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NEWS RELEASE

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INTRODUCTION

MA-8 PRESS KIT

The Mercury-Atlas 8 flight of Astronaut Walter M. Schirra, Jr., is programmed for as many as six orbits. A full nine-hour, six-orbit mission requires no major change in spacecraft systems.

A six-orbit mission would be beneficial in regard to astronaut experience, overall operational training and spacecraft systems development for the one-day mission to be performed later.

The MA-8 flight plan calls for more "drifting" flight than did the plans for the two previous manned orbital Mercury flights. The plan also includes a flare-visibility experiment, further photographic experiments and an experiment with heat-protection materials.

MISSION

The MA-8 mission is the third test to (1) evaluate the performance of a man-spacecraft system, (2) investigate man's capabilities in the space environment, and (3) obtain the pilot's opinions on the suitability of the spacecraft and supporting systems for manned space flight.

LAUNCH DATE

The flight is currently scheduled no earlier than September 28, 1962. The launch will be attempted between 7:00 a.m. and 9:00 a.m. EST; however, technical or weather difficulties could result in "holds" ranging from minutes to days. The projected launch time for a six-orbit mission is planned to provide at least three hours of daylight search time in the probable recovery areas.

FLIGHT DURATION

If the mission ends after the first or second orbit, the MA-8 astronaut will be moved to the Kindley Air Force Base Hospital in Bermuda for a 72-hour rest and debriefing. If the mission is stopped after three orbits, he will be flown to Grand Turk Island (Bahamas) for a similar 72-hour period before being returned to the mainland. If the mission goes four, five or six orbits, the pilot will be taken aboard an aircraft carrier for a 72-hour period.

The end of orbit four will be about 170 miles due east of Midway Island. The recovery area for the completion of orbits five and six will be at the intersection of those orbits, some 275 miles northeast of Midway.

As the spacecraft approaches the west coast of the United States on any of its three orbits, the braking rockets can be fired to bring it down in the appropriate one, two or three-orbit landing area. Orbit one ends about 500 miles east of Bermuda; orbit two about 450 miles south of Bermuda; and orbit three about 800 miles southeast of Cape Canaveral.

PILOT

Project Mercury Astronaut Walter M. Schirra, Jr., age 39, (born March 12, 1923), is a Commander in the United States Navy. He, as one of the Mercury Seven, has been with NASA for nearly three and one-half years on a detached duty basis from the Navy. Backup pilot for this flight is Astronaut L. Gordon Cooper, Jr., age 35, an Air Force Major. (See biographies)

SIX-ORBIT BENEFITS

Benefits from a six-orbit Mercury mission which would make it highly advantageous are:

(1) Development of operational techniques and procedures directly applicable to the one-day mission is one of the most desirable benefits. These techniques include flight planning and flight experience in regard to use of fuel and electrical power, tracking and communications procedures for an extended mission and for areas where tracking range coverage is limited, and recovery operations in areas which have not yet been involved in recovery.

(2) The MA-8 mission will provide the opportunity to obtain spacecraft systems performance data to indicate the adequacy of these systems for a one-day mission. Ground simulations provide the only other source of data for extended time periods.

(3) The accumulation of performance data for extended time durations in regard to the astronaut will be invaluable. Aeromedical data, the astronaut's well-being, and the astronaut's performance for over nine hours will generally minimize the changes involved in going directly from a four and one-half hour mission to a one-day mission.

(4) The six-orbit mission can be performed with the present Mercury spacecraft. A number of minor changes have been made which take advantage of flight experience accumulated to date.

(5) In a three-orbit mission, the astronaut used the first orbit to become familiar with space flight conditions and to monitor the spacecraft systems and spent most of the third orbit preparing for and performing re-entry activities. Time for experiments and observation was thus limited to approximately one orbit. By doubling the length of the mission, the MA-8 pilot will have approximately four times as much opportunity for observation.

SPACECRAFT

The MA-8 spacecraft, listed as No. 16 in engineering documents, has been named Sigma 7 by Astronaut Schirra. The pilot said he picked this name because, mathematically, it means summation. "Project Mercury is the summation of a tremendous scientific and engineering effort involving literally thousands of people," Schirra says. Sigma also is an oft-used engineering symbol. The "7" of course stands for the original seven astronauts.

The spacecraft stands nine and one-half feet tall and measures six feet across the base. Spacecraft weight at launch will be about 4200 pounds. Weight in orbit will be about 3000 pounds and some 2400 pounds on the water at recovery.

Prime contractor for the Mercury spacecraft is McDonnell Aircraft Corp. of St. Louis, Missouri.

NETWORK

For this operation, the Mercury Tracking Network consists of 21 stations around the world. Included in the line-up are five ships, four in the Pacific arranged over a 1500-mile stretch between the Philippines and Midway to get data on the fifth and sixth orbits. These ships are the Rose Knot, the Huntsville, the Watertown, and the American Mariner. The other, the Indian Ocean ship, will have a key communications assignment about 840 miles east of Durben (Union of South Africa) and 50 miles south of Madagascar. Some 500 technicians man the Mercury stations, all of which are in radio or cable communication with Mercury Control Center at the Cape via the NASA Goddard Space Flight Center, Greenbelt, Maryland.

