NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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MISSION TRAINING PROGRAM FOR THE THIRD MANNED APOLLO MISSION

PREPARED BY

MISSION TRAINING SECTION
MISSION OPERATIONS BRANCH
FLIGHT CREW SUPPORT DIVISION

December 12, 1967

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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1.0 SUMMARY

Approximately 1800 hours of crew training is programmed to achieve a highly skilled crew to fly the third manned Apollo mission (see table 5.1). In addition to the programmed training, each crewmember will spend many additional hours participating in other training activities i.e., physical exercise, study, informal briefings and reviews, and necessary mission support activities (A/C flying, suit fits, pilot meetings, travel, physical examination, mission development). Nonprogrammed activities will largely have to be accomplished prior to or after the normal working day. Therefore, optimum utilization of the time available for crew training is a necessity in order to achieve the training program as contained in this document.

2.0 INTRODUCTION

This document defines the preflight training and related operational activities of the primary and backup crews designated for the third Apollo mainline manned flight. It is primarily intended as a guide to the flight crew and personnel responsible for crew training. Modification of the document is the responsibility of the Mission Training Section (MTS) Flight Crew Support Division (FCSD), with the approval of the Director of Flight Crew Operations. The crew commander and training coordinator will tailor the training program to fit the individual crew member requirements and the objectives of the specific mission as they develop. Training requirements are based upon a Saturn V 504/CSM104/LM-4 high ellipse mission (E) with lunar simulations of rendezvous and navigation tasks.

Criteria used to develop the training program and overall training objectives are as follows:

a. The training program encompasses a 10-month period. (Figure 6.1)

b. Initially, crews will be scheduled for a 3-or 4-day training week to permit incorporation of essential mission development activities requiring crew participation that frequently occur early in the training program.

c. The prime and backup crews will receive the same training. The support crewmembers (a third astronaut crew) will primarily support crew training by substituting for the prime and backup crews in activities that are essential for mission development. Simulator training will be obtained by these crewmembers primarily on a "fill in" basis. In addition, the FCSD flight crew support team will alleviate the crew workload by supporting the crew in their specialty area (procedures, training, stowage, equipment design, flight planning, etc.).

d. Because of mission complexity and training time constraints, crewmembers will essentially train for their specific inflight responsibilities with sufficient cross training to assure a redundant capability for the more critical mission tasks. The following abbreviations are used for each crew member:

Crew Commander - CDR

Command Module Pilot - CMP

Lunar Module Pilot - LMP

3.0 TRAINING PROGRAM

3.1 Spacecraft Test Participation

Crew participation in Command and Service Module (CSM) and Lunar Module (LM) spacecraft testing is a major factor in the development of flight systems and operations. The crew will spend approximately 160 cockpit hours and 160 briefing hours during operational checkout procedures (OCP's) at the contractors facility, and test and checkout procedures (TCP's) at Kennedy Space Center (KSC) while testing the CSM and LM.

The support crew and support team will monitor all major spacecraft tests and brief the crew on the results. Of particular importance, the support crew and contractor pilots will significantly reduce unproductive prime and backup crew travel by participating in initial spacecraft test run sequences and providing best possible information relative to whether tests will commence as scheduled. Crew participation in spacecraft tests are divided into two categories:

Category I - Crew Mandatory - One or more members of the prime or backup crew will be in the spacecraft during the test.

Category II - Crew Commanders Option - The crew commander has the option to designate an astronaut or contractor pilot to man the spacecraft.

Crew participation in spacecraft tests will be in accordance with reference 1 and is summarized in table 5.2 and 5.2A.

3.2 Briefings, Reviews and Meetings

3.2.1 Command Service Module (CSM) Systems Briefings- North American Rockwell (NR) instructors will present a series of systems briefings covering each of the major S/C 104 subsystems, describing each subsystem and emphasizing the operation thereof. Although several of the crewmembers previously received Block II systems briefings, they will be covered again in entirety to assure that each crewman has a thorough comprehension prior to initial crew simulator training or participation in spacecraft tests. For maximum retention and learning, briefings will be generally conducted on a 5-hour per day basis. Duration and sequence of the CSM systems briefings is contained in table 5.3. The crew will receive subsequent CSM systems briefings as required with a final crew briefing covering latest modifications conducted by the NR test engineers at KSC approximately 1 month prior to the mission.

3.2.2 Lunar Module (LM Systems Briefings - Following the CM systems briefings, the Grumman Aircraft Engineering Corporation (GAEC) instructors will present a series of systems briefings covering each of the major LM-4 systems, describing each system and emphasizing the

operation thereof. Briefing time utilization will proceed in the same manner as the CSM briefings. Sequence and duration of the LM-3 briefings is contained in table 5.3. The crew will receive interim LM briefings as required with a final briefing at KSC approximately one month prior to the mission.

3.2.3 Launch Vehicle Briefings- The crew will receive briefings on the designated launch vehicle systems operation and performance by personnel of the Marshall Space Flight Center (MSFC); an initial briefing early in the training program with a final review at KSC (approximately one month prior to flight). Launch vehicle related aspects will be discussed during these briefings including countdown techniques, range safety, failure modes, abort situations and vehicle flight dynamics. In conjunction with these briefings, International Business Machines Company personnel will review operations of the launch vehicle instrument unit (IU). These briefings will be supplemented by periodic review within FCSD on launch vehicle timeline and emergency procedures. The crew will spend 1 day reviewing the status of each launch vehicle stage at its respective assembly location. (S-IC-Michoud, S-II-Seal Beach, S-IVB-Huntington Beach).

