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CONTENTS

Title	Page
GENERAL NEWS RELEASE	1-3
Launch Vehicle Countdown	4
Nominal Mission Plan - Gemini 7	5-6
Gemini 7 Experiments	7-14
Experiments Flown on Earlier Missions	7
In-Flight Exerciser	7-8
In-Flight Phonocardiogram	8
Bone Demineralization	8-9
Human Otolith Function	9
Proton-Electron Spectrometer	9-10
Tri-Axis Magnetometer	10
Celestial Radiometry Space Object Radiometry	10-11
Simple Navigation	11
Synoptic Terrain Photography	11-12
Synoptic Weather Photography	12
Visual Acuity Astronaut Visibility	12-14
Experiments to be Flown for the First Time	15-20
Bioassays Body Fluids	15
Calcium Balance Study	15
In-Flight Sleep Analysis	15-16
Optical Communication	16-18
Landmark Contrast Measurements	18
Star Occultation Navigation	18-20
Camera Equipment for Gemini 7 and 6 Missions	21-22
16 MM Maurer Movie Camera	21
70 MM Hasselblad Camera	22

Gemini 7 to be launched no earlier than Dec. 4, 1965.

Gemini 6 to be launched nine days later

-more-

Gemini 7 Fourteen Day Menu Cycle----------------23-24
Menu I, Menu II--------------------------------23
Menu III, Menu IV------------------------------24
Gemini 6 Launch Preparations--------------------25-28
Launch Vehicle Countdown - Gemini 6-------------29
Nominal Mission Plan - Gemini 6-----------------30-34
Launch Windows---------------------------------30
Gemini 6 and 7 Rendezvous Orbit Geometry-----32
Gemini 6 Experiments---------------------------35
Gemini 6 Menu----------------------------------36-37
Manned Space Flight Network Gemini 6 and 7 Missions---38-39
Prime Computing Support----------------------38
Other Computer Support----------------------38-39
Network Readiness---------------------------39
Tracking Two Manned Spacecraft------------------39-40
Orbits - Revolutions----------------------------41
Crew Training Background------------------------42-43
Immediate Pre-Flight Crew Activities------------44-45
Flight Activities----------------------------45
Crew Safety-------------------------------------46-47
Survival Package-----------------------------46-47
Gemini 6 Suit-----------------------------------48
Gemini 7 Suit-----------------------------------49
Medical Checks----------------------------------50
Body Waste Disposal-----------------------------50
Food--50-51
Weather Requirements----------------------------52
Planned and Contingency Landing Areas-----------53
Gemini Spacecraft-------------------------------54-59
Reentry Module-------------------------------54
Adapter Section------------------------------54
Propellant--------------------------------------59
Rendezvous Radar--------------------------------59-60
Electrical Power Systems------------------------60-63
Gemini 7-------------------------------------60-61
Gemini 6-------------------------------------61
Fuel Cell Diagrams---------------------------62-63
Gemini Launch Vehicle---------------------------64-65
Crew Biographies--------------------------------66-74
Previous Gemini Flights-------------------------75-77
Project Officials-------------------------------78
U.S. Manned Space Flights (chart)---------------79
Spacecraft Contractors--------------------------80-81

NOTE TO EDITORS:

Supplemental information will be released as rapidly as it develops.

NEWS NASA
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GEMINI 7/6 FLIGHT

TO ATTEMPT RENDEZVOUS,

LONG DURATION MISSIONS

Within the next three weeks, the National Aeronautics and Space Administration is scheduled to carry out two manned space missions--a long-duration flight of up to 14 days and rendezvous of two Gemini spacecraft.

Gemini 7, a long-duration flight, is scheduled to be launched no earlier than Dec. 4.

Gemini 6, which will rendezvous with Gemini 7, is to be launched nine days later, Dec. 13.

Success in the two flights will represent:

1. The longest U.S. manned flight to date (Gemini 5 Astronauts L. Gordon Cooper and Charles Conrad were in flight 190 hours and 56 minutes, nearly eight days).

2. The first space rendezvous of two manned maneuverable spacecraft.

-more-

11/23/65

3. A minimum turn-around time for launch of two missions from the same pad.

Despite the rendezvous objective of Gemini 6, the two missions will be carried out independently. That is, Gemini 7 will be launched and carried out as originally planned. No major changes have been made in the Gemini 7 flight plan.

The Gemini 6 mission will be carried out according to a flight plan which is nearly identical to the one prepared for the Oct. 25 launch which was postponed when the Agena Target Vehicle failed to achieve orbit. The only major change is that the Gemini 6 spacecraft was to have docked with the Agena.

In the forthcoming flight, the two Gemini spacecraft will not be physically connected.

It was decided that the planned schedule of Gemini 7 and the availability of the Gemini 6 launch vehicle and spacecraft (already checked out on Pad 19) presented an opportunity to carry out a rendezvous of two manned vehicles.

-more-

The first several days of the Gemini 7 mission will be devoted to carrying out experiments. At about five days the crew will maneuver the spacecraft into a target orbit for Gemini 6. During the rendezvous attempt by Gemini 6, the Gemini 7 crew will maintain their orbit and spacecraft attitude, performing only those maneuvers required to make themselves a better target.

Following a successful liftoff, Gemini 6 immediately will begin maneuvers to achieve rendezvous which is planned for its fourth orbit. Following rendezvous, Gemini 6 will station keep (fly formation) on Gemini 7 for about two revolutions. Subsequently, Gemini 7 will fly formation on Gemini 6 for one spacecraft day, about 40 minutes.

Gemini 6 will reenter the Earth's atmosphere and land in the West Atlantic Ocean after about 46 hours and 45 minutes, at approximately 8:20 a.m. EST.

Gemini 7 duration will be about 329 hours and 30 minutes, landing in the same area at approximately 8 a.m. EST, two days later.

(BACKGROUND INFORMATION FOLLOWS)

-more-

LAUNCH VEHICLE COUNTDOWN

Gemini 7

F-3 days	Start pre-count
F-1 day	Start mid-count
T-12 hours	GLV propellant loading
T-390 minutes	Complete propellant loading
T-300 minutes	Begin terminal countdown
T-120 minutes	Flight Crew to Complex 19
T-100 minutes	Crew enters spacecraft
T-75 minutes	Close spacecraft hatches
T-50 minutes	White Room evacuation
T-35 minutes	Begin erector lowering
T-15 minutes	Spacecraft OAMS static firing
T-04 seconds	GLV ignition
T-0 seconds	Liftoff
T+2 minutes, 36 seconds	Booster engine cutoff (BECO)
T+5:41	Second stage engine cutoff (SECO)
T+6:11	Spacecraft-launch vehicle separation

NOMINAL MISSION PLAN

Gemini-7

Gemini-7 is scheduled to be launched from Complex 19, Cape Kennedy at about 2:30pm EST, December 4. It will be launched into an elliptical orbit with an apogee of 210 miles and a perigee of 100 miles. The orbit will be inclined 28.87 degrees to the equator.

The spacecraft is to separate from the booster 30 seconds after sustainer engine cutoff.

Immediately following spacecraft separation, the spacecraft will turn around to blunt end forward, and begin station keeping on the booster second stage. Station keeping will continue for about 25 minutes ground elapsed time (GET) from liftoff. This time extends into about five minutes before the first darkness period.

Celestial radiometry experiments will be conducted during the remainder of the first darkness period.

At three hours, 50 minutes after lift-off as the spacecraft is at its third apogee, thrusters will be fired in a posigrade maneuver to raise the perigee to 124 miles. This maneuver establishes a spacecraft orbital lifetime of 15 days.

The next several days of the flight will be devoted to conducting assigned experiments.

At about five days in flight the crew will circularize the spacecraft orbit to provide the proper target orbit for Gemini 6. The exact maneuvers required will depend on the decay rate of the Gemini 7 orbit and the expected liftoff time of Gemini 6, now planned for eight days, 19 hours and four minutes following Gemini 7 liftoff.

Under present plans, circularization maneuvers will be performed 120 hours after lift-off of the Gemini 7 spacecraft. The crew will give the spacecraft a posigrade thrust at apogee. This will result in a change of velocity of 100 feet per second and circularization at 185 miles.

The rendezvous portion of the Gemini 6 and Gemini 7 spacecraft is described in the Gemini 6 Nominal Mission Plan.

The remaining Gemini 7 experiments will be conducted following completion of rendezvous activities. The Gemini 7 crew will initiate retrofire near the end of the 206 th revolution. Landing will be in the West Atlantic recovery area at the beginning of the 207th revolution.

GEMINI 7 EXPERIMENTS

Twenty experiments are scheduled for Gemini 7. Fourteen are continuing experiments and have been carried aboard previous Gemini flights. In repeating these over a number of manned space flight missions, experimeters hope to gain data covering a number of subjects under varying flight conditions.

Results of the experiments carried aboard Gemini missions 3 and 4 were presented at a symposium in Washington early this fall. Similar sympos ia will be held periodically during the manned space flight program.

Experiments Flown on Earlier Missions

1. Cardiovascular Conditioning (5)*

This experiment will determine the effectiveness of cyclic infla-tions of pneumatic cuffs on the thighs as a preventive measure of cardiovascular deconditioning (heart and blood distribution system) induced by prolonged weightlessness. The cuffs are built into the spacesuit around the thighs and inflated periodically to 80mm of mercury pressure, increasing blood pressure below the cuffs. The automatic pressurization cycle lasts two minutes out of every six and uses oxygen from the environmental control system.

2. In-Flight Exerciser (4 and 5)

The objective of this experiment is to assess the astronauts' capacity to perform physical work and their capability for sustained performance. The rapidity with which the heart rate returns to normal

*indicates previous Gemini mission

after cessation of exercise is an indication of an individual's physical fitness. A workload will be provided by specific periods of exercise at the rate of one pull per second for 30 seconds on an exercise device that requires a known amount of effort.

The exercise device consists of a pair of bungee cords attached to a nylon handle at one end and a nylon foot strap at the other end.

The in-flight data obtained will be compared with the control data to determine the capacity for work in space.

3. In-Flight Phonocardiogram (4 and 5)

In this experiment the fatigue state of an astronaut's heart muscle will be determined by measuring the time interval between the activation of a muscle and the onset of its contraction.

A microphone will be applied to an astronaut's chest wall at the cardiac apex. Heart sounds detected during the flight will be recorded on an onboard biomedical recorder. The sound trace will be compared to the waveform obtained from a simultaneous inflight electrocardiogram to determine the time interval between electrical activation of the heart muscle and the onset of ventricular systole.

4. Bone Demineralization (4 and 5)

The purpose of this experiment is to establish the occurence and degree of bone demineralization influenced by the relative immobilization associated with the cockpit of the Gemini spacecraft and weightlessness.

Special X-rays will be taken of an astronaut's heel bone and the terminal bone of the fifth digit of the right hand. Three pre-flight and three post-flight exposures will be taken of these two bones and compared to determine if any bone demineralization has occurred due to the space flight.

The equipment to be used in this experiment will be closely calibrated clinical X-ray machines, standard 11-inch by 14-inch X-ray films and calibrated wedge densitometers.

5. Human Otolith Function (5)

A visual tester will be used to determine the astronauts orientation capability during flight. The experiment will measure changes in otolith (gravity gradient sensors in the inner ear) functions.

The tester is a pair of special light proof goggles, one eye piece of which contains a light source in the form of a movable white line. The astronaut positions the white line with a calibrated knurled screw to what he judges to be the right pitch axis of the spacecraft. The second astronaut then reads and records the numbers.

6. Proton-Electron Spectrometer (4)

In order to determine the degree of hazard, if any, to which the crew will be subjected on space flight, it is necessary to project what radiation environment any given mission will encounter. Specifically, this experiment will make measurements outside of the spacecraft in a region where the inner Van Allen radiation belt dips close to the earth's surface due to the irregular strength of the earth's magnetic field. This region is usually referred to as the South Atlantic Geomagnetic Anomaly.

This measurement will be accomplished by means of a scintillating-crystal, charged-particle analyzer mounted on the adapter assembly of the spacecraft. Data from this experiment will be used to correlate radiation measurements made inside the spacecraft and to predict radiation levels on future space mission.

7. Tri-Axis Magnetometer (4)

The purpose of this experiment is to monitor the direction and amplitude of the earth's magnetic field with respect to an orbiting spacecraft. The astronauts will operate an adapter-mounted tri-axis fluxgate magnetometer as they pass through the South Atlantic Geomagnetic Anomaly. The magnitude of the three directions of the earth's magnetic field will be measured with respect to the spacecraft. The measurement will be performed in conjunction with the Proton Electron Spectrometer experiment to determine the field, line direction and pitch angle of the impacting particles.

