MANNED SPACECRAFT CENTER
HOUSTON, TEXAS
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ASTRONAUT TRAINING

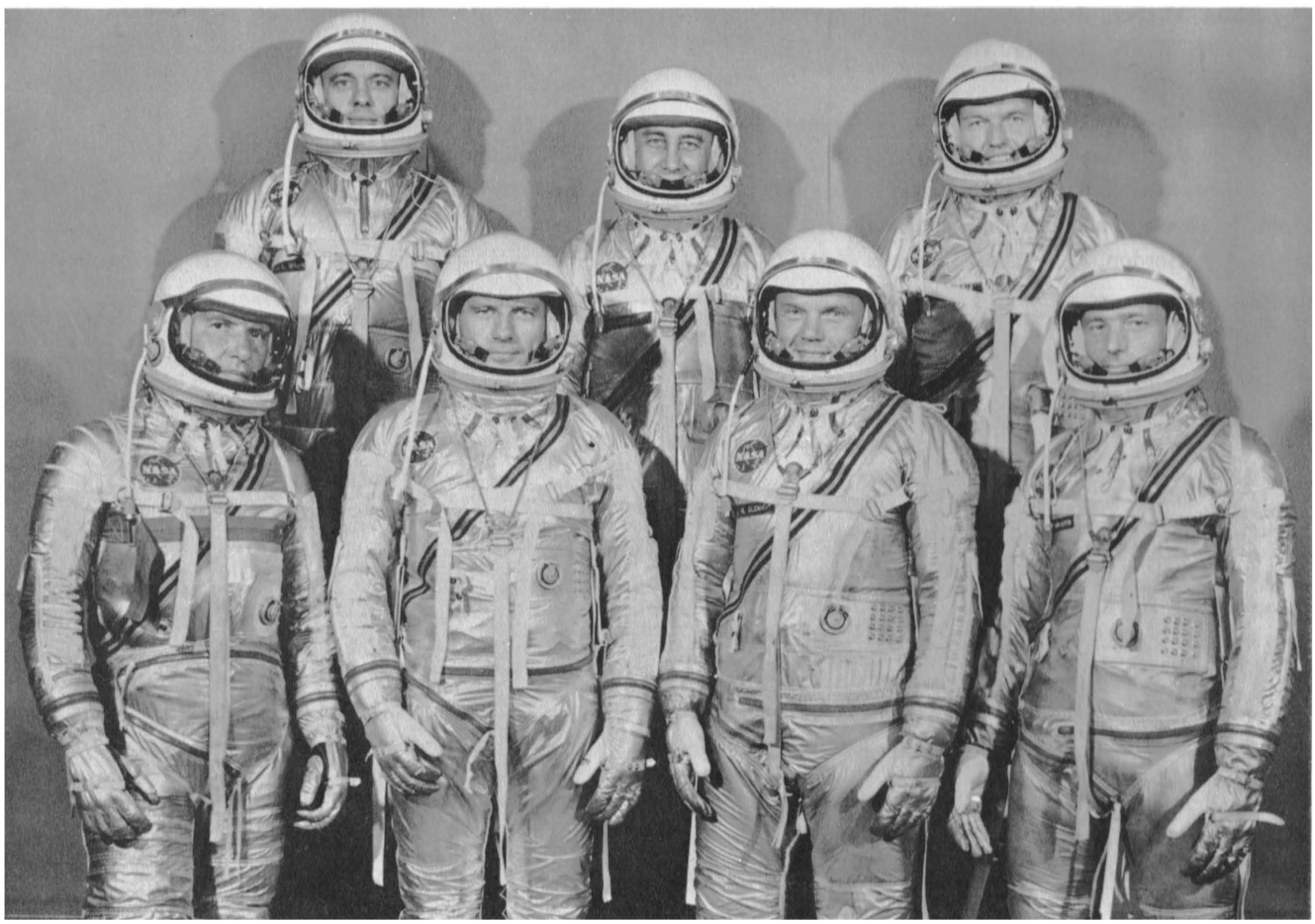
FACT SHEET #290

A most important phase of activity in connection with the manned space flight programs of the United States is, quite naturally, the selection and training of the astronauts who will serve as flight crew members.