3.2.4 Guidance and Navigation (G&N) Program Briefings - The crew will receive operationally oriented briefings on the programs and operations of the CSM and LM G&N systems by the Massachuetts Institute of Technology (MIT) Instrumentation Laboratory personnel at their facility. Briefings will be conducted for a 4-hour period in the morning over a 2-week period in conjunction with computer program verification exercises on the Hybrid simulators (CSM & LM) in the afternoon and evening. The breifings will include the following programs: launch vehicle monitor, launch abort, alignment, tracking, attitude control, navigation (nominal trajectory, coasting, accelerated flight tracking, maneuvers, position determination), inflight guidance and entry guidance.

3.2.5 Photography Briefings- The crew will receive a 3 to 4-hour briefing by the Mission Operations Branch on the photographic requirements of the mission and operation of the involved photographic equipment early in the training program (F-9 months). At this time the training units and film will be given to the crew for their practice. Photographic results during training will be critiqued with the crew by the Mission Operations Branch photographic specialists. A final review of mission photographic requirements and procedures will be conducted approximately 1 month prior to the scheduled launch.

3.2.6 Extravehicular Mobility Unit (EMU) Briefing - The crew will receive a 4-hour briefing and demonstration of the EMU, which consists of the Pressure Garment Assembly (PGA) and the Portable Life Support System (PLSS), by the Crew Systems Division (CSD) or by the contractor personnel (International Latex and Hamilton Standard Corporations respectively) at the beginning of the training program. Both systems and operational aspects of the EMU will be discussed.

3.2.7 Procedures Reviews- Crew participation in procedures reviews is required to assure incorporation of standard operating procedures in all mission planning, documentation, development, hardware testing, and training. The more significant procedures reviews involving crew participation are described below.

3.2.7.1 OCP and TCP Reviews - The crew will receive briefings on the OCP's and TCP's for each of the spacecraft tests that they are planning to participate in by NR & GAEC test engineers, KSC test engineers and MSC support engineers. The benefits from this are: (a) assurance that the test from a procedures standpoint will proceed smoothly and in a safe manner, (b) that the OCP and TCP procedures correlate as much as possible to actual flight procedures (checklist and Apollo Operations Handbook (AOH), (c) that all pertinent subsystem procedures are exercised and (d) that the crew receives valid procedural practice. The time required for each review depends upon the complexity of the spacecraft test. Approximately 80 hours per crewman each CSM and LM will be required.

3.2.7.2 Checklist and AOH Reviews - In addition to the daily use of the checklist and AOH during training exercises, the crew will participate in a formal review of the checklist document at F-9 months with a second and final review at F-1 month. The purpose of these reviews is to assure accuracy of the checklist and consistency with related and supporting documentation (AOH Volume II, Rendezvous, Extravehicular Activities (EVA), Abort Summary and Emergency Procedures documents). Intervening checklist & AOH reviews will be held as appropriate between crewmembers and the checklist and AOH personnel.

3.2.7.3 Emergency, Abort, and Extravehicular Activity (EVA) Procedures Reviews - Emergency and launch abort procedures are covered in the Abort Summary document, AOH Volume II and the checklist. The crew will participate in formal reviews with FCSD personnel responsible for evaluating and documenting these procedures. Informal reviews of emergency and abort procedures will be scheduled with the crew approximately once per month throughout the training program. Although EVA is not scheduled for this mission, the crew will receive a briefing on the LM to CSM EVA (as a backup maneuver to the LM to CSM IVA maneuver), with subsequent EVA procedures reviews as appropriate.

3.2.7.4 Rendezvous Procedures Reviews - The crew will receive briefings on rendezvous techniques and procedures from the FCSD Crew Safety and Procedures Branch prior to commencement of rendezvous simulation training.

The first briefing, of approximately 4 hours duration, will discuss general rendezvous principles, rules and techniques followed by a brief review of the rendezvous profile and procedures planned for prior missions. A second briefing of approximately 6 to 8 hours will be conducted to review in detail the profile and procedures for the specific rendezvous' planned for their mission, including both nominal and dispersion cases. Subsequent rendezvous briefings will be conducted in conjunction with simulator training.

3.2.8 Flight Plan Reviews - The crew will participate in flight planning reviews with FCSD flight planning personnel periodically throughout the training program.

3.2.9 Mission Rules Review - The crew will verify feasibility of mission rules in conjunction with integrated simulations (AMS/LMS-MCCH). Interim mission rules reviews will be concluded between the Flight Operation Directorate (FOD), crewmembers and FCSD personnel, with a final review at F-6 weeks.

3.2.10 Design and Acceptance Reviews - The crew will participate in various spacecraft status reviews (PDR, CDR, CARR), the purpose of which is to verify that the spacecraft is developing according to design and operational criteria, and will satisfy the mission objectives. Because of the crews experience their presence is desirable to make judgements concerning spacecraft systems, operations, and checkout procedures. During these reviews, the crew will be appraised of overall spacecraft systems status and any subsequent OCP or TCP procedures that they may not already be aware of.

