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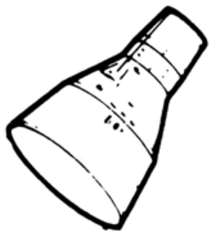

PROJECT: GEMINI 12
(To be launched no earlier than Nov. 9, 1966)

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NEWS

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GEMINI FINALE
98-HOUR FLIGHT
BEGINS NOV. 9

The National Aeronautics and Space Administration will conclude its Gemini manned space program with the four day Gemini 12 flight, to be launched no earlier than November 9 from Cape Kennedy, Fla.

Gemini 12 will include rendezvous and docking with an Agena during the third spacecraft revolution, docking practice, a tethered-vehicle station-keeping exercise, and maneuvers using the Agena primary propulsion system to change orbit.

Fourteen experiments are scheduled for the flight. Three periods of extravehicular activity (EVA) are planned, one for an hour and 53 minutes umbilical EVA, the other two standup activities totaling about three hours.

Splashdown is scheduled in the Western Atlantic some 94 hours 30 minutes after liftoff.

Gemini 12 command pilot is Navy Capt. James A. Lovell, Jr. Pilot is Air Force Maj. Edwin E. Aldrin. Backup crew members are Col. L. Gordon Cooper, Jr., USAF, and Comdr. Eugene A. Cernan, USN.

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Launch of the Agena is scheduled at 2:16 p.m. EST. The target vehicle will be placed in a circular orbit 185 miles above the Earth. Spacecraft launch is scheduled 98.5 minutes later at 3:5)4:32 p.m.

Rendezvous will occur in the third spacecraft revolution over Tananarive about three hours 245 minutes into the flight with docking to take place at three hours 55 minutes ground elapsed time (GET).

About eight hours into the mission, the Agena primary propulsion system (PPS) will boost the docked vehicles into a 185-by-460-mile orbit.

Pilot Aidrin will begin his first standup EVA about 20:15 GET over the Canary Islands and will complete it over Carnarvon, Australia at the end of the second night pass, about 22:33 GET.

An Agena PPS retrograde burn at 30:15 GET over the Rose Knot Victor tracking ship will re-circularize the orbit at 185 miles.

Aidrin's second extravehicular activity will begin over Canton Island 42 hours 37 minutes into the flight. He will attach the Agena tether to the spacecraft docking index bar and will perform a series of work tasks in the spacecraft adapter and forward on the Agena target docking adapter (TDA) to evaluate man's ability to work in space.

-more-

The umbilical EVA, during which Aldrin will use only a hand-over-hand technique to propel himself, will end at 44:30 GET off the west coast of the United States.

Two hours and 40 minutes later the crew will begin the tethered station-keeping exercise using the gravity gradient technique. Tethered station-keeping will last about five hours, ending about 52:00 GET with the jettisoning of the spacecraft docking bar and the attached tether.

Following the station-keeping exercise and before the sleep period begins, the spacecraft will be aligned for solar eclipse photography on Saturday, Nov. 12. The eclipse will be photographed only if it does not interfere with the flight plan.

The eclipse photography will occur at the end of the 39th revolution, 63:48 GET. Aidrin will have begun his third extra-vehicular activity at about 63:20 over the Pacific. He will end it about 64 hours 10 minutes with the jettisoning of EVA equipment.

Retrofire is scheduled approximately 94 hours 2 minutes 41 seconds after liftoff and will occur near Canton Island. As on Gemini 11, the spacecraft onboard computer will use inertial guidance system data to calculate guidance commands and feed them to the spacecraft propulsion system. The crew will monitor the system and will take control of the reentry procedures if necessary.

Splashdown will be in the West Atlantic, area 59-1 at 94:37 GET.

Fourteen experiments are scheduled for Gemini 12, but only two are new to the program. They are photography of a high-altitude sodium vapor cloud formed by a French Centaure rocket to be launched from Hammaguir, Algeria (S-051), and manual mid-course navigation (T-2).

Gemini 12 is the tenth manned flight in the program, which began April 8, 1964.

END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS

PREFLIGHT ACTIVITIES AND INTEGRATED COUNTDOWN

The Gemini flights have been developed by the Manned Spacecraft Center, Houston, under the direction of NASA's Office of Manned Space Flight. The Kennedy Space Center in Florida, is responsible for preflight testing, checkout and launching of the Gemini and Agena. At liftoff, flight control is switched to the Mission Control Center at Houston.

The Gemini 12 launch vehicle (GLV) arrived at KSC August 30 (first stage) and September 2 (second stage), and the spacecraft arrived September 6. The Agena target docking adapter (TDA) arrived August 14, the Agena Itself September 4, and the Atlas standard launch vehicle (ASLV) September 19.

The mission countdown is a simultaneous one involving both launch vehicles, the spacecraft and the target vehicle, the crew, Houston mission control and the worldwide tracking network, the Eastern Test Range, and the radio command guidance system.

Atlas-Agena liftoff occurs at T minus 95 minutes in the simultaneous count. A built-in hold late in the countdown is used to phase the spacecraft liftoff with Agena's orbit.

Launch Vehicle Countdown

Time	Gemini	Atlas-Agena
T-720	GLV propellant loading	
T-6l5		Begin terminal count
T-390	Complete propellant loading	
T-300	Back-up flight crew to 100-foot level of White Room to participate in final flight preparation. Begin terminal countdown. Pilot's ready room, 100-foot level of White Room, and crew quarters manned and made ready for prime crew.	
T-245	Medical examination	
T-240		Start tower removal

Time	Gemini	Atlas-Agena
T-230	Eat	
T-187	Crew leaves quarters	
T-175	Crew arrives at ready room on Pad 16	
T-135	Purging of suit begins	
T-125	Crew leaves ready room	
T-120	Flight crew to Complex 19	
T-119	Crew arrives at 100-foot level	
T-115	Crew enters spacecraft	
T-100	Close spacecraft hatches	
T-95		Liftoff
T-86		Insertion into orbit
T-70	White Room evacuation	
T-55	Begin erector lowering	
T-20	Spacecraft OAMS static firing	
T-03:01	Built-in hold	
T-00:00	Lift off	
T+02:36	Booster engine cutoff	
T+05:40	Second stage engine cutoff (SECO)	
T+06:00	Spacecraft-launch vehicle separation	

Reentry
(Elapsed Time from Gemini Lift-Off)

Time	
94:00:41	Retrofire
94:22:10	400,000 feet
94:24:35	Blackout begins
94:29:54	Blackout ended
94:31:39	Drogue chute deployed (50,000feet)
94:33:19	Main chute fully deployed (9,000 feet)
94:37:43	Spacecraft landing

MISSION DESCRIPTION

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.

(All orbital parameters in this section are in statute miles. To convert these figures to nautical miles, multiply by 0.87, to kilometers multiply by 1.61.)

Launch

Launch Times -- Atlas/Agena - 2:16 p.m. EST, Launch Complex 14
Gemini 12 -- 3:54:32 p.m. EST, Launch Complex 19

Launch Windows -- Gemini 12 is scheduled for launch in the M = 3, or third revolution rendezvous, pane of the launch window. This pane is about 33 seconds, extending from the nominal liftoff time. The M = 4 pane extends to 130 seconds beyond nominal liftoff time. Present plans do not call for use of panes later than M = 4 as long as practical to the overall success of the mission.

Azimuth -- The Agena will be launched along an azimuth of 83.32 degrees east of north. Gemini 12 will be launched on an azimuth of 100.66 degrees, biased to minimize the necessity of a plane change.

IVAR (Insertional Velocity Adjustment Routine -- Some 20 seconds after GLV SECO, the spacecraft separates using the aft-firing orbital attitude and maneuvering system (OAMS) thrusters. This maneuver assures separation of the spacecraft from the launch vehicle and aims for an insertional velocity of about 25,750 feet per second and an elliptical orbit 100 by 168 miles. The Agena will be in a 185-mile circular orbit about 575 miles ahead of the spacecraft at insertion.

RENDEZVOUS

Phase Adjustment: At 50 minutes into the flight, near spacecraft first apogee near Carnarvon, a nominal 58.2 fps posigrade burn will raise perigee to about 137 miles, reducing the catchup rate from 6.3 degrees to 3.9 degrees per orbit. Gemini trails Agena by 360 miles.

Combination Corrective Maneuver: Catchup rate and altitude adjustment, plus final change corrections, will be achieved in a combination maneuver at about 01:45 GET over the Eastern Test Range. Thrust components for this maneuver and for the previous and following maneuvers will be computed by the crew as well as by the ground: the solutions will be compared, and, barring any large disagreement between the two sets of figures, the crew solution will be used. Gemini trails by 161 miles.

