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NEWS RELEASE

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INTRODUCTION

MA-7 PRESS KIT

The MA-6 flight of John Glenn in Friendship 7 has been described as "the end of the beginning" for Project Mercury, the United States' first manned orbital flight program. Much was learned from MA-6; more will be learned from MA-7 and flights to follow.

For example, MA-7 carries several unique experiments. The flight plan calls for the launching of a small balloon and man-made "luminous particles" from the orbiting craft. Some basic research will be conducted on the action of fluids in weightless state. (See Page 14.)

At the same time, a few changes have been built into the MA-7 craft as a result of MA-6. The low-thruster chambers have been modified to prevent clogging. (See Page 9.) Switches actuating heat-shield deployment have been rewired (See Page 9.)

In any case, the National Aeronautics and Space Administration takes this opportunity to thank the news media of the world for (1) your patience and (2) your outstanding reporting of MA-6 and earlier Mercury flights.

MISSION

The MA-7 mission is a second test to (1) evaluate the performance of a man-spacecraft system; (2) investigate man's capabilities in the space environment; (3) obtain the pilot's opinions on the suitability of the spacecraft and supporting systems for manned space flight.

LAUNCH DATE

The flight currently is scheduled no earlier than May 17. The launch will be attempted between 7 a.m. and 12:30 p.m. EST and may "slip" on a day-to-day basis as required. Launch timing will be planned to provide at least three hours of daylight search time in the probably recovery areas.

FLIGHT DURATION

If the mission ends after the first or second orbit, the astronaut will be moved to the Kindley Air Force Base Hospital in Bermuda for a 48-hour rest and debriefing. If the mission goes a full three orbits, he will be flown to Grand Turk Island (Bahamas) for a similar 48-hour period before being returned to the mainland.

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

PILOT

Project Mercury Astronaut M. Scott Carpenter, age 37 (born May 1, 1925), is a lieutenant commander in the United States Navy. He, as one of the Mercury seven, has been with NASA for three years on a detached duty basis from his branch of the armed services. Backup pilot for this flight is Astronaut Walter M. Schirra, Jr., 39. (See biographies.)

SPACECRAFT

The MA-7 spacecraft, listed as No. 18 in engineering documents, has been named Aurora 7 by Astronaut Carpenter.

In exercising the pilot perogative of naming the craft, Carpenter said he settled on Aurora 7 "Because I think of Project Mercury and the open manner in which we are conducting it for the benefit of all as a light in the sky. Aurora also means dawn--in this case, dawn of a new age. The 7, of course, stands for the original seven astronauts."

Carpenter also confides that he grew up on the corner of Aurora and 7th in Boulder, Colorado.

The craft stands 9½ feet high and measures six feet across the base. Spacecraft weight at launch will be about 4,200 pounds; spacecraft weight in orbit (after escape tower jettison) will be approximately 3,000 pounds; and about 2,400 pounds on-the-water recovery weight. Prime contractor for the spacecraft is McDonnell Aircraft Corporation of St. Louis, Missouri.

LAUNCH VEHICLE

A modified Atlas D is used to launch orbital Mercury missions, reaching a speed of about 17,500 miles per hour. At launch, spacecraft and launch vehicle stand 93 feet tall, including the 16-foot tower above the spacecraft. The tower contains a solid propellant rocket hooked to an abort sensing system. Should trouble develop on the launch pad or in the early launch phase of the mission, the escape system will be triggered--automatically or by the pilot or from the ground--to pull the spacecraft away from the launch vehicle. The launch vehicle is manufactured by the Astronautics Division of General Dynamics Corporation. The 6555 Aerospace Test Wing, USAF, assisted by GDA and Aerospace Corp., is responsible for checkout, technical readiness and launch of the Atlas booster (107D) in this experiment.

NETWORK

For this operation, the Mercury Tracking Network consists of 17 stations around the world, including a ship, the Coastal Sentry. This time the Coastal Sentry will be stationed in the Mozambique Channel off the east coast of Africa instead of the middle of the Indian Ocean as in past Mercury tests. The Atlantic ship, normally stationed off the coast of West Africa, will not take part in this exercise. It is in Baltimore for repairs. Some 500 technicians man the Mercury stations, all of which are in radio or cable communication with the Mercury Control Center at the Cape via the NASA Goddard Space Flight Center at Greenbelt, Maryland.