RECOVERY

Extending the upcoming mission to a possible six orbits has necessitated the movement of the primary recovery area to another part of the world -- to the Pacific Ocean. However, with the possibility that the mission could be aborted before insertion of the spacecraft into orbit or that the mission could be terminated after the first, second or third orbit, deployment of ships to Atlantic Ocean primary and contingency recovery areas will still be necessary. More than 20 ships will be deployed in the Atlantic alone. These forces will be under the command of Rear Admiral Harold Bowen, Commander of Destroyer Flotilla Four. In the Pacific, some five ships will be sent out under command of Rear Admiral C. A. Buchanan, Commander, Task Force 130. In addition, more than 100 aircraft around the world could be called into action in the event of an emergency landing of the spacecraft.

RESPONSIBILITIES

Project Mercury, the Nation's initial manned space flight research project, was conceived and is directed by the National Aeronautics and Space Administration. NASA is a civilian agency of the government charged with the exploration of space for peaceful and scientific purposes. The NASA Office of Manned Space Flight, Washington, D.C., exercises overall direction for all NASA's manned flight programs--Mercury, Gemini and Apollo. Technical project direction for Project Mercury is supplied by the Manned Spacecraft Center, directed by Dr. Robert R. Gilruth. Dr. Gilruth and his staff recently completed their relocation to Houston, Texas, from Langley Air Force Base, Virginia.

The Department of Defense (DOD), largely through the Air Force and the Navy, provides vital support for Mercury. DOD support is directed by Major General Leighton I. Davis, USAF, Commander of the Atlantic Missile Range and DOD representative to Project Mercury. In all, more than 30,000 persons have a part in this mission, including both government and industry.

PROJECT COST

Total Project Mercury cost through the orbital flights is estimated at $400 million. About $160 million have gone to the prime spacecraft contractor, subcontractors and suppliers; $95 million for the network operations; $85 million for launch vehicles, including Little Joes, Redstones and Atlases; $25 million for recovery operations and roughly $35 million for supporting development in diverse areas.

MISSION PILOT TASKS

The MA-8 pilot, just as Astronauts Glenn and Carpenter, will perform many control tasks during his flight to examine data on spacecraft performance, his own reactions to weightlessness and stress, and will study the characteristics of the Earth and stars from his vantage point over 100 miles above Earth's surface.

The astronaut will perform several basic functions during his extended mission:

(1) "Systems management," the monitoring of the environmental control system (ECS), electrical system, attitude control and communications systems.

(2) Programming and monitoring critical events of launch and reentry.

(3) Control of vehicle attitude involving unique problems not encountered in standard aircraft.

(4) Navigation.

(5) Communications to check navigational information, fuel management and trajectory data while keeping ground personnel informed of flight progress.

(6) Pre-planned research observations to evaluate man's capability to perform in space.

(7) Keep himself in good condition through pre-planned exercises to be able to accomplish these in-flight tasks.

At designated intervals while making ground station passes, the MA-8 pilot will make detailed voice checks on spacecraft systems and operational conditions. His own transmissions will include critical information such as mode of control, precise attitude, planned retrofire time, amount of remaining oxygen and control system fuel. The astronaut will in turn receive information concerning his own status and new data for resetting his spacecraft clock for retrofire time.

MISSION PROFILE

POWERED FLIGHT -- The manned Mercury spacecraft will again be launched atop an Atlas vehicle from Cape Canaveral as early as 7:00 a.m., EST, after a two-day split countdown. Various reasons primarily affected by technical conditions or unsuitable weather conditions in the Atlantic or the Pacific could, of course, cause delay in launch from minutes to weeks.

According to the flight plan, the spacecraft will be launched on a flight path along the Project Mercury Worldwide Tracking Range on a launch heading of about 73 degrees - just north of east from Cape Canaveral.

An internal programmer in the Atlas will guide the vehicle from liftoff until staging occurs. All of the Atlas liquid-propellant engines will be ignited before liftoff.

At staging, about two minutes after liftoff, two launch vehicle engines will drop off and the sustainer and vernier engines will continue to accelerate the vehicle. Staging occurs at an altitude of about 40 miles and a range of about 45 miles from the launch pad.

During the first two and one-half minutes of flight, an electronic brain, called the Abort Sensing Implementation System (ASIS) is capable of sensing impending trouble in the launch vehicle and triggering the escape rocket. The astronaut can also trigger the Mercury escape rocket to pull the spacecraft away from the Atlas launch vehicle.

About 20 seconds after staging, and assuming the flight is proceeding as planned, the 16-foot escape-rocket motor jettison rockets will be fired to carry the tower away from the vehicle. The parachute landing system will then be armed for use after reentry. The Mercury-Atlas combination will continue to accelerate toward the insertion point guided by ground command stations.

After staging and until orbital insertion, the ASIS will continue to "watch" for trouble. If significant deviation should occur, the system will automatically initiate action for releasing the spacecraft-to-launch vehicle clamp ring and for firing the posigrade rockets on the base of the spacecraft.

About five minutes after liftoff, guidance ground command will shut down the sustainer and vernier engines. As the engines shut down, the spacecraft-to-launch vehicle clamp ring is automatically released and the posi-grade rockets are fired to separate the manned craft from the Atlas.