Co-elliptical Maneuver: Near second spacecraft apogee at about 02:20 over the Indian Ocean a posigrade burn will circularize the spacecraft orbit at a nominal 10 miles below the Agena. Gemini trails by 75 miles and radar lock-on should be achieved.

Terminal Phase Initiate (TPI): At about 03:03 GET over Guaymas, about 12 minutes prior to darkness, TPI will begin with a posigrade burn along the line of sight to the target. Gemini trails by about 25 miles.

Midcourse Corrections: At 12 minutes and 24 minutes after TPI, the two intermediate corrections are made. After the second, range between the vehicles is about 3.0 miles.

Terminal Phase Final (TPF): The braking or velocity matching maneuver to establish rendezvous occurs at about 03:35 GET over Ascension Island. It is followed by a period of formation flying while the crew checks out spacecraft systems and investigates the condition of the Agena. Docking should occur over Tananarive at about 03:55 GET and will be followed by a series of practice undockings by both crew members.

Agena PPS Maneuver

After the first meal period and just before the first sleep period, the Agena primary propulsion system will perform a posigrade translation burn that will change apogee from 185 miles to 460 miles. This high apogee will be sustained from 08:05 GET to 30:15 GET, through the first sleep period and the first standup extravehicular activity. Apogee will occur over the northern hemisphere and over the United States in particular. Thus the synoptic terrain photographs (Experiment S-5) will be of different land masses than those photographed during the northern hemisphere high apogee of Gemini 11.

First Standup Extravehicular Activity

Pilot Aldrin will begin his first standup extravehicular activity at about 20:14 GET over the Canary Islands. He will conduct photographic experiments during both the nighttime and the daytime portions of the EVA period. In the daylight pass, the crew will practice umbilical EVA procedures, and Aldrin will install a handrail to be used during the umbilical EVA. The rail telescopes in four two-foot sections and is spring-loaded at the spacecraft end. Aldrin will extend it to its full length then maneuver the plain end into an attachment hole in the Agena target docking adapter (TD). He will then fit the spring-loaded end under a specially adapted shingle bolt between the spacecraft hatches. Installed, the rail will be slightly canted to the spacecraft longitudinal axis and will afford Aldrin a hand hold during his umbilical EVA movement to the TDA.

Standup EVA procedure will follow that used by Michael Collins on Gemini 10 and Richard Gordon on Gemini 11. Aldrin will be connected to the spacecraft by three umbilicals and a tether. The umbilicals are on 18-inch environmental control system (ECS) suit inlet extension, a 24-inch ECS outlet, and a $28^{1/2}$-inch electrical extension carrying communications and biomedical instrumentation hardline.

The tether is nylon webbing adjustable at 29, 35 and $42^{1/2}$ inches. It fastens to the spacecraft by being slipped under the right-hand seat left arm restraint and passed through a loop on one end of the tether. At the other end is a snap connector that attaches to the tether ring on the astronaut's parachute harness. This EVA will end about 22:34 GET over Carnarvon, a duration of approximately 2 hours 20 minutes.

Umbilical Extravehicular Activity

While portions of the first EVA will occur at the high apogee, the umbilical extravehicular activity will be carried out at 185 miles. An Agena PPS retrograde burn at 30:15 over the Rose Knot Victor will have recircularized the orbit. At 42:37 over Canton Island, Aldrin will begin an EVA specifically designed to gain knowledge of man's ability to work in space.

The one activity of a nature other than work evaluation or directly related to work evaluation will be the attachment of the free end of the Agena tether to the spacecraft docking index bar in preparation for the station-keeping exercise.

To facilitate his tether-attachment activity at the TDA, Aldrin will use a pair of nylon body tethers adjustable from one and a half to three feet. They will fasten by means of pip pins placed into holes at various points around the TDA and into rings on each side of the parachute harness.

Before attaching the Agena tether to the docking bar, Aldrin will rest at the TDA. After tether attachment -- a simplified operation over Gemini 11 in that a cable with a slip loop will be passed over the bar, then drawn tight -- Aldrin will return to the spacecraft cabin area by way of the telescoping handrail. Me will hand the EVA sequence camera, mounted in operation on the bracket behind the pilot's hatch, to the command pilot and will take the work area sequence camera from the command pilot. (The 16mm work area camera is not listed in the camera data in the Experiments Section of this press kit; it is identical to the EVA sequence camera.)

Aldrin will enter the adapter prior to sunset, routing the umbilical through the umbilical guide, positioning his feet in the "overshoe" foot restraints, and mounting the work area sequence camera on the left handrail. After a rest period, he will begin his work task evaluation. The work site, measuring about 30 x 30 inches, is a panel on which is mounted hardware such as electrical and fluid connectors, hook-and-ring combinations, strips of Velcro, and fixed bolt and removable bolt.

He will work with these items using the foot restraints only, then the body tethers only to see how they help maintain his body position. Following another rest period, he will dismount the camera and fasten it to the ELSS, free the umbilical from the guide, and return to the hatch area after sunrise.

Trading sequence cameras with the command pilot and mounting the EVA camera pointed forward toward the TDA, Aldrin will return to the spacecraft nose area and go through another sequence of work tasks at a work site similar to but smaller than that in the adapter. As he did during his first activity at the TDA, Aldrin will use the waist tethers to help maintain control of his body position. At the completion of these tasks, he will return to the cabin area, jettison the telescoping handrail, retrieve the EVA sequence camera, and enter the cabin to end the umbilical EVA at about 44:40 GET west of Mexico.

Station-keeping Exercise

About 47:10 at sunrise over Carnarvon, the spacecraft will undock from the Agena and translate up to draw the Dacron web tether out of the TDA storage bag. The spacecraft will be positioned above the Agena so that the longitudinal axis points through that of the Agena toward the center of the Earth. If the crew can successfully establish a relative rate between the spacecraft and the Agena of 1/10 fps, a gravity gradient situation will have been established. The vehicles will remain aligned and pointed toward the center of the Earth as they circle the Earth. The exercise will be continued for about five hours. The spin-up technique used by Gemini 11 is not planned by Gemini 12.

Solar Eclipse Phasing

Before the sleep period, the crew will initiate a phasing maneuver designed to place the spacecraft in a position for photography of the solar eclipse on Saturday. Magnitude and direction of the maneuver will be determined in real time from ground data on the spacecraft trajectory.

Second Standup EVA

Photographic coverage of the solar eclipse will be attempted only if it does not conflict with the rest of the mission. The optimum position for eclipse photography from the spacecraft will be over Galapagos at 63:48 GET.

Aldrin will begin his standup EVA about 63:20 GET with jettisoning of unnecessary EVA equipment. He will then photograph the solar event with the 16 mm sequence camera mounted on the retro adapter bracket behind the pilot hatch. Camera data: 25mm f.95 lens at 1/50 shutter speed; Eastman S085 black and white film, ASA 6000, at 16 frames per second. The Maurer 70mm camera with UV lens and film back will be mounted on the hatch bracket and operated by the cable release. The command pilot window 16mm sequence camera will expose color film at 1 frame per second.

The standup EVA will end about 64:00 GET.

Retrofire and Reentry

Retrofire is scheduled at 94:00:41 over the Pacific near Hawaii. Reentry guidance will be in the automatic mode used on Gemini 11. The spacecraft onboard computer will use data from the inertial guidance system (IGS) to calculate guidance commands and feed them to the spacecraft propulsion system. The crew will monitor the system during the automatic portion of reentry and will take control of the reentry procedures if necessary.

Splashdown should occur at 94:37 GET in the West Atlantic recovery area 59-1.

EXPERIMENTS

Of the 114 experiments that will fly in Gemini 12, two are new: Sodium Cloud Photography (S-015) and Manual Midcourse Navigation (T-2).

The complete list of Gemini 12 experiments is:

1. D-l0 Ion Sensing Attitude Control
2. T-2 Manual Midcourse Space Navigation
3. M-4O5 (MSC-3) Tri-Axis Magnetometer
4. M-408 (MSC-6) Beta Spectrometer
5. M-409 (MSC-7) Bremsstrahlung Spectrometer
6. S-3 Frog Egg
7. S-5 Synoptic Terrain Photography
8. S-6 Synoptic Weather Photography
9. 5-10 Micrometeoroid Cratering
10. 8-11 Airglow Horizon Photography
11. S-l2 Micrometeoroid Collection
12. 8-13 UV Astronomical Camera
13. S-29 Earth-Moon Libration Region Photography
14. 8-051 Sodium Cloud Photography

Description of each experiment follows:

D-l0 Ion Sensing Attitude Control

Purpose - To investigate determination of spacecraft attitude in yaw and pitch from measurement of ion flow variations. The recording of ion sensor outputs during pitch and yaw maneuvers will be compared with data obtained from the inertial guidance system and the horizon scanner. Results of the comparison and the astronaut evaluation will form the basis for further development of simple, lightweight orbital attitude determination systems.