RECOVERY

More than 20 ships will be deployed in the Atlantic alone to cover prime and contingency recovery areas. Recovery forces will again be under the command of Rear Admiral John J. Chew, Commander of Destroyer Flotilla Four. In addition, more than 100 aircraft around the world could be called into action in the event of an emergency landing. More than 15,000 men from Department of Defense agencies will have a hand in recovery efforts.

RESPONSIBILITIES

Project Mercury, the Nation's initial manned space flight research project, was conceived and is directed by the Manned Spacecraft Center of 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. Technical project direction for Project Mercury is supplied by the Manned Spacecraft Center, directed by Robert R. Gilruth and presently moving to Houston, Texas, from Langley Field, 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 government and industry.

PROJECT COST

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

MISSION PILOT TASKS

The MA-7 pilot, just as Astronaut Glenn, will perform many control tasks during flight to obtain maximum data on spacecraft performance, his own reactions to weightlessness and stress, and to study the characteristics of the earth and stars from his vantage point over 100 miles above the earth's surface.

The astronaut will perform several basic functions during his flight:

(1) "Systems management," the monitoring of the environmental control system, 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) 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.

Every 30 minutes while making ground station passes, the MA-7 pilot will make detailed voice checks on spacecraft systems and operations conditions. His own transmissions will include critical information such as mode of control, precise attitude, planned retrofire time, amount of remaining control system fuel and oxygen. The astronaut will 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 launch 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 weather 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 World-Wide 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 2½ minutes of flight, an electronic brain, called the Abort Sensing and Implementation System (ASIS) is capable of sensing impending trouble in the rocket 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 landing system will then be armed. The Mercury-Atlas vehicle will continue to accelerate toward the insertion point guided by ground command guidance.

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 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 posigrade rockets are fired to separate the craft from the Atlas.

ORBITAL INSERTION -- After a few seconds of automatic damping (removal of any attitude changing motions) the spacecraft will swing 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 the $7\frac{1}{2}$ "G." Re-entry "G" will also reach $7\frac{1}{2}$.

A three orbit flight will last approximately 4 3/4 hours. The Mercury craft will reach a peak altitude (apogee) of about 155 statute miles off the West Coast of Australia and a low point (perigee) of 100 miles at the insertion point near Bermuda.

REENTRY -- As the spacecraft approaches the west coast of the United States, retro or braking rockets will be fired to initiate reentry. The spacecraft will experience 0.05G (beginning of entry into the atmosphere) approximately over the southeastern U. S. coast and 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.

Shortly after the retrorockets are fired, the exhausted retrorocket package will be jettisoned and the spacecraft will automatically assume reentry attitude. The craft will begin to encounter more dense atmosphere of the earth approximately over the east coast 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 miles and 12 miles altitude -- covering a slant distance of 760 miles -- spacecraft speed should go from 17,500 miles per hour down to 270 miles per hour in a little over five minutes.

At about 21,000 feet, a six-foot diameter drogue parachute will be deployed to stabilize the craft. At about 10,000 feet, the antenna fairing above the spacecraft cylindrical section will be jettisoned to deploy the 63-foot ringsail-type main landing parachute. The impact bag will also be deployed at this time.

At impact, the main parachute will be jettisoned. Onboard electrical equipment will be shut down, and location aids will be activated.

RECOVERY -- The astronaut may -- as John Glenn did -- elect to remain in the spacecraft until it is safely on the deck of a ship. Or he may leave the spacecraft in the water via the neck or side hatch and be greeted by two frogmen who would cinch a flotation collar around the base of the craft for added seaworthiness. Frogmen 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 emerges, grabs a "horse collar" lift from a hovering helicopter and is whisked up into the craft and to the waiting recovery ship.

Meanwhile, a smaller ship would go along side the spacecraft, hoist it onto its deck before transferring it to a prime recovery ship for delivery to Cape Canaveral

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 Department of Defense (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 para-rescue men who will jump from aircraft and care for the astronaut until a surface vessel arrives. These rescue teams will use 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 MA-7 pilot. Specific locations of these teams are: Bermuda; Azores; Mauritius; Puerto Rico; Benguerir, Morocco; Kano, Nigeria; Nairobi, Kenya; Salisbury, S. Rhodesia; Perth, Australia; Townsville, Australia; Canton Island; Nandi (Fiji) Island; Kwajalien Island; Hawaii; San Diego; Eglin AFB, Fla.