8. Celestial Radiometry
Space Object Radiometry (5)

The results of these experiments will provide information on radiation intensity of celestial bodies and various objects in space. Instrumentation includes a three-channel spectro-radiometer, a dual-channel Michelson Interferometer-Spectrometer, and a cryogenically cooled spectrometer. The equipment can measure radiant intensity from the ultra-violet through the infrared region. The sensing units are housed in the Gemini adapter section and are directed toward the objective by orienting the spacecraft.

The objectives for these experiments are to determine the onset of sensitivity values for earth objects and sky background radiation and radiation signatures of various objects in space and on the ground.

Observations will include exhaust plumes of rocket vehicles launched from the Eastern or Western Test Ranges, rocket sled exhausts at Holloman Air Force Base, volcanoes and forest fires as well as contrasting background areas such as deserts and warm ocean currents.

9. <u>Simple Navigation</u> (4)

The capability of man to navigate in space and to provide a reliable navigation system independent of ground support will be tested in this experiment. Two special instruments have been developed for use on Gemini spacecraft to allow detailed manual-visual examination of the space phenomena thought to be best for space navigation purposes. These are a space stadimeter and a sextant. This flight will only carry the space sextant with which the astronaut will use to make star-horizon angular measurements for orbital orientation determinations. The results will be compared with actual measurements to determine the accuracy of the procecures.

10. <u>Synoptic Terrain Photography</u> (4 and 5)

The purpose is to obtain photos of selected parts of earth's surface for use in research in geology, geophysics, geography, oceanography. This experiment has been flown on every flight since MA-8.

Experiment -- 70mm Hasselblad camera with 80mm Zeiss F2.8 lens; two packs of color film with 65 exposures each. Approximately ninety pictures will be taken over areas of the world. Primary areas are the shallow waters around the Bahamas, the Red Sea, and the west central portion of Mexico.

11. Synoptic Weather Photography (3,4 and 5)

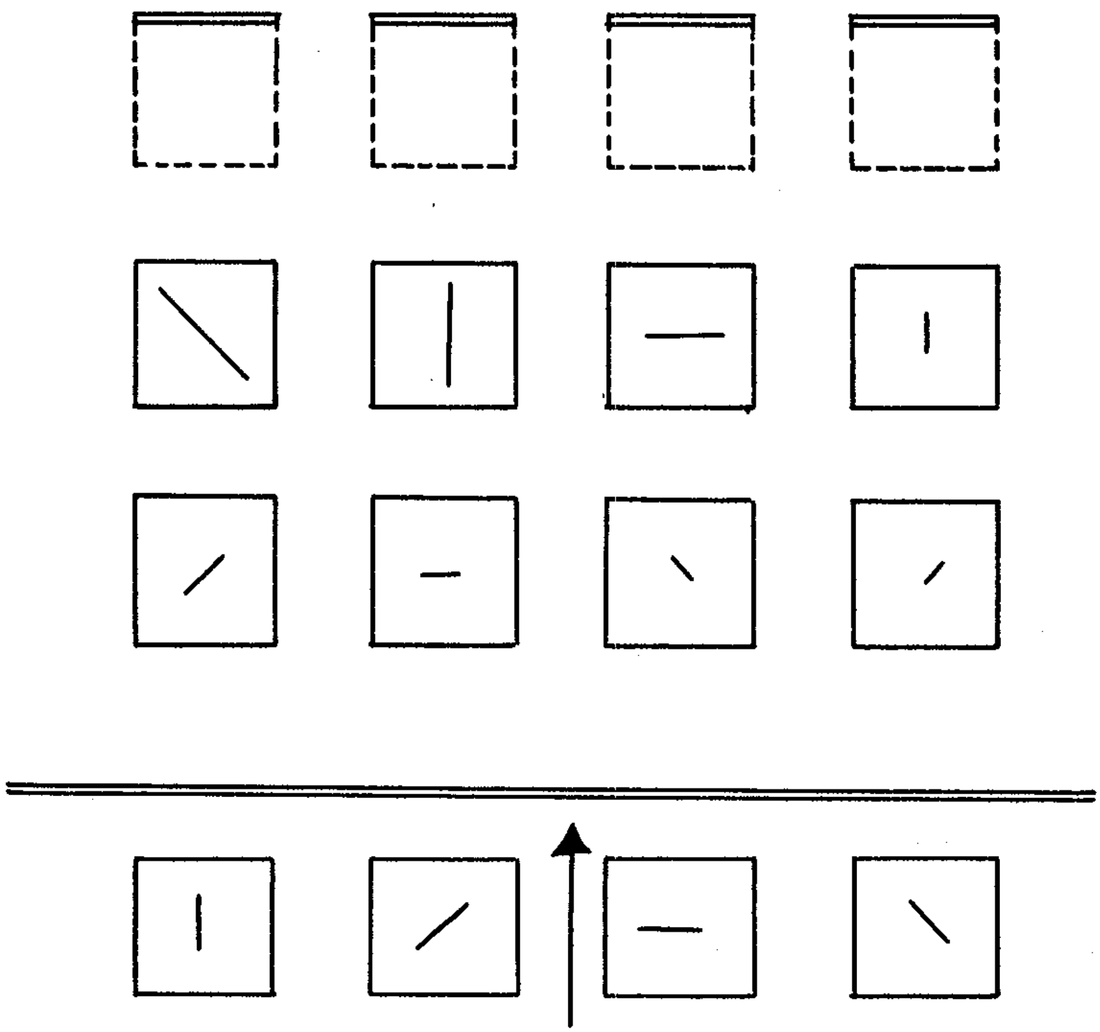
The Synoptic Weather Photography experiment is designed to make use of man's ability to photograph cloud systems selectively--in color and in greater detail than can be obtained from the current TIROS meteorological satellite.

A primary purpose of the experiment is to augment information from meteorological satellites which are contributing substantially to knowledge of the earth's weather systems. In many areas they provide information where few or no other observations exist.

Experiment -- 70mm Hasselblad camera with 80mm Zeiss F2.8 lens; two magazines of color film with 65 exposures each. Areas of Interest -- Squall line clouds, thunderstorm activity not associated with squall lines, frontal clouds and views of fronts, jetstream cirrus clouds, typical morning stratus of Gulf states, coastal cloudiness, tropical and extratropical cyclones, intertropical convergence zone, cellular pattern in subtropical phenomenon, wave clouds induced by islands and mountain ranges, broad banking of clouds in the trade winds or other regions.

12. Visual Acuity
Astronaut Visibility (5)

The visual ability of the astronauts in the detection and recognition of objects on the earth's surface will be tested in these experiments. The spacecraft will be equipped with a vision tester and a photometer. The astronauts will use the vision tester to evaluate visual sightings from space relative to earthbound baseline values.



The photometer will measure light attenuation of the spacecraft window due to scattering. While the spacecraft is oriented the astronauts will view a pattern of panels laid out near Laredo, Texas and record their findings. Viewings will be correlated with laboratory experiments and vision will be checked pre- and post-flight.

During passage of the spacecraft over the sites, the command astronaut shall be responsible for maintaining the proper spacecraft attitude while the second astronaut observes the target area and makes verbal comments to the principal investigator at the site.

For five minutes in each 24 hour period, each astronaut will use the on-board vision tester to test his own visual acuity on an opportunity basis.

EXPERIMENTS TO BE FLOWN FOR THE FIRST TIME

1. Bioassays Body Fluids

In this experiment the astronauts reaction to stress during space flight will be studied by means of analysing body fluids. Pre-flight and post-flight blood samples will be taken. In-flight urine will be measured at each voiding and a portion of this stored in special bags.

From analysis of these fluids experimenters hope to measure body hormones, electrolytes, proteins, amino acids and enzymes which may be produced as a result of stress.

2. Calcium Balance Study

The rate and amount of calcium change to the body during the conditions of orbital flight will be evaluated in this experiment by means of controlled calcium intake and output measurements. In addition to calcium, other electrolytes of interest such as nitrogen phosphorous, sodium chloride and magnesium will be monitored.

The two astronauts will be maintained on a prescribed calcium diet for two weeks prior to flight, during and after flight. Careful recording of input-output will be accomplished and total fecal and urine specimens will be preserved for analysis. Sweat will also be measured by careful cleansing of the crew in distilled water following recovery. Undergarments will be similarly cleaned and the water analysed.

3. In-Flight Sleep Analysis

The objectives of this experiment are to assess the astronauts' state of alertness, levels of consciousness, and depth of sleep during flight. An electroencephalograph (EEG) on the astronauts will be taken during weightless flight to establish the possible use of the EEG as a monitoring tool to help determine the state of alertness and depth of sleep. The electrical activity of the cerebral cortex will be monitored by two pairs of scalp electrodes and recorded on the biomedical recorder.

4. Optical Communication (Laser)

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Stimulated emission is produced by greatly exciting the atom. When excited the atom will emit small quantities of light in phase or unison. Thus the light is "coherent," that is, it is directed in a constant steady beam in one precise direction.

This experiment is an attempt to demonstrate a new technique for communication between an orbiting spacecraft and a ground station. In doing this, a demonstration of optical frequencies for communications will be achieved and certain atmospheric data will be recorded and the value of an astronaut as a "pointing control" will be established.

The primary atmospheric data to be obtained are background radiance and attenuation. This data and the experience obtained from this experiment will be useful in designing future systems.

The experiment equipment consists of a flight transmitter and a ground-based receiver transmitter system.

The flight transmitter resembles and is about the same size as a home movie camera. It weighs about six pounds and is completely self-contained. It is made up of four injection lasers, a 10-volt power supply (eight rechargeable nickel-cadmium batteries), a d.c. (direct current) to d.c. converter, a telescopic sight and a microphone.

Four gallium arsenide injection lasers are the heart of the transmitter. They deliver a total of 16 watts of light power at a wavelength of 9,000 angstroms. The beams produced by the lasers form four lines of light arranged one above the other making a square pattern at distances of several feet to infinity.

Injection lasers were chosen for their compactness, light weight and efficiency in converting electric energy into light energy.

The ground-based receiver resembles a short, blunt telescope. It is 30 inches in diameter and consists of a collector and focusing unit with a photomultiplier (optical detector) located at the focal plane. An argon gas laser beacon is mounted atop the receiver barrel.

The argon gas laser has an output of three watts into a three milliradian beam spread or about 0.17 degree. At 300 miles the beam will be approximately 0.9 mile in diameter.

Receiver systems have been installed at White Sands Missile Range, Ascension Island and Kauai, Hawaii. The receivers are slaved to FPS radars and always point toward the spacecraft when it is within range of the radar.

In operation the command pilot will maintain proper spacecraft orientation while the co-pilot aims the laser transmitter by sighting through the telescope at the ground-based argon laser. The argon laser beam will be visible to the naked eye.

When the spacecraft laser beacon is acquired by the ground receiver the ground-based argon laser will be flashed to indicate that contact has been established. Both beacons will then be aligned and voice communications can begin. The co-pilot will switch to the voice channel and say, "1, 2, 3, 4, 5, testing 5, 4, 3, 2, 1."

Voice communications will be one way only - from spacecraft to ground.

During the experiment the astronauts will wear safety goggles for protection against eye damage which might be caused by stray or reflected light from the onboard laser. The glasses have shields for stopping radiation which enter the eye from the side and lenses that filter out the infrared energy emitted by the laser.

5. Landmark Contrast Measurements

The purpose of this experiment is to measure the visual contrast of land-sea boundaries and other types of terrain to be used as a service of navigation data for the onboard Apollo Guidance and Navigation system. Landmark contrast measurements made from outside the atmosphere will provide data of a high confidence level to effectively duplicate navigation sightings for Apollo.

Landmark measurements will be made of such areas as the Florida Coast, South American Chilean Coast, African-Atlantic Coast and Australian Coast. A photometric telescope sensor and equipment used for the Star Occultation Navigation experiment will be used.

6. Star Occultation Navigation

The feasibility and operational value of star occulting measurements in the development of a simple, accurate and self-contained orbital navigational capability will be investigated in this experiment.

The astronauts will determine the orbit of the Gemini spacecraft by measuring the time stars dip behind an established horizon.

As much of the existing Gemini onboard equipment as is possible will be used for the recording of photometric sensor output signal intensity and time. Nevertheless, certain special equipment will be necessary for the performance of the navigational studies. Included in the equipment is a photoelectric sensor.

The photoelectric sensor consists of a telescope, eyepiece, reticle, partially silvered mirror, iris, chopper, optical filters, photomultiplier, pre-amplifier and associated electronics. The instrument is hand-held to the astronaut's eye for viewing out the spacecraft's window.

