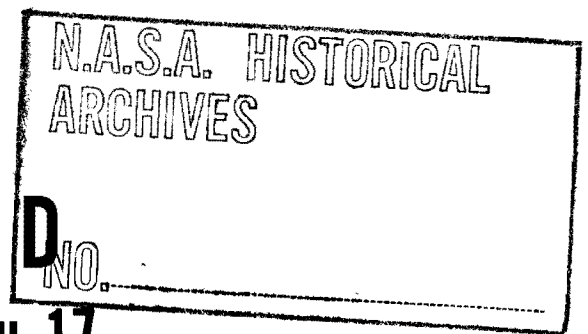


- Panels
12. Witness statements
Detailed narrative
 13. Ground emergency provisions
 14. Security of operations
 15. Board Administrative Procedures
 16. Special Test
 17. Final Board Report Panel

REPORT OF APOLLO 204 REVIEW BOARD

TO
THE ADMINISTRATOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

APPENDIX D
PANELS 12 thru 17



25/pty.

APOLLO SPACECRAFT

The spacecraft (S/C) consists of a launch escape system (LES) assembly, command module (C/M), service module (S/M), and the spacecraft/lunar module adapter (SLA). The LES assembly provides the means for rapidly separating the C/M from the S/M during pad or suborbital aborts. The C/M forms the spacecraft control center, contains necessary automatic and manual equipment to control and monitor the spacecraft systems, and contains the required equipment for safety and comfort of the crew. The S/M is a cylindrical structure located between the C/M and the SLA. It contains the propulsion systems for attitude and velocity change maneuvers. Most of the consumables used in the mission are stored in the S/M. The SLA is a truncated cone which connects the S/M to the launch vehicle. It also provides the space wherein the lunar module (L/M) is carried on lunar missions.

TEST IN PROGRESS AT TIME OF ACCIDENT

Spacecraft 012 was undergoing a "Plugs Out Integrated Test" at the time of the accident on January 27, 1967. Operational Checkout Procedure, designated OCP FO-K-0021-1 applied to this test. Within this report this procedure is often referred to as OCP-0021.

TESTS AND ANALYSES

Results of tests and analyses not complete at the time of publication of this report will be contained in Appendix G, Addenda and Corrigenda.

CONVERSION OF TIME

Throughout this report, time is stated in Greenwich Mean Time (GMT). To convert GMT to Eastern Standard Time (EST), subtract 17 hours. For example, 23:31 GMT converted is 6:31 p.m. EST.

**REPORT OF PANEL 12
WITNESS STATEMENTS
APPENDIX D-12
TO
FINAL REPORT OF
APOLLO 204 REVIEW BOARD**

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WITNESS STATEMENTS

A. TASK ASSIGNMENT

The Apollo 204 Review Board established the Witness Statements Panel, 12. The task assigned for accomplishment of Panel 12 was prescribed as follows:

An orderly process to collect all data from witnesses (includes eye witnesses as well as console monitors). This includes a determination of who to interview, arranging for competent people to conduct the interviews, recording data, and collecting it into a form suitable for publication as an appendix to the formal report. Included also in this task is an analysis of the pertinent sequence of events as reported by the bulk of the witnesses together with a summary of that testimony which is contradictory to the main data.

B. PANEL ORGANIZATION

1. MEMBERSHIP

The assigned task was accomplished by the following members of the Witness Statements Panel:

- Mr. Norbert B. Vaughn, Manned Spacecraft Center, (MSC), NASA, Chairman
- Mr. J. J. O'Donnell, Kennedy Space Center, (KSC), NASA
- Mr. C. B. Netherton, Kennedy Space Center, (KSC), NASA
- Mr. H. F. Blackwood, Headquarters, NASA
- Lt. Col. J. W. Rawers, U. S. Air Force
- Mr. C. J. McNanara, North American Aviation, (NAA), Kennedy Space Center (KSC)

2. COGNIZANT BOARD MEMBER

Colonel Charles F. Strang, U. S. Air Force, Board Member, was assigned to monitor the Witness Statements Panel.

C. PROCEEDINGS

1. OBJECTIVES

- a. To collect all data through written statements and taped interviews from:
 - (1) Eye Witnesses
 - (2) All other personnel who had access to Launch Complex (LC) 34 during the test
 - (3) All monitoring personnel at:
 - (a) The Launch Complex 34 Blockhouse
 - (b) The Acceptance Checkout Equipment (ACE) Control Rooms in the Manned Spacecraft Operations Building (MSOB)
 - (c) All the other observation or recording stations where audio or television (TV) monitoring was available.
 - (4) Other personnel as required by the Board
 - (5) Volunteers of pertinent information that were not contacted in (1), (2), (3), or (4) above.
- b. To construct a sequence of events from the bulk of witness reports and to update this information on a timely basis for use by the Review Board and other Panels.
- c. To identify the pertinent inconsistent or contradictory statements to the main data as presented in 5. Objective (b).
- d. To summarize the pertinent information for use by the Review Board and other Panels.
- e. To prepare the statements in proper form for publication as Appendix B to the Final Report.