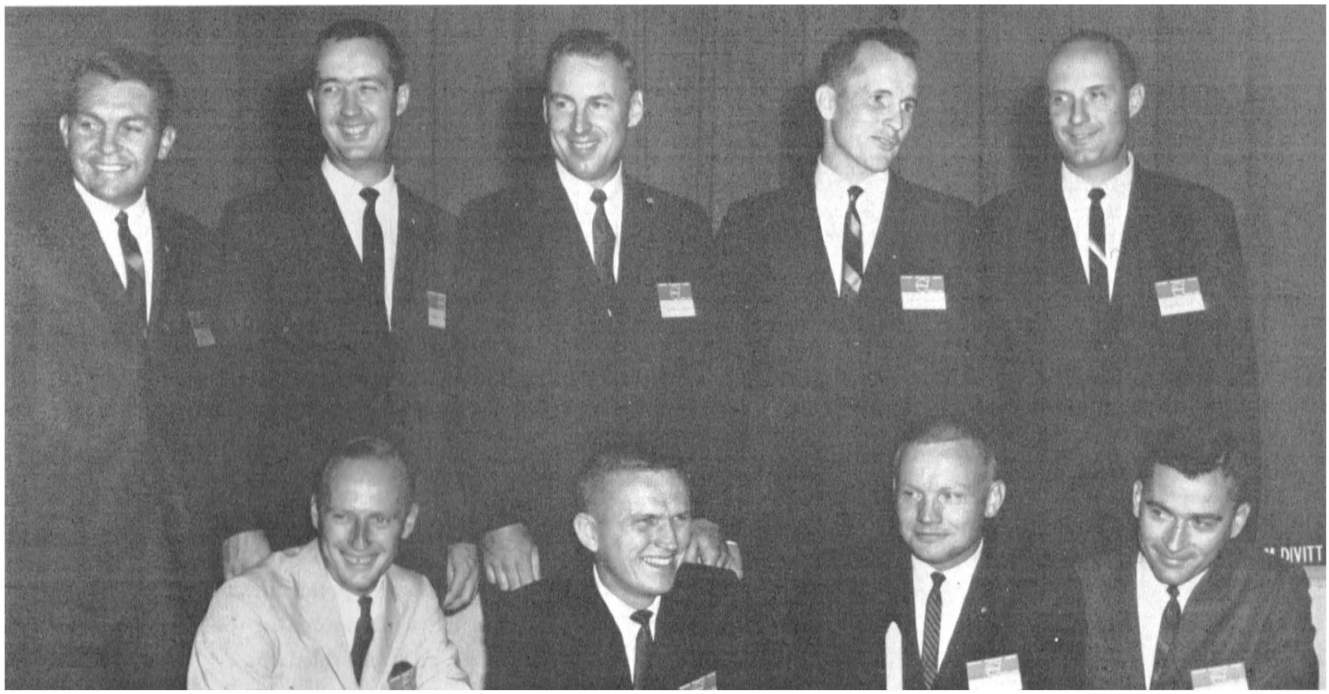
Manned Spacecraft Center at Houston, Texas, has a number of specific responsibilities in connection with the manned space programs, including flight crew selection, training and mission performance. These responsibilities are assigned to the Flight Crew Operations Directorate.

To date, since the inception of America's first manned space goals were set, there have been three groups of astronauts selected. The first group was named in April 1959, consisting of seven men — M. Scott Carpenter, L. Gordon Cooper, Jr., Virgil I. Grissom, John H. Glenn, Jr., Alan B. Shepard, Jr., Walter M. Schirra, Jr., and Donald K. Slayton. This group was identified as the Mercury astronauts and served as flight personnel for the two suborbital and four orbital missions flown in the successful Mercury program. These same astronauts, with the exception of John Glenn, who left the National Aeronautics and Space Administration early in 1964, serve as the nucleus of a pool of astronauts to fly the two-man Gemini and three-man Apollo missions.

Nine astronauts were named in the selections made in September 1962, and an additional 14 were added to the rolls in October 1963. An additional group of scientists-astronauts will be chosen during 1965. The 1962 selectees were Neil Armstrong, Frank Borman, Charles Conrad,



THE FIRST ASTRONAUT GROUP, named in April 1959, were (left to right): Walter M. Schirra Jr., Alan B. Shepard Jr., Donald K. Slayton, Virgil I. Grissom, John H. Glenn Jr. (resigned from program in January 1964), L. Gordon Cooper Jr., and M. Scott Carpenter.