As the astronaut views the horizon, he looks for bright stars about to be occulted. He then points the telescope at one and centers the star within a reticle circle. A portion of the radiation is then diverted to a photomultiplier. With a hand-held switch, the astronaut initiates a calibration mode in which the intensity of the star is measured automatically. He then tracks the star within the reticle as the star passes into the atmosphere and behind the edge of the earth. The tracking period for each star is approximately 100 seconds. During this tracking period the astronaut will manually indicate the passage of the star through the air glow, the 50% intensity level and complete occultation simply by momentarily depressing the calibration switch.

The astronaut plays an essential role in the procedure, First, he solves the star acquisition problem by locating the next star to be transited. Second, he uses his head to point the telescope thus eliminating a two-gimbal automatic tracking system which would of necessity be used if he were not onboard. Third, he records star occultation times manually for comparison with the automatic calibration mode. Finally, he notes peculiarities in the data as it is collected. In performing this latter function, the man is used to greatest advantage to advance the state of the navigational art as rapidly as possible.

CAMERA EQUIPMENT FOR GEMINI 7 AND 6 MISSIONS

16MM MAURER MOVIE CAMERA

I. Camera

A. Equipment

1. two cameras
2. 75mm lens (one camera)
3. 75mm, 25mm, 18mm lens set (second camera)

B. Characteristics

1. Six frames/second
2. f-11 aperture
3. 1/200 second shutter speed
4. 40 lines/mm resolution

II. Film

Kodak S. O. 217 color film

III. Purpose

Weather and Terrain Photography
General Purpose

70MM HASSELBLAD CAMERA

I. Camera

A. Equipment

1. Camera
2. 80mm lens
3. 250mm lens
4. Photo event indicator
5. Ring Sight
6. UV filter
7. Film backs

B. Characteristics

1. 80mm focal length
2. f2.8 to f22.0 aperture
3. Time exposures and speeds up to 1/500 second
4. Resolution: approximately 125 lines/mm
5. Approximately 1.5X magnification

II. Film

Kodak S. O. 217, MS, Ektachrome
ASA-64 color emulsion on 2.5 mil Estar Polyester base

III. Purpose

Weather and Terrain
General Purpose

GEMINI 7

FOURTEEN DAY MENU CYCLE

MENU I - DAYS 1, 5, 9 & 13

MEAL A Days 5, 9, 13 only		CALORIES
(R)	Grapefruit drink	83
(B)	Apricot cereal cubes (8)	114
(R)	Sausage patties (2)	223
(R)	Banana pudding	282
(R)	Fruit cocktail	87
		789

Apricot cereal cubes (day 13 only)

MEAL B		
(R)	Beef and vegetables	98
(R)	Potato salad	143
(B)	Cheese sandwiches (6)	324
(B)	Strawberry cubes (6)	283
(R)	Orange drink	83
		931

MEAL C		
(R)	Orange-grapefruit drink	83
(R)	Tuna salad	214
(R)	Apricot pudding	150
(B)	Date fruitcake (4)	262
		709

Total Calories 2,429
Food Only Weight 521.12 gm

MENU II - DAYS 2, 6, 10 & 14

MEAL A		CALORIES
(R)	Grapefruit drink	83
(R)	Chicken and gravy	92
(B)	Beef sandwiches (6)	268
(R)	Applesauce	165
(B)	Peanut cubes (6)	297
		905

MEAL B		
(R)	Orange-grapefruit	83
(R)	Beef pot roast	119
(B)	Bacon & egg bites (6)	206
(R)	Chocolate pudding	307
		715

MEAL C Days 2, 6, 10 only		
(R)	Potato soup	220
(R)	Shrimp cocktail	119
(B)	Date fruitcake (4)	262
(R)	Orange drink	83
		684

Total Calories 2,304
Food Only Weight 518.62 gm

(B) = Bite-sized food not requiring rehydration prior to ingestion. Usual serving consists of six bite-size pieces.

(R) = Rehydratable food, i.e., food which must be reconstituted prior to ingestion.

GEMINI 7 MENU

MENU III - Day 3, 7, 11

MEAL A

		CALORIES
(R)	Salmon salad	246
(R)	Green peas	81
(B)	Toasted bread cubes (8)	107
(B)	Gingerbread (6)	183
(R)	Cocoa	190
		807

Toasted bread cubes - day 3 only

MEAL B

(R)	Grapefruit drink	83
(B)	Bacon squares (4)	90
(R)	Chicken & vegetables	75
(B)	Apricot cubes (6)	284
(B)	Pineapple fruitcake (6)	379
		911

MEAL C

		70
(B)	Cheese sandwich (6)	324
(R)	Butterscotch pudding	234
(R)	Orange drink	83
		711

Total Calories 2,429
Food Only Weight 515.06 gm

MENU IV - Day 4, 8, 12

MEAL A

		CALORIES
(B)	Strawberry cereal cubes (8)-day 8 only	114
(B)	Bacon squares (4)	135
(R)	Ham and applesauce	127
(R)	Chocolate pudding	307
(R)	Orange drink	83
		766

MEAL B

(R)	Beef and gravy	160
(R)	Corn chowder	252
(B)	Brownies (6)	241
(R)	Peaches	98
		751

MEAL C

(B)	Coconut cubes (6)	310
(B)	Cinnamon toast (6)	99
(R)	Chicken salad	237
(R)	Applesauce	165
(R)	Grapefrut drink	83
		894

Total Calories 2,411
Food Only Weight 509.58 gm

GEMINI 6 LAUNCH PREPARATIONS

The launching of Gemini 7 and the rapid turn-around for the Gemini 6 mission will be one of the most complex operations ever conducted by launch operations crews. A work schedule has been established for flight testing, checkout and launching of Gemini 6 nine days after Gemini 7.

The Gemini 6 spacecraft and launch vehicle were checked out thoroughly and counted down to some 42 minutes before liftoff on October 25. Since that time both the spacecraft and launch vehicle were placed in "bonded" storage under guard to insure that their mechanical and electrical integrity remains intact.

The Gemini 6 checkout will be the same as if a problem had occurred several days before the originally planned Gemini 6 flight and the spacecraft had to be de-mated from the launch vehicle. With the problem solved, the spacecraft would again be mated and a "compressed" checkout would take place in the days leading up to a launch, as most of the previous testing was still valid.

Once Gemini 7 has been launched, crews will be ready to erect the 6 launch vehicle and mate the spacecraft as soon as possible. The schedule calls for this to be completed some 24 hours after Gemini 7 liftoff.

Certain tests conducted during a normal mission will not have to be repeated for Gemini 6 because they will still remain valid (their validity will be checked, however). These include various calibrations of launch vehicle, spacecraft and blockhouse automatic ground support equipment; weight and balancing of the erector, certain spacecraft pre-mate and extensive spacecraft launch vehicle combined systems tests. Another departure from regular checkout procedure is that the Gemini 6 spacecraft will be fueled and the water supply and batteries will be installed before it gets to the launch pad.

The spacecraft and launch vehicle crews (McDonnell Aircraft is prime contractor for the spacecraft and Martin Company for the launch vehicle) will work on a three-shift, 24-hour schedule during the period between the launches.

The following is a general outline of the comprehensive work schedule:

The Gemini 7 is scheduled for launch at 2:30 p.m. EST.

As soon as possible an assessment of pad damage will be made. The blast damage has been very minimal in the past, requiring replacement primarily of some expendable wiring at the base of the pad. Various umbilical cables etc. will be checked to insure that they are operating. This work can be accomplished at the same time as the two launch vehicle stages are being erected and as the spacecraft is mated.

During launch days plus one and two, preparations will be made for final spacecraft systems tests. The validity of the electrical interface between the spacecraft and launch vehicle will be verified on the third day as individual tests of the two continue.

The final spacecraft systems tests are to be conducted on days three and four. During this time the previous verification of guidance between the spacecraft and launch vehicle is checked.

Liquid oxygen for the spacecraft environmental control system will be loaded aboard during this time as preparations are made for the simulated flight, scheduled for launch day plus five. From this point, to Gemini 6 liftoff, the checkout will be generally the same as of any other Gemini flight.

The simulated flight, which lasts some 10 to 12 hours, consists of three simulated launches -- A mode II abort run (an abort occurs some 1:38 after liftoff), a switchover to secondary guidance during powered flight, and finally, a normal flight and insertion into orbit, during which various orbital exercises, reentry and recovery tests are run. The prime pilots and their backups participate in these tests aboard the spacecraft at Launch Complex 19.

Another "time saver" comes after the simulated flight when the various pyrotechnics aboard the spacecraft are thoroughly checked and connected. Since the pyrotechnics system was varified previously and left in a flight mode configuration, only a short test for verification will be required.

The Gemini 6 pre-count (lasting some four hours on the third day before launch) and the mid-count (lasting some four hours on the second day before launch) will be very similar to regular Gemini procedures. During the pre-count significant portions of each spacecraft system are again checked.

Final interface tests between the spacecraft and launch vehicle (guidance, abort procedures etc.) are conducted during the mid-count.

The Gemini 7 and 6 final countdowns will be about the same--the spacecraft starting at about T-6 hours and the launch vehicle at T-4 hours. However, on Gemini 6, a hold will be declared at T-3 minute mark in the count to adjust the launch time to the planned rendezvous with Gemini 7. This hold will last 25 minutes. The Gemini 6 launch time is scheduled for 9:35 a.m. EST.

LAUNCH VEHICLE COUNTDOWN

Gemini 6

F-3 days	Start pre-count
F-1 day	Start mid-count
T-12 hours	GLV propellant loading
T-390 minutes	Complete propellant loading
T-300 minutes	Begin terminal countdown
T-120 minutes	Flight Crew to Complex 19
T-90 minutes	Crew enters spacecraft
T-75 minutes	Close spacecraft hatches
T-50 minutes	White Room evacuation
T-35 minutes	Begin erector lowering
T-15 minutes	Spacecraft OAMS static firing
T-3 minutes	25-minute hold
T-04 seconds	GLV ignition
T-0 seconds	Liftoff
T+2 minutes, 36 seconds	Booster engine cutoff (BECO)
T+5:41	Second stage engine cutoff (SECO)
T+6:11	Spacecraft-launch vehicle separation

NOMINAL MISSION PLAN

Gemini 6

Gemini 6 is scheduled to be launched December 13 at about 9:34am EST from Launch Complex 19 at Cape Kennedy, Fla. It will be launched into an elliptical orbit of 168 miles apogee and 100 miles perigee. Second stage booster yaw steering will be used to place the spacecraft into the same orbital plane as Gemini 7. Yaw steering provides up to 0.55 degree inclination increment change if needed. The spacecraft will trail Gemini 7 by 1208 miles at insertion.

Launch Windows (EST)

Nominal Day	9:34am to 10:21am	11:09am to 11:24am
N + 1	9:38am to 10:25am	
N + 2	8:07am to 8:54am	9:42am to 10:14am
N + 3	8:11am to 8:58am	
N + 4	6:59am to 7:25am	8:14am to 9:01am

Rendezvous is planned for the fourth orbit of Gemini 6, if liftoff is on time. During the first 35 minutes of each launch opportunity each 100 seconds delay in liftoff delays rendezvous by one spacecraft orbit. If liftoff time occurs beyond 300 seconds, rendezvous will not be attempted until the beginning of the second day when better tracking coverage is available.

Should liftoff occur during the last 12 minutes of the maximum 47 minute window, a different intermediate sequence of maneuvers will be initiated to narrow the catch-up distance between the spacecraft.

In this case, engine cutoff occurs earlier to reduce velocity by 50 feet per second. This causes the spacecraft to be inserted into a lower orbit than planned, with a perigee of about 100 miles and apogee of 138 miles. In this orbit the Gemini 6 catchup rate will be increased due to the greater difference in altitude between the two spacecraft.

Varying insertion velocity as described above has the effect of widening the launch window.