3.2.11 Flight Readiness Review - The crew commanders will participate in a flight readiness review (FRR) at launch minus approximately 30 days. All major areas are examined at this review including spacecraft and launch vehicle, flight control, crew training, and launch pad and related support.

3.2.12 Training Reviews - Frequent meetings between the crew commander and training coordinator will be concluded to implement the overall training program commensurate with the Mission Training Program. The training coordinator will provide the crew current information conconerning crew status, requirements and training equipment capability.

3.2.13 Team Meetings - Meetings will be held weekly or "as required" with the FCSD flight crew support team to review the overall mission, spacecraft and action item status.

3.2.14 Pilot Meetings - The flight crews will attend whenever possible the pilots meetings held the first and third Mondays of each month. These meetings provide opportunity for the flight crews to exchange information concerning training activities and flight hardware development.

3.3 Simulator Training

The crew will receive extensive practice in performing all of the nominal and contingency mission tasks on one or more of the simulators located at MSC, KSC, and the contractor sites. Contractor simulators are primarily intended for engineering development. A brief description of planned crew training on each of the simulators is discussed below, and a summary of simulator training requirements is contained in table 5.1. Although the training, in hours, is broken out for each simulator, the extent of training on each simulator is primarily significant in the achievement of the total simulator training requirement. The total simulation hours do not necessarily reflect completion or noncompletion of the training requirement. Individual crew requirements, in-flight tasks, simulation capability and procedures development are all factors determining the ultimate crew utilization of simulators.

3.3.1 Command and Service Module (CSM) Simulators

3.3.1.1 Apollo Mission Simulator (AMS) - The most important as well as extensive CM crew training will be accomplished on two Apollo Mission Simulators, one located at MSC and one at KSC. Utilization of all other simulators is dependent upon availability and operation of these two simulators, which are capable of simulating the entire CM mission in the appropriate spacecraft configuration with external visual displays (window, sextant, telescope) and interface with the LMS and the Mission Control Center.

Crew training on the AMS #1 (MSC) and AMS #2 (KSC) will proceed through three phases, progressing from basic systems familiarization and individual crew tasks to integrated mission simulations employing full crew complement, AMS/MCCH operations. Phase I (Subsystem Familiarization) and Phase II (Mission Simulations) will be concluded on the AMS #1; whereas, Phase III (Integrated Mission Simulations) will be accomplished utilizing AMS #2.

Typically, each AMS training exercise will include a briefing and debriefing. The briefing will cover salient aspects of the training exercise to be concluded (mission phase, simulator limitations) and information relating to the system or operations exercised (failure indications, crew procedures and techniques). Crew questions, performance and simulation discrepancies will be reviewed during the debriefing. Regularity and length of the briefings and debriefings will diminish as crew proficiency increases. An outline of the AMS training is contained in table 5.4.

3.3.1.2 Command Module Procedures Simulator (CMPS) - The crew will initially utilize the CMPS to acquire a thorough understanding of the various CM active rendezvous procedures and techniques, (nominal, dispersions, and malfunctions relating to both primary and backup systems). Rendezvous training utilizing the CMPS will consist of (a) the nominal CM active rendezvous with a full crew complement (two crewmembers in the simulator and the LM pilot monitoring at his option from the console) and (b) the LM rescue rendezvous involving only the CM pilot. After attaining proficiency in the nominal and rescue rendezvous maneuvers, and these procedures have been fairly well defined, the crew will practice these maneuvers in the AMS as part of integrated flight tasks.

3.3.1.3 Dynamic Crew Procedures Simulator (DCPS) - The crew will utilize the DCPS to obtain basic familiarity and subsequently maintain proficiency in crew procedures relative to the Launch Escape System (LES) and Service Propulsion System (SPS) aborts with the attendant entry maneuver. DCPS training supplements AMS launch abort training due to early availability, quick turnaround, and inclusion of some physical cues (vibration, pitch motion). This training also provides the crew the opportunity to review with launch vehicle cognizant engineers nominal and abnormal booster systems operations and performance. Training exercises will progress from normal runs with minor deviations to runs with one or more malfunctions inserted. The crew will receive familiarization runs prior to AMS launch abort training, with proficiency runs at specific intervals up to launch date.

3.3.2 Lunar Module Simulators

3.3.2.1 Lunar Module Mission Simulator (LMS) - The most important and extensive LM crew training will be accomplished on the two Lunar Module Mission Simulators, one each located at Houston and KSC. The extent of crew training on all other LM simulators is dependent upon availability and operation of the LMS(s), which are capable of simulating the entire LM mission in the appropriate configuration with external displays and interfaces with the AMS and the Mission Control Center.

LMS training will be concluded in three phases being: (a) Subsystems Familiarization, (b) Full Mission Simulations, and (c) Integrated Mission Simulations. Simultaneous with Phase I and Phase II of LMS training the crew will accomplish a comprehensive rendezvous training program on the Lunar Module Procedures Simulator (LMPS). Phase I will frequently require only one crewmember in the LMS, whereas Phase II and Phase III will require both the crew commander and LM pilot. The CM pilot will receive only those LMS exercises denoted by an asterisk (see table 5.5), plus exercises accomplished on a "fill in" basis. Crew briefings and debriefings will be similar to those conducted in conjunction with AMS training (see paragraph 3.3.1.1).