Equipment - Two independent but identical systems are used, one for the measurement of pitch and one for yaw. Each set of sensors is mounted on a boom approximately three feet in length which is extended on command by the astronaut.

Weight (Total System)	140 lbs.
Sensors (Each)	
Weight	7 lbs.
Size	11″ x $6^{1/2}$″ x 6

Procedure - The simultaneous deployment of the two booms, followed by pyrotechnic release of the sensor package covers is accomplished by one of the astronauts by activating a cabin switch. A second switch is used to turn the experiment on and subsequently to direct the sensor outputs to the pilot's Flight Director Indicator (FDI).

Propellant Requirement - 17 pounds

Experimenters - Dr. Rita Sagalyn, Upper Atmosphere Physics Lab., AFCRL, Office of Aerospace Research and Maj. R. J. Hamborsky, Space Systems Division Detachment 2, NASA Manned Spacecraft Center.

T-2 Manual Midcourse Space Navigation

Purpose - To evaluate the ability of an astronaut to measure, using a hand-held sextant, the angle between various celestial bodies from on-board the stabilized Gemini spacecraft. The experiment will be conducted in a manner to provide (1) maximum benefit to Apollo spacecraft technology, and (2) Information to aid design of a simplified navigation system for future spacecraft.

Equipment - Hand-held sextant.

Experimenter - D. W. Smith and B. Y. Creer, Ames Research Center.

Propellant Requirement - 38 pounds

M-405 (MSC-3) Tri-Axis Magnetometer

Purpose - To monitor the direction and amplitude of the Earth's magnetic field with respect to an orbiting spacecraft.

Equipment - An adapter mounted tri-axis fluxgate magnetometer.

Procedure - The astronaut will operate the experiment as the spacecraft passes 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.

Experimenter - W. D. Womack, MSC

Propellant Requirement - None

Note: Also flown on Gemini 4, 7, 10

M-408 (MSC-6) Beta Spectrometer

Purpose - Prior to the Apollo missions it will be necessary to predict, as accurately as possible, the radiation doses to which the astronauts will be subjected so that the degree of hazard can be assessed for each mission and preventive measures taken. The Beta Spectrometer experiments will provide accurate data on the electron source term. This source term data will be an input to computer calculations for dose due to secondary X-ray emission.

Equipment - The spectrometer is mounted in the adapter equipment section. The mounting is such that the axis of the electron cone is normal to the plane of the outward face of the detector.

Procedures - Since the experiment will detect electrons in the Gemini orbit, operation during launch and retro phases is not required. The bulk of data to be collected will originate in the South Atlantic anomaly region, an area bounded approximately by 15 degrees south and 55 degrees south geodetic and 30 degrees east, 60 degrees west geodetic. Operation while in this area is of prime importance. The experiment will be turned on every time the spacecraft passes through any portion of this region and in addition, will be left on for three continuous orbits to gather background data outside the anomaly.

Experimenter - J. Marbach, MSC

Propellant Requirement - 2 pounds

Note: Also flown on Gemini 10

M-409 (MSC-7) Bremsstrahlung Spectrometer

Purpose - When a spacecraft passes through a region of high free electron concentration an interaction takes place between the vehicle structure and the electrons, producing a continuous x-ray spectrum. This experiment is designed to measure the bremsstrahlung flux as a function of energy immediately behind the vehicle when the vehicle passes through the South Atlantic anomaly, as well as electron flux within the spacecraft.

Equipment - The bremsstrahlung spectrometer consists of an x-ray detection system mounted on the inner wall of the pressurized cabin.

Procedure - The only experimental procedure is turning the spectrometer on and off at the correct time.

Experimenter - R. Lindsey, MSC

Propellant Requirement - None

Note: Also flown on Gemini 10

S-3 Frog Egg Experiment

Purpose - To study the effect of sub-gravity on a biological system known to be sensitive to disorientation with respect to gravity. Sub-gravity may provide a particularly useful instrument for the extension of our knowledge of terrestrially influenced vertebrate embryology.

Equipment - Hardware consists of one unit mounted on the right hatch. The unit contains four two-celled chambers; one is the egg cell, the other the fixative (formalin) cell. These will be manipulated to actuate fixation at critical stages of development.

Procedure - Rana pipens eggs will be fertilized as close to launch time as possible and maintained in the flight hardware at 6 to 10 degrees C until launch. At launch the temperature will be raised, with an electrical heating coil, to approximately 22 degrees C so that development can proceed.

Experimenter - Dr. R. S. Young -- Ames

Propellant Requirement - None

Note: Also flown on Gemini 8

S-5 Synoptic Terrain Photography

Purpose - To improve and extend the techniques of synoptic geographic and topographic aerial photography up to orbital altitudes.

Equipment - 70 mm Maurer camera, film magazine, 80 mm lens.

Procedures - Photographs will be taken of typical physiographic features of the terrain for which information is known or is readily obtainable such as folded mountains, volcanic fields, major fault zones, impact craters, and cratonic areas.

Experimenter - Dr. Paul Lowman, Goddard

Propellant Requirement - 10 pounds

Note: Also flown on Gemini 4, 5, 6, 7, 10, 11

S-6 Synoptic Weather Photography

Purpose - To learn more about the Earth's weather systems as revealed by the details contained in selective, high quality, color cloud photographs.

Equipment - Same as S-5

Procedure - Photographs will be taken of weather systems for comparisons with lower resolution, higher altitude television pictures from meteorological satellites to advance the present state of knowledge. Photographs will be taken in a wide range of categories which might best be located by the pilots from their own knowledge of weather analysis and which unexpectedly appear near the flight path or which may be suggested by meteorological experts utilizing world-wide information.

Experimenter - Kenneth Nagler, U. S. Weather Bureau

Propellant Requirement - 10 pounds

Note: Also flown on Gemini 4, 5, 6, 7, 10, 11

S-10 Micrometeoroid Cratering Experiment

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

Equipment - A two-piece aluminum box on the Agena which hinges on a stainless steel rod. The inside provides area for eight surfaces consisting of polished metals, polished glass, and special surfaces designed to capture the small particles intact.

Procedures - The samples will be collected by exposing controlled surfaces to the ultrasmall particles which make up the majority of the meteoroid environment of near-Earth space. From these samples, the nature and frequency of high velocity micrometeoroid impacts under flight conditions can be studied.

Experimenter - Dr. Curtis Hemenway, Dudley Observatory

Propellant Requirement - None

Note: Also flown on Gemini 8, 9, 10

S-11 Airglow Horizon Photography

Purpose - To photograph the night airglow layer which, from orbiting altitudes, can be seen as a narrow bright .band lying above the nighttime horizon.

Equipment - Parts of the Maurer 70 mm General Purpose Camera have been specially designed to carry out the airglow horizon photography. Because of the faintness of the airglow layer, a lens of large relative aperture, plus fast black-and-white film are used.

Procedure - The optical sight is installed in the left-hand window, the mounting bracket in the right-hand window. The experiment is conducted by photographing the horizon in a specific manner. This will result in the airglow layer being observed “edge on" and photographed as a "layer" or thin bright line lying some distance above the terrestrial horizon.

Experimenter - Martin Kooman, U. S. Navy Research Lab.

Propellant Requirement - 24 pounds docked, 12 pounds undocked

Note: Also flown on Gemini 9, 11

S-12 Meteoroid Collection

Purpose - (1) To collect ultra-small meteoroids in near Earth space to study the nature and frequency of hyperballistic impacts under flight conditions, (2) to expose microbiological specimens to the space environment to determine their ability to survive the vacuum, extreme temperatures, and radiation, and (3) to search for any organisms capable of living on micrometeoroids in space.

Equipment - Aluminum collection box, 11 inches long by 5.5 inches wide by 1.25 inches deep, weighing 7 pounds, 6 ounces. The device has two collection compartments, an internal electric motor, and thermally insulated batteries. The collection compartment materials are aluminum-shadowed, 200 Angstrom thick nitrocellulose and formvar mounted on 200-mesh copper screening. They are the same collection materials used by the experimenters in previous rocket, balloon, and aircraft sampling experiments.

Procedure - The experiment is mounted on the retro adapter directly behind the pilot's hatch. The hinged lid will be opened and closed and locked by ground command. It is planned to open the experiment only during the first eight-hour crew sleep period when the spacecraft is in drifting flight to avoid contamination by the spacecraft OAMS system. One of the compartments will be sterilized to determine the presence or absence of micro-organisms in the meteoroids collected. When returned to the laboratory, cultures designed for non-terrestrial organisms will be prepared to determine if any types of life are present in the sample. A set of representative Earth micro-organisms such as bacteria, molds, and spores will be placed in the non-sterile compartment. They will be quantitatively assayed after the flight exposure to determine the fractions which survive.