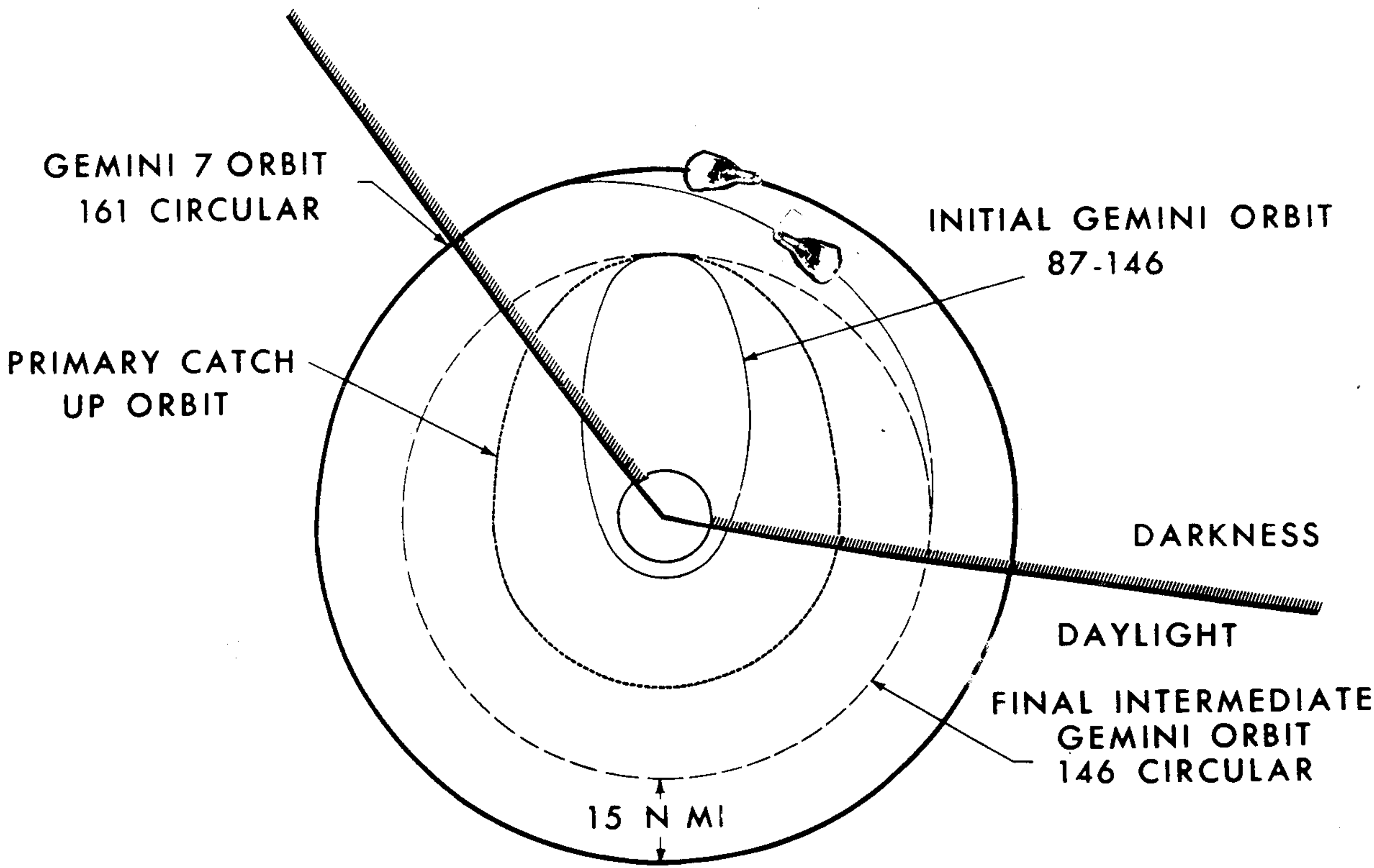
Following a successful, on-time liftoff and insertion the uncertainties of the effect of drag on the spacecraft during its initial orbit may require a one foot per second posigrade burn at first perigee to raise apogee. In the event of small insertion dispersions, the magnitude of this maneuver may vary but the resulting apogee will be 168 miles.

Near the second apogee a posigrade burn will add 53 feet per second to raise perigee to about 134 miles. This reduces the catchup rate from 6.7 degrees to 4.5 degrees per orbit and will provide the proper phase relationship between the two spacecraft for circularization at third apogee.

Should the two spacecraft be in different planes, a plane adjustment will be made by Gemini 6 at the common node (where the two spacecraft orbits intersect) following the second apogee posigrade burn.

At the third Gemini 6 spacecraft apogee, a posigrade burn of 53 feet per second will be made to circularize the orbit at 146 miles.

GEMINI 6 AND 7 RENDEZVOUS ORBIT GEOMETRY



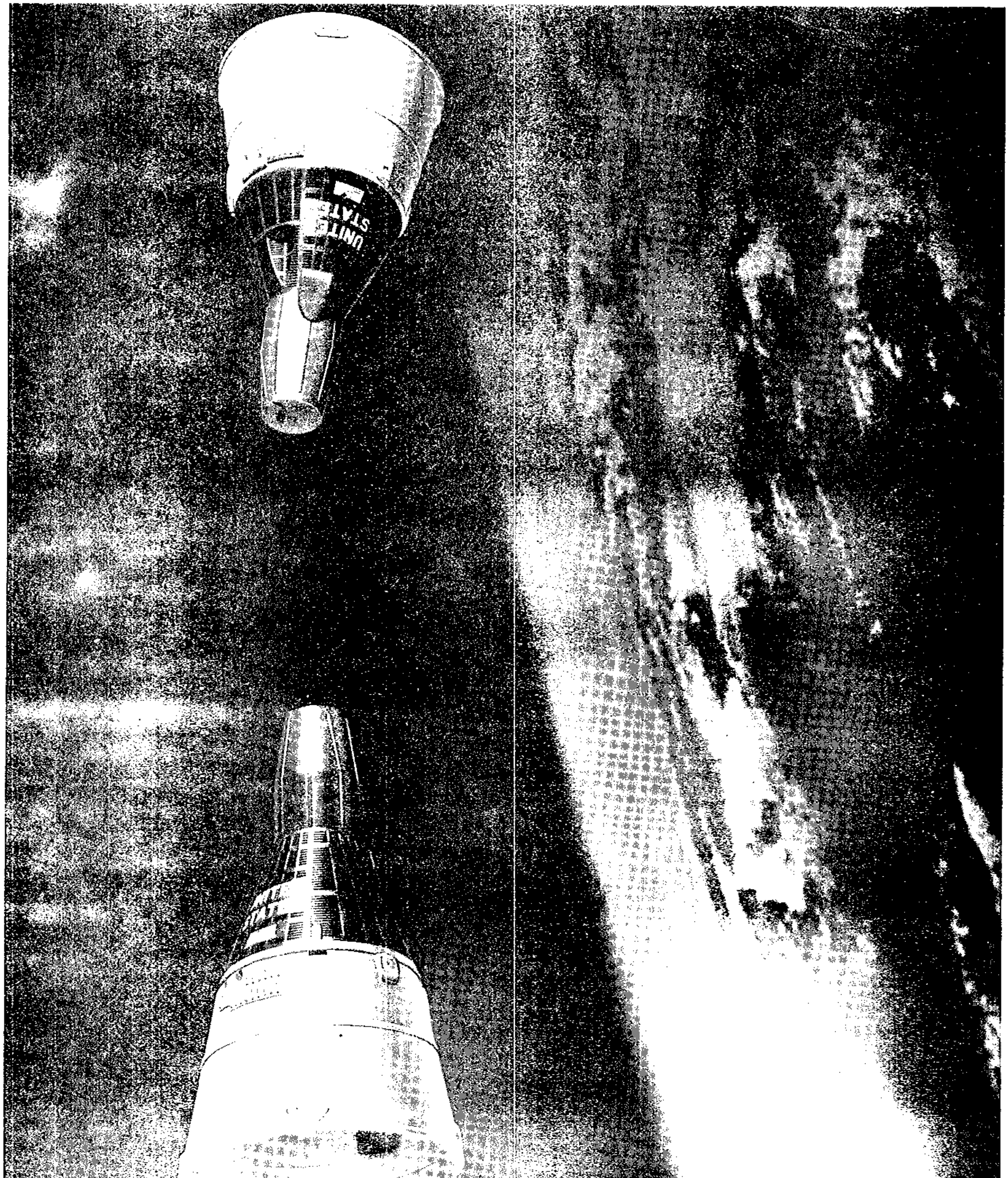
Gemini 6 will then be trailing Gemini 7 by about 184 miles. This is within range of the onboard radar and lock-on should have occurred.

A 32 feet per second posigrade burn will be made at terminal phase initiation along the line of sight to Gemini 7. This will be at a ground elapsed time of about 5 hours, 15 minutes - about one minute after entering darkness. The range between the spacecraft at this time is expected to be about 39 miles.

Approximately 33 minutes following terminal phase initiation a posigrade velocity of 43 feet per second will be applied to Gemini 6. This places the two spacecraft into the same orbit and rendezvous will have been accomplished.

Should there be computer, platform or radar failure, the mission can still proceed using ground data and radar-optical or optical rendezvous modes.

Retrofire will occur at a ground elapsed time of 46 hours and 10 minutes, during the 29th revolution. Landing will be in the West Atlantic recovery area.



GEMINI 6 EXPERIMENTS

Three experiments will be performed during the Gemini 6 mission:

1. Synoptic Weather Photography
2. Synoptic Terrain Photography
3. Radiation in spacecraft

The photography experiments are repeats of those flown on all previous Gemini flights. A description of these appears in the Gemini 7 experiments section.

The radiation experiment is designed to measure radiation levels and distribution inside the spacecraft. Seven sensors are located throughout the spacecraft. One is shielded to simulate the amount of radiation the crew members are receiving beneath their skin. The shield will be removed as the spacecraft passes through the South Atlantic anomaly, the area where the radiation belt dips closest to the earth's surface.

This experiment was also flown on Gemini 4.

DAY #1	MEAL "A"	CALORIES
Bacon Square		90
Potato Soup (Rehydratable)		252
Gingerbread		183
Peanut Cubes		297
Grapefruit Drink (Rehydratable)		83
	TOTAL CALORIES	905

MEAL "B"

Chicken and Gravy (Rehydratable)		92
Cheese Sandwiches		324
Strawberry Cereal Cubes		171
Pineapple Fruitcake		253
Orange-Grapefruit Drink (Rehydratable)		83
	TOTAL CALORIES	923

MEAL "C"

Salmon Salad (Rehydratable)		246
Cinnamon Toast		99
Butterscotch Pudding (Rehydratable)		117
Brownies		241
Grapefruit Drink (Rehydratable)		83
	TOTAL CALORIES	786

FIRST DAY - TOTAL 2,614

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DAY #2	MEAL "A"	CALORIES
Chicken Sandwich		196
Shrimp Cocktail (Rehydratable)		119
Date Fruitcake		262
Coconut Cubes		310
Orange-Grapefruit Drink (Rehydratable)		83
	TOTAL CALORIES	970

MEAL "B"

Tuna Salad (Rehydratable)		214
Apricot Cereal Cubes		171
Strawberry Cubes		283
Peaches (Rehydratable)		98
Grapefruit Drink (Rehydratable)		83
	TOTAL CALORIES	849

MEAL "C"

Bacon and Egg Bites		178
Meat & Spaghetti (Rehydratable)		70
Toasted Bread Cubes		161
Chocolate Pudding (Rehydratable)		307
Grapefruit Drink (Rehydratable)		83
	TOTAL CALORIES	799

SECOND DAY TOTAL 2,618

MANNED SPACE FLIGHT NETWORK
GEMINI 7 AND 6 MISSIONS

The Manned Space Flight Network consists of NASA and Department of Defense facilities.

The Mission Control Center in Houston, Texas (MCC-H) will control the entire Gemini 7-6 mission. As on Gemini missions 4 and 5, Houston's Real-Time Computer Complex (RTCC) (a key element of the MCC-H) will serve as the mission computing center.

For Gemini 7-6 the network will provide:

(1) Tracking and telemetry data during launch and orbital phases from both the Gemini 7 and the Gemini 6 spacecraft for position determination and systems operation.

(2) Capability for transmission and verification of ground commands to either or both spacecraft. These commands, generated at the mission control center, update the spacecraft computer to provide current information for time-of-retrofire determination and reentry calculations and displays.

Prime Computing Support

Immediate computing support will be provided from launch through impact by the RTCC at the Manned Spacecraft Center. During the launch and insertion phase, the RTCC will receive high-speed radar data from Bermuda and radar and MISTRAM (Missile Tracking and Measurement System) data from the Air Force Eastern Test Range (AFETR) radars via the Cape Kennedy-Houston GLDS (Gemini Launch Data System).

Other Computer Support

NASA's Goddard Space Flight Center (GSFC) real-time computing support for Gemini 7-6 includes the processing of skin tracking information

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obtained from the second stages of both launch vehicles and the computation of their predicted impact points. Additionally, the GSFC RTCC will generate skin track (radar echo bounce) space position predictions for the Manned Space Flight Network and the Department of Defense for their use in the event of spacecraft beacon loss or powered-down flight.

Network Readiness

Computers at the GSFC will certify the worldwide network's readiness to support Gemini 7-6 through a system-by-system TLM, CMD, RDR, station-by-station, computer-programmed checkout method called CADFISS (Computation and Data Flow Integrated Subsystem Tests). Checkout of network facilities also will be performed by the GSFC during post-launch periods when the spacecraft are not electronically "visible" by some stations and continue until the vehicles are again within acquisition range.