2. INTRODUCTION

For use as general information and orientation are Enclosures 12-1 through 12-5, which are drawn approximately to scale. Enclosure 12-1 is a simulated aerial view of Launch Complex (LC) 34. Enclosure 12-2 shows the Service Structure elevators and the Umbilical Tower elevator on LC 34. At the time of the incident, the Umbilical Tower elevator (450 feet per minute capability) was held at

the top of the tower in anticipation of the schedule "egress" exercise. The Service Structure elevators were programmed as follows for this test:

- No. 1 (Northeast) - 200 feet per minute, capable of being stopped at every level
- No. 2 (Northwest) - 100 feet per minute, capable of being stopped at every level
- No. 3 (Southwest) - 200 feet per minute, capable of being stopped at every level
- No. 4 (Southeast) - 450 feet per minute, capable of being stopped at every level

The Pedestal elevator (65 fpm capability) is a hydraulic lift type platform that rises to the 27 foot level. Enclosure 12-3 is a plan view of adjustable level 8 (A-8) at LC 34. Enclosure 12-4 is a plan view of adjustable level 7 (A-7) at LC 34. The overlays in Enclosures 12-3 and 12-4 show the position of the eye witnesses at the time of the incident. On the Enclosures 12-2, 12-3, and 12-4 are arrows indicating the direction North and an assumed North. The assumed North is a Kennedy Space Center common practice used for ease of locating items relative to the Service Structure axes. Witness statements make use of this in describing their existing the Structure on elevators after the incident. Enclosure 12-5 is a sketch of the Command Module, White Room, Egress Access Arm, and Umbilical Tower elevator, showing the egress route of astronauts on LC 34.

3. INVESTIGATION

Investigation by the Witness Statement Panel was initiated January 31, 1967 when the Panel received nine (9) miscellaneous written statements and twenty-six (26) "eye-witness" statements from the NASA-KSC Security Office. These were written or taped statements obtained the evening of the Apollo 204 incident. At the same time, twenty-one (21) Pan American World Airway (PAA) employee witness statements were received from the Air Force Eastern Test Range (AFETR) Representative to the Board.

4. OBJECTIVE A

Panel objective a (Collection of Data) was accomplished by contacting the contractors and agencies involved in the test operations. Those contacted were either "eye-witnesses", or television (TV) or audio monitors of the incident. A total of eighteen (18) agencies or contractors were contacted (See General File for list). There were responses for 590 people with 572 written statements and forth (40) recorded statements. Since some witnesses submitted more than one written statement or were interviewed twice, a total of 612 statements was obtained.

5. OBJECTIVE B

Panel 12 objective b (Sequence of Events) was accomplished as shown below, and by the Review Board Counsel as shown in Enclosure 12-6. Enclosure 12-6 is a detailed narrative description of the events. The sequence of events briefly listed herein was established from the bulk of the witness statements.

SEQUENCE OF EVENTS FROM WITNESS STATEMENTS

Between time 6:31:00 p.m. EST to
6:31:15 p.m. EST

Events:

The: Witnesses in Launch Vehicle
Aft Interstage, Level A-2:

Felt two definite rocking or shaking movements of vehicle seconds prior to "Fire" report. Unlike vibrations experienced in past from wind, engine gimbaling or equipment input.

Witnesses on Levels
A-7 & A-8:

Heard "Fire" and/or "Fire in Cockpit" transmissions
Heard muffled explosion, then two loud whooshes of escaping gas (or explosive releases).
Observed flames jet from around edge of Command Module and under White Room.

TV Monitors:

Heard "Fire" and/or "Fire in Cockpit" transmissions. Observed astronaut helmet, arm, and back movements; increase of light in Spacecraft window, and tongue-like flame pattern within Spacecraft.

Observed flame progressing from lower left corner of window to upper right, then spreading flame filled window, burning around hatch openings, lower portion of Command Module, and cables.

Between time 6:31:15 p.m. EST to
6:33 p.m. EST

Witnesses on Levels A-7
& A-8:

Repeated attempts to penetrate White Room for egress action. Fought fires on Command Module, Service Module, and in White Room area.

TV Monitors:

Observed smoke and fire on Level A-8. Progressive reduction of visibility of Spacecraft hatch on TV monitor due to increase of smoke.

Between time 6:33 p.m. EST to
6:37 p.m. EST

Repeated attempts to remove hatch and reach crew. Continued fire-fighting on Levels A-7 and A-8 in White Room.

Spacecraft Boost Protective Cover (BPC) removed by NAA personnel J. D. Gleaves and D. O. Babbitt.

Spacecraft outer (Ablative) hatch removed by NAA personnel J. W. Hawkins, L. D. Reece, and S. B. Clemmons. Spacecraft Inner hatch opened and pushed down inside by NAA personnel J. W. Hawkins, L. D. Reece, and S. B. Clemmons at approximately 6:36:30 p.m. EST. No visual inspection of Spacecraft interior possible due to heat and smoke. No signs of life.

Between time 6:37 p.m. EST to
6:45 p.m. EST

Extinguish remains of fires. Fire and Medical support arrive.

Fireman J. A. Burch, Jr. and NAA Technician W. M. Medcalf removed the Spacecraft Inner hatch from the Spacecraft.

Examination of crew and verification of condition.

Between time 6:45 p.m. EST,
January 27, 1967 to 2:00 a.m. EST,
January 28, 1967

Service Structure cleared. Photographs taken. Crew removed.