Experimenter - Dr. C. Hemenway, Dudley Observatory, Albany, N. Y.

Propellant Requirement – None

Note: Also flown on Gemini 9, 10.

S-13 UV Astronomical Camera

Purpose - Primarily to devise and test techniques of ultraviolet photography and spectroscopy under vacuum conditions. To investigate the distribution of light intensity in the ultraviolet portions of stellar spectra down to a limit of 200 A. Also to explore the ultraviolet spectra of 0 and B stars and some of the planets.

Equipment - 70 mm Maurer camera with 73 mm f3.3 UV Mauer lens, an objective prism and grating.

Procedure - The spacecraft is oriented toward the star field to be photographed. The cabin will be depressurized and the hatch opened. The camera will be positioned manually and guided by the pilot. A defraction grating will be used to obtain spectrograms of the desired stars and planets.

Experimenter - Dr. Karl Henize, Dearborn Observatory

Propellant Requirement - 19 pounds

Note: Also flown on Gemini 10, 11

S-29 Photographic Study of Earth-Moon Libration Regions

Purpose - To investigate by photographic techniques the libration points of the Earth-Moon system to determine the possible existence of clouds or particulate matter orbiting the Earth in these regions.

Equipment - Maurer 70 mm camera with 50 mm lens (f/o.95) extended shutter actuator, and the S-11 mounting bracket.

Procedure - The L4 and L5 libration regions are the La Grangian points of stable equilibrium where centrifugal forces balance gravitational forces. They are located 60 degrees ahead of aid 60 degrees behind, respectively, the Moon in its orbital path. The libration points will be photographed during two separate orbits of the spacecraft. The points will be photographed during one orbit early in the mission and the same sky areas will be re-photographed during an orbit near the end of the mission.

Experimenter - Elliott Morris, USGS
Propellant Requirement - 8 pounds docked, 4 pounds undocked

Note: Scheduled on Gemini 11, not conducted because launch date slipped.

S-051 Sodium Cloud Photography

Purpose - To measure the daytime wind velocity vector of the high atmosphere as a function of altitude between 62 and 93 miles. The measurements will be obtained from the deformations of a rocket-made vertical sodium cloud.

Equipment - Maurer 70 mm camera with f/0.95, 50 mm lens, special objective filter, and goggles.

Procedures - A rocket will be launched from Hammaguir, Algeria, in front of the Gemini spacecraft to eject sodium vapor from 37 to 97 miles altitude during the ascent and descent. The vapor, whose optical resonance will be excited by the solar yellow light, will be visible from the spacecraft as a faint yellow cloud. A series of pictures of the cloud will be taken from the spacecraft. From a couple of pictures taken about 19 miles apart the detailed tridimensional shape of the cloud at a given time can be obtained by stereogrammetric recombination. This pair of pictures has to be taken with an interval of from 3 to 5 seconds. From a second identical pair of pictures taken some time later, the tridimensional configuration of the cloud will again be obtained. A comparison of the state of the cloud at different times will give the wind velocity in the atmosphere at all relevant altitudes, supposing that only horizontal winds exist.

Experimenter - Jacques-Enille Blamont, Scientific and Technical Director, National Center of Space Studies, France

Propellant Requirement - 3 pounds

CAMERAS

On-board cameras for various experiments and for operational photography on Gemini 12 are:

1. Maurer 70 mm still camera with three lenses and seven magazines. The camera was developed for space photography by J. A. Maurer Inc., Long Island City, New York. The camera body is aluminum; lenses and magazines are matched to specific focal plane distances and are color coded for easy matching. Carbon dioxide gas, contained in a capsule within the camera, insures flattening of film against machined, curved platen.

   Lenses:
   1. Standard 3-inch focal length, f2.8
   2. Ultraviolet 73 mm, f3.3
   3. Low-light 50 mm, fO.95

   Film:
   1. Eastman SO-368 color, ASA 64, for experiments S-5 and S-6.
   2. Eastman 103-D black and white thin base, ASA 3000, for experiment S-11.

3. Eastman 1-0, spectrographic black and white thin base, ASA 1600, for S-13 and M-407

4. Eastman S0-166 black and white thin base, ASA 6000

2. Hasselblad 70 mm still camera with one lens and several magazines. The camera is a standard commercial model single lens reflex.

Lens: 80 mm Zeiss Planar, f2.8
Film: Eastman SO-368 color, sprocketed to give 50 exposures.

3. Two Maurer 16 mm motion picture cameras with three lenses and variable-speed drive.

Lenses:
1. 75 mm focal length, f2.5
2. 18 mm, f2, 40 x 30 degree field
3. 5 mm, f2, 118 x 78 degree field, used for EVA

Shutter: Shutter speeds 1/50, 1/100, 1/200 and 1/250 with frame rates of 1, 6, and 16 fps

Film: Eastman SO-368 color, 80 feet per magazine

CREW PROVISIONS AND TRAINING

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 crew procedures development trainer, spacecraft boilerplate model, and actual recovery equipment and personnel. Pad emergency egress training using elevator and slide wire, and breathing apparatus.

3. Celestial pattern recognition in the University of North Carolina's Morehead Planetarium at Chapel Hill.

4. Zero gravity training in KC-135 aircraft to practice EVA. Stowage and donning of EVA equipment is done in aircraft and crew procedures trainer.

Additional EVA training is performed in 20-foot chamber at vacuum conditions.

5. Suit, seat and harness fittings.

6. Training sessions totaling approximately 15 hours per crew member on the Gemini translation and docking simulator.

7. Detailed Agena and Gemini 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.

9. Ejection seat training.

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-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 12 Suits

The pressure suit worn by the command pilot will be similar to suits worn on all Gemini flights except 3 and 6. The pilot will wear a suit with special thermal protective cover layers for EVA activities.

Command Pilot Suit

The Gemini command pilot's suit has five layers and weighs 23 pounds. The layers are, starting inside the suit:

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 nylon link net to restrain pressure garment and maintain its shape.

5. White HT-1 nylon outer layer.

Pilot Suit

The pressure suit worn by the Gemini 12 pilot is identical to the command pilot's suit with the following exceptions:

Thermal protection for the hands is built into the basic suit glove -- no EVA thermal over-gloves will be worn.

The EVA coverlayer is a lay-up consisting of, from inside to outside layer: micrometeoroid protection, super insulation, and HT-1 nylon outer protective layer.

The extravehicular suit weighs 33 pounds.

For extravehicular activity, the pilot will wear a detachable overvisor which has attachment 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 meteoroid protection. The outer visor is goldcoated and provides protection for the eyes from solar glare.

When the cabin is depressurized, the suits automatically pressurize to 3.7 pounds per square inch to provide pressure and breathing oxygen for both crew members.

Extravehicular Life Support System (ELSS)

It is a 142-pound rectangular box which is worn on the chest. It provides electrical, mechanical and life support connections between the EVA astronaut and the spacecraft. The system is 18 inches high, 10 inches wide and 6 inches deep. It contains an ejector pump for circulation, a heat exchanger for cooling air, and a 30-minute emergency oxygen supply. Controls and a warning system for the emergency oxygen supply are mounted on the top of the unit. The ELSS functions as a suit pressurization and air supply system during EVA.

Medical Checks

At least one medical check will be made each day by each crew member. Performed over a convenient ground station, a check will consist of: oral temperature and 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 box and brought back for analysis.

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

Water Measuring System

A mechanical measuring system has been added to 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 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 -- 13 per astronaut for mission.