Data Flow Tests (DFT's) from the worldwide network to the Manned Spacecraft Center's Real-Time Computing Complex will be conducted from the Manned Spacecraft Center under the direction of the CADFISS Test Director.

TRACKING TWO MANNED SPACECRAFT

For Gemini 7-6, various combinations of spacecraft tracking and data acquisition assignments will be accomplished according to individual station capability.

Both Gemini spacecraft are equipped with C-Band beacon systems that aid station radars of the Manned Space Flight Network in pinpointing precise space position of each vehicle. In order that these radiated signals be readily distinguishable by the ground systems, their identifying codes have been altered slightly for precise recognition.

Through the detection of the spacecraft beacon, ground trackers pinpoint each spacecraft with an accuracy equivalent to a 22 bullet hitting a twenty-five cent piece at a distance of one mile. Electronically coordinated (slaved) telemetry receiving and radio command antenna systems acquire data from and send instructions to each spacecraft based in part on the space position information provided by the beacon tracking radars.

After Gemini 6 spacecraft insertion into orbit, stations in the Manned Space Flight Network will, for the first time, simultaneously track and acquire information from two orbiting manned spacecraft.

While both spacecraft are in orbital flight the on-site flight data summary computer (UNIVAC 1218) called TOMCAT (Telemetry On-Line Monitoring, Compression and Transmission) processes Gemini 6 or 7 (whichever spacecraft has been designated "prime") spacecraft data.

Upon termination of the Gemini 6 mission, all network station systems will revert to previous Gemini 7 operating modes for the remainder of the mission.

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.

CREW TRAINING BACKGROUND

In addition to the extensive general training received prior to flight assignment 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 Moorehead Planetarium, Chapel Hill, North Carolina.

4. Parachute descent training over water using a towed parachute technique.

5. Zero gravity training in KC-135 aircraft.

6. Suit, seat and harness fittings.

7. Training sessions for each crew.

member on the Gemini translation and docking simulator.

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

10. Participation in mockup reviews, systems review, subsystem tests and spacecraft acceptance review.

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During final preparation for flight, the crew participates in network launch abort simulations, joint combined systems test and the final simulated flight tests. At T-two 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.

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IMMEDIATE PRE-FLIGHT CREW ACTIVITIES

T-7 hours	Back-up flight crew reports to the 100-foot level of the White Room to participate in final flight preparations.
T-5 hours	Pilots' ready room, 100-foot level of White Room and crew quarters manned and made ready for prime crew.
T-4 hours, 30 minutes	Primary crew awakened
T-4 hours	Medical examination
T-3 hours, 40 minutes	Breakfast
T-3 hours, 15 minutes	Crew leaves quarters
T-3 hours, 5 minutes	Crew arrives at ready room on Pad 16

During the next hour, the biomedical sensors are placed, underwear and signal conditioners are donned, flight suits minus helmets and gloves are put on and blood pressure is checked. The helmets and gloves are then attached and communications and oral temperatures systems are checked.

T-2 hours, 15 minutes	Purging of suit begins
T-2 hours, 4 minutes	Crew leaves ready room
T-2 hours	Crew arrives at 100-foot level
T-1 hour, 30 minutes	Crew enters spacecraft

From entry until ignition, the crew participates in or monitors systems checks and preparations.

Flight Activities

At ignition the crew begins the primary launch phase task of assessing system status and detecting abort situations. Thirty seconds after SECO, the command pilot initiates forward thrusting and the pilot actuates spacecraft separation and selects rate command attitude control. Ground computations of insertion velocity corrections are received and velocity adjustments are made by forward or aft thrusting. After successful insertion and completion of the insertion check list, the detailed flight plan is begun.

CREW SAFETY

Every Gemini system affecting crew safety has a redundant (Back-up) 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.

GEMINI 6 SUIT

The pressure suit worn by the crew of Gemini 6 is identical to that worn by the Gemini 5 crew. It is not suitable for extra-vehicular activity.

It has five layers:

1. White cotton constant wear undergarment with pockets 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. White HT-1 nylon outer layer to protect against wear and solar reflectance.

The suit is a full pressure garment, including a helmet with mechanically sealed visor. Oxygen is furnished by the environmental control system. Gaseous oxygen is provided to the suit through a "suit loop" to cool the astronaut and provide him with a breathable atmosphere of 100 percent oxygen. Oxygen in the cabin maintains 5.1 pounds per square inch (psi) pressure. The suit, if cabin pressure fails, is pressurized to 3.5 psi (+.4,-0).

GEMINI 7 SUIT

A new lightweight suit has been developed for long duration space flights. It will be worn for the first time by the Gemini 7 crew. It is an intravehicular suit designed to give maximum mobility when depressurized.

It has two layers:

1. The inner layer is the pressure retaining neoprene-coated nylon bladder.
2. The outer layer is six ounce HT-1 nylon

It is a full pressure suit and weighs 16 pounds, including an aviator's crash helmet which is worn under the soft helmet. The suit can be completely taken off during flight or can be worn in a partially doffed mode in which gloves and boots are removed and the helmet is unzipped at the neck and rolled back to form a headrest.

Emergency time to donn the suit from a partially doffed mode is about 35 seconds. When the suit is totally doffed it takes from five to ten minutes to donn it.

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

Two separate systems are used for collection of body wastes.

A plastic bag with an adhesive lip to provide secure attachment to the body is used for the collection of feces. It contains a germicide which prevents formation of bacteria and gas. Soiled items, toilet tissues and a wet towel, are placed in the bag following use. The adhesive lip is then used to form a liquid seal and the bag is rolled and stowed in the empty food container spaces and brought back to earth for analysis.

Urine is collected into a horn-shaped receptacle with a self adjusting opening. The receptacle is connected by a hose to a pump device which either transfers the liquid to the evaporator or dumps it overboard. The system is much like the relief tube used in military fighter planes.

FOOD

Number of Meals -- Three per day per astronaut.

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

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Storage -- Meals individually wrapped in aluminum foil and polyethelene, polyamide laminate. First day meals stored in compartment beside knees of each crewman. Succeeding days meals in right aft food compartment.

The water intake of each astronaut will be carefully measured. A mechanical measuring system is an integral part of the 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 use of gun.

WEATHER REQUIREMENTS

The following are guidelines only. Conditions along the ground track will be evaluated prior to and during the mission.

Launch Area

Surface Winds -- 18 knots with gusts to 25 knots

Ceiling -- 5,000 feet cloud base

Visibility -- Six miles

Wave Height -- Five feet maximum

Planned Landing Areas

Surface Winds -- 30 knots maximum

Ceiling -- 1,500 feet cloud base

Visibility -- Six miles

Wave Height -- Eight feet maximum

Contingency Landing Areas

Flight director will make decision based upon conditions at the time.

Pararescue

Surface Winds -- 25 knots maximum

Ceiling -- 1,000 feet cloud base

Visibility -- Target visible

Waves -- Five feet maximum; swells 10 or 11 feet maximum

PLANNED AND CONTINGENCY LANDING AREAS

There are two types of landing areas for Gemini spacecraft, 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.

Planned Landing Areas

PRIMARY	Landing in the West Atlantic 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 for abort during early phase of flight, includes an area about 41 miles seaward from Cape Kennedy, 3 miles toward Banana River from Complex 19.
LAUNCH ABORT	Landing in the event of abort during powered flight, extending from 41 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.

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.

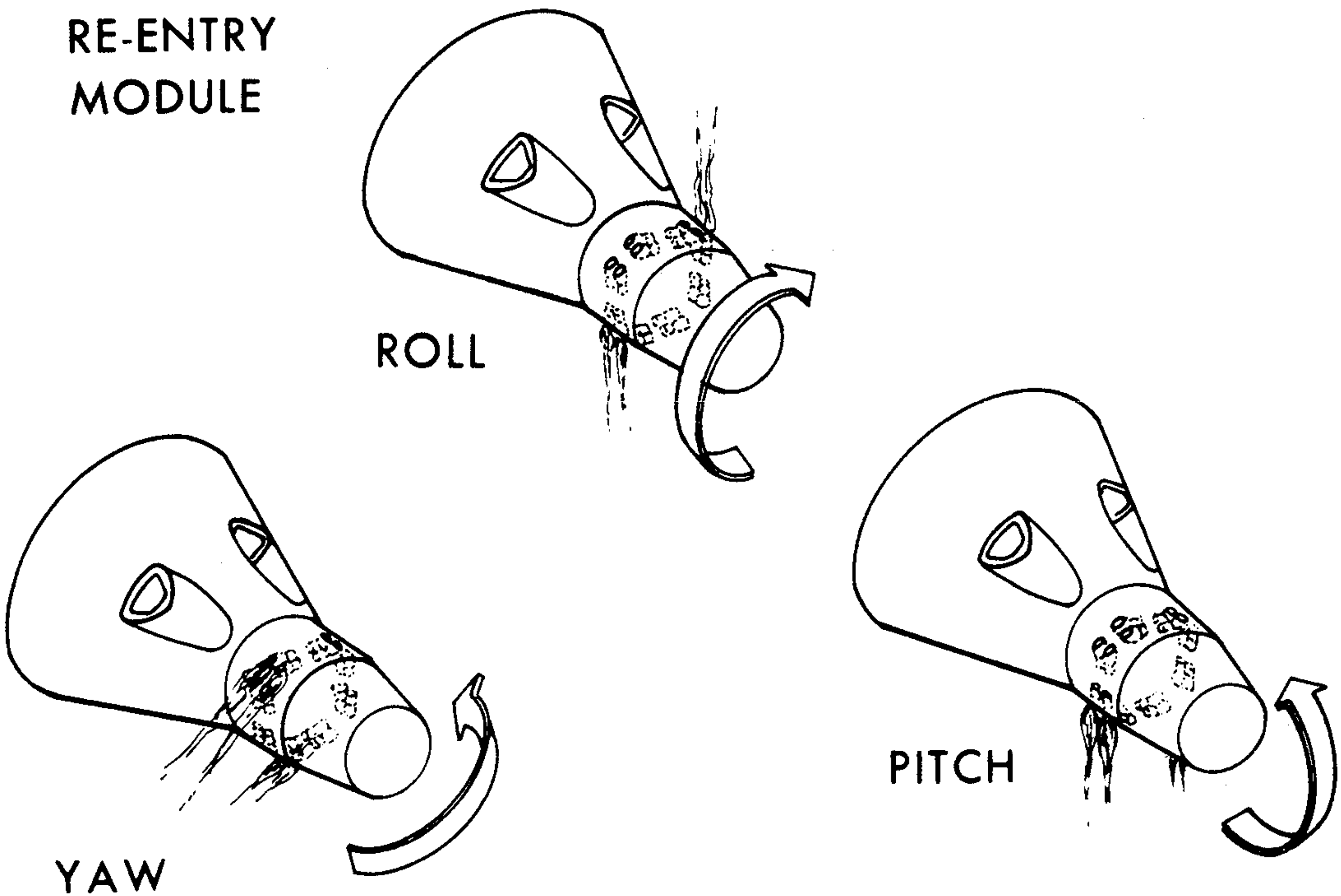
Reentry control section between R&R and cabin sections contains fuel and oxidizer tanks, valves, tubing and two rings of eight attitude control thrusters each for control during reentry. A parachute adapter assembly is included for main parachute attachment.

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 a 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.