3.3.2.2 Lunar Module Procedures Simulator (LMPS) - The crew will receive their basic familiarization and initial proficiency training on LM rendezvous procedures and techniques (nominal, dispersions, and malfunctions) related to the Abort Guidance System (AGS) and the Primary Guidance and Navigation System (PGNS) utilizing the LMPS. Prior to intensive LMPS training the crew will have received a comprehensive series of briefings on the LM Guidance and Control system, and will have concluded the G&C subsystems familiarization training utilizing the LMS. Subsequent to the LMPS rendezvous training the crew will obtain and maintain proficiency in LM rendezvous utilizing the LMS as part of integrated flight tasks. Command Module pilot participation is optional.

3.3.2.3 Translation and Docking Simulator (TDS) - The LM crew will utilize the TDS to obtain familiarization with the LM active dock- with a passive CM. The TDS provides a limited six-degrees-of-freedom simulation of the LM docking maneuver (100 feet to dock) with appropriate control systems (rate command, direct, pulse) response. The crew commander will obtain proficiency in the LM docking task under various lighting and malfunction (thruster off) situations (12 hours).

3.3.3 Contractor Simulators - The crew will verify CSM and LM procedures and programs utilizing contractor simulators developed for this purpose. These are the NAR CM Mission Evaluator, the GAEC Full Mission Engineering Simulator (FMES), and the CM and LM Hybrid Simulators at MIT. The contractor simulators utilize flight type hardware as much as possible enabling a direct analysis of flight programs.

Normally, the crew will utilize these simulators during those periods they are at the contractor facility, participating in OCP's (NR, GAEC) or, in conjunction with computer program briefings, (MIT). The crew will utilize the simulators (10 hours each simulator) within the framework of the presently established verification program for each, which are currently: MIT (F-9 months), NR and GAEC (F-7 to F-4 months).

3.4 Special Purpose Trainers and Facilities

The crew will receive training on various special purpose trainers and facilities to achieve the necessary experience in such areas as stowage, EVA, egress and celestial training. Crew training for EVA will be accomplished primarily through the use of full and partial mockups, either as 1 "g" walkthrough exercises or by simulating zero "g" by installing mockups in the Water Immersion Facility (WIF) or a KC-135 aircraft modified to perform extensive zero "g" parabolas (approximately 30 seconds of weightlessness per parabola). The crew will utilize a specially constructed and configured Apollo boilerplate (B/P 1102A) to practice water egress procedures in the egress tank and at sea; and a partial mockup (M/U 2) to practice pad emergency egress procedures. Supplementary celestial recognition training is achieved through the use of planetariums (Zeiss projectors) at locations conducive to crew utilization.

Complete information concerning EVA and egress training is contained in training documents relating to these areas (ref. 2 through 6). A brief summary of EVA, stowage, and egress training is contained in the following paragraphs and tables 5.1 and 5.6.

3.4.1 One "g" Walkthroughs - All stowage and EVA tasks will be practiced in a one 'g' condition prior to performing the same in the WIF and thereafter, if required, in the KC-135 aircraft. The crew commander and LM pilot will participate in all CM and LM mockup exercises (stowage and EVA); whereas the CM pilot will participate only in the CM exercises. A specific amount of training under a one "g" condition is prescribed for each mockup prior to zero "g" crew training exercises.

3.4.1.1 Command Module Mockups - The crew will utilize the CM mockup #28 for stowage practice in conjunction with design reviews at NR (PDR, CCSR, CDR). The crew will utilize the MSC mockups periodically throughout their training program (six sessions, 2 hours each) to review CM stowage procedures and perform EVA tasks, i.e., EMU donning/doffing, couch lowering, side hatch operation and egress-ingress.

3.4.1.2 Lunar Module Mockups - The crew will utilize the LM test article #1 (LTA-1) for stowage practice and design reviews at GAEC (PDR, CCSR, CDR). The crew will utilize the MSC LM mockups (4 sessions, 2 hours each) to periodically review LM stowage procedures and EVA tasks, i.e., EMU donning/doffing, forward hatch operation and ingress-egress.

3.4.1.3 Transfer Tunnel Mockup - Each crewmember scheduled to transfer from the CM to the LM will practice the CM to LM and return transfer operations utilizing Mockups 27-A and B. Tasks to be accomplished during the four exercises of approximately 2 hours each are: CM hatch operation, LM hatch operation, hard dock latching and unlatching, electrical interface connecting and disconnecting, drogue and probe operations.

3.4.2 Underwater Zero "g" Training - The most important and critical EVA crew training (Phase II) will be accomplished using the MSC Water Immersion Facility (WIF) with pertinent neutral bouyancy mockups oriented to offset the effects of imperfect bouyancy. The crew will practice all major EVA tasks initially utilizing scuba equipment, and subsequently the Pressure Garment Assembly (PGA) training unit. The crew will practice the LM and CM EVA transfer and the appropriate IVA tasks while in a pressurized suit condition. Prior to crew participation in WIF training exercises the crew will complete the scuba checkout program, an abbreviated PGA checkout program, the specified one "g" walkthroughs for each mockup and one EMU checkout exercise. The overall WIF safety requirements are contained in the FCSD Safety Procedures Brochure (ref. 4).