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

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 12 Menu

Day 1: Meal A	Calories
Applesauce	139
Sugar Frosted Flakes	139
Bacon Squares	180
Cinnamon Toast	56
Cocoa	190
Orange Drink	83
	787

Day 1: Meal B	
Pea Soup	220
Tuna Salad	214
Cinnamon Toast	56
Date Fruitcake	262
Pineapple-grape-fruit drink	83
	835

Day 1: Meal C	
Beef Pot Roast	119
Potato Salad	143
Cinnamon Toast	56
Chocolate Pudding	307
Brownies	241
Tea	32
	898

Day 2: Meal A	
Applesauce	139
Sugar Frosted Flakes	139
Bacon Squares	180
Cinnamon Toast	56
Cocoa	190
Orange Drink	83
	757

Day 2: Meal B	
Beef/Vegetables	98
Meat/Spaghetti	70
Cheese Sandwiches	158
Apricot Pudding	300
Gingerbread	183
Grapefruit Drink	83
	892

Day 2: Meal C	
Pea Soup	220
Tuna Salad	214
Cinnamon Toast	56
Date Fruitcake	262
Pineapple-grape-fruit drink	83
	835

Day 3: Meal A	Calories
Peaches	98
Strawberry Cereal Cubes	171
Sausage Patties	223
Cinnamon Toast	56
Orange Drink	83
Grapefruit drink	83
	711

Day 3: Meal B	
Potato Soup	220
Chicken Salad	237
Beef Sandwiches	138
Butterscotch Pudding	311
Tea	32
	938

Day 3: Meal C	
Shrimp Cocktail	119
Beef and Gravy	160
Creamed Corn	105
Toasted Bread Cubes	161
Pineapple Fruitcake	253
Orange-grapefruit drink	83
	881

Day 4: Meal A	
Fruit cocktail	87
Toasted Oat Cereal	91
Bacon Squares	180
Ham/Applesauce	127
Cinnamon Toast	56
Orange Drink	83
Pineapple-grape-fruit drink	83
	707

Day 4: Meal B	
Shrimp Cocktail	119
Chicken/Gravy	92
Toasted Bread Cubes	161
Pineapple Fruitcake	253
Coconut Cubes	206
Orange-Grapefruit Drink	83
	914

Day 4: Meal C	
Beef/Vegetables	98
Meat/Spaghetti	70
Cheese Sandwiches	158
Apricot Pudding	300
Gingerbread	183
Grapefruit Drink	83
	892

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MANNED SPACE FLIGHT TRACKING NETWORK GEMINI 12 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 12, the network will provide flight controllers:

(1) Radar tracking, command control, voice and telemetry data from launch through Gemini spacecraft splashdown. Except for voice communications, the network provides the same functions for the Agena as long as electrical power is available.

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

Real Time Computer Complex (RTCC)

The RTCC at the Manned Spacecraft Center is responsible for the control of the entire mission. The RTCC collects, stores, processes, sends, and displays the necessary computer support information required by the flight controllers at the Mission Control Center (MCC).

During the launch phase, the RTCC receives launch trajectory and telemetry data from the various sites and stores and processes this information for command and control of the mission. This telemetered information consists of bio-medical, environmental, electrical, command maneuvering, and other spacecraft systems parameters. This information is displayed at the various flight controllers consoles in the MCC where the necessary decisions are made. The flight controllers use the information to determine voice messages or computer commands to the spacecraft.

Tracking

The mission requires separate tracking of four vehicles: the Gemini spacecraft, the Agena target vehicle, Gemini launch vehicle (GLV), and as required, the Atlas Standard Launch Vehicle (SLV). The Agena carries one C-band and one S-band beacon. Skin tracking of the spacecraft, Agena and Gemini launch vehicle throughout orbital lifetime is a mission requirement. The MSFN Wallops Station (WLP) Space Range Radar (SPANDAR) and facilities of the North American Air Defense Command (NORAD) will be used. However, NORAD will not track during rendezvous phase.

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Spacecraft tracking will be according to individual station capability. Some sites have radar systems capable of providing space position information on both the Gemini and Agena simultaneously through their Verlort (S-band) and FPS-16 or FPQ-6 (C-band) antennas. Data transmission links, however, have only a single system capability; therefore, priority is established by the Flight Director or Flight Dynamics Officer according to their needs.

During the first revolution of the Agena (prior to Gemini spacecraft liftoff), all stations will track this vehicle to establish its position as accurately as possible. After Gemini spacecraft liftoff, as a general rule, the C-band radars will track the Gemini spacecraft while the S-band radars will track the Agena target vehicle. The sites with dual-tracking capability will track both vehicles simultaneously.

Goddard Space Flight Center Computer Support

NASA's Goddard Space Flight Center, Greenbelt, Md., real-time computing support for Gemini includes the processing of real-time tracking information beginning with mission simulations through Gemini spacecraft recovery and Agena lifetime.

Goddard's computer certifies the worldwide network's readiness to support Gemini through a system-by-system, station-by-station, computer-programmed check-out method called CADFISS (Computation and Data Flow Integrated Subsystem).

Gemini Spacecraft

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

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. 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

All network sites receive real-time acquisition messages (pointing data) from the Real Time Computing Center at MSC, Houston. This information is used to position telemetry and radar antennas for acquisition of RF signals from the spacecraft when they appear over the horizon. Most sites also have an acquisition aid system which permits "slaving" the radar antennas to the telemetry antennas or vice versa. Since the telemetry antennas have a much broader beamwidth than the radar antennas, they may acquire the spacecraft RF signal first, making it possible to point the radar antennas in the general vicinity of the spacecraft to allow rapid radar acquisition.

Mission Message Requirements

Low speed telemetry data (on-site teletype summaries) from flight controller manned stations are 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 in computer format. MCC-K/TEL III, Grand Bahama Island, Grand Turk Island, and Antigua 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) at key stations throughout the worldwide network. Command control of the mission from launch through recovery is provided by the Flight Director at Houston.

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 initiate all uplink data command transmissions.

Following astronaut recovery, further commands will be sent 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 are not manned by flight controllers. Uplink data command transmissions through these sites will be remoted in real time from Houston Control Center.

In addition to real-time commands and onboard 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 are controlled either by the station or by remote (tone) keying from Houston and Goddard.

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

Cape Kennedy; Grand Bahama Island; Tannanrive, Malagasy Republic; Kano, Nigeria; Bermuda; Grand Turk Island; Pt. Arguello, Calif.; Antigua Island; Ascension Island; Canton Island; USNS Wheeling, and the voice relay air-craft.

Spacecraft Systems Support

The Gemini spacecraft communications systems (antennas, beacons, voice communications, telemetry transmitters, recovery light, and digital command) 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, TM systems data transmission, and postlanding and recovery data transmission. The sole link between the ground and the spacecraft is by these systems.

The Agena target vehicle communications systems (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 system.

Agena Target Vehicle On-Board Systems Support by Network Stations

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

Gemini Spacecraft On-Board Systems Support by Network Stations

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 (Telemetry Readouts)
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 11 will be used for Gemini 12. Shore stations for USNS Rose Knot and USNS Coastal Sentry ship support are based upon the mission-designated ship positions and predicted HF radio propagation conditions.

Network Responsibility

Manned Spacecraft Center (MSC). 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 arid Data Acquisition has centralized the responsibility for the planning, implementation, and technical operations of Goddard Space Flight Center.

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.

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

NETWORK CONFIGURATION

Stations \ Systems	C-Band Radar	S-Band Radar	Telemetry Receive & Record	Telemetry Real Time Display	Low Speed (TTY) Telemetry Data Transmission	Wide Band Data	High Speed Data	On Site Data Process & Summary	Gemini Launch Vehicle Telemetry	Gemini Launch Vehicle Command	Digital Command System	Voice - Transmit & Receive	Teletype - Transmit & Receive	Flight Control Team Manned	Spacecraft Acquisition Aid System	Skin Track
Mission Control, Houston (MCC-H)				X				X			X	X	X	X		
Mission Control, Kennedy (MCC-K)			X	X		X			X	X	X	X	X		X	
Merritt Island, Fla. (MLA)	X															X
Cape Kennedy, Fla. (CNV)	X	X	X			X			X	X	X	X	X		X	
Patrick AFB, Fla. (PAT)	X												X			X
Grand Bahama Island (GBI)	X	X	X			X			X	X	X	X	X		X	X
Grand Turk Island (GTI)	X	X	X			X			X	X	X	X	X		X	X
Bermuda (BDA)	X	X	X				X				X	X	X		X	
Grand Canary Island (CYI)	X	X	X	X	X			X			X	X	X	X	X	
Kano, Nigeria (KNO)			X									X	X		X	
Tananarive, Malagasy (TAN)			X									X	X		X	
Pretoria, South Africa (PRE)	X												X			
Carnarvon, Australia (CRO)	X	X	X	X	X			X			X	X	X	X	X	X
Woomera, Australia (WOM)	X												X			
Canton Island (CTN)			X									X	X		X	
Kauai, Hawaii (HAW)	X	X	X	X	X			X			X	X	X	X	X	
Guaymas, Mexico (GYM)		X	X	X	X			X				X	X	X	X	
Pt. Arguello, Calif. (CAL)	X	X	1									X	X		X	
White Sands, N. M. (WHS)	X												X		X	X
Eglin, Fla. (EGL)	X												X		X	X
Antigua Island (ANT)	X		X			X			X	X	X	X	X		X	X
Ascension Island (ASC)	X		X									X	X		X	X
Coastal Sentry Quebec (CSQ)			X	X	X			X			X	X	X	X	X	
Rose Knot Victor (RKV)			X	X	X			X			X	X	X	X	X	
Range Tracker (RTK)	X											X	X			X

1. Last two passes prior to reentry.

ABORT AND RECOVERY

Crew Safety

Every Gemini system affecting crew safety has a backup feature. The Malfunction Detection System aboard the launch vehicle warns the crew of a 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 — Retrorockets salvo fired after engine shutdown is commanded.