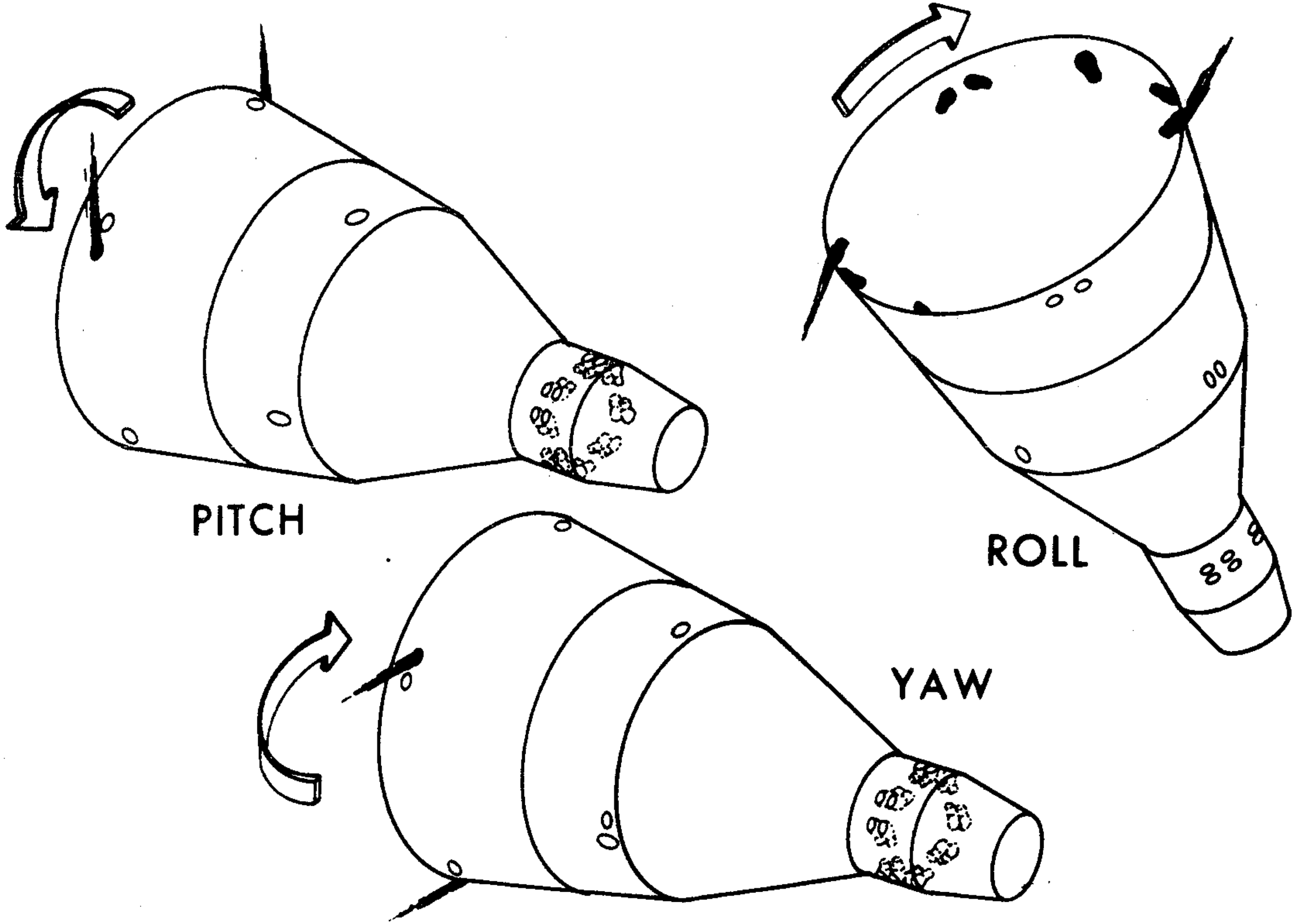
Adapter Section

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

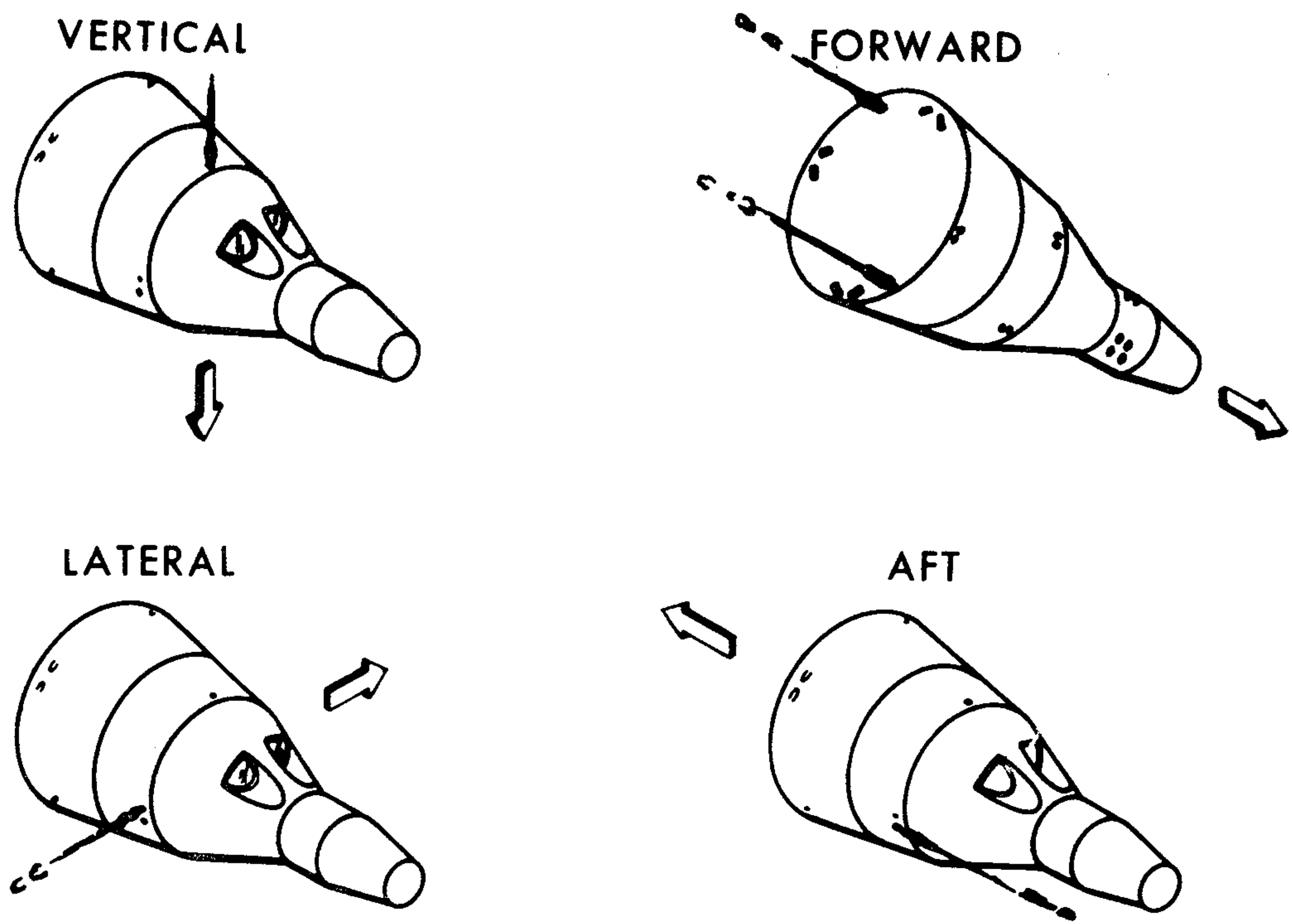
RCS FUNCTION



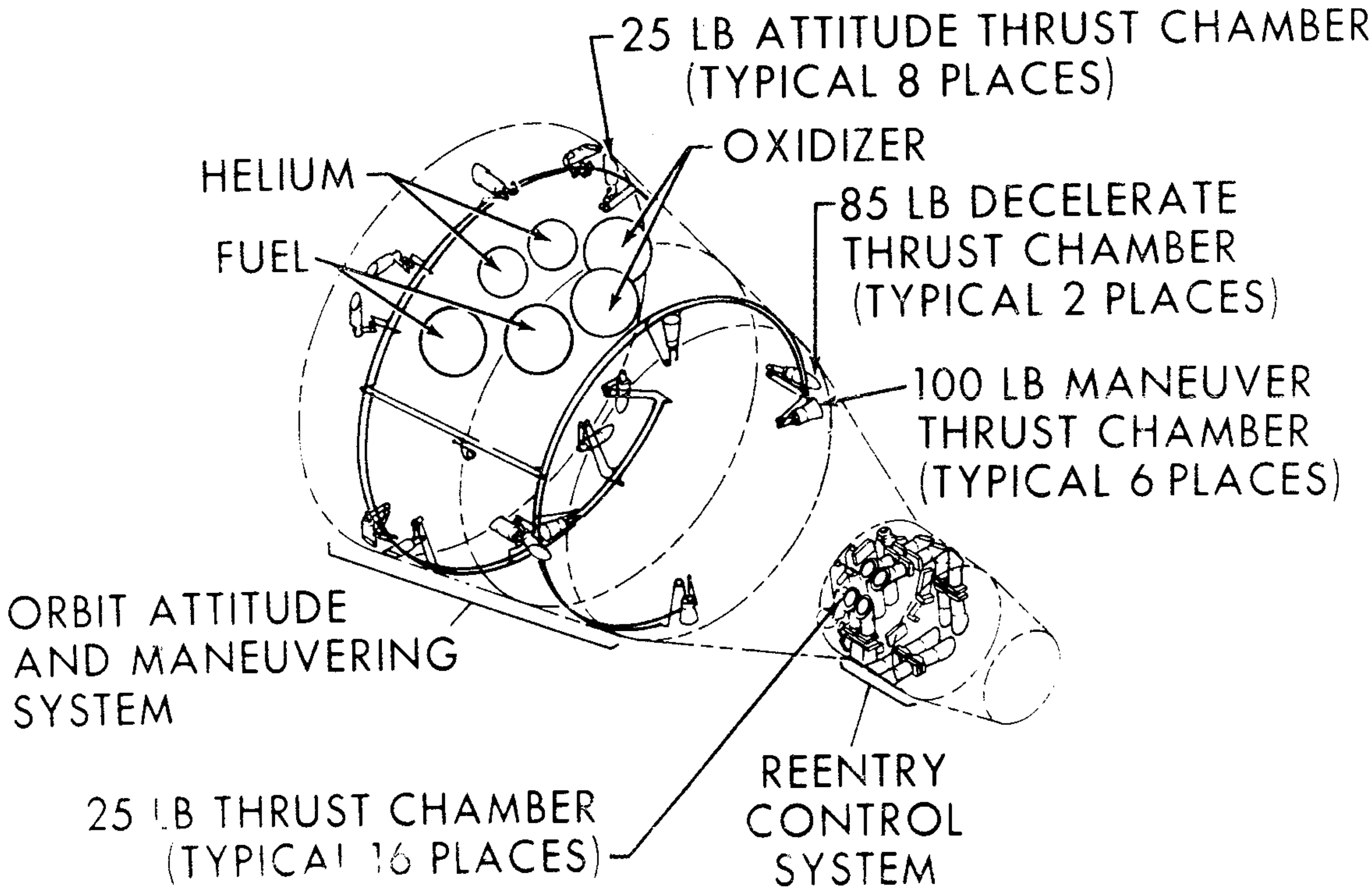
SPACECRAFT RESPONSES TO ORBIT ATTITUDE CONTROL THRUST



MANEUVERING CONTROL



LIQUID ROCKET SYSTEMS GENERAL ARRANGEMENT



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

Equipment section contains electrical power source systems, fuel for the orbit attitude and manuever system (OAMS), primary oxygen for the environmental control system (ECS). 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.

PROPELLANT

Gemini-7 -- 423 pounds

Gemini-6 -- 669 pounds

GEMINI -7 SPACECRAFT MODIFICATIONS

The following modifications have been made to the Gemini-7 spacecraft to support Gemini-6 rendezvous mission:

1. A transponder to receive and transmit signals from the Gemini-6 rendezvous radar system has been installed in the nose of the spacecraft.

2. Two acqusition lights have been placed on the adapter section 180 degrees apart. These are the same lights designed for the Agena target vehicle. They flash about 80 times per minute and can be seen for approximately 23 miles.

RENDEZVOUS RADAR

Gemini-6

Purpose -- Enables crew to measure range, range rate, and bearing angle to Gemini-7. Supplies data to Inertial Guidance System computer so crew can determine maneuvers necessary for rendezvous.

Operation -- Transponder on Gemini 7 receives radar impulses and returns them to Gemini 6 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.

Size -- less than two cubic feet.

Weight -- less than 50 pounds.

Power Requirement -- less than 80 watts.

ELECTRICAL POWER SYSTEMS

Gemini-7

The fuel cell power subsystem includes two 68-pound pressurized fuel cell sections, each containing three fuel cell stacks of 32 series-connected cells. Operating together, these sections produce up to two kilowatts of DC power at peak load.

Four conventional silver zinc batteries provide backup power to the fuel cells during launch and are primary power for reentry, landing and post-landing. Three additional batteries are isolated electrically to activate pyrotechnics aboard the spacecraft. (The four main batteries can also be brought on line for this purpose if necessary.)