ORBITAL INSERTION -- After a few seconds of automatic damping (removal of any attitude changing motions) the spacecraft will pitch over 180 degrees so that the blunt face of the craft is turned forward and upward -- 34 degrees above the horizontal. From that point on during orbital flight, the spacecraft can be controlled in proper attitude automatically or manually by the pilot.

If all goes well, the Mercury spacecraft will be inserted into orbit in the vicinity of Bermuda. By that time, the vehicle will be at an altitude of approximately 100 miles and traveling at a speed of about 17,500 miles per hour. At engine cut-off, the craft will have been subjected to more than seven and one-half "G". Reentry "G" will also reach seven and one-half.

A six-orbit flight will last approximately nine hours and 12 minutes, since the recovery area will be in the Pacific rather than in the Atlantic. The Mercury craft will reach a peak altitude (apogee) of about 160 statute miles off the West Coast of Austraila and a low point (perigee) of about 100 miles at the insertion point near Bermuda.

REENTRY -- As the spacecraft approaches a point some 350 miles northwest of the Rose Knot, the Pacific Command Ship, retro and braking rockets will be fired to initiate reentry. The command ship, located 800 miles north of Guam, has the capability of firing the retro rockets if necessary. The spacecraft will experience maximum deceleration and reentry heating at an altitude of about 25 statute miles. The automatic attitude control system will hold the craft in the proper attitude during this braking.

(In the event of only one, two, or three orbits, the retros will be fired as the spacecraft approaches the West Coast of the United States.)

Shortly after the retro rockets are fired, the exhausted retro rocket package will be jettisoned and the spacecraft will automatically assume reentry attitude. The craft will begin to encounter more dense atmosphere of the Earth at an altitude of about 55 miles. At this point, temperatures will start mounting on the spacecraft's ablation heat shield. On a nominal mission, peak reentry temperature of about 3,000 degrees F will occur at 25 miles altitude while the spacecraft is moving at nearly 15,000 miles per hour. All told, the craft will sustain temperatures in this neighborhood for about two minutes. Almost coincident with the heat pulse is a dramatic reduction in spacecraft speed. Between 55 and 12 miles altitude -- covering a slant distance of about 760 miles -- spacecraft speed should be reduced from 17,500 miles per hour down to 270 miles per hour in a little over five minutes.

At about 21,000 feet, the six-foot diameter drogue chute will be deployed automatically to stabilize the craft. The pilot may elect to deploy the chute manually, however, as high as 40,000 feet. At about 10,000 feet, the antenna fairing above the spacecraft cylindrical section will be jettisoned and the 63-foot ringsail-type main landing parachute will be deployed. The impact bag will also be deployed at this time.

At impact, the main parachute and reserve chute will be jettisoned. Onboard electrical equipment will then be shut down, and location aids -- dye marker, seasave beacon, super SARAH, a flashing light, and a 3,500 foot underwater charge (dropped into water before touchdown) -- will be activated.

RECOVERY -- The astronaut may remain in his spacecraft until it is recovered and safely on the deck of a ship, or he may leave the spacecraft in the water via the cylindrical neck or side hatch and be greeted by two frogmen who will cinch a flotation collar around the base of the craft for added seaworthiness.

Frogmen will leap into the water with the quick-inflating flotation collar from a recovery helicopter off a ship in one of the prime recovery zones. As soon as they have secured the three-foot-high flotation collar, the astronaut will emerge, grab a "horse collar" lift from a hovering helicopter and be pulled up into the craft and off to the waiting recovery ship.

Meanwhile, a smaller ship will probably go along side the spacecraft and hoist it onto its deck before transferring it to a prime recovery ship. The spacecraft will be returned to the Cape - possibly after a stop in Hawaii where the spacecraft may be loaded aboard an aircraft.

Based on the needs of the MA-8 mission, the recovery area has been moved to northeast of Midway Island. From here -- with a slight increase in recovery forces over those used for the three-orbit missions -- once-an-orbit recovery capability can still be maintained.

Orbit four passes over Midway and orbits five and six pass very close to it. Orbit four recovery can be made about 170 miles due east of Midway. Both orbits five and six can be recovered at one point, about 275 miles northeast of Midway.

Ample DOD support is available in the area. Both Midway Island and the Hawaiian Islands support large military facilities and can support Project Mercury.

CONTINGENCY RECOVERY -- Most Mercury recovery planning is based on spacecraft landing in one of nine areas in the Atlantic Ocean, where a combination of ships, airplanes and helicopters will pick up the astronaut and spacecraft. However, due to remote possibilities that a landing may occur outside the planned areas, small DOD and Royal Australian Air Force teams are stationed along the orbital track around the globe to locate the astronaut and recover him should such a "contingency" landing occur. These units consist of Rescue Control Centers, rescue planes and crews capable of homing in on electronic beacons housed within the spacecraft, and the pararescue men who will jump from aircraft and care for the astronaut until a surface vessel arrives. These rescue teams will use the auxiliary flotation collar and frogman equipment which will enable them to "float" the astronaut and spacecraft for several days if necessary.

A total of sixteen of these teams, deployed around the world and connected with Mercury Control Center at the Cape, provide an assurance that all precautions have been taken to insure safety of the Mercury pilot. Specific locations of these teams are: Bermuda; Azores; Mauritius; Puerto Rico; Benguerir, Morocco; Kano, Nigeria; Nirobi, Kenya; Salisbury, S. Rhodesia; Perth, Australia; Townsville, Australia; Canton Island; Nandi (Fiji) Island; Kwajalein Island; Hawaii; San Diego; and Eglin AFB, Florida.

