# 2.0 TRAINING PROGRAM

A schedule of the general training program over the 15-month period is presented on page 12. This length of time is established because of the seasonal requirements on the survival and geology field trip sites, and because it enables the crews to become familiar with space flight hardware and operational procedures prior to flight assignment.

The following paragraphs will discuss each segment of the training program.

2.1 Science and Technology Summary Courses - The space science and technology courses provide a means for bringing the flight crews to a common level of understanding in the prescribed subjects. These subjects were chosen to provide the proper background to enable the crew to understand the design and operation of the spacecraft, launch vehicle and mission experiments. With the exception of Guidance and Navigation, the courses are fundamental in nature. The Guidance and Navigation course is a functional description of the Apollo system but also covers the basic components of inertial guidance systems.

A detailed schedule for the academic program is presented on page 11. Each week, the courses are scheduled on Monday through Wednesday. The remainder of the week during this period of academic training is devoted to operations and project briefings and field trips.

The following listing identifies course content and the hours of instruction.

| Course | Hours of Instruction |
|---|---|
| Geology I - Basic terrestrial mineralogy, petrology and geological processes, identification of basic rock structures and geologic mapping techniques | 56 |
| Geology II - Terrestrial analogs of lunar geographic features, geologic mapping, geophysical studies and appropriate sampling techniques | 56 |

Geology Field Trips - (Integral part of geology course)

1. Grand Canyon, Arizona
2. West Texas (Marathon Basin and Santa Elena Canyon)
3. Bend, Oregon (Newberry Crater and Lava Butte)
4. Katmai, Alaska (Valley of Ten Thousand Smokes)

| Course | Hours of Instruction |
|---|---|
| Geology Field Trips (Continued)<br>5. Los Alamos, New Mexico (Valles Caldera)<br>6. Pinacate Volcanic Area, Mexico (Cerro Colorado and Elegante Craters)<br>7. Hawaii (Island of)<br>8. Flagstaff, Arizona (Sunset Crater Area and Meteor Crater)<br>9. Medicine Lake Area, California<br>10. Iceland (Askja Caldera and Laki Fissure Area) | |
| Astronomy - Astronomical terminology, solar system and celestial sphere. | 15 |
| Digital Computers - Digital computer components, operation, and programming techniques | 8 |
| Medical Aspects of Space Flight - Physiology of the human body as affected by the space environment | 12 |
| Flight Mechanics - Earth orbit, lunar, midcourse and entry mechanics | 24 |
| Meteorology - Meteorological considerations on space flight operations, global weather system observations | 4 |
| Guidance and Navigation - Apollo navigation technique, functional description of the Apollo guidance and navigation system | 34 |
| Rocket Propulsion - Rocket performance parameters, liquid rocket engine operation, solid propellant rocket operation, and reaction control system operation | 8 |
| Communications - Basic communications concepts, radio ranging, radio telemetry, and Apollo telecommunications performance | 10 |
| Physics of the Upper Atmosphere and Space - The environment of the interplanetary medium and the sun's effect on this environment, the earth's upper atmospheric conditions and associated phenomena | 12 |

2.2 Apollo Project Familiarization - The Apollo project familiarization will consist of three Apollo orientation briefings.

2.2.1 Mission Profile Briefing - This briefing will cover the Apollo mission objectives, the proposed launch schedules, a general description of the spacecraft and a definition of the lunar profile. Approximately 4 hours will be required to complete the briefing.

2.2.2 Launch Vehicle Familiarization - The Marshall Space Flight Center will conduct a briefing on the S-IB and S-V launch vehicles and systems. Also, a tour of MSFC facilities will be conducted during a 2-day stay at Marshall. In conjunction with the launch vehicle familiarization, a third day will be spent at the Mississippi Test Facility to familiarize the crew with these facilities and associated test programs. A static firing of one of the Saturn boosters may be viewed during this tour.

2.2.3 Spacecraft Familiarization - A general 18-hour briefing will be presented to the crews on the Command Service Module by North American Aviation instructors. Also, a 12-hour Lunar Excursion Module briefing will be conducted by Grumman instructors. These spacecraft familiarization briefings will be followed with complete and detailed systems briefings on each of the spacecraft after the initial academic program has been completed.

2.3 Space Flight Operations Familiarization - The following tours and briefings will be carried out to familiarize the new crews with manned space flight operations.

2.3.1 Launch Operations - A visit to Kennedy Space Flight Center will be made to receive briefings on the spacecraft and launch vehicle launch preparations and countdown operations. They will tour the Apollo launch complexes, the Vertical Assembly Building, the Apollo checkout buildings and Central Control.