Complex and area under secure conditions. Personnel from Washington and Houston arrive and assume control of situation.

6. OBJECTIVE C

Panel objective c (Contradictory Statements) was accomplished. The only significant deviation, which had no other substantiation, was the statement of Mr. Gary W. Propst, RCA Technician. The Witness was monitoring Operational Intercommunication System (OIS) channel Black 3 and observing the TV view of the S/C 012 hatch. The call of "Fire" over the OIS and observation of a bright glow in the spacecraft occurred simultaneously. He stated there was a two to two and one-half minute time elapse from the call until flames increased and covered the hatch opening. At about three (3) minutes, Mr.

Propst stated, the flames from the outside bottom of the spacecraft began to eat through the area where the bottom lip of the White Room meets the Spacecraft, and the White Room began to fill with smoke. He also stated there was movement inside the Spacecraft lasting about two (2) minutes before the flames began to block the view, and no one entered the White Room until it had become smoke-filled some minutes later. Mr. Propst stated that he changed the electronic control knobs on the hatch TV monitor while the incident was happening. This caused all the other TV monitor screens as mentioned by some witnesses, to have a momentary (1 to 2 seconds) loss of picture, with either gray, black, or white-out, but most probably white appearance. As the camera built-in electronics and internal mechanisms were adjusting themselves, the hatch area could have appeared washed-out due to the Spacecraft interior brightness for approximately 2 seconds.

7. OBJECTIVE D

Panel objective d (Summary of Pertinent Information) was accomplished as shown herein. Section (a.) is a summary prepared from the statements of witnesses located primarily on adjustable levels 7 and 8 of the Launch Complex 34 Service Structure. Section (b.) is a summary prepared from statements of witnesses who had access to TV monitors located at either the Launch Complex 34 Blockhouse or at the ACE Control Rooms. These summaries indicate only the initial observations of the witnesses. Subsequent observations and actions taken are contained in the witnesses entire statements found in Appendix B.

SUMMARY OF WITNESS OBSERVATIONS REGARDING FIRE

a. Levels A-7, A-8 and other Areas of Service Structure

Name, Duty, Location	Time Reference	Initial Observation
Donald O. Babbitt NAA, Project Engineer Pad Leader; A-8 Pad Leader Desk	Immediately after OIS report	Flame from under BPC near steam duct - followed by concussion.
James D. Gleaves NAA, Mechanical Lead Technician; A-8 Flyaway Umbilical	Shortly after hearing OIS report - believed to be Astronaut Chaffee.	Heard loud shooooo - entered White Room, saw flash - followed by fire and debris covered right side of Spacecraft.
L. D. Reece NAA, Systems Technician; A-8, Flyaway Umbilical	Immediately after OIS report.	Sheet of flame from Command Module 12 access.
Richard A. Hagar NAA, Electrical Systems Technician; A-8, -Y Area	Immediately after OIS report.	Two loud pops - fire blew out of -Y and +Y access panels.
Richard L. Bachand NAA, Systems Technician; A-8, +Z +Y area	Immediately after OIS report.	Low burp, large whoosh, wall of flame - floor to ceiling.
Stephen B. Clemmons NAA, Systems Technician; A-8, Pad Leader Desk	Immediately after OIS report.	White glow around BPC, access panel between umbilical and White Room. Loud venting of gases, then ignition like gas jet being ignited. No loud explosion.
James E. Cromer PAA, Elevator Technician; Umbilical tower elevator looking at White Room	Did not hear report - saw flash first.	Flash of fire from White Room door-side doors blew open.
Joseph H. Pleasant NAA, Systems Technician; A-8, near stairs to White Room	Someone called "There's a fire in spacecraft".	Heard someone call fire in Spacecraft - heard muffled explosion - fire around bottom of Command Module - several places - smoke.
Bruce, W. David NAA, Systems Technician; A-8, Flyaway umbilical	Immediately after OIS report.	Flames within open access panels near umbilical - followed by whoosh and flames shooting out of the panels.
Friend D. Hickenbottom NAA, Systems Technician; A-8, South of Tower	Immediately after OIS report.	Spurt of flame under White Room - explosion - flames at all Command Module openings.