Contingency recovery for this six-orbit mission can be accomplished with no additional support other than that already used in three-orbit missions. Some of the aircraft will be relocated, but the six orbits can still be covered to meet the current requirements for contingency location within 18 hours.

PILOT OBSERVER CAMERA -- The eight-pound pilot-observer camera previously used on the three-orbit spacecraft has been replaced by a newly developed, multi-purpose, four-pound camera. This camera has been mounted in the instrument panel to photograph the astronaut during launch, orbit and reentry.

HANDHELD CAMERA -- The MA-8 pilot will carry a hand-held 35mm camera like the one first carried by John Glenn.

PERISCOPE -- An earth periscope is located approximately two feet in front of the pilot and will provide a 360-degree view of the horizon. The pilot may manually adjust for "low" or "high" magnification. On "low" he will have a view of the earth of about 1,[illegible]00 miles in diameter. On "high" the field of view will be reduced to about 80 miles in diameter. Altitude can be measured within plus or minus ten nautical miles by comparing the diameter of the earth image with calibrated markings on the periscope screen. The Mercury-Earth periscope will, in addition, serve as a navigational guide.

ENVIRONMENTAL CONTROL SYSTEM -- The environmental control system provides the MA-8 spacecraft cabin and the astronaut with a 100 per cent oxygen environment to furnish breathing, ventilation, and pressurization gas required during flight. The system is completely automatic, but in the eventthe automatic control fails, emergency controls can be used.

The system consists of two individual control circuits (the cabin circuit and the suit circuit), which will normally operate for about 28 hours. Both systems are operated simultaneously. The suit circuit is isolated from the cabin circuit by the astronaut when he closes the faceplate on his helmet. Unless there is a failure in cabin circuit causing loss of pressure, the pilot's pressure suit will not be inflated.

No modifications to this system were required for MA-8.

AEROMEDICAL INFORMATION -- Throughout the flight, the physical well-being of the pilot will be monitored. The pilot's respiration rate and depth, electrocardiogram and body temperature will be telemetered to flight surgeons on the ground.

PILOT COMMUNICATIONS -- The MA-8 astronaut may remain in touch with the ground through the use of high-frequency and ultra-high-frequency radios, radar recovery beacons, and if the situation dictates a command receiver and/or a telegraphy-type code key.

The communications system will remain the same as for the three-orbit missions; however, the telemetry transmitters and the C- and S-Band beacons will be turned off during the major part of the fourth and fifth orbits, when the craft is not within communications distance of a tracking station. These transmitters and beacons can then be turned on at the proper time by ground command when within proper range.

Since the spacecraft will be out of communication range of the ground stations more often during this flight, more dependence will be placed upon the mission pilot to monitor spacecraft systems. This will also be the case for future one-day missions.

FUEL SUPPLY AND USAGE -- The rate of usage of hydrogen peroxide for the Reaction and Control System is the most critical item in accomplishing the six-orbit mission. Fuel usage rates are determined basically by the mode used in controlling the craft. Manual control, either by the manual proportional system or by the rate command (RSCS) system uses fuel in greater quantities than the automatic (ASCS) or fly-by-wire (FBW) systems because the manual control systems use the larger thrusters. In terms of fuel economy, past flight experience indicates that the ASCS mode is the most economical of the four control modes, and the manual proportional mode is the most expensive.

MAIN BATTERY SYSTEM -- Three 3,000 watt-hour batteries and one 1,500 watt-hour battery are connected in parallel to provide power for the complete mission and approximately a 12-hour post-landing period. A standby backup power system of 1,500 watt-hour capacity is also provided. To further insure reliable operation of the pyrotechnic system, each device has a completely isolated power feed system.

ALTIMETER -- The Mercury barometric altimeter is a single-revolution indicator with a range from sea level to 100,000 feet. The dial face has reference marks at the drogue and main parachute deployment altitudes.

At the top right corner of the main panel are located environmental displays, providing the pilot with indications of cabin pressure, temperature, humidity, and oxygen quantity remaining.

FOOD AND WATER STORAGE -- As with all manned spacecraft, MA-8 will be supplied with about 3,000 calories of non-residue food and about six pounds of water. The water supply, which is sufficient for at least 28 hours, is contained in two flat bottles, each fitted with an extendable tube.

CLOCK AND RETRO-FIRE TIMER -- There will be a clock in the MA-8 spacecraft with three major separate operational components: (1) a standard aircraft elapsed time clock, (2) a "seconds from launch" digital indicator with a manual reset, and (3) a resettable timer and time-delay relay which will initiate the retrograde fire sequence. When the preset time has passed, the relay closes and actuates the retrograde fire signal, at the same time sending a telemetered signal to the ground.

SURVIVAL EQUIPMENT -- The survival package consists of a one-man life raft, desalting kit, shark repellant, dye markers, first aid kit, distress signals, a signal mirror, portable radio, survival rations, matches, a whistle, and ten feet of nylon cord.

A lightweight, radar-reflective life raft is fabricated of Mylar (for air retention) and nylon (for strength). The three pound, four-ounce raft features three water ballast buckets for flotation stability and a deflatable boarding end which may be reinflated by an oral inflation tube following boarding. The raft made of the same material used in the Echo satellite balloon, is international orange.