2.3.2 Mission Control Center Operations - A full briefing on the Mission Control Center facilities and its operation will be given the crew by Flight Operations Directorate. The briefing will include a functional breakdown of each monitoring position in the Mission Operations Control Room as well as the function and operation of each one of the Staff Support Rooms. The real-time operations organization will be covered along with the network data flow. A detailed tour of the Mission Control Center will conclude this familiarization.

2.3.3 Recovery Operations - A detailed briefing on the planned recovery for the Apollo program will be given by the Recovery Operations Branch.

2.4 Spacecraft Systems Training - Complete spacecraft systems briefings are scheduled at the completion of the academic program. These systems courses will be conducted 4 days a week, 6 hours per day for approximately 8 weeks. The cognizant spacecraft contractor instructor personnel will make the briefings using the systems trainers when applicable for their courses.

2.4.1 Command and Service Module Systems Training - These systems briefings will be conducted by NAA instructors.

| System Course Title | Hours Duration |
|---|---|
| 1. Structures | 6 |
| 2. Electrical Power System | 12 |
| 3. Crew Systems | 6 |
| 4. Communications | 8 |
| 5. Environmental Control System | 12 |
| 6. Sequential Events Control System | 15 |
| 7. Propulsion System | 12 |
| 8. Stabilization and Control System | 24 |

2.4.2 Lunar Excursion Module Systems Training - Grumman Engineering Aircraft Corporation instructors will present this series of systems courses to the flight crews.

| System Course Title | Hours Duration |
|---|---|
| 1. Structures and Mechanical Systems | 6 |
| 2. Electrical Power Systems | 10 |
| 3. Instrumentation | 6 |

| System Course Title | Hours Duration |
|---|---|
| 4. Crew Systems | 6 |
| 5. Communications | 6 |
| 6. Environmental Control | 12 |
| 7. Propulsion | 12 |
| 8. Guidance, Navigation and Control | 24 |

2.5 Environmental Familiarization - For experienced aircraft pilots, the environmental conditions of space flight are unique in the sense that they are either more extreme or occur for longer duration than in aircraft flying. Since these environmental conditions have an effect on the performance of the man relative to his familiarity with the condition, each man is exposed to three environmental conditions of space flight; weightlessness, launch and reentry accelerations, and pressure suit familiarization.

2.5.1 Weightlessness - By means of a modified KC135 to fly at zero gravity for approximately 30 seconds per parabolic trajectory the flight crews will be exposed to weightlessness. Each pilot will experience 18 to 20 parabolas in one flight on the Air Force KC135. Three crew members can be accommodated on each flight, therefore, the training will require eight flights (two flights per day for 4 days) for completion.

2.5.2 Launch and Reentry Acceleration - The Manned Spacecraft Center centrifuge will be used to familiarize the crews with the expected acceleration profiles of the Apollo S-IB earth orbit launch, selected launch aborts and orbit reentry. A familiarity with the forces encountered in these periods of the mission will not only give the crews understanding of the accelerations, but it will also give them an appreciation for the astronaut's operational capability during these portions of the mission. Four to six runs per crew member are planned.

The initial Apollo centrifuge crew station does not have control capability. Crew station angular positions and acceleration profiles will be preprogrammed in the centrifuge control computer.

2.5.3 Pressure Suit Indoctrination - The crews will be given an indoctrination on the Apollo Block II pressure suit. Crew Systems Division personnel will conduct this training through briefings and demonstrations. The content of the indoctrination is as follows:

1. Briefing on the suit design and construction

2. Demonstration of the donning and doffing of the suit

3. Demonstration of mobility of the pressure suit at 3.5 psi differential pressure

4. Briefing on the miscellaneous crew equipment and demonstrations as required

5. Experience in donning, mobility, and doffing of suit

Throughout the specific mission training program, the pilots will wear their pressure suits to become familiar with its operation in the different phases of the mission.

2.6 Survival Training - The three basic survival conditions for which training will be accomplished are tropic, desert and water. The purpose of the training is to provide the pilots with the confidence and ability to survive in an emergency landing environment until rescue can be effected. In each case, the training is divided into three phases: lectures and briefings on survival techniques; demonstrations of the survival methods; and field experience to apply the knowledge gained from the first two phases.

2.6.1 Water Survival - The one-half day academic portion of the water survival training will be given by the Recovery Operations Division. This lecture will cover the following topics: requirements for human survival, food and water requirements and sources at sea; progressive aspects of survival; effects of drinking sea water.

For the practical experience in water survival, one day of activities is scheduled at the Water Safety and Survival School, Naval School of Preflight, Pensacola, Florida. The following training will be conducted in an enclosed tank without and with the pressure suits: basic swimming strokes, underwater escape from a cockpit; life raft boarding, helicopter rescue by sling and seat.