Jerry W. Hawkins NAA, Systems Technician; A-8, Swing Arm	After hearing someone yell "Fire".	Flame from Spacecraft to Pad Leader desk.
W. Donald Brown NAA, Mechanical Inspector; A-8, -Y Quality Control Desk	No time reference	Command Module 012 access seemed to ignite - minor explosion - 2 loud whooshes - escaping gas
Jessie L. Owens NAA, Systems Engineer; A-8, Pad Leader Desk, +Y area	Immediately after OIS report.	Heard relief valve open - hi-velocity gas escaping, burst into flame.
Robert C. Hedlund NAA, Systems Technician; A-8, +Z +Y Area	Immediately after OIS report.	Hears whoosh - saw small flames from access hatches.
John E. Markovich NASA/KSC, Q. C. Inspector; A-8, +Z (NW)	Heard explosion - first notice	Heard muffled explosion - saw huge flash fire - service port +Z axis.
Joseph L. Stoeckl NASA/KSC, Q. C. Inspector; A-8, SW corner	Hears explosion - first notice	Muffled explosion - Command Module engulfed in flame.
Henry H. Rogers, Jr. NASA/KSC, Q. C. Inspector; A-8, on S.W. Elevator	Very shortly after hearing report on PA	Entered White Room - fire appeared burning from inside Spacecraft out.
Creed A. Journey NAA, Electrical Leadman; A-8, +Z -Y axis Area	Heard shout as entering level A-8 from A-7. Threw self to floor as fire burst out.	Fire broke out of Command Module in high velocity streams, 6 to 7 feet long out of servicing ports in southeast corner (-Y area).
William J. Schneider NAA, GSE Technician; A-7, with back to Service Module at +Y Area	Heard "Fire" either over squawk box or down from level A-8.	Felt heat on back at call "Fire". Went out to get on NE passenger elevator. Didn't get on. Saw fire inside Service Module. Got fire extinguisher and extinguished fire in Service Module.
Dave E. Howard NAA, Systems Technician; A-7, near access to Service Module	After initial fire - no reference to OIS report. Heard Astronaut say, "Fire in cockpit".	Saw fire diminish from first flame - loud swoosh ball of flame from bottom of Command Module.
J. C. Scott NAA, Q. C. Inspector; A-7, under umbilical	Heard someone say, "Fire in cockpit"	Heard noise - then second noise - ball of fire fell from Command Module to Service Module.

Robert I. Bass NAA, Systems Technician; ACE Room	Hears explosion - saw smoke heard shouts of "Fire".	Muffled explosion - smoke pouring out and around swing arm into White Room.
John C. McConnell NAA, GSE Technician; Umbilical Tower level 190 Ft.	Heard someone on A-8 or else over OIS say "Fire in the Spacecraft".	At indication of "Fire" sound - level A-8 all lit up when it exploded. Got fire extinguisher - and crossed over to A-6, grabbed 2 gas masks and went up to level A-8.
Burt B. Belt NAA, GSE Leadman; On Service Structure express elevator, level 2	Heard people yelling "Fire in the Spacecraft" as eleva- tor was going to level A-6.	Wanted elevator to go to A-8 but stopped at A-6. Grabbed gas masks and took up to A-8. Started fighting fires coming from parts of Command Module with extinguishers.
George W. Rackleff NAA-Tulsa, Systems Technician; A-7, under White Room	Heard report from spacecraft crew member	Large puff of smoke and explosion - swing arm entry hatch.
Samuel Williams NAA, GSE Technician; A-7, A14-019 Fly-Away umbilical connection	Astronaut: "Fire in cockpit" over headset.	Heard explosion immediately follow- by another, then fire down through A-7 at Swing Arm.
Forrest R. Rooker NAA, GSE Technician; A-7, A14-019 Fly-Away umbilical connection	Astronaut: "We have fire in cockpit" over headset.	Heard small explosion then larger one - Flash of flame through open- ing A-8 and A-7 at umbilical swing arm.
William H. Wingfield NAA, GSE Electrical Technician; Level A-5	Heard Chaffee say "Fire" over OIS.	Smoke came down to area, saw paper on fire flying from A-8 level. Went up to A-8 for few moments only and went down to 188 ft. level to open power supply breakers.
Marvin L. Nelson NASA/KSC QC Inspector; A-7, N.E. side of Service Module	Immediately after report from P/A	Smoke began to fill the area.
Patrick E. Mitchell NASA/KSC QC Inspector; A-7, A14-019 umbilical dis- connect	Immediately after report	Level filled with smoke
William C. Deaver NAA, Electronic Technic- ian; A-7, A14-019 Fly-Away umbilical connection	Heard someone say, "Fire in Cockpit"	Heard 2 explosions - then fire be- tween Command Module and Ser- vice Module.
Willis M. Medcalf NAA, Mechanical Technic- ian; Service Structure ele- vator between levels 3 and 4	Heard cry of "Fire" as ele- vator passed levels 3 and 4	Elevator stopped at level A-8 Ran down a level or two and took gas masks to A-8.

Robert C. Foster
NAA, QC Inspector;
Complex 34 Fuel Area

Saw smoke

Looked upward and saw smoke. Carried gas masks and fire extinguishers to SE elevator and took to level A-8.

b. TV and Audio Monitors

Name, Duty, Location

Initial Notice

Observation

Clarence A. Chauvin
NASA/KSC Test Conductor;
Test Conductors Console
ACE Control Room 1,
MSO Building

"Fire" over Operational
Intercommunications System
(OIS).

Noticed flames in vicinity of apex cover at top of Command Module. Not aware fire was in Spacecraft until heard over headset shortly after.

William H. Schick
NASA/KSC Assistant Test
Supervisor; Test Supervisor's
Console - Blockhouse Launch
Complex 34

"Fire in Cockpit" over OIS

Saw flames climbing about halfway up the side of the Spacecraft coming from the interface between the Command Module and the Service Module.

Gary W. Propst
RCA Technician;
Operational TV Control
Racks - Blockhouse Launch
Complex 34

"Fire in the cockpit" over
OIS

Observed hatch in TV monitor. Saw bright glow in Spacecraft. Observed Astronaut arm and leg movements lasting about 2 minutes until flames obscured vision. A split second later flames go past window. Fire increased steadily. Flames from outside bottom of Spacecraft where it meets lip of White Room and from under hatch.