PRESSURE SUIT -- Mercury astronaut pressure suits were designed to provide an artificial environment similar to the cabin atmosphere in the event of spacecraft pressurization failure. The B. F. Goodrich suit is a 20-pound, aluminum-coated, nylon-and-rubber garment, incorporating oxygen-cooling and respiratory systems, automatic warning gauges and pick-ups for medical telemetering systems to record temperature and respiration, electrocardiographs for recording heart action, and other scientific apparatus. The full-pressure suit consists of four basic parts -- torso, helmet, gloves and boots.

The astronaut is protected primarily by his cabin pressure system, but should this pressure fail he is encased in a suit capable of providing a similar environment.

PILOT's MAP - A small cardboard diagram of the MA-8 flight path with recovery forces indicated is contained within a bag suspended beneath the periscope. On the reverse side, the pilot's view through the periscope from maximum altitude is shown. Last minute information on cloud formations and weather phenomena will be marked by Mercury weather experts.

HATCH -- The MA-8 spacecraft is equipped with an explosive-actuated hatch just as a pilot's canopy is secured in high performance aircraft. The astronaut can jettison the hatch by pushing a plunger button inside the spacecraft or by pulling a cable. The explosive charge for the hatch was added as an additional pilot safety device to insure easy and rapid escape if necessary. The hatch may also be removed by recovery teams.

CYLINDRICAL NECK CONTENTS -- Above the astronaut's cabin, the cylindrical neck section contains the main and reserve parachute system.

Three parachutes are installed in the spacecraft. The drogue chute has a six-foot diameter, conical, ribbon-type canopy with approximately six-foot long ribbon suspension lines, and a 30-foot long riser made of Dacron to minimize elasticity effects during deployment of the drogue at an altitude of 21,000 feet. The drogue riser is permanently attached to the spacecraft antenna by a three point suspension system terminating at the antenna in three steel cables which are insulated in areas exposed to heat.

The drogue parachute is packed in a protective bag and stowed in the drogue mortar tube on top of a light-weight sabot or plug. The sabot functions as a free piston to eject the parachute pack when pressured from below by gases generated by a pyrotechnic charge.

The function of the drogue chute is to provide a backup stabilization device for the spacecraft in the event of failure of the Reaction Control and Stabilization System.

The reserve chute is identical to the main chute. It is deployed by a flat circular-type pilot chute.

Other components of the landing system include mortar and cartridge, barostats, antenna fairing ejector, and a sea marker packet.

Following escape tower separation in flight, the 21,000 and 10,000 foot barostats are armed. No further action occurs until spacecraft descent causes the 21,000 foot barostat to close, activating the drogue ejection system.

Two seconds after the 10,000 foot barostat closes, power is supplied to the antenna fairing ejector -- located above the cylindrical neck section -- to deploy the main landing parachute and an underwater charge, which is dropped to provide an audible sound landing point indication. The ultra-high frequency SARAH radio then begins transmitting. A can of sea-marker dye is deployed with the reserve chute and remains attached to the spacecraft by a lanyard.

On landing, an impact switch jettisons the landing parachute and initiates the remaining location and recovery aids. This includes release of sea-marker dye with the reserve chute if it has not previously been deployed, triggering a high-intensity flashing light, extension of a 16-foot whip antenna and the initiation of the operation of a high-intensity radio beacon.

If the spacecraft should spring a leak or if the life support system should become fouled after landing, the astronaut can escape through this upper neck section or through the side hatch.

IMPACT SKIRT -- Following deployment of the main landing parachute, the heat shield is released, extending the landing-impact bag to form a pneumatic cushion primarily for impact on land. It is also required for spacecraft stability after water landing.

The air cushion is formed by a four-foot skirt made of rubberized fiberglass that connects the heat shield and the rest of the spacecraft. After the main chute is deployed, the heat shield is released from the spacecraft and the bag fills with air. Upon impact, air trapped between the heat shield and the spacecraft is vented through holes in the skirt as well as portions of the spacecraft which are not completely air tight, thereby providing the desired cushioning effect.

ADDITIONAL SCIENTIFIC EXPERIMENTS -- The Mercury spacecraft, as a manned orbit laboratory, offers possiblities for scientific experimentation that have never before been possible. Certain research experiments, though not in direct support of Mercury may expedite future space efforts.

A second meeting of the Mercury Scientific Experiment Panel, chaired by Lewis R. Fisher of the Manned Spacecraft Center, was held on July 17, 1962, to review all research experiments proposed for Mercury and to assign priority to experiments for MA-8.

This panel was formed in mid-April 1962 to establish the scientific value, relative priority, suitability for orbital flight, and ramifications with regard to the flight activity schedule of each proposed experiment.

The following are experiments recommended by the panel for the MA-8 mission.

FLARE-VISIBILITY EXPERIMENT -- The first priority experiment will be a flare-visibility study. For the MA-8 flight, two sites have been chosen for location of the ground-based flares in an attempt to decrease the probability of cloud cover interference. At the primary site, Woomera, Australia, three high-intensity flares will be ignited. At the secondary location, Durban, South Africa, electric lamps of three-million candle power will be displayed.