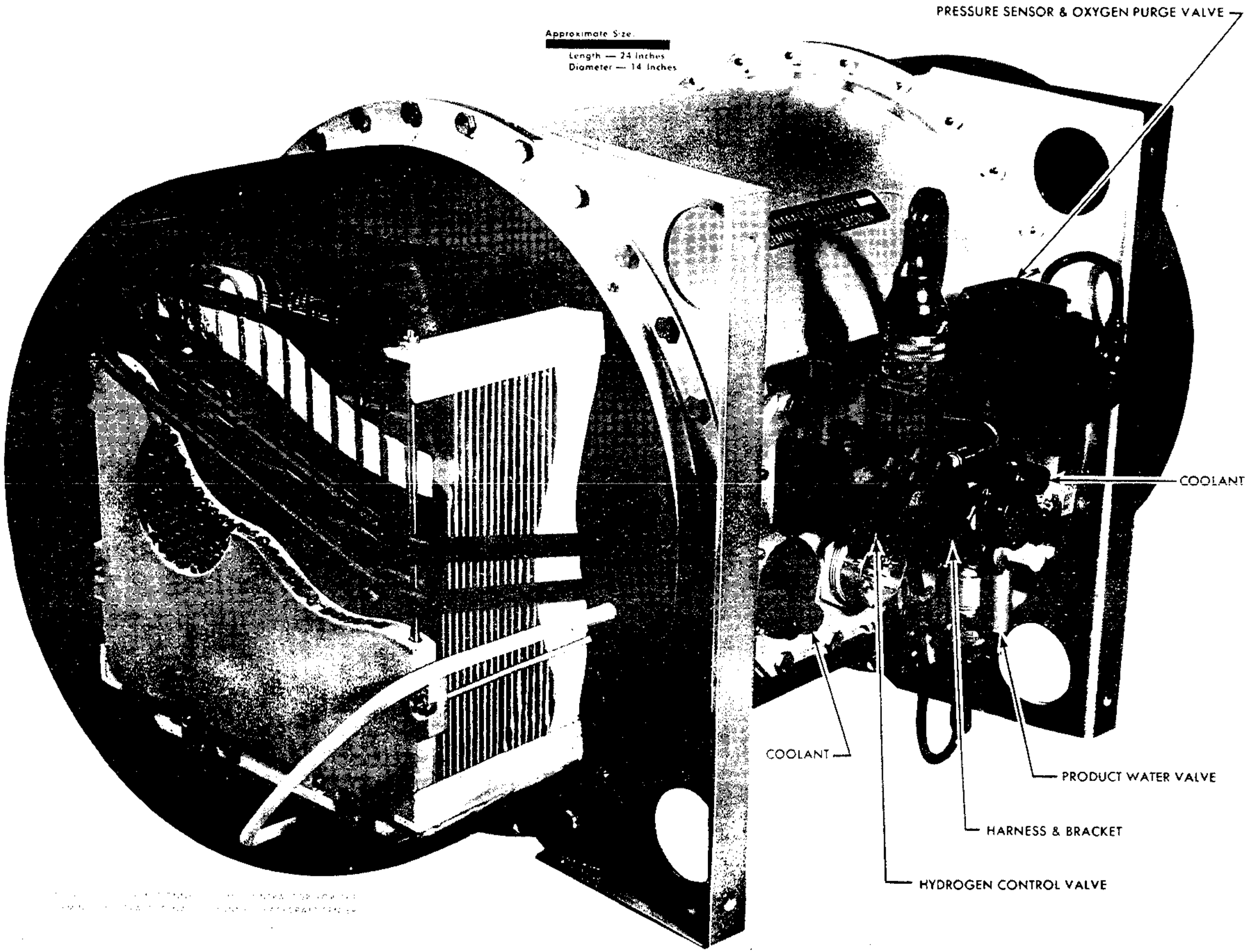
Besides its two cylindrical sections, the fuel cell battery subsystem includes a reactant supply of hydrogen and oxygen, stored at supercritical pressures and cryogenic temperatures.

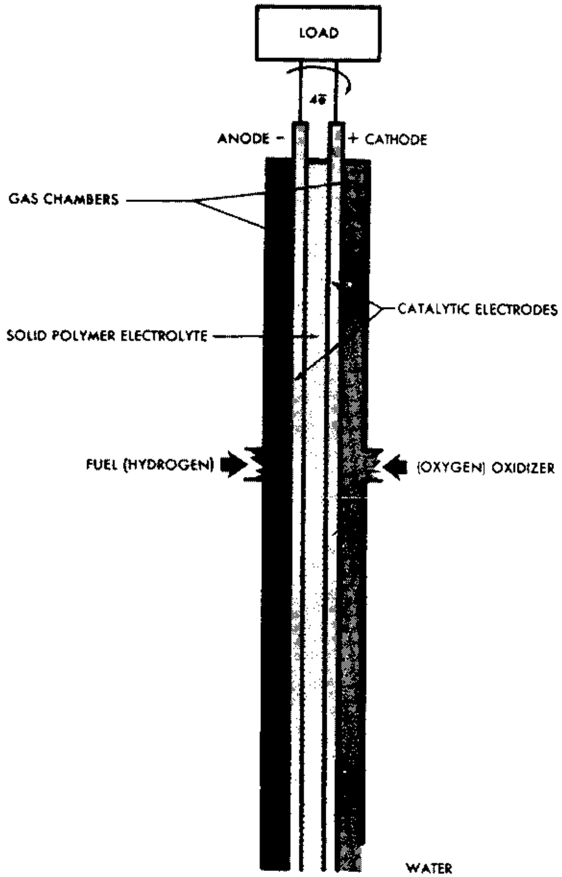
Energy is produced in the fuel cell by forcing the reactants into the stacks where they are chemically changed by an electrolyte of polymer plastic and a catalyst of platinum. Resultant electrons and ions combine with oxygen to form electricity, heat and water. This chemical reaction will theoretically continue as long as fuel and oxidant are supplied. Electricity is used for power, heat is rejected by the spacecraft coolant system, and water is diverted into the spacecraft drinking supply tanks where it is seperated from the crew's drinking supply by a bladder and used as pressurant to supply drinking water.

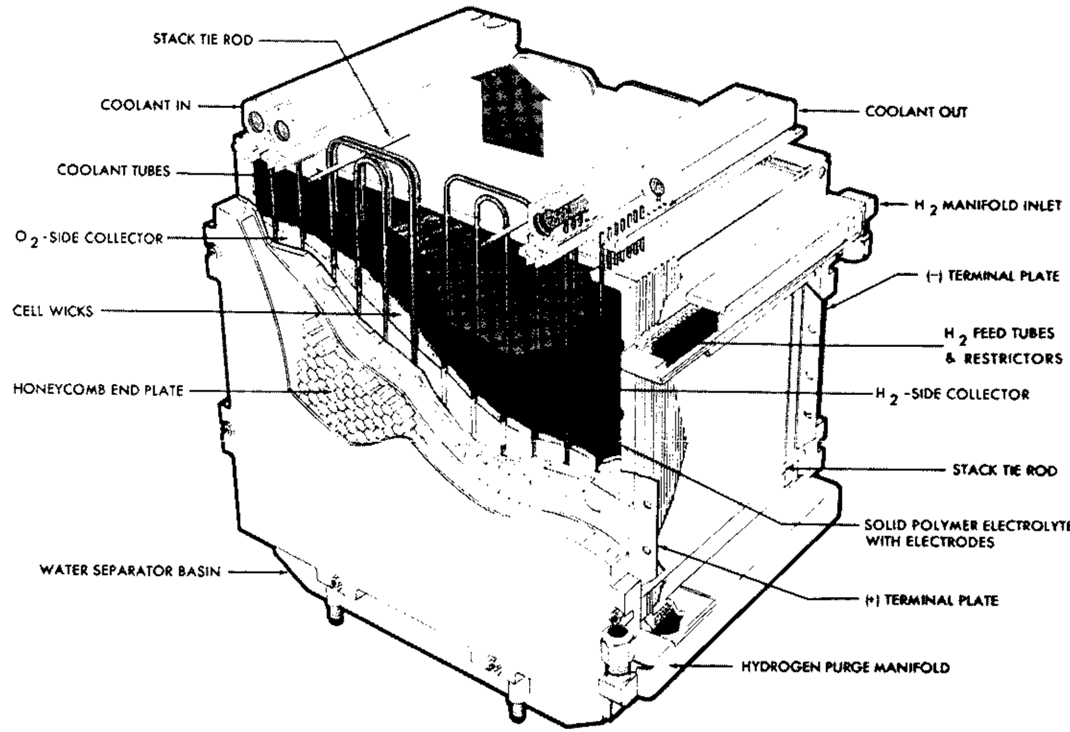
Gemini-6

Gemini-6 spacecraft carries 10 batteries. Included in these are:

Adapter Batteries	three 400-amp/hour units, housed in the adapter section. Primary power source.
Main Batteries	four 45-amp/hour units in the reentry section for power prior to and during reentry.
Squib Batteries	three 15-amp/hour units in the reentry section, used to trigger explosive squibs.


PRESSURE SENSOR & OXYGEN PURGE VALVE
Approximate Size:
Length — 24 Inches
Diameter — 14 Inches
COOLANT
COOLANT
PRODUCT WATER VALVE
HARNESS & BRACKET
HYDROGEN CONTROL VALVE


LOAD
ANODE -
+ CATHODE
GAS CHAMBERS
SOLID POLYMER ELECTROLYTE
CATALYTIC ELECTRODES
FUEL (HYDROGEN)
(OXYGEN) OXIDIZER
WATER


STACK TIE ROD
COOLANT IN
COOLANT TUBES
O_2-SIDE COLLECTOR
CELL WICKS
HONEYCOMB END PLATE
WATER SEPARATOR BASIN
COOLANT OUT
H_2 MANIFOLD INLET
(−) TERMINAL PLATE
H_2 FEED TUBES & RESTRICTORS
H_2-SIDE COLLECTOR
STACK TIE ROD
SOLID POLYMER ELECTROLYTE WITH ELECTRODES
(+) TERMINAL PLATE
HYDROGEN PURGE MANIFOLD

GEMINI LAUNCH VEHICLE

The Gemini Launch Vehicle (GLV) is a modified U. S. Air Force Titan II intercontinental ballistic missile consisting of two stages.

GLV dimensions are:

	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 is 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:

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

2. Backup 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.

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

CREW BIOGRAPHIES

Frank Borman, Gemini 7 command pilot

BORN: Gary, Ind., Mar. 14, 1928

HEIGHT: 5 feet, 10 inches WEIGHT: 163 lbs. Blonde hair, blue eyes

EDUCATION: Bachelor of Science degree, United States Military Academy, 1950; Master of Science degree in aeronautical engineering, California Institute of Technology, 1957.

MARITAL STATUS: Married to the former Susan Bugbee of Tucson, Ariz.

CHILDREN: Frederick, Oct. 4, 1951; Edwin, July 20, 1953

EXPERIENCE: Upon graduation from West Point, Borman, now an Air Force Major, chose an Air Force career and received his pilot training at Williams Air Force Base, Calif.

From 1951 to 1956 he served with fighter squadrons in the United States and in the Philippines and was an instructor at the Air Force Fighter Weapons School.

From 1957 to 1960 he was an instructor of thermodynamics and fluid mechanics at the U.S. Military Academy.

He was graduated from the USAF Aerospace Research Pilots School in 1960 and later served there as an instructor. In this capacity he prepared and delivered academic lectures and simulator briefings, and flight test briefings on the theory and practice of spacecraft testing.

Borman has logged more than 4,400 hours flying time, including more than 3,600 hours in jet aircraft.

CURRENT ASSIGNMENT: Borman was one of the nine astronauts named by NASA in September 1962.

Borman is the son of Mr. and Mrs. Edwin Borman, Phoenix, Ariz.

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James A. (for Arthur) Lovell, Jr., Gemini 7 pilot

BORN: Cleveland, Ohio, March 25, 1928

HEIGHT: 6 feet WEIGHT: 165 lbs. Blond hair, blue eyes

EDUCATION: Bachelor of Science degree from the United States Naval Academy, 1952; attended University of Wisconsin 1946-1948.

MARITAL STATUS: Married to the former Marilyn Gerlach of Milwaukee

CHILDREN: Barbara Lynn, Oct. 13, 1953; James A., Feb. 15, 1955; Susan Kay, July 14, 1958

EXPERIENCE: Lovell, a Navy Lieutenant Commander, received flight training following his graduation from Annapolis.

He served in a number of Naval aviator assignments including a three-year tour as a test pilot at the Naval Air Test Center at Patuxent River, Md. His duties there included service as program manager for the F4H Weapon System Evaluation.

Lovell was graduated from the Aviation Safety School of the University of Southern California.

He served as flight instructor and safety officer with Fighter Squadron 101 at the Naval Air Station at Oceana, Va.

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

CURRENT ASSIGNMENT: Lovell was selected as an astronaut by NASA in September 1962. In addition to participating in the overall astronaut training program, he has been assigned special duties monitoring design and development of recovery and including crew life support systems and developing techniques for lunar and earth landings and recovery.

Lovell is the son of Mr. and Mrs. James A. Lovell, Sr., Edgewater Beach, Fla.