MODE III — Normal separation from launch vehicle using OAMS thrusters, then 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, 3 by 5 feet, with CO2 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 transmission and 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: planned, where recovery forces are pre-positioned to recover spacecraft and crew within a short time, and contingency, requiring special search and rescue techniques and a longer recovery period.

Planned Landing Areas

PRIMARY	West Atlantic where the primary recovery aircraft carrier is pre-positioned.
SECONDARY	East Atlantic, West Pacific and Mid-Pacific areas where ships are deployed.
LAUNCH SITE	Off-the-pad abort or 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	Abort during powered flight, extending from 41 miles at sea from Cape Kennedy to west coast of Africa.

Contingency Landing Areas

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

Recovery forces are provided by the military services under the operational control of the Department of Defense Manager for Manned Space Flight Support Operations.

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 $7^{1/2}$ 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 is between R&R and cabin sections and 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 the 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 is $7^{1/2}$ 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.

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

Electric Power Systems

Gemini 12 will carry two fuel cells for the primary power supply during launch and orbital flight. The cells consist of three stacks of 32 individual cells. Cryogenic liquid oxygen and hydrogen react to produce electrical energy.

Four 45-amp-hour batteries will also be carried in the spacecraft to insure a continuous power supply during reentry and landing. They also will 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 separations during the mission.

Propellant
Usable: 917 pounds. Budgeted, no dispersions: 620 pounds.

Rendezvous Radar

Purpose -- to measure range, range rate, and bearing angle to Agena so crew can determine maneuvers necessary for rendezvous.

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

Size -- less than two cubic feet.

Weight -- less than 70 pounds.

Power Requirements -- less than 80 watts.

Auxiliary Tape Memory (ATM) -- The auxiliary tape memory is a 15-track magnetic tape recorder which stores 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 for external storage of computer programs. The computer has onboard 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 magnetic tape. The magnetic tape is driven by the endless, seamless 3/4-inch wide mylar belt. The peripheral drive belt is in turn driven by two capstans coupled by mylar belts. By not exposing the magnetic tape to drive stresses, its useful life is extended.

The unit weighs 26 pounds, contains 700 cubic inches, and uses approximately 18 watts. The A is built by Raymond Engineering Laboratories, Middletown, Conn., under contract to the International Business Machines, Electronics Systems Division, Owego, N.Y., for the prime Gemini Contractor, McDonnell Aircraft Corp.

Gemini Launch Vehicle

The Gemini Launch Vehicle 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 (one engine, two nozzles)	100,000 pounds (one engine)
FUEL	Aerozine 50 – half-and-half blend of hydrazine and unsymmetrical diniethyl-hydrazine (UDMH).	
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. Malfunctions 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, Air Force Systems Command.

Agena Target Vehicle

The Agena target vehicle for Gemini 12 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 crew.

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	Primary propulsion
	400 pounds	Secondary Engines, Unit II
	32 pounds	Secondary Engines, Unit I
Fuel	UDMH (Unsynnnetrical Dlmethyl 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 orbit 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.

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

Atlas Launch Vehicle

The Atlas Standard Launch Vehicle 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 $1^{1/2}$-stage Standard Launch Vehicle, igniting all three main engines on the pad, then dropping off the two outboard booster engines at staging, allowing the single sustainer engine to continue thrusting at altitude, aided by two small vernier engines.

Height	77 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	Two booster (outer) engines
	247,000 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.	

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 12 mission include:

1. Special autopilot system for rendezvous mission.

2. Improved propellant utilization system to assure simultaneous depletion of both fuel and 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, Air Force Systems Command.

CREW BIOGRAPHIES

NAME: James A. Lovell, Jr.

BIRTHPLACE AND DATE: Cleveland, Ohio, March 25, 1928.

EDUCATION: Bachelor of Science degree from the United States Naval Academy.

MARITAL STATUS: Married to the former Marilyn Gerlach of Milwaukee, Wisconsin.

CHILDREN: Barbara L., October 13, 1953; James A., February 15, 1955; Susan K., July 14, 1958; Jeffrey Carl, January 114, 1966.

SPECIAL AWARDS: NASA Exceptional Service Medal and Navy Astronaut Wings. American Astronautical Society, Flight Achievement Award.

EXPERIENCE: Lovell, a Navy captain, received flight training following 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, University of Southern California.

He served as flight instructor and safety officer, Fighter Squadron 101 at the Naval Air Station, Oceana, Va. Lovell has logged 3,300 hours flying time, including more than 2,200 hours in jets.

CURRENT ASSIGNMENT: Lovell was selected as an astronaut by NASA in September 1962. In addition to participating in the astronaut training program, he has performed special duties, including monitoring design and development of recovery and crew life support systems. Lovell was pilot of the history-making Gemini 7 mission, which was launched December 4, 1965, and splashed down after 330 hours and 35 minutes, establishing a number of space "firsts": longest manned space flight; first rendezvous of two manned maneuverable spacecraft as Gemini 7 was joined in orbit by Gemini 6; longest multi-manned space flight, and numerous technical and medical experiments. Lovell previously was backup pilot for the second manned Gemini space mission, and backup command pilot for Gemini 9.

NAME: Edwin E. Aldrin, Jr.

BIRTHPLACE AND DATE: Monclair, N.J., January 20, 1930.

EDUCATION: Bachelor of Science degree from the U.S. Military Academy, 1951; and Sc.D. degree in astronautics from Massachusetts Institute of Technology, 1963.

MARITAL STATUS: Married to the former Joan A. Archer of Hohokus, New Jersey.

CHILDREN: James M., September 2, 1955; Janice R., August 16, 1957; Andrew J., June 17, 1958.

SPECIAL AWARDS: Distinguished Flying Cross, and the Air Medal with two oak leaf clusters; Group Achievement Award for Rendezvous and Operations Planning Team.

PROFESSIONAL SOCIETIES: Member, American Institute of Aeronautics and Astronautics; Sigma Gamma Tau, aeronautical engineering society; and Sigma Xi, national science research society.

EXPERIENCE: Aldrin, a major, U.S. Air Force, received his wings at Bryan, Tex., in 1952.

He flew 66 combat missions in F-86 aircraft in Korea with the 51st Fighter Interceptor Wing. Aldrin was credited with two MIG-15's destroyed and damaged.

He served a tour as aerial gunnery instructor at Nellis AFB, Nev.; then attended the Squadron officers’ School, Air University, Maxwell AFB, Ala.

Following a tour as administrative assistant to the Dean of Faculty, U.S. Air Force Academy, Aldrin flew F-100's as a flight commander with the 36th Tactical Fighter Wing at Bitburg, Germany.

After completing his work at MIT, where his doctoral thesis concerned guidance for manned orbital rendezvous, he was assigned to the Gemini Target Office of the Air Force Space Systems Division, Los Angeles.

While there, he was member of the special study group which made recommendations concerning Air Force participation in the NASA Gemini Program. He was later transferred to the USAF Field Office at the Manned Spacecraft Center, which is responsible for integrating DOD experiments into the NASA Gemini flights.

Aldrin has logged 2,850 hours flying time, including 2,450 hours in jets.

CURRENT ASSIGNMENT: Aldrin was one of the third group of astronauts named by NASA in October 1963. In addition to participating in the astronaut training program, his specific area of responsibility is mission flight planning for Gemini and Apollo flights. He has played a key role in the formulation of mission profiles for the early Gemini rendezvous flights. He was the designated backup pilot for the Gemini 9 mission.

NAME: L. Gordon Cooper, Jr.

BIRTHPLACE AND DATE: Shawnee, Okla., March 6, 1927.

EDUCATION: Bachelor of Science degree in aeronautical engineering, Air Force Institute of Technology.

MARITAL STATUS: Married to the former Trudy Olson of Seattle.

CHILDREN: Camala, November 16, 1948; Janita, March 15, 1950.

SPECIAL AWARDS: NASA Distinguished Service Medal and USAF Astronaut Wings; NASA Exceptional Service Medal and USAF Command Astronaut Wings; Firefly Club Award.

EXPERIENCE: Cooper, a colonel, U.S. Air Force, received an Army commission after completing three years of schooling at the University of Hawaii. He was transferred to the Air Force and went on extended active duty in 1949 and was given flight training.