3.4.2.1 Command Module Mockups - Subsequent to completing two-one "g" exercises the crewmen will perform three exercises, each of 2 hours duration, utilizing the CM neutral bouyancy mockup. During these exercises the crew will practice applicable EVA procedures to include PGA doffing/donning, couch lowering, side hatch operation, egress-ingress, and EVA related stowage and housekeeping activities.

3.4.2.2 Lunar Module Mockups - After completing 2 one "g" exercises, the LM EVA crewmen will perform three 2-hour exercises utilizing the LM and neutral bouyancy mockups to practice PLSS donning/doffing, forward hatch operation, and egress-ingress tasks.

3.4.2.3 Transfer Tunnel Mockup - Crew transfer training in the WIF will commence only after completing the one "g" walkthroughs and at least one each CM and LM underwater exercise. Crew transfer training will initially consist of utilization of the CM and transfer tunnel mockups to practice CM intravehicular transfer preparation, and CM to LM intravehicular transfer and tunnel reconfiguration (three 2 hour sessions). The second phase of crew transfer training, utilizing the joined CM and LM neutral bouyancy mockups, will consist of three 2-hour sessions practicing tunnel reconfiguration, LM intravehicular transfer preparations, one and two crewmen LM to CM intravehicular transfer, and one and two crewmen LM to CM extravehicular transfer.

3.4.3 Zero "g" Aircraft Training (Modified KC-135) - Crew training in the KC-135 aircraft will be accomplished either at MSC (EAFB) or at KSC (PAFB) to further define unresolved EVA procedures and supplement the EVA training (particularly such tasks as EMU donning/doffing) previously concluded through one "g" walkthroughs and training in the WIF. The zero "g" aircraft training requirements are summarized below.

3.4.3.1 Command Module Mockup - After the crew has completed at least two 1 "g" walkthrough exercises and one CM exercise in the WIF, they will complete two flights of approximately three hours each in the KC-135 aircraft (80 parabolas). Crew training tasks will consist of PGA donning/doffing, couch lowering, side hatch operation and egress/ingress.

3.4.3.2 Lunar Module Mockup - After the crew has completed at least two 1 "g" LM walkthrough exercises and one LM exercise in the WIF, the crew will complete two zero "g" aircraft flights (approx. 80 parabolas) during which they will practice PLSS donning/doffing, forward hatch operation, and egress/ingress tasks.

3.4.3.3 Transfer Tunnel Mockup - Subsequent to completing at least two each 1 "g" and underwater transfer tunnel exercises, the crew will conclude one 3-hour tunnel exercise in the zero "g" aircraft. During this flight the crew will perform the entire transfer operation one time (30 parabolas), or if more appropriate, concentrate on specific transfer operations not defined during previous 1 "g" walkthroughs and training in the WIF.

3.4.4 Extravehicular Mobility Unit (EMU) Checkout - Prior to EVA training or crew use of the EMU in conjunction with S/C tests, each crewmember will don his respective flight item EMU and conclude a 2-hour familiarization and checkout exercise (ambient conditions) with EMU engineers and suit technicians in attendance to obtain comments and correct any discrepancies. Prior to launch each crewmember transferring to the LM will conclude a 4-hour EMU checkout and crew familiarization exercise in the MSC thermal vacuum chamber.

3.4.5 Egress Training - Egress training consists of preparing the crew for all preflight and postflight nominal and emergency egress from the spacecraft while in cacuum chambers, on test stands, on the launch complex and in the water. The crew will practice egress procedures prior to participating in the more critical OCP's and TCP's. Water egress training, which will be accomplished in three phases, and launch pad egress training, are summarized in the following paragraphs (ref. 5).

3.4.5.1 Water Egress Training

Phase I - Procedures familiarization utilizing a CM mockup (4 hours)- The crew will receive a briefing and demonstration on the survival gear components and their operation. Following this, the crew will review egress procedures (unsuited) utilizing the MSC CM mockup and survival equipment. During this review, they will receive further instruction on hatch operation, survival equipment stowage, location and removal, and postlanding system activation.

Phase II - Fresh Water Tank Exercise (4 hours) - The crew will receive a briefing on the differences between the spacecraft (CM 104) and the trainer article (BP 1102A). This briefing will be followed by

crew egress (suited) practice from the egress trainer while floating upright (Stable I position) in the flotation tank, located in Building #260 at MSC. Upon completing two Stable I runs per crewmember, the crew will receive a briefing on apex down (Stable II) egress with subsequent practice in uprighting the trainer article. The crew will not practice Stable II egress.

Phase III - Full Scale Recovery Operation in the Gulf of Mexico (4 hours) - The crew will receive a briefing on overall recovery operations and crew recovery procedures. The crew will subsequently practice uprighting the trainer to the Stable I position, egress into their rafts and be picked up by helicopter.