Alan R. Caswell
RCA-Communications
Controller; Communication
Control Racks - Blockhouse
Launch Complex 34

Technician Propst called
attention to monitor - stating
Fire in Spacecraft.

Observed hatch on TV monitor. Flames flickered inside Spacecraft on left side of window and in 15-20 seconds almost covered window. Saw center astronaut's helmet move during first few seconds.

Donald K. Slayton
NASA-MSC, Director of
Flight Crew Operations; As-
tronaut Console Blockhouse
Launch Complex 34

Call of "Fire" on OIS

Observed Spacecraft hatch on TV monitor. Flame around hatch. Smoke increased. Detected people trying to get to hatch door. Smoke obscured view from TV Camera.

Daryl O. Cain
NAA, Spacecraft 017 Test
Conductor; ACE Control
Room No. 2, MSO Build-
ing

Hatch Camera seemed to
blank out like someone had
shined a very bright light
into lens of camera.

Picture was regained. Saw "Guttery" type flames about 6 inches high mostly on right hand side at base hatch. Impression one of the quads had fired and fire was outside Spacecraft underneath the Command Module. Observed the fire fighting attempts and

assumed Astronauts were safe and staying inside craft until fire extinguished and smoke cleared from area. Camera eventually turned off. Not aware of tragedy for couple of hours because principally engaged in monitoring own test on spacecraft 017.

Donald R. Jones
NASA/KSC - Chief,
Electrical Systems, Saturn
IV-B; VIP Room - Block-
house Launch Complex 34

Illumination within Space-
craft and call of "Fire"
over OIS

Noted tongue of flame between center Astronaut's helmet and hatch window on hatch camera. Saw Astronaut's arms move toward hatch. At this time interior of Spacecraft was illuminated to such brilliance picture blacked out.

Albert E. Jorlan
NASA/KSC - Launch Ve-
hicle Measuring Instrumen-
tation Engineer; Measuring
Station-Blockhouse Launch
Complex 34

"Hey, there's a fire in here",
over Spacecraft communication
channel. Identifies voice as
Chaffee's.

Observed 2 distinct tongues of fire positioned at 11 and 7 o'clock on TV monitor. Screen was dark, location of fire not identifiable. Camera and/or target was not identified in statement.

8. APPENDIX B - WITNESS STATEMENTS

The witness statements and releases for the statements contained in Appendix B are from:

- (1) Personnel on adjustable levels 7, 8, and other areas of Launch Complex 34 Service Structure (34 total)
- (2) Representative TV monitors (7)
- (3) Representative audio monitors (2)
- (4) Other Witnesses (3)

The index of Appendix B contains witnesses names, organization, position or duty, location at the time of the incident, and date(s) of statement(s). A page of common abbreviations and definitions is included in Appendix B. Only the witness statements containing testimony relevant to the investigation are included in this Appendix.

9. OTHER STATEMENTS

The statements of witnesses (names listed in Appendix B), which do not provide relevant testimony, are retained in the Apollo 204 Review Board General File as a matter of record. These statements, not part of Appendix B, are arranged by order of primary importance within the categories:

- (1) TV monitors
- (2) Audio monitors
- (3) Related areas
- (4) Miscellaneous

The relevancy of testimony has been reviewed by Counsel to the Board. The Board Administrative Procedure No. 16, titled "Coordination Policy for Interviewing Witnesses", was used when obtaining recorded witness statements. The General File also includes all original statements and/or tape recordings of all witnesses.

10. OTHER RESPONSIBILITIES

A total of thirty (30) requirements for information were placed on the Panel. These requests varied from lists of witnesses to information in definite disciplines (Enclosure 12-7). The requirements came from the Board, the Board Panel Coordination Committee, other Panels, and NASA Headquarters.

11. WITNESS CATEGORIES

Several categories of witnesses were established on the basis of information contained in their statements. These were: gas or vapor odors during pre-ingress, astronaut ingress, eye-witnesses of the incident, TV monitors, audio monitors, and rescue, security and medical personnel. A tape recorded conference among members of Panel 7 (Test Procedures), Panel 8 (Materials Review), and witnesses who had mentioned an unusual odor during ingress or cabin purge, was conducted February 9, 1967. The purpose of this conference was to ascertain the exact articles passed in and out of the Spacecraft hatch, the placement of articles in the Spacecraft, and a more detailed description of any odors noticed. The findings obtained in this conference were forwarded to Panels 7 and 8. The minutes of the conference are contained in the Review Board General File.

D. FINDING AND DETERMINATION

FINDING

A total of 612 witness statements were obtained by Panel 12.