The primary objectives of this experiment are to determine if the astronaut can acquire an Earth-based light source of known intensity and to establish atmospheric attenuation of this light source.

The astronaut will first calibrate his visual perception and dark adaptation by measuring -- with a photometer -- a light source mounted on the instrument panel. He will calibrate his location by taking a known star reading, and then acquire and measure the ground-based light source, using the photometer.

PHOTOGRAPHIC STUDY -- The second priority experiment will be photographic studies similar to those previously conducted on the MA-6 and MA-7 missions. A 35mm camera and film will again be carried. The pilot will take photographs of general terrestrial features in which Goddard is primarily concerned.

Goddard scientists are interested in color photography of folded mountains, fault zones, volcanic fields, meteor impacts and glaciers. They also want his photography to investigate the photometric properties of various land surfaces with applications to the study of the moon and the planets.

EXPERIMENT WITH HEAT-PROTECTION MATERIALS -- The third experiment is one of a passive nature. Certain advanced heat-protection materials will be studied after exposure to orbital reentry heating. These ablation samples are mounted on the cylindrical portion of the spacecraft; they are attached through lamination with the external beryllium shingles.

AVCO Corporation, NASA Langley Research Center and McDonnell Aircraft Corporation have been assigned two each of the available panels for their respective materials to be tested, Emerson Electric, Chance-Vought Corporation and General Electric are each bonding a sample to one each of the remaining shingles. Earlier, these contractors were sent samples of the beryllium -- which is currently used on the cylindrical portion of the craft -- to establish compatibility of their material. These were sent to McDonnell Aircraft Corporation for testing prior to their installation on the spacecraft.

In an addition to an evaluation of the reentry heating effects on these materials, discrete cracks or slots will be placed in the materials, half of which will be filled or repaired; the remainder will not be altered. This will establish the effectiveness of heat shield repairs and provide non-critical damage as a comparison.

Due to this heat-protection study, the MA-8 spacecraft will require special handling after the flight.

RADIATION-SENSITIVE EMULSION STUDY -- Another MA-8 experiment is a radiation - sensitive emulsion study, sponsored by Goddard Space Flight Center. Goddard scientists are primarily interested in the type and magnitude of nuclear interactions in orbital space. Their experiment has been proposed for the study of primary cosmic radiation, the energy spectrum of the low energy cosmic ray particles, high energy gamma rays, and to search for rare particles. Two packs, each weighing about a pound and measuring 3 by 2 5/8 by 1¼ inches, will be mounted on either side of the couch.

THE ATLAS LAUNCH VEHICLE -- The launch vehicle to be used for the Mercury-Atlas 8 test is an Atlas D Model 113-D, one of the several Atlases especially modified for use in the Mercury flight test program. This vehicle develops 360,000 pounds of thrust and burns RP-1, highly refined, kerosene-like fuel, and liquid oxygen.

Principal differences in the Mercury-Atlas and the military version of the vehicle include:

(1) Modification of the spacecraft-launch vehicle adapter section to accommodate the Mercury vehicle.

(2) Structural strengthening of the upper neck of the Atlas to provide for the increase in aerodynamic stress imposed on the Atlas when used for Mercury missions.

(3) Inclusion of an Automatic Abort Sensing and Implementation System (ASIS) designed to sense deviations in the performance of the Atlas and to trigger the Mercury Escape System before an impending catastrophic failure.

The Atlas measures 65 feet from its base to the Mercury adapter section and is ten feet in diameter at the tank section. With the adapter section, spacecraft and escape tower, the Mercury-Atlas combination stands 93 feet tall.

The Atlas is constructed of thin-gage metal and maintains structural rigidity through pressurization of its fuel tanks. For manned orbital flights, the Atlas has a heavier gage skin at the forward end of the liquid oxygen tank, the same as that used in other launches of Atlas space systems.

All five engines are ignited at the time of launch -- the sustainer (60,000 pounds thrust), the two booster engines (150,000 pounds thrust each), which are outboard of the sustainer at the base of the vehicle, and two small vernier engines used for minor course corrections during powered flight. During the first minute of flight, the Atlas launch vehicle consumes more fuel than a commercial jet airliner during a transcontinental trip.

This Atlas, however, is equipped with baffle injection engines. It is the first Mercury-Atlas launch vehicle so equipped. It requires a hypergolic (self igniting) start. This is a significant change, requiring a flight readiness firing during pre-flight. This static test was conducted successfully on Sept. 8 at the Cape.

The launch venicle is manufactured by the Astronautics Division of general Dynamics Corp. The 6555th Aerospace Test Wing, USAF, assisted by GDA and the Aerospace Corp., is responsible for checkout, technical readiness and launch of the booster.

ASTRONAUT PARTICIPATION

All seven Project Mercury astronauts will participate in the MA-8 orbital mission, some as flight controllers from vantage points around the world.

Astronauts Schirra, prime pilot, Cooper, back-up pilot, and Donald K. Slayton, capsule communicator, will be at Cape Canaveral.

Astronaut Alan B. Shepard, Jr., will be aboard the Pacific Command Ship, while Astronaut Virgil I. Grissom will be stationed on Kauai Island, Hawaii. Astronaut John H. Glenn, Jr., will participate from the tracking station at Pt. Arguello, Calif., and Astronaut M. Scott Carpenter, Jr., will be at the Guaymas, Mexico, station.