3.4.5.2 Launch Pad Egress Training (4 hours) - The crew will utilize the egress mockup (M/U 2) very early in the training program to obtain familiarity with operation of egress equipment and practice egress procedures in conjunction with spacecraft tests in vacuum chambers and test stands. Launch pad procedures will cover fire (see paragraph 3.4.6), internal, and external contaminants, electrical power failures, and other emergencies.

At approximately F-40 days, the crew will accomplish a launch pad egress exercise at KSC designed to assure a rapid crew egress from the spacecraft and launch pad vicinity. This training will consist of a briefing on the total launch pad operation, followed by a practice launch pad egress exercise conducted in the Vertical Assembly Building (VAB) or the launch pad.

3.4.6 Spacecraft Fire Training - The crew will receive a briefing and demonstration on the proper use of the available cockpit fire suppression equipment in the CM and LM prior to participation in the crew compartment fit and function (CCFF) test, and a mockup exercise in the KSC altitude chamber prior to their respective spacecraft altitude chamber test. Further crew training will consist of: review of BP1224 and M6 "burn test" film, procedural practice simulating cockpit fires in conjunction with one "g" walkthroughs utilizing mockups, simulators and the spacecraft; and as part of the launch pad emergency and evacuation procedures training at the fire service training area at KSC. Further information concerning crew training for fire in and about the spacecraft is contained in the Spacecraft Fire Training document, dated Dec. 12, 1967 (ref. 6).

3.4.7 Planetarium Training - The crew will increase their capability to orient themselves relative to celestial information through periodic utilization of the Morehead Planetarium, Chapel Hill, N. C., and the Griffith Planetarium at Los Angeles, California. Particular emphasis will be placed upon learning thoroughly all aspects of the 37 Apollo Navigation stars utilized by the Apollo Guidance computer (AGC). The crew will utilize the Griffith Planetarium during the period that their spacecraft is undergoing tests at NR (F-9 to F-4) to study the entire celestial sphere and the AGC stars. Subsequent to the spacecraft delivery to KSC the crew will utilize the Morehead Planetarium to further study the AGC stars and review of those stars and constellations near the orbital track.

3.5 Other Training Activities

The crew will be engaged in various other tasks during their preflight training program which are important to achieving the training and Apollo program. They are not programmed as part of their formal training for the specific mission because they are either (a) informal training activities accomplished on an individual basis (study, physical training), (b) general training activities for non-specific missions (aircraft flying, LLTV checkout and currency flights), or (c) crew activities in support of the mission or Apollo program (suit fits, physical examinations, pilot meetings, travel, flight monitoring, engineering and operational development effort). Except for the Lunar Landing Training Vehicle (LLTV) checkout program, these activities, nor the estimated time (hours) for each, are not contained in this document. However, they are important considerations in scheduling crew training activities.

3.5.1 Lunar Landing Training Vehicle (LLTV) Checkout and Currency Flight - The S/C 104/LM-4 crew commanders and LM pilots (prime and backup) are in the process of concluding a checkout program in flying the lunar landing training vehicle. Although this is not a mission task, it was decided that it would be more advantageous to have the crewmen checkout in the LLTV at the earliest possible date to ease the severe training loads imposed by the lunar landing missions. Until the LLTV is available, the crew will utilize the Lunar Landing Research Vehicle (LLRV) which is similar to the LLTV but with reduced operational capability and ease of turnaround. The Aircraft Operations Office (FCOD) has the overall responsibility for this program.

The LLRV/TV checkout and proficiency requirements as presently established for this crew (ref. 7) are as follows:

Pre-Checkout

a. Helicopter checkout - 100 hours total and 5 hours in the last 30 days.

b. Approximately ten flights utilizing the Lunar Landing Landing Research Facility (LLRF) at Langley Research Center (LRC). The LLRF is a tethered simulation of the lunar landing phase (175' vertical).

c. A progressive series of pre-LLRV checkout flights on the LLRV/TV simulator (10 hours).

d. Ejection seat swing at Weber Aircraft Co., Burbank, Calif. (1 day).

Checkout

a. Ground run and c. g. fixture attitude rocket firings.

b. Approximately eleven progressive flights under supervision of a staff instructor pilot.

Currency

a. Maintain helicopter currency and at least two LLRV/TV flights within a 30-day period.

b. Or, four LLRV/TV flights within a 30-day period.

4.0 REFERENCES

1. Allen, L. D., Spacecraft/Crew Integration Plan For Manned Block II Apollo CSM and LM Missions, Revision "A", Crew Station Branch document dated December 15, 1967.

2. Brzezinski, M., Extravehicular and Intravehicular Activities (EVA and IVA) Training Program for the Apollo Mainline Mission and the Initial Apollo Applications Mission (AAP), Mission Training Section document dated March 1, 1967.

3. Garrett, D., Water Immersion Facility Activities in Support of Apollo Mission, memorandum CF221-7M-184 dated June 12, 1967.

4. Zaleski, J. R., Water Immersion Facility Procedures Brochure, Crew Station Branch document dated January 31, 1967.

5. Ward, T., Crew Egress Training Plan for Apollo Block II Missions, Revision "A", Mission Training Section document dated Dec. 15,1967.