THE MA-7 MERCURY SPACECRAFT

The MA-7 production spacecraft is similar to those used for previous Mercury flights of Astronauts Shepard, Grissom, and Glenn. Bell-shaped in configuration, it measures a little over nine feet in height and six feet across at the base.

Here are some of the major items of equipment in the MA-7 pilot's cabin:

INSTRUMENT PANEL -- Instruments are located on a main instrument panel, a left console and right console. The main panel is directly in front of the pilot. Navigational instruments are located in the left and center sections of the panel and the periscope is located in the center. The right section of the main panel is composed of environmental system indicators and controls, electrical switches, and indicators and communication system controls.

The left console includes sequencing telelights and a warning panel, indicators and controls for the spacecraft's automatic pilot, (ASCS), environmental control and landing system. Altogether, there are over 100 lights, fuses, switches and miscellaneous controls and displays.

A significant change from MA-6 warning signal circuitry was made in MA-7 with regard to the heat shield deploy indicator circuit. The limit switches which indicate that the heat shield is released have been wired in series and rigged farther away from the actuation points to prevent accidental operation.

RATE STABILIZATION AND CONTROL -- Attitude of the Mercury spacecraft is changed by the release of short bursts of super-heated steam (hydrogen peroxide) from 18 thrust nozzles located on the conical and cylindrical portions of the craft's surface. Timing and force of these bursts are controlled by one of the following: (1) Automatic Stabilization and Control System (ASCS), or "Auto-Pilot"; (2) Rate Stabilization and Control System (RSCS), or "Rate Command" System; (3) the Manual Proportional Control System, a manual-mechanical system; and (4) the Fly-By-Wire (FBW), (a manual-electrical system.

As a result of difficulties with the low-thrust attitude control chambers in John Glenn's MA-6 flight, design changes were incorporated into the MA-7 thrusters. MA-7 changes were designed to preclude nozzle clogging and improve the thermal characteristics of the chambers. Changes include the use of platinum wire instead of stainless steel screens; reposition of fuel metering orifice; smaller internal chamber volume and a new fuel distribution plate.

PILOT OBSERVER CAMERA -- A pilot observer camera is mounted in the instrument panel and will be operated from launch through recovery.

HAND-HELD CAMERA -- The MA-7 pilot will carry a hand-held, pistol-grip, 35mm camera like the one first carried by Astronaut Glenn. Three photographic experiments are slated for the MA-7 mission. The first of these will involve daylight color photography of any earth-sky or terrestrial features of general scientific interest. This experiment will employ a special haze filter. The second exercise was requested by the Weather Bureau to determine particular wave lengths on photographs. The third study is sponsored by the MIT Instrumentation Laboratory in support of its Apollo guidance system development program for NASA; this experiment is primarily concerned with definition of the earth's horizon at orbital altitudes. MIT scientists are interested in determining the accuracy with which the earth's illuminated limb can be used as an optical reference for mid-course corrections during lunar missions. This will also require a special filter for the camera. Each of the three experiments will employ a special film magazine, which can be rapidly installed and removed from the 35mm camera. The objects and phenomena peculiar to each experiment to be photographed have been incorporated into the flight activity schedule.

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 1,900 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 aid.

PILOT SUPPORT COUCH -- The astronaut's couch is constructed of a crushable honeycomb material bonded to a fiberglass shell and lined with rubber padding. Each astronaut has a flight couch contoured to his specific shape. The couch is designed to support the pilot's body loads during all phases of the flight and to protect him for acceleration forces of launch and reentry.

RESTRAINT SYSTEM -- The pilot's restraint system, which consists of shoulder, leg and crotch straps, lap belt and toe guards, is designed to restrain the astronaut in the couch during maximum deceleration.

ENVIRONMENTAL CONTROL SYSTEM -- The environmental control system will provide the MA-7 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 event of automatic control malfunction the 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's closing the helmet faceplate. Unless there is a failure in the cabin circuit causing loss of pressure, the pilot's pressure suit will not be inflated.

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 in ground tracking stations.

PILOT COMMUNICATIONS -- The MA-7 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.

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 will have 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-7 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-7 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-7 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-7 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 has been 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 gasses 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. Additionally, the drogue chute will serve to slow the spacecraft to approximately 250 feet per second at the 10,000 foot altitude of main parachute deployment.

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 drogue mortar and cartridge, barostats, antenna fairing ejector, and sea marker packet.