Cooper was assigned to the 86th Fighter Bomber Group in Munich, Germany, where he flew F-84's and F-86's for four years. While in Munich, he attended the European Extension of the University of Maryland.

Returning to the United States, he studied for two years at the Air Force Institute of Technology.

After graduation from AFIT, Cooper attended the Air Force Experimental Flight Test School, Edwards AFB, Calif. He was graduated from this school in April 1957, and was assigned to the Performance Engineering Branch of the Flight Test Division. He flew experimental fighter aircraft as a test pilot.

Cooper has logged more than 3,000 hours flying time, including more than 2,000 hours in jets.

CURRENT ASSIGNMENT: Cooper was one of the seven Project Mercury astronauts named by NASA in April 1959. On May 15-16, 1963, he piloted "Faith 7" spacecraft on a 22-orbit mission which completed the operational phase of Project Mercury. He attained a maximum altitude of 166 miles, a speed of 17,546 miles per hour, and traveled 546,167 miles in a flight of 34 hours, 20 minutes.

As command pilot of the eight-day Gemini 5 mission, he was the first man to make a second orbital flight, and broke the Russian lead in man-hours in space by accumulating a total of 225 hours and 15 minutes. Gemini 5 flight which began on August 21 and terminated on August 29, 1965, established a record of 190 hours, 55 minutes in 120 revolutions, and covered a total of 3,338,200 miles.

NAME: Eugene A. Cernan

BIRTHPLACE AND DATE: Chicago, March 14, 1934.

EDUCATION: Bachelor of Science degree in electrical engineering from Purdue University; Master of Science degree in aeronautical engineering from United States Navy Postgraduate School.

MARITAL STATUS: Married to the former Barbara J. Atchley of Houston.

CHILDREN: Teresa Dawn, March 4, 1963.

SPECIAL AWARDS: NASA Exceptional Service Medal and Navy Astronaut Wings.

PROFESSIONAL ORGANIZATIONS: Member of Tau Beta Pi, national engineering society; Sigma Xi, national science research society; and Phi Gamma Delta.

EXPERIENCE: Cernan, a commander, U.S. Navy, received his commission through the Navy ROTC program at Purdue, and entered flight training upon graduation.

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

He has logged more than 1,900 hours flying time, more than 1,700 in jets.

CURRENT ASSIGNMENT: Cernan was named in the third group of astronauts selected by NASA in October 1963. He was pilot of the Gemini 9 mission, which began on June 3, 1966, and remained in orbit for almost three days. He spent one hour and forty seven minutes in extra vehicular activity on that flight. Rendezvous was achieved with the Augmented Target Docking Adapter by three different techniques.

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 over 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 short of planned landing area in Atlantic because spacecraft did not provide expected lift during reentry. First manned spacecraft to maneuver out of plane, alter its own orbit. Grissom, who made suborbital Mercury flight, is the 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, 56 minutes of flight. Astronaut James A. McDivitt was command pilot. Astronaut Edward H. White II was pilot, accomplished 23 minutes of extravehicular activity (EVA), using a hand-held maneuvering unit for the first time in space. Near-rendezvous attempt with GLV second stage was terminated after reaching allotted fuel limitation. Malfunction in inertial guidance system required crew to perform zero-lift reentry.

Gemini 5 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 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 7 Dec. 4-18 1965

Holds current world record for long-duration 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 7 served as target for the Gemini 6 spacecraft on the first successful rendezvous in space. In proving man's ability to operate in space for a period of up to two weeks, the crew of Gemini 7 carried out an ambitious list of 20 experiments including all medical experiments in the Gemini program, a test of laser communications from space, and visual acuity. The Gemini 7 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 7 landed in the Atlantic on Dec. 18, making a controlled reentry which brought it within 10 miles of the recovery carrier.

Gemini 6 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 l00-by-l67 mile orbit into a 185 mile circular orbit, rendezvousing with Gemini 7 over the Pacific Ocean at 5 hours, 47 minutes 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 6 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 primary propulsion system. On Dec. 12, the Gemini Launch Vehicle failed to achieve liftoff when a booster tail plug dropped out prematurely.

Gemini 8 March 16 1966

Astronaut Neil Armstrong, command pilot, and David Scott, pilot, completed the first rendezvous and docking with an Agena spacecraft launched into orbit approximately 100 minutes earlier. The planned three-day flight was terminated near the end of the sixth revolution after an electrical short circuit in the Gemini spacecraft caused continuous firing of a roll thruster. The crew undocked from the Agena and activated the reentry reaction control system to regain control of the spacecraft. The crew made a guided reentry and landed in the Pacific Ocean 500 miles east of the island of Okinawa and only approximately five miles from the aiming point. A recovery aircraft was on the scene before splashdown to parachute a recovery team to the spacecraft. The crew and spacecraft were picked up by a Navy destroyer approximately three hours after splashdown.

Gemini 9 June 3-6 1966

Three separate rendezvous with the Augmented Target Docking Adapter and a 2-hour 8-minute extravehicular activity were the primary accomplishments of the seventh manned Gemini flight. Col. Thomas P. Stafford, a veteran of the first U.S. rendezvous mission in Gemini 6, was command pilot for the 3-day flight. Eugene Cernan was pilot and performed the EVA. The flight, originally scheduled for May 17, was postponed two weeks when the Atlas booster which was launching the Agena target vehicle developed an electrical short circuit which caused its engines to gimbal hard over and abort the flight. The ATDA was substituted for the Agena and was launched on June 1. Gemini 9 did not launch when a malfunction in the Data Transmitting System, sending data to the spacecraft caused an automatic hold at T-3 minutes. Gemini 9 was launched two days later, and although the shroud had failed to separate from the ATDA which prevented any docking exercises, an initial third orbit rendezvous was achieved, followed by an equiperiod rendezvous, and a lunar abort or rendezvous from above on the following day. The EVA was postponed to the following day when Cernan spent more than one orbit outside the spacecraft. Visor fogging in his helmet forced termination of the EVA before the Astronaut Maneuvering Unit experiment could be performed. Gemini 9 landed approximately 300 yards from the planned impact point in the West Atlantic after 44 revolutions of the Earth.

Gemini 10 July 18-21 1966

Rendezvous and docking, two extravehicular activities, docked maneuvers, a dual rendezvous, and a new altitude record were the prime accomplishments of Gemini 10, the eighth manned Gemini flight. Astronauts John W. Young and Michael Collins maneuvered the docked Gemini-Agena 10 to 475 miles altitude in the course of achieving a dual rendezvous with Agena 8. Collins conducted a standup EVA and an umbilical EVA.

During the umbilical EVA, Collins used the Hand Held Maneuvering Unit (HHMU) to maneuver to Agena 8 and retrieve the attached meteoroid experiment package. In the 38 hours 47 minutes while Gemini was docked with Agenda 10, six maneuvers of the docked configuration using the Agena 10 propulsion system were successfully completed. Gemini 10 splashed down in the Atlantic after completing 43 revolutions at 70 hours 47 minutes after liftoff. Landing was within three miles of the planned landing point.

Gemini 11 Sept. 12-15 1966

Astronauts Charles Conrad and Richard Gordon, using only onboard systems, steered Gemini 11 to a direct ascent, first orbit rendezvous and docking with the orbiting Agena. After four dockings with Agena, two EVA exercises totaling 167 minutes, and a record altitude flight to 850 miles above Earth, the astronauts undocked and slowly spun the tethered Gemini-Agena vehicles in a station keeping experiment to save maneuvering fuel. The umbilical EVA was terminated early due to moisture in Astronaut Gordon's eye. The astronauts wound up the Gemini 11 mission with an Apollo-type rendezvous and the first, closed loop, automatic reentry, splashing down 2.5 to 3 miles from the primary recovery ship. Mission duration was 71 hours and 17 minutes or 44 revolutions.