The survival equipment will be exercised during water egress training in specific mission training.

2.6.2 Tropic Survival - The 5-day course in tropical survival will be supported by the USAF Tropic Survival School, Albrook Air Force Base, Panama Canal Zone. The first 2 days will be lectures and demonstrations and the next 3 days will be field training. The academics will include lectures on the major types of tropical rain forests, tropical plants and animals as applicable to survival, terrain, travel, self-first-aid, use of kit equipment, and contacting indigeneous people.

The demonstrations include shelter construction, improvising equipment, building animal snares and traps, and signaling.

Two days will be spent at field sites with one day required to travel to and from the field area. In the field, the crews will be split into teams of three men each, as the case would be in an Apollo landing, and assigned an area for their campsite remote to the other teams. One instructor is assigned to two teams to monitor their activities and give advice when necessary. Each man will have the same equipment as he would have in an actual survival situation. In the field training, the flight crews will receive first-hand experience in procuring food, establishing a camp, improvising equipment and clothing and signaling rescue aircraft in the tropical environment.

2.6.3 Desert Survival - The desert survival course will be a 5-day course implemented in the same manner as the tropic survival. The Air Force Survival School, 3635th Flying Training Wing, Stead Air Force Base, Nevada, will provide the instruction formulated around space flight mission requirements. One and one-half days of academics will be received on the characteristics of world desert areas and survival techniques. One day of demonstrations will be given at the field site on the proper use and care of the survival equipment, and the use of the parachute in the construction of clothing, shelters and signals. The field training will be conducted in an area considered representative of many of the world's desert regions. As in the tropic survival field training, the teams of three pilots each will spend 2 days at remote sites practicing desert survival techniques in practical training.

2.7 Control Task Training - Because of unique techniques required in the use of side-arm rotation and translation controllers, a certain amount of time is required on part task trainers to acquaint the crews with the control of various space flight maneuvers. These part task simulators incorporate partial crew station displays with out-the-window infinity optics displays of the earth, stars, and rendezvous targets.

2.7.1 Gemini Part Task Trainer - The Gemini Part Task Trainer has the capability to simulate orbit attitude and maneuver thrusting control, retrofire control, terminal rendezvous, and at a future date reentry control in three control modes: rate command, direct (acceleration) and pulse control. This part task simulation has the out-the-window visual display and a three-axis attitude display (8-ball). The out-the-window display presents a starfield with an occluding disc to produce a horizon. For the rendezvous control practice, the out-the-window display is an electronic generated image of the Agena. Approximately 12 hours of training time per man will be spent on this trainer in the following training situations.

1. Orbital attitude and maneuver control - Practice in orbit attitude control and in thrusting maneuvers will be accomplished using all three control modes using the cockpit attitude reference system first and then the out-the-window display. Particular attention will be given to the problem of controlling the cross-coupling from the maneuver thrusters in the direct control mode.

2. Retrofire control - Using the 8-ball attitude indicator and the out-the-window horizon display, attitude control of the engine misalignment torques will be practiced using the rate command and direct control modes. The trainer instructor has the capability to vary the misalignment torques.

3. Reentry control - Practice damping the oscillations in pitch and yaw and controlling the roll to the commanded position will be accomplished in the rate command and direct control modes.

4. Terminal rendezvous - The terminal rendezvous maneuver will be practiced using the electronic generated image of the target display under different initial conditions. The cockpit display instrumentation of range and range rate and the flight director indicator are used to accomplish the maneuver.

2.7.2 Translation and Docking Simulator - Several 2-hour training sessions will be scheduled on the Translation and Docking Simulator to receive practice in maneuvering the spacecraft during the final docking phase. The maneuver will be practiced using the rate command, direct and pulse control modes with different initial conditions.

2.8 Launch Vehicle Abort Training - A session on the Dynamic Crew Procedures Simulator (DCPS) will be given the crews to give them an appreciation for the manual abort requirements. The DCPS

combines the crew station displays and physical cues for simulation of a wide variety of booster malfunctions and is capable of running many abort situations in rapid succession. The types of runs and the approximate number of runs will be as follows:

1. Normal runs - 2
2. Engine/propulsion system failures - 6
3. Propulsion failures - 3
4. Staging/sequential failures - 3
5. Control failures - 8
6. Structural failures - 2

2.9 Aircraft Flight Program - Spacecraft flight readiness will be maintained through the use of T-33 and T-38 type aircraft assigned to MSC and based at Ellington Air Force Base. These aircraft will be utilized for cross-country TDY trips as well as local flying.

A 2-week course in helicopter familiarization will be provided by the Naval School of Preflight, Pensacola, Florida, with a continuing program conducted at Houston. Helicopter flying will provide initial familiarization of lunar landing trajectories.