DETERMINATION

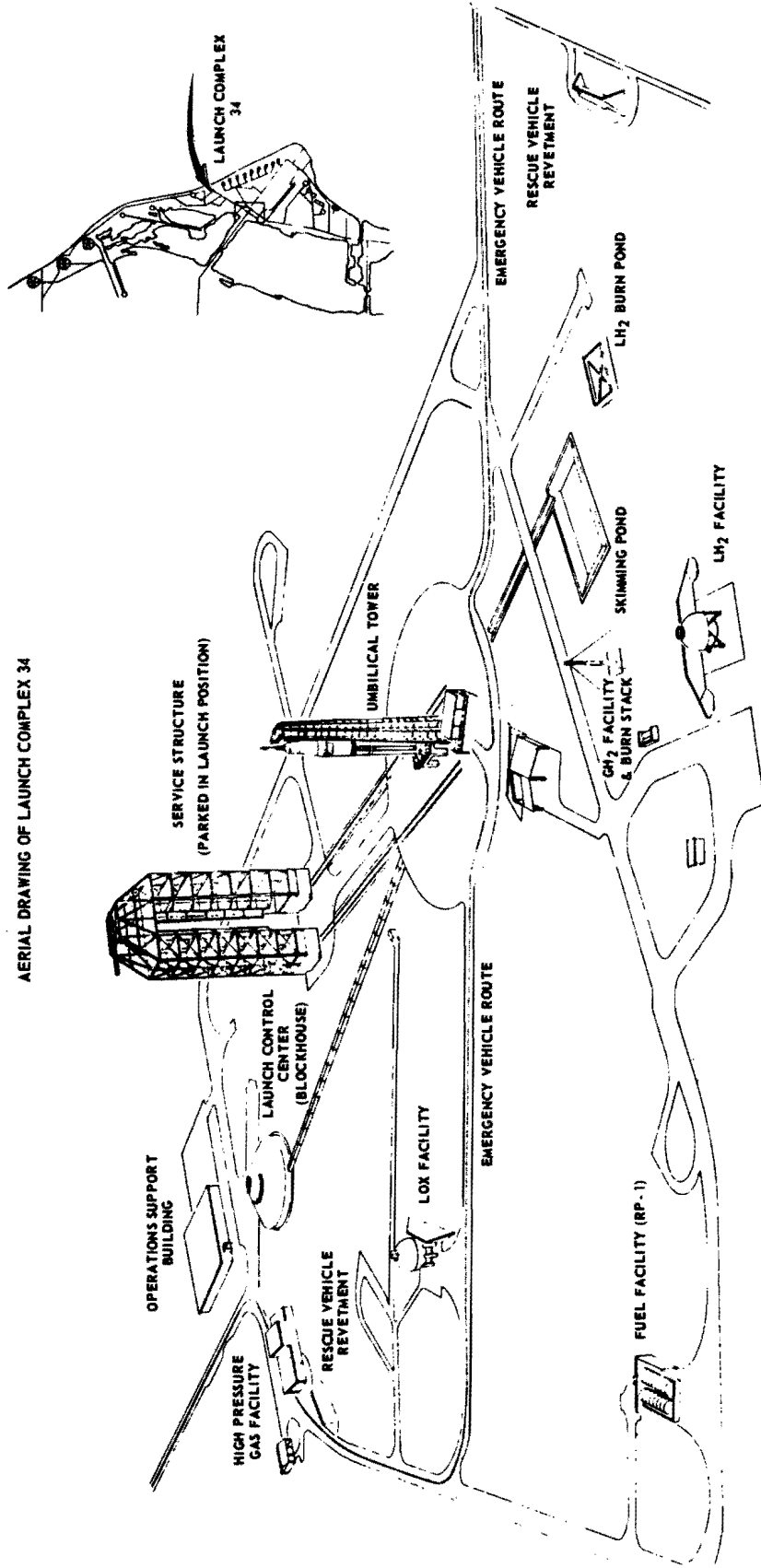
The Witness Statements Panel 12 believes that all people with pertinent information regarding the Apollo 204 incident of January 27, 1967 have been contacted.