Edward H. (for Higgins) White II, Gemini 7 backup command pilot

BORN: San Antonio, Tex., Nov. 14, 1930

HEIGHT: 6 feet WEIGHT: 171 lbs. Brown hair, Brown eyes

EDUCATION: Bachelor of Science degree from United States Military Academy, 1952, Master of Science degree in aeronautical engineering, University of Michigan, 1959

MARITAL STATUS: Married to the former Patricia Eileen Finegan of Washington, D.C.

CHILDREN: Edward, May 15, 1953; Bonnie Lynn, Sept. 15, 1956

PROFESSIONAL ORGANIZATIONS: Associate member of Institute of Aero-space Sciences; member of Sigma Delta Psi, athletic honorary; and member of Tau Beta Pi, engineering honorary

EXPERIENCE: White, an Air Force Major, received flight training in Florida and Texas, following his graduation from West Point. He spent $3\frac{1}{2}$ years in Germany with a fighter squadron, flying F-86's and F-100's.

He attended the Air Force Test Pilot School at Edwards Air Force Base, Calif., in 1959.

White was later assigned to Wright-Patterson Air Force Base, Ohio, as an experimental test pilot with the Aeronautical Systems Division. In this assignment he made flight tests for research and weapons systems development, wrote technical engineering reports, and made recommendations for improvement in aircraft design and construction.

He has logged more than 3,600 hours flying time, including more than 2,200 hours in jet aircraft.

CURRENT ASSIGNMENT: White is a member of the astronaut team selected by NASA in September 1962. He was assigned as the pilot for the second manned Gemini mission which flew for four days (June 3-7, 1965). White was the first U.S. astronaut to take part in extravehicular activities. He was outside the Gemini 4 spacecraft for 22 minutes and was the first human to use a personal propulsion unit for maneuvering in space.

White is the son of Maj. Gen. and Mrs. Edward H. White, St. Petersburg, Fla.

Michael Collins, Gemini 7 backup pilot

BORN: Rome Italy, Oct. 31, 1930

HEIGHT: 5 feet, $10\frac{1}{2}$ inches WEIGHT: 163 lbs. Brown hair brown eyes

EDUCATION: Bachelor of Science degree from United States Military Academy

MARITAL STATUS: Married to the former Patricia M. Finnegan of Boston, Mass.

CHILDREN: Kathleen, May 6, 1959; Ann S., Oct. 31, 1961; Michael L., Feb. 23, 1963

EXPERIENCE: Collins, an Air Force Major, chose an Air Force career following graduation from West Point.

He served as an experimental flight test officer at the Air Force Flight Test Center, Edwards Air Force Base, California. In that capacity, he tested performance and stability and control characteristics of Air Force aircraft, primarily jet fighters.

He has logged more than 3,000 hours flying time, including more than 2,700 hours in jet aircraft. He is a member of the Society of Experimental Test Pilots.

Collins was one of the third group of astronauts selected by NASA in October 1963.

He is the son of the late Maj. Gen. James L. Collins and Mrs. James L. Collins of Washington, D.C.

Walter M. (for Marty) Schirra, Jr., Gemini 6 command pilot

BORN: Hackensack, N.J., Mar. 12, 1923

HEIGHT: 5 feet, 10 inches WEIGHT: 170 lbs. Brown hair, brown eyes

EDUCATION: Bachelor of Science degree, United States Naval Academy, 1945

MARITAL STATUS: Married to the former Josephine Fraser of Seattle, Wash.

CHILDREN: Walter M. III, June 23, 1950; Suzanne, Sept. 29, 1957

EXPERIENCE: Schirra, a Navy Captain, received flight training at Pensacola Naval Air Station, Fla. As an exchange pilot with the United States Air Force, 154th Fighter Bomber Squadron, he flew 90 combat missions in F-84E aircraft in Korea and downed one MIG with another probable. He received the Distinguished Flying Cross and two Air Medals for his Korean service.

He took part in the development of the Sidewinder missile at the Naval Ordnance Training Station, China Lake, Calif. Schirra was project pilot for the F7U3 Cutlass and instructor pilot for the Cutlass and the FJ3 Fury.

Schirra flew F3H-2N Demons as operations officer of the 124th Fighter Squadron onboard the Carrier Lexington in the Pacific.

He attended the Naval Air Safety Officer School at the University of Southern California, and completed test pilot training at the Naval Air Center, Patuxent River, Md. He was later assigned at Patuxent in suitability development work on the F4H.

He has more than 3,800 hours flying time, including more than 2,700 hours in jet aircraft.

Schirra was one of the seven Mercury astronauts named in April 1959.

On Oct. 3, 1962, Schirra flew a six-orbit mission in his "Sigma 7" spacecraft. The flight lasted nine hours and 13 minutes from liftoff through landing and he attained a velocity of 17,557 miles (28,200 kilometers) per hour, a maximum orbital altitude of 175 statute miles (281 kilometers) and a total range of almost 144,000 statute miles (231,700 kilometers). The impact point was in the Pacific Ocean, about 275 miles (443 kilometers) northeast of Midway Island. He was awarded the NASA Distinguished Service Medal for his flight. He was the backup command pilot for the Gemini 3 mission. Schirra is the son of Mr. and Mrs. Walter M. Schirra, Sr., San Diego, Calif.

Thomas P. (for Patten) Stafford, Gemini 6 pilot

BORN: Weatherford, Okla., Sept. 17, 1930

HEIGHT: 6 feet WEIGHT: 175 lbs. Black hair, blue eyes

EDUCATION: Bachelor of Science degree from United States Naval Academy, 1951

MARITAL STATUS: Married to the Former Faye L. Shoemaker of Weatherford, Okla.

CHILDREN: Dianne, July 2, 1954; Karin, Aug. 28, 1957

EXPERIENCE: Stafford, an Air Force Major, was commissioned in the United States Air Force upon graduation from the U.S. Naval Academy at Annapolis. Following his flight training, he flew fighter interceptor aircraft in the United States and Germany, and later attended the United States Air Force Experimental Flight Test School at Edwards Air Force Base, Calif.

He served as Chief of the Performance Branch, USAF Aerospace Research Pilot School at Edwards. In this assignment he was responsible for supervision and administration of the flying curriculum for student test pilots. He established basic text books and participated in and directed the writing of flight test manuals for use by the staff and students.

Stafford is co-author of the Pilot's Handbook for Performance Flight Testing and Aerodynamic Handbook for Performance Flight Testing.

He has logged more than 4,300 hours flying time, including more than 3,600 hours in jet aircraft.

Stafford was one of the nine astronauts named by NASA in September 1962. He was the backup pilot for Gemini 3. Stafford is the son of Mrs. Mary E. Stafford and the late Dr. Thomas S. Stafford, Weatherford, Okla.

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Virgil I. (for Ivan) "Gus" Grissom, Gemini 6 backup command pilot

BORN: Mitchell, Ind., April 3, 1926

HEIGHT: 5 feet 7 inches WEIGHT: 150 lbs. Brown hair, brown eyes

EDUCATION: Bachelor of Science degree in mechanical engineering from Purdue University

MARITAL STATUS: Married to the former Betty L. Moore of Mitchell, Ind.

CHILDREN: Scott, May 16, 1950; Mark, Dec. 30, 1953

EXPERIENCE: Grissom is a lieutenant colonel in the United States Air Force, and received his wings in March 1951. He flew 100 combat missions in Korea in F-86's with the 334th Fighter-Interceptor Squadron. He left Korea in June 1952 and became a jet instructor at Bryan, Tex.

In August 1955, he entered the Air Force Institute of Technology at Wright-Patterson Air Force Base, Ohio, to study aeronautical engineering. In October 1956, he attended the Test Pilot School at Edwards Air Force Base, Calif., and returned to Wright-Patterson Air Force Base in 1957 as a test pilot assigned to the fighter branch.

Grissom has logged more than 4,000 hours flying time, including more than 3,000 hours in jet aircraft. He was awarded the Distinguished Flying Cross and the Air Medal with Cluster for service in Korea.

Grissom was named in April 1959 as one of the seven Mercury astronauts. He was the pilot of the Mercury-Redstone 4 (Liberty Bell 7) suborbital mission, July 21, 1961 and the command pilot of the Gemini 3 mission, March 23, 1965.

He is responsible for the Gemini group in the Astronaut Office, one of three organizational units in that office. (The others - Apollo and Operations).

Grissom is the son of Mr. and Mrs. Dennis Grissom, Mitchell, Ind.

John W. (for Watts) Young, Gemini 6 backup pilot

BORN: San Francisco, Calif., Sept. 24, 1930

HEIGHT: 5 feet 9 inches WEIGHT: 172 lbs. Brown hair, green eyes

EDUCATION: Bachelor of Science degree in aeronautical engineering from Georgia Institute of Technology

MARITAL STATUS: Married to the former Barbara V. White of Savannah, Ga.

CHILDREN: Sandy, Apr. 30, 1957; John, Jan. 17, 1959

EXPERIENCE: Upon graduation from Georgia Tech, Young entered the United States Navy and is now a Commander in that service. From 1959 to 1962 he served as a test pilot, and later program manager of F4H weapons systems project, doing test and evaluation flights and writing technical reports.

He served as maintenance officer for all-weather Fighter Squadron 143 at the Naval Air Station, Miramar, Calif. In 1962, Young set world time-to- climb records in the 3,000 meter and 25,000 meter events in the F4B Navy fighter.

He has logged more than 3,200 hours flying time, including more than 2,700 hours in jet aircraft.

Young was among the group of nine astronauts selected by NASA in September 1962. He was the pilot of Gemini 3, March 23, 1965.

He is the son of Mr. and Mrs. William H. Young, Orlando, Fla.

PREVIOUS GEMINI FLIGHTS

Gemini 1, 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 2, 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 3, 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 sub-orbital Mercury flight, is first man to fly into space twice.

Gemini 4, June 3-7, 1965

Second manned Gemini flight completed 62 revolutions and landed in primary Atlantic recovery area after 97 hours, 59 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. Attempt to perform near-rendezvous with GLV second stage failed because of insufficient quantity of maneuvering fuel. Malfunction in Inertial Guidance System required crew to perform zero-lift reentry.

Gemini 5, Aug. 21-29, 1965

Longest space flight on record. Astronauts L. Gordon Cooper and Charles (Pete) Conrad, Jr., circled the earth 120 times in seven days, 22 hours and 59 minutes. Cooper is first to make two orbital space flights; has more time in space than any other human. Conrad, on first space flight, becomes world's second most experienced astronaut. Failure of oxygen heating system in fuel cell supply system threatened mission during first day of flight, but careful use of electrical power, and excellant operational management of fuel cells by both crew and ground personel, 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.

Note: Gemini 6 previously was scheduled for launch Oct. 25, 1965. The launch attempt was cancelled when the Agena, with which Gemini 6 was to rendezvous, failed to achieve orbit despite a successful Atlas booster launch.

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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, NASA Headquarters
William C. Schneider	Deputy Director, Mission Operations, Office of Manned Space Flight, NASA Headquarters, Gemini 7 and 6 Mission Director
Charles W. Mathews	Gemini Program Manager, Manned Spacecraft Center, Houston, Texas
Christopher C. Kraft	Flight Director, Manned Spacecraft Center, Houston
G. Merritt Preston	Deputy Mission Director for Launch Operations, John F. Kennedy Space Center, NASA, Kennedy Space Center, Florida
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 and Commander AFETR
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, Florida
Rear Adm. W. C. Abhau	USN, Manned Spacecraft Support, Commander, Task Force 140 (Atlantic Ocean Recovery Forces)

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U.S. MANNED SPACE FLIGHTS

MISSION	SPACECRAFT HRS.			MANNED HOURS IN MISSION			TOTAL MANNED HRS. CUMULATIVE		
	HRS.	MIN.	SEC.	HRS.	MIN.	SEC.	HRS.	MIN.	SEC.
MR-3 (Shepard)		15	22		15	22		15	22
MR-4 (Grissom)		15	37		15	37		30	59
MA-6 (Glenn)	4	55	23	4	55	23	5	26	22
MA-7 (Carpenter)	4	56	05	4	56	05	10	22	27
MA-8 (Schirra)	9	13	11	9	13	11	19	35	38
MA-9 (Cooper)	34	19	49	34	19	49	53	55	27
Gemini 3 (Grissom & Young)	4	53	00	9	46	00	63	41	27
Gemini 4 (McDivitt & White)	97	56	11	195	52	22	259	33	49
Gemini 5 (Cooper & Conrad)	190	56	01	381	52	02	641	25	51

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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
IBM Corp. New York, N.Y.	Computer, Guidance
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

Titan II contractors (cont.)

Aerojet-General Corp., Sacramento, Calif.	Propulsion Systems
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.

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