Following escape tower separation in flight, the 21,000 and 10,000 foot barostats are armed. No further action occurs until the 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 parachute 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-frequency 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 parachute 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 orbital laboratory, offers possibilities for scientific experimentation heretofore nonexistent. Certain research experiments, though not in direct support of Mercury, may expedite future space efforts.

A Mercury Scientific Experiment Panel, chaired by L. R. Fisher of the Manned Spacecraft Center, was formed in mid-April 1962 to review all research experiments proposed for Mercury. This group established the scientific value, relative priority, suitability for orbital flight, and ramifications with regard to the flight activity schedule of each proposal. Here is a description of the balloon experiment and zero gravity experiment recommended by the panel for MA-7:

BALLOON EXPERIMENT -- The MA-7 spacecraft has been outfitted with a system that will deploy a tethered balloon during the mission orbital phase. Of primary interest will be the visual phenomena in a space environment. Aerodynamic drag measurement will be a secondary objective.

The visual portion of this experiment will be concerned with the reflection characteristics of various colored surfaces in space. The relative merit of these colors for optimum visibility will be evaluated and a correlation between observed and actual separation of the object from the spacecraft after release will be established. The aerodynamic portion will measure atmospheric drag and stability while deployed and a relationship between these parameters and object separation following release will be analyzed.

An additional objective is provided by the simultaneous dispersion of a cluster of multi-colored particles or "confetti" -- one-fourth inch Mylar discs which will be placed in the folds of the balloon. The visual effects and the behavior of these known objects will be closely studied.

The test apparatus consists of a 30-inch, Mylar-aluminum sphere which is to be inflated by an attached 900 psi nitrogen bottle. The balloon is divided equally into five segments. The corresponding colors or these reflective surfaces are orange, white, silver (aluminum), yellow, and phosphorescent, which has a glow characteristic at night. The balloon is tethered with a 100-foot nylon line and a coiled eight-foot strip of .005 aluminum, which acts as a shock absorber as it uncoils. A small metal beam, instrumented with a strain gage, will provide the means of measuring drag. Electric squibs will actuate the spring-loaded deployment and line-cutting mechanisms.

The entire experiment package weighs about 7 pounds and will be installed within the antenna section.

The operational plan calls for deployment of the balloon by the astronaut at the beginning of the second orbit over Cape Canaveral. Output from the strain gage and pilot description of visual observations will be recorded on tape. It is desired that the tethered phase last for nearly one orbital period; however, maneuverability of the spacecraft is necessarily restricted with the balloon attached and earlier release may be required. The astronaut will observe the operation from the deployment sequence, through tethering, to release and separation, and any oscillations or gyrations will be noted. Photography of angular displacement, the various colors, and the confetti dispersion will be provided for correlation with visual responses. The astronaut will orient the spacecraft in order to track the balloon's trajectory after it is released and photographs during this phase are requested when distances are recorded.

This project was initiated in January of this year, and a rigorous qualification test phase at the NASA Langley Research Center, Newport News, Va., was followed by delivery of the packaged unit to Cape Canaveral on March 13.

ZERO GRAVITY EXPERIMENT -- Very little is actually known about the behavior of liquids in a weightless environment. Various tests have been conducted using drop towers and aircraft in parabolic flight, but the test durations are too short. Project Mercury offers the first opportunity to observe and photograph such behavior throughout an extended period.

The major objective of this exercise is to analyze liquid behavior in a zero-gravity state for an extended duration and to supply the results to other space programs. The Gemini and Apollo projects require a detailed analysis of weightless liquid phenomena in order to correctly design fluid storage tanks. This experiment will primarily establish the effect of surface tension in liquid behavior, but other effects such as viscosity, mass, and liquid/gas volume ratio will be studied.

The apparatus consists of a spherical glass flask of about three inches diameter with an internal one-inch standpipe, which extends from the internal surface to slightly past center. The standpipe has three holes equally spaced around its base to allow passage of the fluid. The flask is guarded on one hemisphere by a lucite shield and on the other by an aluminum reflector. An O-ring is sandwiched between these two shields, so that in the event of breakage of the flask, the liquid will not leak into the cabin. The glass flask has an internal volume of 300 milliliters (about a cup) and the liquid occupies 20 per cent of this, or 60 milliliters. The constituents of this liquid are distilled water, green dye,an aerosol solution to reduce surface tension, and a silicone additive to inhibit foaming.