E. SUPPORTING DATA

Enclosure

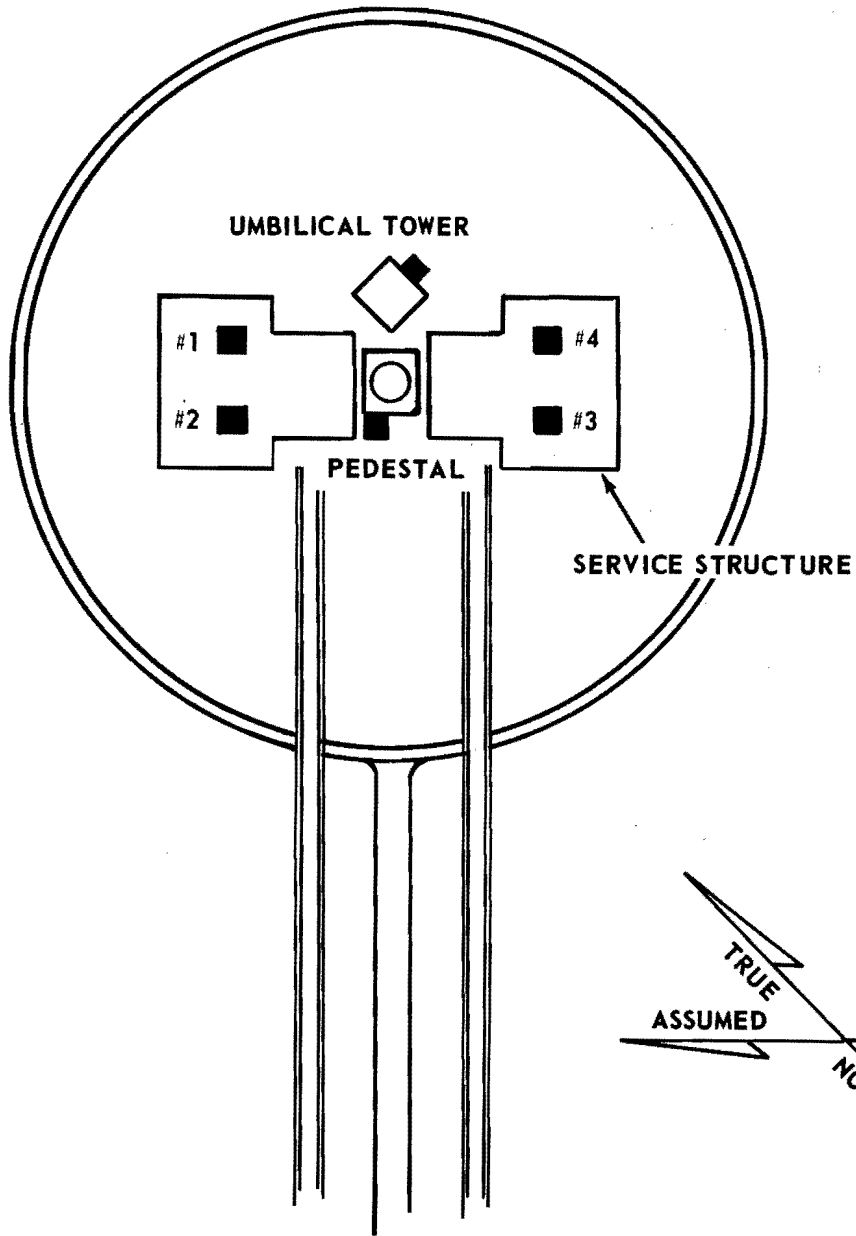
- 12-1 Aerial Drawing of Launch Complex 34
- 12-2 Launch Complex 34 Elevators
- 12-3 LC 34 Service Structure Adjustable Level 8 Platform
- 12-4 LC 34 Service Structure Adjustable Level 7 Platform
- 12-5 LC 34 Egress Route for Astronauts
- 12-6 Detailed Narrative Description of the Sequence of Events
- 12-7 Requirements placed on Panel 12.

