapter

Food Contractors:

U.S. Army Laboratories Natick, Mass.	Food Formulation Concept
Whirlpool Corp. St. Joseph, Mich.	Procurement, Processing, Packaging
Swift and Co., Chicago and Pillsbury Co., Minneapolis	Principal Food Contractors

Suit Contractor:

The David R. Clark Co.
Worcester, Mass.

ABBREVIATIONS AND SYMBOLS FREQUENTLY USED

ASCO	AUXILIARY SUSTAINER CUT OFF
CGLVTC	CHIEF GEMINI LAUNCH VEHICLE TEST CONDUCTOR
ECS	(S/C) ENVIRONMENTAL CONTROL SYSTEM
ESP	EXTRAVEHICULAR SUPPORT PACK
ETR	EASTERN TEST RANGE
EVA	EXTRAVEHICULAR ACTIVITY
ELSS	EXTRAVEHICULAR LIFE SUPPORT SYSTEM
FLT	FLIGHT DIRECTOR (HOUSTON)
GAATV	GEMINI ATLAS AGENA TARGET VEHICLE
GATV	GEMINI AGENA TARGET VEHICLE
GEN	GENERAL INFORMATION
GLV	GEMINI LAUNCH VEHICLE
GN2	GASEOUS NITROGEN
GT	GEMINI TITAN
HHMU	HAND HELD MANEUVERING UNIT
IMU	INERTIAL MEASURING UNIT
IRFNA	INHIBITED RED FUMING NITRIC ACID
LC (14)	LAUNCH CONDUCTOR - COMPLEX 14
LD (14)	LAUNCH DIRECTOR - COMPLEX 14
LD (19)	LAUNCH DIRECTOR - COMPLEX 19
LMD	LAUNCH MISSION DIRECTOR

LN2	LIQUID NITROGEN
LO2	LIQUID OXYGEN
LTC	LOCKHEED TEST CONDUCTOR
MCC	MISSION CONTROL CENTER (DEFINED WITH THE WORD HOUSTON OR CAPE)
MD	MISSION DIRECTOR (HOUSTON)
OAMS	ORBIT ATTITUDE MANEUVERING SYSTEM
PCM	PULSE CODE MODULATION
S/C	(GEMINI) SPACECRAFT
SPCFT	CHIEF SPACECRAFT TEST CONDUCTOR
SLD	SIMULTANEOUS LAUNCH DEMONSTRATION
SLV	STANDARD (ATLAS) LAUNCH VEHICLE
STC	SLV TEST CONDUCTOR
SRO	SUPERINTENDENT OF RANGE OPERATIONS
TDA	TARGET DOCKING ADAPTER
UDHM	UNSYMMETRICAL DIMETHLHYDRAZINE
WMSL	WET MOCK SIMULATED LAUNCH

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