The unit will be installed within the cabin of the MA-7 spacecraft and will be observed by the Astronaut-observer camera. The test device will be located to the right and behind the astronaut's head, and he will periodically observe the experiment using a hand-held mirror. A phase of the flight which is of particular interest is the period during and immediately following retrofire. It is theorized that in a zero-gravity condition, the liquid within the sphere will rise in the standpipe or capillary tube because of surface tension, rather than float around in globules as might be expected.

The test unit has been qualified for flight at Cape Canaveral by NASA's Lewis Research Center (Cleveland, Ohio) where it was designed and developed.

THE ATLAS LAUNCH VEHICLE -- The launch vehicle to be used for the Mercury-Atlas 7 test is an Atlas D model (107D), one of 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.

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

(1) Modification of the payload adapter section to accommodate the Project Mercury spacecraft.

(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 adapter section, spacecraft and escape tower, the Mercury-Atlas 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 run.

ASTRONAUT PARTICIPATION -- All seven of Project Mercury's team of astronauts will participate in the MA-7 orbital mission, some as flight controllers from vantage points around the world.

Astronauts Carpenter, prime pilot, Walter M. Schirra, Jr., back-up pilot, Virgil I. Grissom, and John Glenn will be at Cape Canaveral, with Grissom serving as capsule communicator. Alan B. Shepard, Jr., will be stationed at the Mercury site at Point

Arguello, California, and Donald K. Slayton will participate from the Mercury tracking station in Muchea, Australia. L. Gordon Cooper, Jr., will be at Guaymas, Mexico, Mercury station.

THE NETWORK -- World-Wide Mercury Tracking Stations, including a ship off east Africa, will monitor the MA-7 flight. The Space Computing Center of the NASA Goddard Space Flight Center in Greenbelt, Maryland, will make trajectory computations.

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 and performing efficiently in space -- and since only three 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.

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

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

During late 1961, an industrial team headed by the 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 Rose, 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 telephones, 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 Point 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 the 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, 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 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 computer also originates 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 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 must 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, e.g., liftoff, launch vehicle separation.

These data are transmitted from Cape Canaveral to Goddard where IBM 7090's compare the spacecraft trajectory to a pre-determined flight path -- and flash the results back to Canaveral. 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 system 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 -- 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 (MCC) with "real time" information from world-wide tracking stations having contact with the orbiting Mercury spacecraft.

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

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

These lines are used during an orbit 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 orbit exercises, the 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) Systems and vehicle familiarization -- The Mercury astronauts were given lectures in the spacecraft systems by NASA

and several 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 Dr. William K. Douglas, 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 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 5½ 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 10-foot swells were experienced). Water survival training was also accomplished in August 1960 and December 1961 at Langley. 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 Center 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, autopilot and horizon scanners.
Schirra --	Environmental 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 Project Mercury flight requiring medical support, an Operational Bioastronautic Group has been formed to support the MA-7 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 2 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.

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NEWS RELEASE

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MA-7 MERCURY RECOVERY FORCE

Location, recovery and delivery of the astronaut and his spacecraft are the tasks assigned the Project Mercury Recovery Force. This organization under the command of Rear Admiral John L. Chew, USN, Commander Destroyer Flotilla FOUR will consist of 20 ships, over seventy aircraft and a specialized group in the launch site area. Admiral Chew exercises overall control of the recovery force from the recovery room located next to the control room in the Mercury Control Center at Cape Canaveral. At lift off the force will be prepositioned in the launch site and at nine potential landing areas in the North Atlantic.

LTCOL Harry E. Cannon, USAF, of the Air Force Missile Test Center, will head the recovery group in the launch site that consists of four Marine Air Group TWENTY-SIX helicopters, three Army LARC's (Light Amphibious Vehicle) and small boats.