6. Ward, T., Spacecraft Fire Training Plan, Mission Section document dated December 12, 1967.

7. Ream, H. E., Astronaut Training Plan - LLRV/LLTV, Aircraft Operations Office memorandum dated February 9, 1967.

TABLE 5.1 - CREW TRAINING SUMMARY

NOTE - Only the formal crew training activities are listed. Total crew involvement exceeds these hours with considerable variance between crewmembers due to crew position and preflight assignments.

ACTIVITY	HOURS	ACTIVITY	HOURS
Briefings & Reviews		Simulators (LM)	
CSM	140	LMS	125
LM	100	LMPS	60
L/V	20	FMES	10
G&N Programs	60	LM Hybrid (MIT)	10
EMU	4	TDS	12
Photography	8	Simulator Brief	50
Procedures		Special Purpose Training	
C/L & AOH	50	Stowage	30
OCP & TCP Review	100	Walkthroughs	32
Design & Acceptance Reviews	60	Underwater (WIF)	26
		WIF C/O (scuba, PGA)	50
Rndzv.	20	Zero "g" Aircraft	15
EVA	15	EMU C/O	12
Emer., Abort, Rules	40	Egress	20
Flight Plan	50	Spacecraft Fire Training	10
Training	30		
Team	60	Planetarium	20
Flt. Readiness	10	LLTV C/O Program (exc. helio)	50
S/C OCP's & TCP's (cockpit)		TOTAL	1789
CSM	80		
LM	80		
Simulators (CM)			
AMS	160		
CMPS	60		
Mission Eval. (NAR)	10		
Cm Hybrid (MIT)	10		
DCPS	15		
Simulator Brief	75		

TABLE 5.2 CREW PARTICIPATION IN CSM OCP'S AND TCP'S

	Downey	KSC
Mandatory	Manned Suit Loop CCFF Integrated Systems	CM-LM/AS Mech Docking Egress Test/CCFF Alt. Chamber Run (Sim, 1 & 2) Open Loop Comm Check Emergency Egress Practice FRT MCCH Interface Crew C/D CDDT Countdown
Optional	Comm System G&N System Functional RCS Elect. System SECS C/O SPS Electrical & Instr. SCS Inertial Phasing S-Band Antenna Control Systems Interface	CM Docking Sys. & Alignment Test Fuel Cell Activation CSM-LM-SLA Elect. Interface Test MCCH Interface Plugs In Plugs Out S/C Systems Verification

TABLE 5.2A CREW PARTICIPATION IN LM OCP'S & TCP'S

	Bethpage	KSC
Mandatory	CCFF FEAT - Plugs In FEAT - Plugs Out	Egress Training Egress Practice Altitude Chamber Run (Sim, 1 & 2) CCFF & Egress Test FRT MCCH- SIT (Voice Comm only) Checklist & Switch Setting for CDDT & Terminal Count
Optional	Data ch. Verification (C&W only) G&N Functional G&N Alignment Comm Functional S-Band Steerable Antenna CES Functional AGS Functional RR Performance LR Performance Lighting Functional Flight Controls ECS Functional	CSST Mission Sims - Plugs In Mission Sims - Plugs Out CSM-LM-SLA Elect. Interface Check CST MCCH - SIT (Voice Comm Only)

TABLE 5.3 - SYSTEMS BRIEFINGS HOURS (CONTRACTOR)

CSM

Sub-System	Initial (MSC)	Interim	Final (KSC)
EPS	6	2	2
COMM	6	2	2
Docking	4	2	
SECS	12	4	3
Prop & RCS	12	4	3
ECS	12	2	3
G&C	40	12	7

LM

Sub-System	Initial (MSC)	Interim	Final (KSC)
EPS	4	2	1
COMM	6	2	1
Instrumentation	4	2	1
Prop. & RCS	8	2	2
ECS	8	2	1
CES	6	2	1
Radar	6	2	1
AGS	6	3	2
PGNS	15	6	4

TABLE 5.4 - AMS CREW TRAINING SUMMARY

(Average exercise duration is approximately 4 hours)

Phase I - Sub-Systems Familiarization

The typical operating method will be a group briefing (all crew members) on each system followed by crew practice on the AMS.

Exercise Number	Exercise Description
1	EPS - normal and malfunctions (include comm. system)
2	RCS & SPS - normal and malfunctions
3	SCS - normal
4	SCS - malfunctions
5	ECS - normal and malfunctions
6	G&N - activation, alignment
7	G&N - navigation (lunar, star, earth and earth horizon)
8	G&N - attitude modes, malfunctions
9	G&N - Delta V
10	SCS - Delta V
11	G&N Entries - nominal and contingency
12	SCS Entries - nominal
13	SCS Entries - contingency
14	Launch and Launch Aborts - Mode I (a, b, c)
15	Launch Aborts - Modes II, III, IV, I Bravo

Phase II - Mission Simulations

Training will be conducted with a full crew unless otherwise noted.