THE SECOND GROUP OF ASTRONAUTS was named in September 1962. They are (kneeling, left to right) Charles Conrad Jr., Frank Borman, Neil A. Armstrong, and John W. Young. Standing (left to right) are Elliot M. See Jr., James A. McDivitt, James A. Lovell Jr., Edward H. White II, and Thomas P. Stafford.

Jr., Elliot M. See, Jr., James Lovell, James McDivitt, Edward H. White II, John W. Young, and Thomas A. Stafford.

The 14 named in 1963 were Edwin E. Aldrin, Jr., William A. Anders, Alan L. Bean, Eugene A. Cernan, Roger B. Chaffee, Walter Cunningham, Charles A. Bassett II, Donn F. Eisele, Theodore C. Freeman, Michael Collins, Richard F. Gordon, Jr., Russell L. Schweickart, David R. Scott and Clifton C. Williams, Jr. Freeman was killed in a T-38 aircraft crash near Ellington Air Force Base, Texas, October 31, 1964, while completing a training flight.

This total pool of pilot personnel is in a training program which will prepare them for flight duty on either the Gemini or the Apollo programs.

The training program currently in use incorporates

A THIRD GROUP OF ASTRONAUTS was added to the NASA pilot team in October 1963. They are, first row, left to right, Edwin E. Aldrin Jr., William A. Anders, Charles A. Bassett II, Alan L. Bean, Eugene A. Cernan, and Roger B. Chaffee. Second row, left to right, are Michael Collins, Walter Cunningham, Donn F. Eisele, Theodore C. Freeman (killed in a routine training crash near Ellington AFB, Texas, October 31, 1964), Richard F. Gordon Jr., Russell L. Schweickart, David R. Scott, and Clifton C. Williams Jr.

much of the knowledge gained during Project Mercury in the field of astronaut training. As NASA personnel entered that program there was no precedent as to what training was necessary, what training most valuable, and what training could be minimized. Consequently, in order to assure success in this phase of activity, all types of training were used at the outset of the program. As Mercury progressed, the training varied due to the information gleaned by the pilots themselves as to what phases of training were most useful.

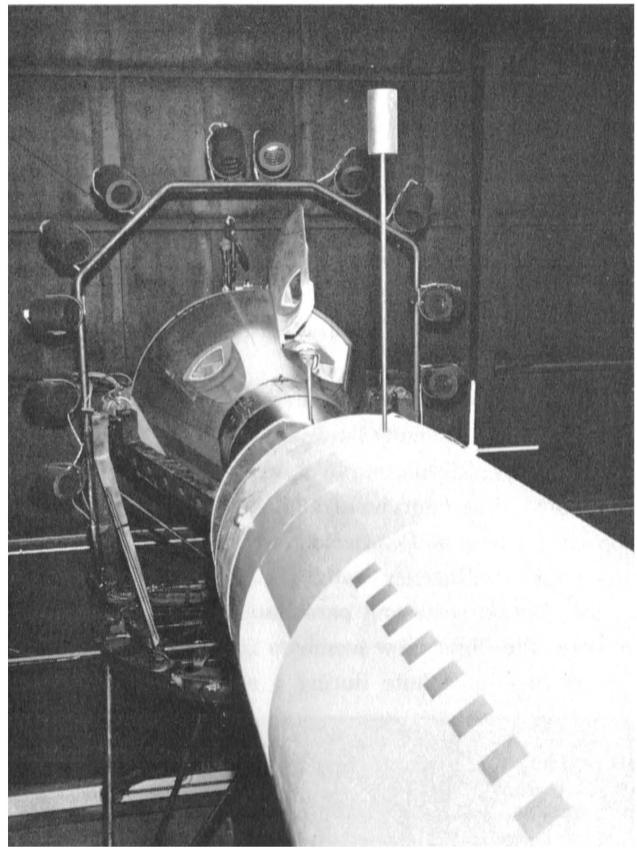
At the present time, there are two basic purposes taken into consideration in the flight crew training program.

*First, and most important, is to provide crew members prepared to operate the spacecraft in the best possible manner — both in normal pursuit of particular flight objectives as well as in emergency and contingency situations.