Captain A. F. Blair, Commander Destroyer Division TWENTY-TWO embarked in the USS ENGLISH, will command the group responsible for recovery in Area One, from just off-shore to the vicinity of Bermuda. This group will consist of:

- USS Swerve (MSO 495) commended by LCDR W. E. Pettee, USN
- USS Sturdy (MSO 494) commanded by LCDR A. G. Hodge, USN
- USS Opportune (ARS 41) commanded by LCDR T. F. Byrnes, Jr., USN
- USS English (DD 696) commanded by CDR W. S. Mayer, USN
- USS Hank (DD 702) commanded by CDR J. M. Dinwiddie, USN
- USS Dewey (DLG 14) commanded by CDR M. G. Tremaine, USN
- 2 P2V Aircraft from Patrol Squadron SIXTEEN commanded by CDR C. E. Rogers, USN
- 2 SA-16 Aircraft from the 48th Air Rescue Squadron commanded by LTCOL M. C. Frazee, USAF

Captain C. E. Pond, Commander Destroyer Squadron TWO embarked in the USS Barton, will command the group responsible for Area Two and Seven. Area Two extends from the vicinity of Bermuda to approximately half way across the Atlantic. Area Seven is the site selected for the spacecraft landing if it is decided to terminate the flight after one orbit. Units of this group are:

USS Wren (DD 568) commanded by CDR P. C. Koelach, USN
USS Soley (DD 707) commanded by CDR O. N. Hibler, Jr., USN
USS Barton (DD 693) commanded by CDR C. E. Delaney, USN
USS Spiegel Grove (LSD 32) commanded by CAPT W. G. Boyer, USN
2 WV Aircraft from Airborne Early Warning Squadron FOUR commanded by CDR J. D. Langfur, USN
3 P5M Aircraft from Patrol Squadron FORTY-NINE commanded by CDR H. C. Hansen, USN
4 P2V Aircraft from Patrol Squadron SIXTEEN commanded by CDR C. E. Rodgers, USN
2 SC-54 Aircraft from 55th Air Rescue Squadron commanded by LTCOL N. V. Rudrud, USAF.

3 HUS Helicopters from Marine Air Group TWENTY-SIX commanded by COL R. L. Cochrane, USMC.

Captain W. W. Spears is assigned the recovery task for Areas Three, Four and Five which are all in the Eastern Atlantic along the first orbit track. This group consists of:

USS Hunt (DD 674) commanded by CDR E. C. Hoban, USN
USS Elokomin (AO 55) commanded by CAPT W. W. Spears, Jrs., USN
USS Remey (DD 688) commanded by CDR R. A. Gibney, Jr., USN
4 WV Aircraft from Airborne Early Warning Training Unit Atlantic commanded by CDR L. J. Papas, USN
4 P2V Aircraft from Patrol Squadron SEVEN commanded by CDR W. F. Abernathy, USN
4 SA-16 Aircraft from the 57th Air Rescue Squadron commanded by LTCOL F. V. Sohle, USAF

CDR R. N. Cook is responsible for Area Six near the Canary Islands. This group includes:

USS Massey (DD 778) commanded by CDR R. H. Cook, USN
4 P2V Aircraft from Patrol Squadron SEVEN commanded by CDR W. F. Abernathy, USN.

CAPT R. E. Sinnott, Commander Destroyer Squadron TEN embarked in the USS Fred T. Berry, has command of the group in Area Eight at the end of orbit Two. This group consists of:

USS Fred T. Berry (DDE 858) commanded by CDR E. L. Burgess, USN
USS Donner (LSD 20) commanded by CDR M. V. Cornetta, USN
3 HUS Helicopters from Marine Air Group TWENTY-SIX commanded by COL R. L. Cochrane, USMC
3 P5M Aircraft from Patrol Squadron FORTY-FIVE commanded by CDR G. F. Obryan, USN

Rear Admiral E. R. Eastwold, Commander Carrier Division SIXTEEN embarked in the USS Intrepid, will command the group in Area Nine. This group at the end of the third orbit consists of:

USS Intrepid (CVS 11) commanded by CAPT J. L. Abbott, Jr., USN
USS Robinson (DD 562) commanded by CDR W. A. Murphy, USN
USS John R. Pierce (DD 753) commanded by CDR A. V. Lorentson, USN
6 P2V Aircraft from Patrol Squadron EIGHTEEN commanded by CDR R.F. Lyons, USN
2 C-54 or C-130 Aircraft of the AFMTC commanded by Lt. COL Glenn T. Stitt, USAF
4 (2 SA-16 and 2 SC-54) Aircraft of the Air Rescue Service from units under the command of LTCOL P. B. Mudge, USAF
3 HUS Helicopters from Marine Air Group TWENTY-SIX commanded by COL R. L. Cochrane, USMC

The deployed recovery teams have several techniques or modes of operation available for adapting to different possible situations. Each unit has practiced the procedures required for the recovery force role.