THE NETWORK

World-Wide Mercury Tracking Stations, including five ships at sea, will monitor the MA-8 flight. The Space Computing Center of the NASA Goddard Space Flight Center in Greenbelt, Maryland, will make trajectory computations, just as for all past Mercury flights.

During the flight, information will pour into the Space Computing Center from tracking and ground instrumentation points around the globe at the rate, in some cases, of more than 1,000 bits per second. Upon almost instantaneous analysis, the information will be relayed to the Cape for action.

In addition to again proving man's capability for surviving in an performing efficiently in space -- and since only four other flights have been made along the world-wide tracking network -- the test will further evaluate the capability of the network to perform tracking, data-gathering and flight control functions.

The Mercury network, because of the man factor, demands more than any other tracking system. Mercury missions require instantaneous communication. Tracking and telemetered data must be collected, processed, and acted upon in as near "real" time as possible. The position of the vehicle must be known continuously from the moment of liftoff through recovery.

After injection of the Mercury spacecraft into orbit, orbital elements must be computed and resulting prediction of "look" information passed to the next tracking site so that station can acquire the spacecraft.

Data on the numerous spacecraft systems must be sent back to Earth and presented in near "real" time to observers at various stations. And during the recovery phase, spacecraft impact location predictions will have to be continuously revised and relayed to Mercury recovery forces.

NETWORK HISTORY

During late 1961, an industrial team headed by Western Electric Company turned over this $60 million global network to the National Aeronautics and Space Administration.

Other team members were Bell Telephone Laboratories, Inc.; the Bendix Corporation; Burns and Roe, Inc.; and International Business Machines Corporation. At the same time, the Lincoln Laboratory of Massachusetts Institute of Technology also advised and assisted NASA on special technical problems related to the network.

The concluding contract involved extensive negotiations with Federal agencies, private industry, and representatives of several foreign countries in the establishment of tracking and ground instrumentation.

The system spans three continents and three oceans, interconnected by a global communications network. It utilizes land lines, undersea cables and radio circuits, and special communications equipment installed at commercial switching stations in both the Eastern and Western hemispheres.

The project includes buildings, computer programming, communications and electronic equipment, and related support facilities required to direct, monitor, and provide contact with the Nation's orbiting Mercury astronaut.

Altogether, the Mercury system involves approximately 60,000 route miles of communications facilities to assure an integrated network with world-wide capability for handling satellite data. It comprises 140,000 actual circuit miles --

100,000 miles of teletype, 35,000 miles of telephone lines, and over 5,000 miles of high-speed data circuits.

Sites linked across the Atlantic Ocean are: Cape Canaveral, Grand Bahama Island, Grand Turk Island, Bermuda and Grand Canary Island.

Other stations in the continental United States are at Pt. Arguello in Southern California; White Sands, New Mexico; Corpus Christi, Texas; and Eglin, Florida. One station is located on Kauai Island in Hawaii.

Stations at overseas sites include one on the south side of Grand Canary Island, 120 miles west of the African Coast; Kano, Nigeria, in a farming area about 700 rail miles inland; Zanzibar, an island 12 miles off the African Coast in the Indian Ocean; two in Australia -- one about 40 miles from Perth, near Muchea, and one near Woomera; Canton Island, a small coral atoll about halfway between Hawaii and Australia; one in Mexico near Guaymas on the shore of the Gulf of Mexico; and one in Bermuda -- mentioned above -- an independent, secondary control center.

Some 20 private and public communications agencies throughout the world provided leased land lines and overseas radio and cable facilities.

Site facilities include equipment for acquiring the spacecraft; long range radars for automatic tracking; telemetry equipment for controlling the manned vehicle from the ground, if necessary; and voice channels for ground-to-air communications. The extensive ground communications system interconnects all stations through Goddard and Mercury Control Center.

Sites equipped with tracking radars have digital data conversion and processing equipment for preparing and transmitting information to the computing system without manual processing, marking a significant achievement -- global handling of data on a real-time basis.

One function of the computer system is to transmit information regarding the spacecraft's position to Mercury Control Center at the Cape, where it is displayed on the world map in the Operations Room. The computers also originate acquisition information which is automatically sent to the range stations.

During every major Mercury launch, the attention of some 15 NASA flight controllers is focused on dozens of consoles and wall displays in the Operations Room of Mercury Control Center. This room is the control point for all information that will flow through the world-wide tracking and communications system. In this room, NASA flight controllers make all vital decisions required and issue or delegate all commands.

In the fifty-foot square room, about 100 types of information register at various times on the indicators of the consoles and the high range-status map. Of these 100 quantities, several show biomedical conditions, approximately 30 concerning life support equipment and about 60 give readings on spacecraft equipment. This information flows in on high-speed data circuits from computers at the Goddard Center, on direct teletype circuits from remote sites, and by launch vehicle and spacecraft telemetry relayed over radio and wire circuits.

Three kinds of data start pouring into the computing system as soon as the launch vehicle lifts half an inch off the launch pad:

(1) Radar data triggers the Cape Canaveral IBM 7090 which monitors the spacecraft's flight path and predicts its impact point if the mission were suddenly to be aborted.

(2) Guidance data is radioed from the spacecraft to a special purpose computer at the Cape.