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	SO		15	22		15	22
MR-4 (Grissom)		15	37	SO		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	55	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	51
Gemini 7 (Borman & Lovell)	330	35	13	206	661	10	26	1302	36	17
Gemini 6 (Schirra & Stafford)	25	51	24	15	51	42	48	1354	19	05
Gemini 8 (Armstrong & Scott)	10	42	06	6.6	21	24	12	1375	43	17
Gemini 9 (Stafford & Cernan)	72	20	56	44	144	41	52	1520	25	09
Gemini 10 (Young & Collins)	70	46	45	43	141	33	30	1661	58	39
Gemini 11 (Conrad & Gordon)	71	17	08	44	142	34	16	1804	32	55

PROJECT OFFICIALS

Dr. George E. Mueller	Associate Administrator for Manned Space Flight, NASA Headquarters; Acting Director, Gemini Program
John Edwards	Deputy Director, Gemini Programs, Office of Manned Space Flight, NASA Headquarters
William C. Schneider	Gemini 12 Mission Director, Deputy Director, Mission Operations, Office of Manned Space Flight, NASA Headquarters
Dr. Robert R. Gilruth	Director, NASA Manned Spacecraft Center, Houston
Charles W. Mathews	Gemini Program Manager, Manned Spacecraft Center, Houston
Christopher C. Kraft	Assistant Director for Flight Operations, Manned Spacecraft Center, Houston
Dr. Kurt H. Debus	Director, John F. Kennedy Space Center, Fla.
G. Merritt Preston	Deputy Mission Director for Launch Operations, John F. Kennedy Space Center, Fla.
Lt. Gen. Leighton I. Davis	USAF, National Range Division, Command and DOD Manager of Manned Space Flight Support Operations
Maj. Gen. V. G. Huston	USAF, Deputy DOD Manager of Manned Space Flight Support Operations; Commander of Air Force Eastern Test Range
Col. Robert R. Hull	USAF, Director, Gemini Launch Vehicles Directorate, Space Systems Division, Air Force Systems Command

Col. Alfred J. Gardner	USAF, Director, Gemini Target Vehicle Directorate and Agena Directorate Space Systems Division, Air Force Systems Command
Col. Otto C. Ledford	USAF, Commander 6555th Aerospace Test Wing, Space Systems Division at Air Force Eastern Test Range
Col. John G. Albert	USAF, Chief, Gemini Launch Division, 6555th Aerospace Test Wing, Space Systems Division at Air Force Eastern Test Range
Lt. Col. L. E. Allen, Jr.	USAF, Chief, Atlas Division, 6555th Aerospace Test Wing, Space Systems Division at Air Force Eastern Test Range
R. Adm. William C. Abhau	USN, Commander Task Force 140 Primary Recovery Area
R. Adm. T. W. Jackson	USN, Commander Task Group l40.3
R. Adm. Henry S. Persons	USN, Commander Task Force 130 Pacific Recovery Area

SPACECRAFT CONTRACTORS

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

AlResearch Manufacturing Co. Los Angeles	Environmental Control System
IBM Federal Systems Division Electronic Systems Center Owego, N.Y.	Onboard Computer
General Electric Co. West Lynn, Mass.	Fuel Cells
The Eagle Pitcher Co. Joplin, Mo.	Batteries
Northrop Corp. Newbury Park, Cal.	Parachutes
Rocketdyne Division, North American Aviation, Inc. Canoga Park, Cal.	OAMS, RCS
Thiokol Chemical Corp. Elkton, Md.	Retrorocket System
Weber Aircraft Corp. Burbank, Cal.	Ejection Seats
Westinghouse Electric Corp. Baltimore, Md.	Rendezvous Radar System
Honeywell, Inc. Minneapolis, Minn.	Attitude Control Electronics
St. Petersburg, Fla.	Inertial Guidance Platform

Atlas contractors include:

General Dynamics, Convair Division San Diego, Cal.	Airframe and Systems Integration
Rocketdyne Division North American Aviation, Inc. Canoga Park, Cal.	Propulsion Systems
General Electric Co. Syracuse, N. Y.	Guidance

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Burroughs Corp. Paoli, Pa.	Ground Guidance Computer

Titan II contractors include:

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

Agena D contractors include:

Lockheed Missiles and Space Co. Sunnyvale, Cal.	Airframe and Systems Integration
Bell Aerosystems Co. Niagara Falls, N.Y.	Propulsion Systems
McDonnell Aircraft Corp. 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 Pillsbury Co., Minneapolis	Principal Food Contractors

Suit contractor:

The David R. Clark Co.
Worcester, Mass.

Approximate Times of Major Events
In Nominal Gemini 12 Mission

GET Hours	Event	GET Hours	Event
00	- Launch	13	-
	- Insertion		-
	- Alige Platform		-
	-	14	-
01	-		-
	- Out-of-plane Translation		-
	-		-
	- CSE Translation	15	-
02	-		-
	- CDH Translation		-
	- Radar Track Agena		-
	-	16	-
03	- TPI Translation		-
	- Midcourse Correction		- S-12 Experiment (door closed)
	- Baking		-
	- Fly Formation	17	- Eat Period
04	- First Docking		-
	-		-
	- First Undocking		-
	- Second Docking		-
05	- M 408 Experiment	18	- Standup EVA Preps.
	-		-
	- Second undocking		-
	- Third Docking		-
06	- Third Undocking	19	-
	- Fourth Docking		-
	- Eat Period		-
	- M 408 Experiment		-
07	-	20	-
	-		- Depressurize
	-		- Open Hatch
	- Prep. for Agena PPS Burn		-
	-		- Standup EVA
	-	21	– S-13 Experiment
08	-		-
	- Posigrade PPS Translation		-
	- (161 x 400 nm)		-
	- Sleep Period		-
09	- S-12 Experiment (door open)	22	-
	-		-
	-		- Close Hatch
	-		- Repressurize
	-	23	-
10	-		- Post EVA
	-		-
	-		-
	-		-
11	-	24	- Eat Period
	-		-
	-		-
	-		- S-5 and s-6 Experiments
12	-	25	-
	-		- S-11 Experiment
	-		-

-more-

GET Hours	Event
26 -	
-	S-5 and S-6 Experiment
-	
-	S-11 Experiment
27 -	
-	
-	
-	S-5 and S-6 Experiment
28 -	
-	
-	S-11 Experiment
-	
29 -	Eat Period
-	
-	
-	
30 -	Prep. for Agena PPS Burn
-	Retrograde PPS Translation
-	
-	Sleep Period
31 -	
-	
-	
-	
32 -	
-	
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33 -	
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34 -	
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36 -	
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37 -	
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38 -	
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-	Eat Period
-	

GET Hours	Event
39 -	
-	
-	Umbilical EVA Preps.
-	
40 -	
-	
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41 -	
-	
-	
-	
42 -	
-	
-	Depressurize – Open Hatch
-	Umbilical EVA
43 -	
-	
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44 -	
-	
-	Close Hatch - Repressurize
-	Post EVA
45 -	
-	
-	
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46 -	
-	Eat Period
-	
-	Tether Exercise Prep.
47 -	
–	Fourth Undocking & Tether Exercise
-	
-	
48 -	
-	
-	
-	
49 -	
-	
-	
-	
50 -	Eat Period
-	
-	
-	
51 -	
-	
-	Terminate Tether Exercise
-	
-	

GET Hours | Event

52 – Fly Formation
-
- Eclipse Phasing Translation
- Sleep Period
53 -
-
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54 -
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55 -
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56 -
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57 -
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58 -
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-
59 -
-
-
-
60 -
-
-
- Eat Period
61 -
- Eclipse Phasing Translation
-
- Standup EVA Preps.
62 -
-
-
-
63 -
- Depressurize & open Hatch
- Jettison Equipment, Standup EVA &
- Mount S-13 Equipment
- Eclipse & Retrieve S-13
64 – Close Hatch & Repressurize
-
- Post EVA
-

GET Hours | Event

65 -
-
-
-
66 - T-2 Experiment
-
-
-
67 -
-
-
-
68 -
- Eat Period
-
-
69 - T-2 Experiment
-
-
-
70 -
-
-
-
71 -
-
-
-
72 -
- S-29 Experiment
-
-
73 -
– D-10 Experiment
-
- S-11 Experiment
74 -
- D-10 Experiment & Eat Period
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75 -
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76 -
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GET Hours	Event
78 -	
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79 -	
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80 -	
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81 -	
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82 -	
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83 -	
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84 -	
-	
-	Eat Period
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85 -	
-	
-	
-	T-2 Experiment
86 -	
-	
-	S-51 Experiment
-	
87 -	D-10 Experiment
-	
-	
-	
88 -	
-	S-51 Experiment
-	D-10 Experiment
-	
89 -	
-	
-	
-	
90 -	
-	Stow Equipment
-	
-	

GET Hours	Event
91 -	
-	
-	Eat Period
-	
92 -	
-	
-	Retro Preps.
-	
93 -	
-	
-	
-	
94 -	Retrofire
-	
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95 -	
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96 -	
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97 -	
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98 -	
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99 -	
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100-	

LOCAL TIME A.M.	LOCAL TIME P.M.
12:00 -	12:00 -
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01 -	01 -
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02 -	02 -
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03 -	03 -
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04 -	04 -
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05 -	05 -
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08 -	08 -
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09 -	09 -
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10 -	10 -
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12 -	12 -
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Note: Clip the time scales at left and slide then along the scales showing the approximate ground elapsed time of a nominal mission. Place the local time of liftoff opposite the 00 on the GET scale and you will be able to read off the approximate local times of major events.

-end-