16	Thrusting Maneuvers (SPS)
17	Thrusting Maneuvers (S-IVB)

TABLE 5.4 - Continued

Exercise Number	Exercise Description
18	Thrusting Maneuvers (LM-DPS & APS)
19	Rendezvous & Docking (include sep. and extraction)
*20	LM Rescue Rendezvous (CMP)
21	Deorbit and Entry - nominal, contingency (include RCS deorbit)
22-31	Mission Segments (accelerated) CSM/LM operations
22	Segment I - launch through LOI Delta V
23	Segment II - TEI through simulated LM postlanding checkout
24	Segment III - Simulated LM pre-ascent through LM shutdown and jettison
25	Segment IV - SPS phasing Delta V through CM active rendezvous
26	Segment V - TEI Delta V through CM-SM separation and entry
27-31	Segment I through V - repeat exercises 22-26 with the crew utilizing the PGA and random malfunctions inserted
32	Deorbit and Entries
33	Launch Aborts (CDR)
34	Deorbit and Entries (suited)

Phase III - Integrated Simulations - AM/LMS - MCCH flight rehearsals

Crew participation (prime or backup) will depend upon S/C tests. Usually the backup crew will participate in the initial Integrated Simulation of each type. The crew may participate in the launch phase of the network simulations. The integrated mission segments are not presently determined, however, they will be developed to preclude frequent AMS-LMS crew transfer.

*CDR and LMP will receive basic fam. with LM rescue rdzv. utilizing the CMPS.

TABLE 5.4 - Continued

Exercise Number	Exercise Description
35	Simulated Network Simulation (Backup)
36	Launch Aborts (Prime)
37	Simulated Network Simulation (Prime)
38	Entry Simulation (all)
39	Launch Aborts (Backup)
40	Simulated Network Simulation (Backup)
41	Launch Aborts (all)

TABLE 5.5 - LMS CREW TRAINING SUMMARY

(Average exercise duration is approximately 4 hours)

Phase I - Familiarization

Typical operating method is a group briefing (prime and backup crew) followed by crew practice on the simulator.

Exercise Number	Exercise Description
*1	Control Modes (PGNS, AGS, SCS)
2	Propulsion Systems Operations (RCS, DPS, APS)
3	EPS Operation
4	Communications
5	ECS (Suited)
*6 & 7	Guidance and Control (IMU alignment, G&N operations and malfunctions, LGC failures)
*8 & 9	Rendezvous and docking
	Phase II - Mission Training
10	Powered Descent
11	Ascent Operation
12 & 13	Abort procedures
14 & 15	Simulated lunar descent and landing
16 & 17	Simulated lunar ascent and docking
18 & 19	Simulated lunar descent and landing with random malfunctions (suited)
20 & 21	Simulated lunar ascent and docking with random malfunctions (suited)

*CMP participation

TABLE 5.5 - Continued

Phase III - Integrated Mission Training

Crew participation will depend upon S/C tests. Normally the backup crew will participate in the initial integrated simulation of each type.

Exercise Number	Exercise Description
22	Simulated Network Simulations
23 & 24	Simulated descent aborts
25 & 26	Simulated lunar ascent

TABLE 5.6 - EVA AND STOWAGE TRAINING SUMMARY

Module	*Stowage Reviews		1 "g" Walkthroughs (EVA)		Water Immersion Facility		Zero "g" Aircraft			Alt. Chamber		Total Hours
	Exer.	Hrs.	Exer.	Hrs.	Exer.	Hrs.	Exer.	Hrs.	Para.	Exer.	Hrs.	
CM	3	12	6	12	3	6	2	6	80	1	4	40
LM	3	12	4	8	3	6	2	6	80	1	4	36
Tunnel	2	6	4	8	6	12	1	3	30			29
SM			1	2	1	2						4
EMU			1	2						1	4	6
Total	8	30	16	32	13	26	5	15	190	3	12	115

*Stowage reviews at contractor primarily in support of S/C development (CSSR, PDR, CDR).

THIRD MANNED APOLLO CREW TRAINING SCHEDULE

(short block increments do not indicate actual duration of activity)

▮▮▮▮▮▮ as available or convenient
□ CM M/U
○ LM M/U
MSC

MONTHS TO LAUNCH

TRAINING ACTIVITY	10	9	8	7	6	5	4	3	2	1
CSM OCP's & TCP's (Mandatory)						SHIP				
LM OCP's & TCP's (Mandatory)				SHIP						
CSM Briefings										
LM Briefings										
L/V Brief & Reviews (inc. abort reviews)										
Proc. Reviews(C/L,OCPs & TCP's,Rendz,EVA)	INITIAL			(AS REQUIRED)		FINAL VERIFICATION				
Flight Plan	MONTHLY OR AS REQUIRED								FINAL	
Support Team (Photo, stowage, training)	WEEKLY OR AS REQUIRED TO LAUNCH									
G&N Brief & Program Verif. (MIT)										
Flight Readiness Review										
Pilot Meetings	1st and 3rd MONDAY EA. MONTH UNTIL CREW RESIDENCE AT KSC									
AMS (MSC)										
AMS (KSC)										
LMS (MSC)										
LMS (KSC)										
CMPS										
LMPS										
DCPS										
TDS										
Contractor Simulators										
Stowage Reviews (shaded CCSR)										
One "g" Walkthroughs										
Zero "g" (WIF)										
Zero "g" (Modified KC-135)										
Egress										
Planetarium										
LLRV/TV Checkout & Proficiency Flights										

MSC FORM 1956C (REV JUN 66)

FIGURE 6.1