(3) Telemetry data includes check point reports, eg., liftoff, launch vehicle separation.

These data are transmitted from Cape Canaveral to Goddard where IBM 7090's compare the spacecraft trajectory to a predetermined flight path -- and flash the results back to the Cape. This is a "real time" operation -- that is, the system receives, moves it over 2,000 miles, analyzes, predicts and displays data so that observers and controllers follow events as they happen.

COMMUNICATIONS INFORMATION -- The network carries telephone, teletype and high-speed data (1,000 bits per second) information. It can accept a message from a distant site and deliver it to the final destination -- regardless of location along the network -- in a little over one second.

Radio teletype facilities use single sideband transmitters, which are less susceptible to atmospheric interference. All circuits, frequencies and paths were selected only after a careful study of data accumulated over 25 years by the National Bureau of Standards on the various propagation qualities of many radio paths.

Submarine cables to London (via New York), to Hawaii (via San Francisco), and to Australia (via Vancouver, B. C.) are included in the Mercury communications network.

The Mercury Voice Network has a twofold mission:

(1) Provide Mercury Control Center with "real time" information from world-wide stations having contact with the orbiting Mercury spacecraft.

(2) Provide a rapid means for dealing with emergency situations between Mercury Control Center and range stations during a mission.

The network is essentially a private line telephone system radiating from Goddard Space Flight Center to Mercury Control Center and the project's world sites.

These lines are used during an orbital mission to exchange verbal information more rapidly than can be done by teletype. Conversations are recorded both at Goddard and Mercury Control Center for subsequent playback.. When not used for orbital exercises, these circuits are utilized for normal communications operations.

ASTRONAUT TRAINING PROGRAM SUMMARY -- The following are some of the general training activities that the Nation's seven Project Mercury astronauts have undergone since May 1959.

(1) <u>Systems and vehicle familiarization</u> -- The Mercury astronauts were given lectures in Mercury spacecraft systems by NASA and several of the contracting companies. NASA Langley Research Center gave them a 50-hour course in astronautics. McDonnell Aircraft Corporation engineers talked to them on Mercury spacecraft subsystems. Lectures were given to the astronauts by the Astronaut Flight Surgeon on aeromedical problems of space flight.

At the Navy centrifuge trainer in Johnsville, Pennsylvania, the astronauts flew Mercury acceleration profiles. At several Air Force bases, they flew brief zero-gravity flight paths.

Checkouts of the Mercury environmental system and the pressure suit were accomplished at the Navy Air Crew Equipment Laboratory in Philadelphia. At the Naval Medical Research Institute, they became familiar with the physiological effects of high CO_2 content in the environment. The Army Ballistic Missile Division and its associated contractors indoctrinated them on the Redstone launch vehicle. The Air Force Space Systems Division and its associated contractors briefed the astronauts on the Atlas launch vehicle.

(2) Star-recognition -- Each astronaut has periodically received concentrated personal instruction on the elements of celestial navigation and on star recognition at the Morehead Planetarium, Chapel Hill, North Carolina. A trainer simulating the celestial view through a spacecraft window permitted astronaut practice in correcting yaw drift.

(3) Desert survival -- A five and one-half day course in desert survival training was carried out at the USAF Training Command Survival School at Stead Air Force Base, Nevada. The course consisted of survival techniques through lectures, demonstrations, and application in a representative desert environment. The Mercury survival kit was also evaluated during this period.

(4) Egress training -- During March and April 1960, open-water normal egress training was conducted in the Gulf of Mexico off Pensacola, Florida. Each astronaut made at least two egresses through the upper hatch (up to ten-foot swells were experienced). Water survival training was also accompanied in August 1960 and December 1961 at Langley Research Center. Each of the astronauts made underwater egresses, some of which were made in the Mercury pressure suit.

(5) Specialty assignments -- The astronauts contributed to the development program by working directly with Manned Spacecraft engineers and by attending NASA - McDonnell coordination meetings and launch vehicle panel meetings in their specialty areas. Astronaut specialty areas are:

Carpenter -- Communications equipment and procedures, periscope operations, navigational aids and procedures.

Cooper -- Redstone launch vehicle, trajectory aerodynamics, countdown, and flight procedures, emergency egress and rescue.

Glenn -- Cockpit layout, instrumentation, controls for spacecraft simulations.

Grissom -- Reaction control system, hand controller, auto-pilot and horizon scanners.

Schirra -- Enviromental control systems, pilot support and restraint, pressure suit, and aeromedical monitoring.

Shepard -- Recovery systems, parachutes, recovery aids, recovery procedures and range network.

Slayton -- Atlas launch vehicle and escape system, including Atlas configuration, trajectory, aerodynamics, countdown, and flight procedures.

BIOASTRONAUTICS -- As in the case of each previous Mercury flight requiring medical support, an Operational Bioastronautic Group has been formed to support the MA-8 launch. This group is made up of 129 people including 69 from Air Force, 34 from Navy, 23 from Army, one from the U. S. Public Health Service and two from the Royal Australian Air Force.

They include 55 physicians in the recovery force, 17 physicians monitoring aeromedical data and 30 medical technicians at various posts.

The management element of this group is responsible to Col. Raymond A. Yerg, USAF, MC, Assistant for Bioastronautics, Department of Defense Representative, Project Mercury Support.