*Second, to provide competent observers in the appropriate non-operational disciplines in order to successfully accomplish the scientific objectives of the flights.

In order to achieve the desired proficiency, the training program is broken down into a number of areas according to activity. The amount of time spent on each of these phases is dependent upon a number of factors.

Astronaut Walter Cunningham, wearing a proposed pressurized lunar landing suit and protective cover, and using a "Jacob's Staff," is shown as he climbs a slope on the pumice fields near Bend, Oregon.



ASTRONAUT Richard F. Gordon Jr. shown at the pilot's position in the Gemini Translation and Docking Simulator, one of the training devices utilized to prepare astronauts for specific space flight assignments.

All astronauts participate in specific formal training areas which apply to both the Gemini and Apollo programs. These areas are science and technology summary courses, operations familiarization, environmental and contingency training, spacecraft and launch vehicle design and development, and an aircraft flight program.

The majority of the science and technology courses are basic in nature, but two of them deal directly with spacecraft systems — the Gemini onboard computer and the Apollo guidance and navigation. A basic digital computer course is given prior to the specific Gemini course and the basic material of the inertial guidance systems is covered in conjunction with the Apollo guidance and navigation instruction.

Other courses in this area include geosciences (geology, geophysics, geochemistry) — including terrestrial and simulated lunar training — flight mechanics, rocket propulsion systems, aerodynamics, astronomy, communications, physics of the upper atmosphere and space, medical aspects of space flight, and meteorology.

In the operations familiarization area, the astronauts are briefed on pre-launch activities at Cape Kennedy and at Houston, tour all pertinent operational facilities at both these sites with emphasis on the Mission Control Centers

at each location, and become familiar with all recovery operations.

During the environmental familiarization and contingency training area, the astronauts are exposed to acceleration, weightlessness, lunar gravity, vibration and noise, and pressure suit environment. Weightlessness is experienced through use of an Air Force K-135, while a gravity platform device may be used to simulate the one-sixth lunar gravity. Pressure suits are worn during such training and vibration and noise effects are simulated where appropriate.

The contingency training stresses survival training in the event the astronauts land in other than the normally planned sites — tropic survival training is accomplished in Panama, desert survival training in Nevada, and water survival training at Pensacola, Florida, and in Galveston Bay. Other contingency training includes that concerning use of ejection seats and parachutes. Parachute training prepares the flight crew members for contingency use of the personal parachute during a mission. This training includes instruction in parachute landing, maneuvering to avoid ground obstacles, and drag following impact.

In the area of spacecraft and launch vehicle and development, the training is accomplished by astronaut participation in spacecraft and launch vehicle engineering and mock-up reviews in specific contractor and MSC design and development studies and simulation, through various internal and contractor meetings which are of concern to the pilots such as pressure suit and personal equipment development, ground test programs and development of the preflight test program of the spacecraft.

The aircraft flight training program provides spacecraft flight readiness through use of T-33, F-102, and T-38 aircraft assigned to MSC and based at Ellington Air Force Base. In addition, a continuing program of helicopter flight instruction is provided to prepare the flight crews for simulations of lunar landings.

Special program briefings and systems training have been used to familiarize the astronauts with the total Gemini program, starting with a description of the mis-

WEIGHTLESS TRAINING is accomplished through specially adapted aircraft at Wright-Patterson Air Force Base, Ohio. In the photo above, three helmeted astronauts sample space food while they encounter a brief period of weightlessness. They are, left to right Frank Borman, Thomas P. Stafford (upside down) and James A. Lovell Jr.

sion to be performed, and progressing to launch vehicle systems, spacecraft systems, and the crew station.

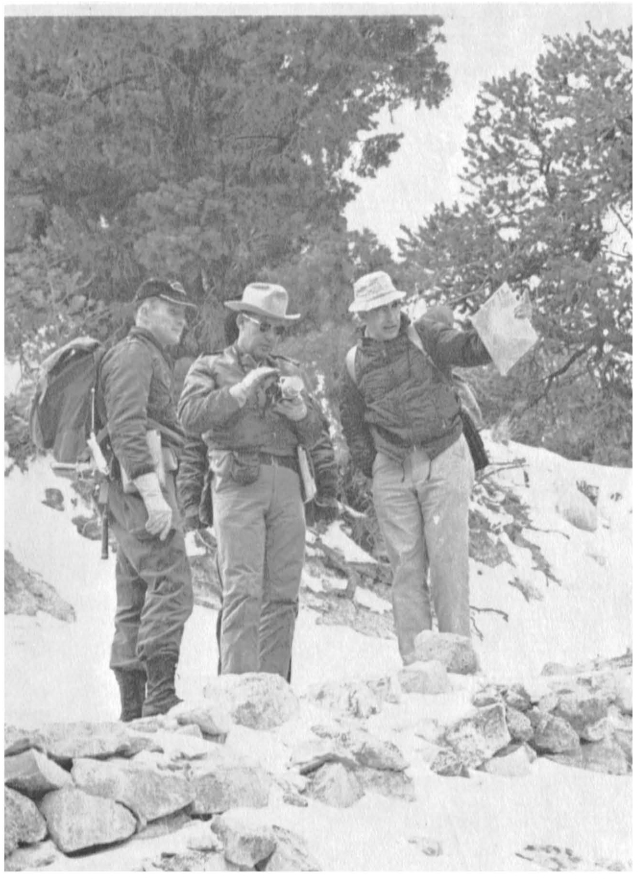
In a little more detail, the launch vehicle briefing is broken down into two phases — first on airborne systems, with stress on electrical, propulsion and propellant, guidance and control, malfunction detection, launch safety, ordnance instrumentation and countdown techniques; and, second on vehicle and sub-systems flight characteristics. This phase covers familiarization on flight dynamics, guidance and control, propulsion, failure modes and abort systems.

Training on the spacecraft systems and systems trainer operations is accomplished through lectures, operationally and sequentially oriented, utilizing the Gemini systems trainers extensively.

Controls and displays are discussed, system by system, with the total crew station available. In addition, all the astronauts spend time in the Gemini mission simulator for familiarization purposes.

Part task training is presented to prepare the crews for and to supplement the mission simulator training in the retrofire and reentry control tasks.

Launch vehicle abort training is accomplished on a moving base simulator designed to provide a high fidelity simulation, including kinesthetic cues of a wide variety of Gemini normal and malfunction trajectories.



ASTRONAUTS Edward White, left, and Walter Schirra, center, are briefed on rock formation as they stand at the rim of Grand Canyon during a geological training trip.

ADDITIONAL geological training has been held at other locations. James McDivitt, left, and Donald Slayton are shown here during a training exercise in Arizona.

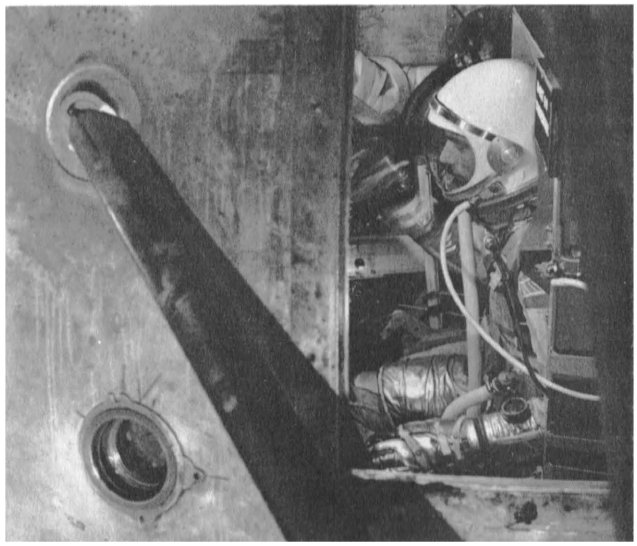
The egress training program includes areas in sink rate and attitude; underwater, surface and shipboard egress; personal equipment operation; flotation characteristics; flooding effects; use of Gemini survival gear; pre-impact and impact procedures; radio operation; and snorkel and cabin vent valve operation.

Centrifuge training, in which the astronauts are exposed to high G-force of entry and launch, is presently being accomplished in the centrifuge at the Johnsville, Pennsylvania Naval Air Station.

General Gemini mission training provides the crews with experience in both normal and abnormal spacecraft and spacecraft systems operations. The Gemini mission simulator, supplemented by the systems trainers, briefings, and the docking simulator are used to provide this training in a four-phase program.

*Familiarization — to thoroughly indoctrinate crew members with Gemini spacecraft systems and their normal operation throughout an entire normal mission.

*Systems Failure Training — to thoroughly prepare



CENTRIFUGE TRAINING enables the astronauts to become familiar with the g-forces encountered during the liftoff and reentry phases of space flight. Astronaut M. Scott Carpenter is shown here during centrifuge training at Johnsville, Penna.

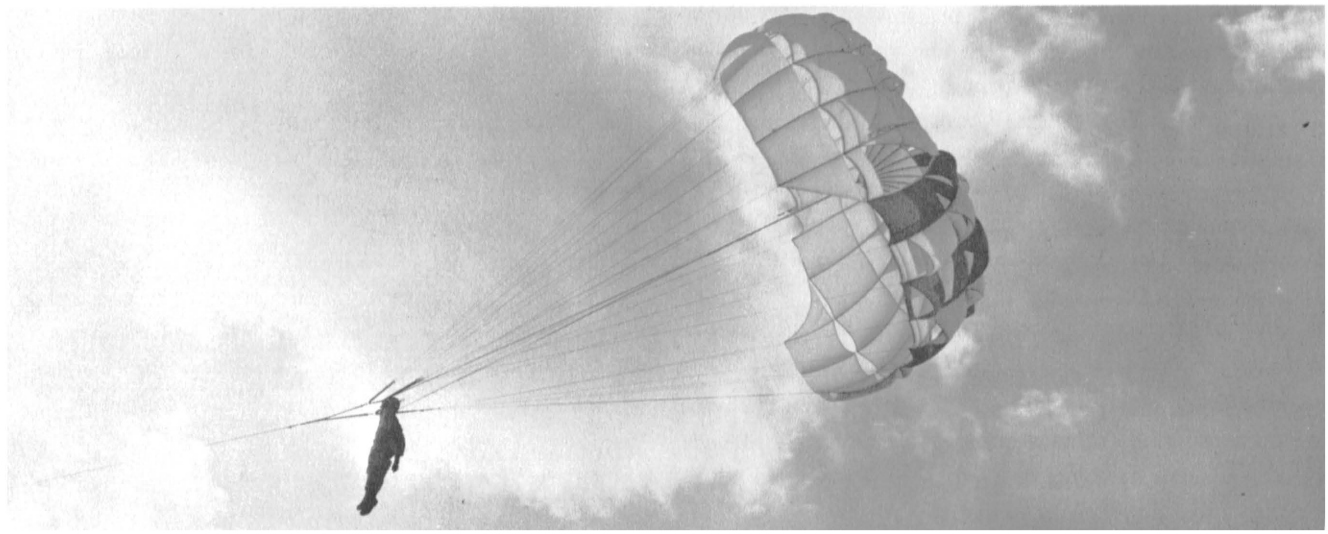
the flight crews in systems failure indications, analysis, correction and alternate procedures.

*Random Malfunctions — to provide realistic situations by programming a pre-selected list of possible malfunctions which would not normally require an early abort or early mission termination. A part of this training phase, however, is devoted to launch abort problems.

*Docking Training — to provide experience in a typical docking maneuver, including the alignment of the spacecraft with the Agena target vehicle, maneuver into the docking cone, engagement, docking tasks, and maneuver out of the docking cone.

Currently, specific Apollo training is conducted only in the areas of Program Briefings to familiarize the flight crews with the Apollo mission and present state of development of the spacecraft and development and by Systems Familiarization Briefings. The Program Briefings include material on projected launch schedules, launch vehicle, general spacecraft description of the command, service and lunar excursion modules, and the lunar landing mission profile. The systems briefings provide background knowledge in systems operations to facilitate the overall mission study. The various systems covered in these briefings are guidance and navigation, stabilization control, reaction control, spacecraft propulsion, power generation and distribution, sequential circuits, environmental control, communication, and instrumentation.

A GROUP of astronauts, plus local instructors, take a brief respite during a hike out of a dense jungle area in the Panama Canal Zone. All the astronauts have undergone jungle survival training.

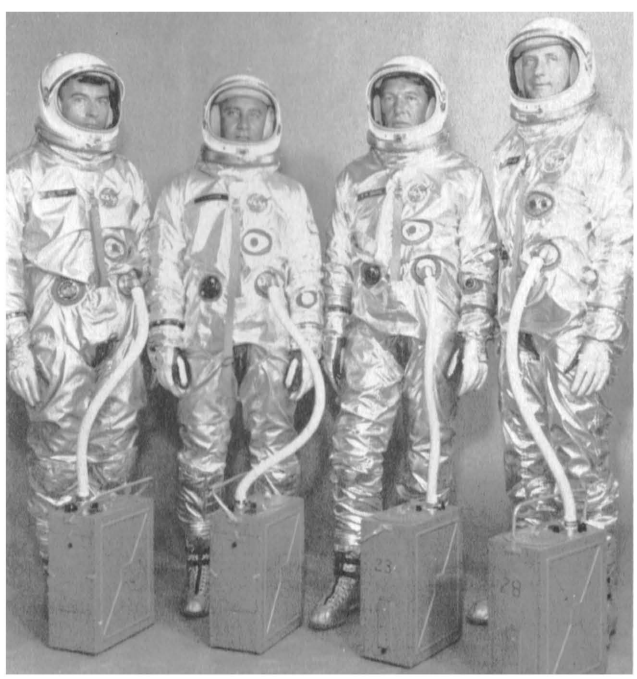


PARACHUTE TRAINING is required for all astronauts. One of them is shown here as he is being towed to an altitude of 400 feet prior to being cut loose from the tow-vehicle. This type training gives the astronauts know-how as to what to expect in such eventuality as far as impact, avoiding ground obstacles, etc.

With programs of this size, nature and complexity, it is impossible for the astronauts to keep up with all the day-to-day progress and the ever-changing status of the launch vehicles, spacecraft, and their many intricate systems.

The Flight Crew Operations Directorate has solved this problem by assigning one or more astronauts to various vital specialized fields. These astronauts "bird-dog" these activities and periodically report to the entire group of astronauts on the changes and progress effected. The areas of specialized assignments are the command and service modules; lunar excursion module and cockpit layout; Apollo, Gemini and Agena launch vehicles; control systems, communication systems and instrumentation; mission planning, guidance and navigation; recovery and crew systems; trajectory analysis and flight plans; environmental control systems, radiation and thermal protection; training and simulators; spacecraft and Agena

WATER EGRESS procedures are developed through testing procedures. Two astronauts are shown here after practicing egress from a boilerplate Gemini spacecraft in Galveston Bay.



ASTRONAUTS CHOSEN as the prime and backup flight crews for the first manned Gemini flight are shown here. Left to right are John Young, prime pilot; Virgil I. Grissom, prime command pilot; Walter Schirra, backup command pilot, and Thomas Stafford, backup pilot.

propulsion; deep space network; pressure suits and extra-vehicular experiments; electrical and sequential systems and monitoring non-flight experiments, (these include experiments to be conducted on the lunar surface in Apollo), in other programs which may be related to MSC programs; attitude and translation control systems, cockpit integration; future manned programs and in-flight experiments; and range operations and crew safety.

When a flight crew for a specific mission is named, they start an intensive training schedule as required by the overall mission objectives and experiments about six months prior to the scheduled flight date. This schedule includes refresher training in many of the fields covered by the general training program. For instance, in the Gemini program, it is anticipated that each astronaut will spend over 100 hours in the Gemini simulators prior to flight date. In addition, they maintain close surveillance of all systems checks in their assigned spacecraft and are present for active participation in all of the launch vehicle tests during the time of the launch vehicle spacecraft mating tests at Cape Kennedy. Such tests are conducted prior to and concurrent with full network simulations support by the mission simulator.

Other refresher training for the selected crew members is conducted in egress activities, star identification and familiarization with the constellation above the planned orbital path, parachute landings, centrifuge, restraint system, and controls and displays. All of this training is accomplished to insure that the crew members attain a peak of efficiency in these and related areas prior to flight time.

Since the inception of the Mercury program, the National Aeronautics and Space Administration has taken advantage of existing training devices of the military services and private industry in order to cut down on the overall cost. This has resulted in almost endless travel for the astronauts and has added problems to their already overcrowded work schedule.

DESERT SURVIVAL TRAINING is also required of all astronauts. A group of them are shown here receiving instruction on the use of signal mirrors. This training is conducted at Stead Air Force Base, Nevada.