AERIAL DRAWING OF LAUNCH COMPLEX 34

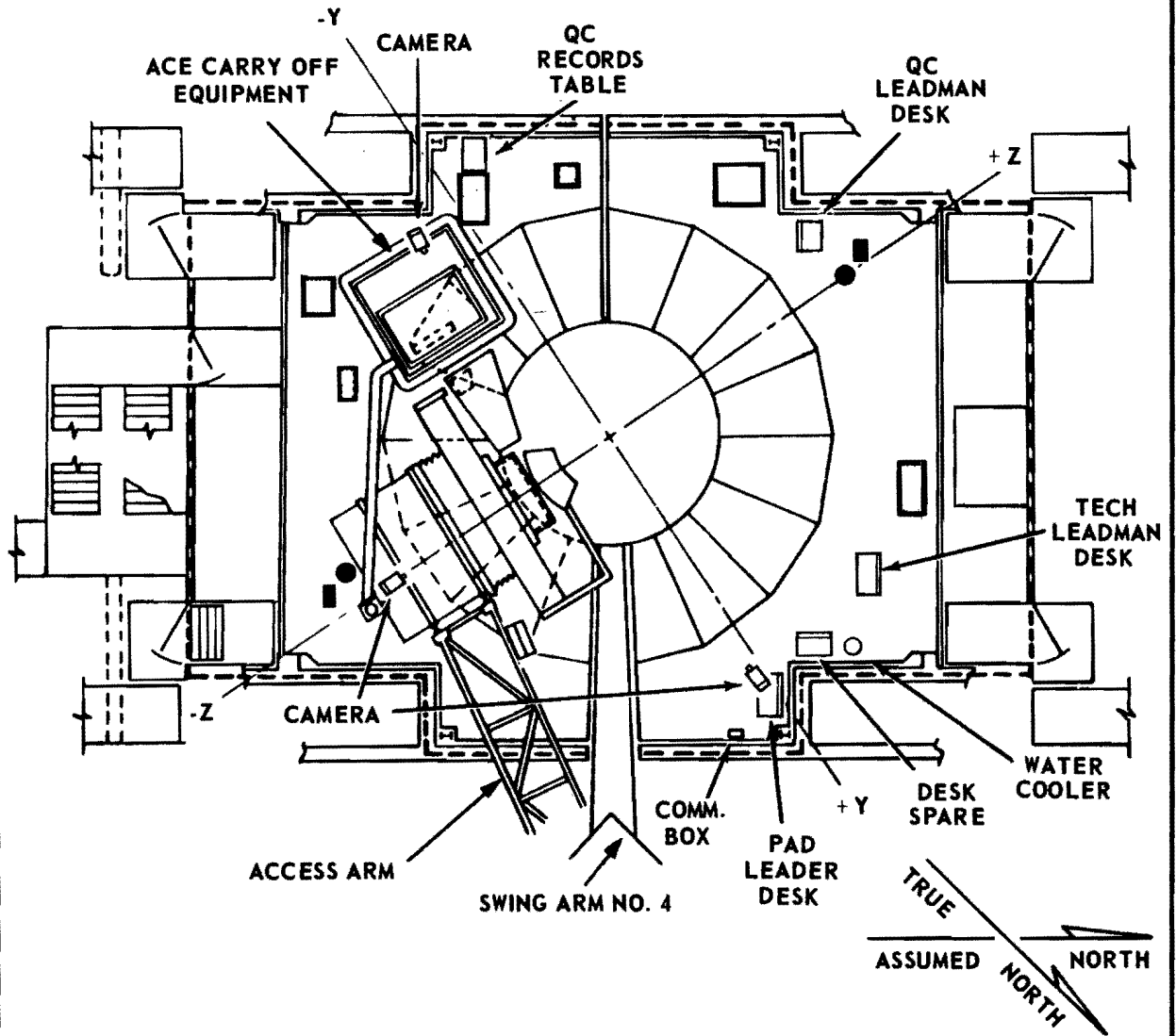


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LAUNCH COMPLEX 34 ELEVATORS



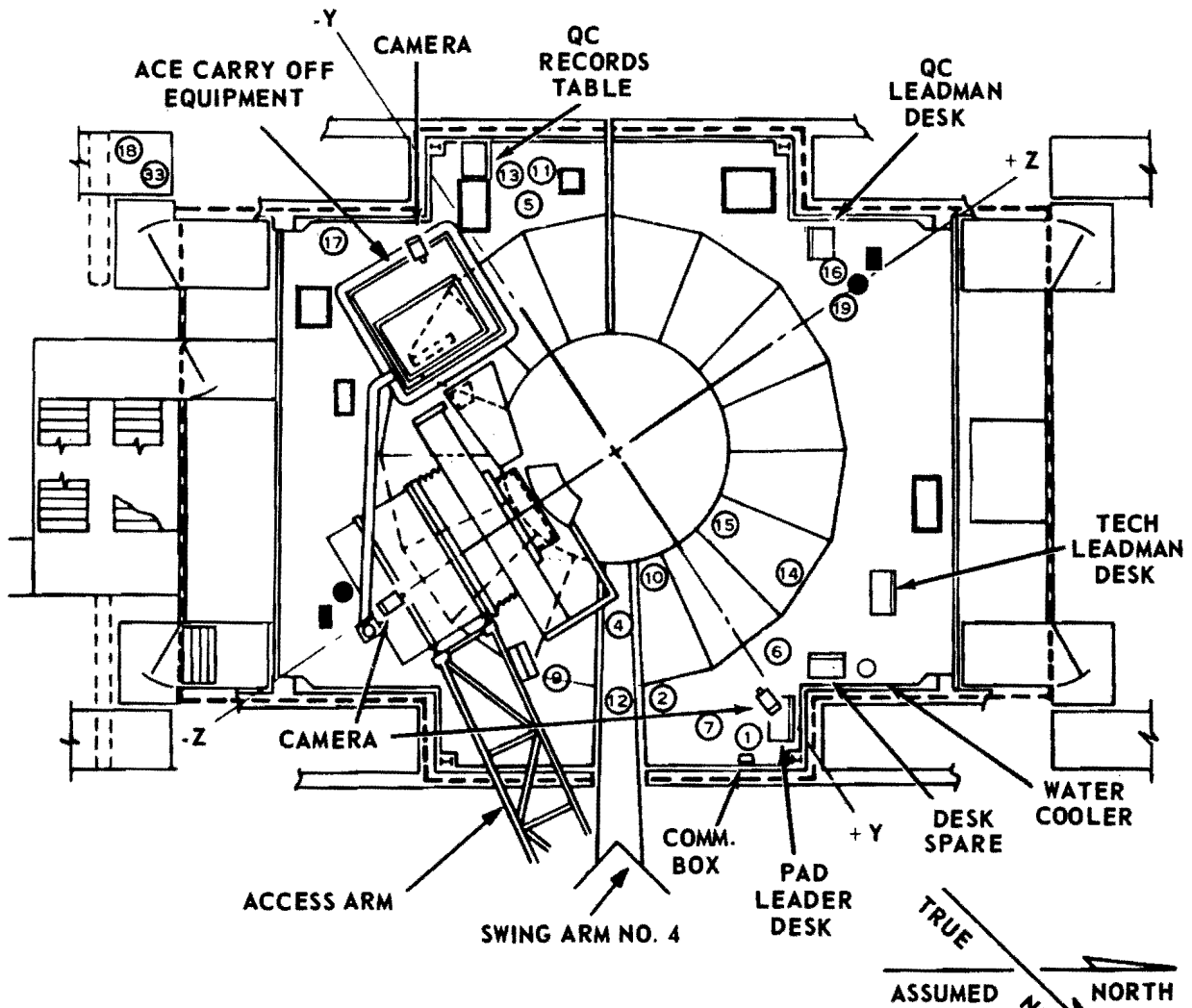
LC-34 SERVICE STRUCTURE ADJUSTABLE LEVEL 8 PLATFORM



ENCLOSURE 12-3A

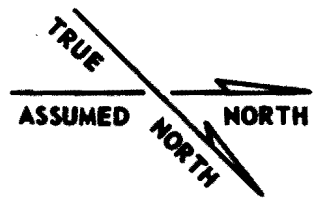
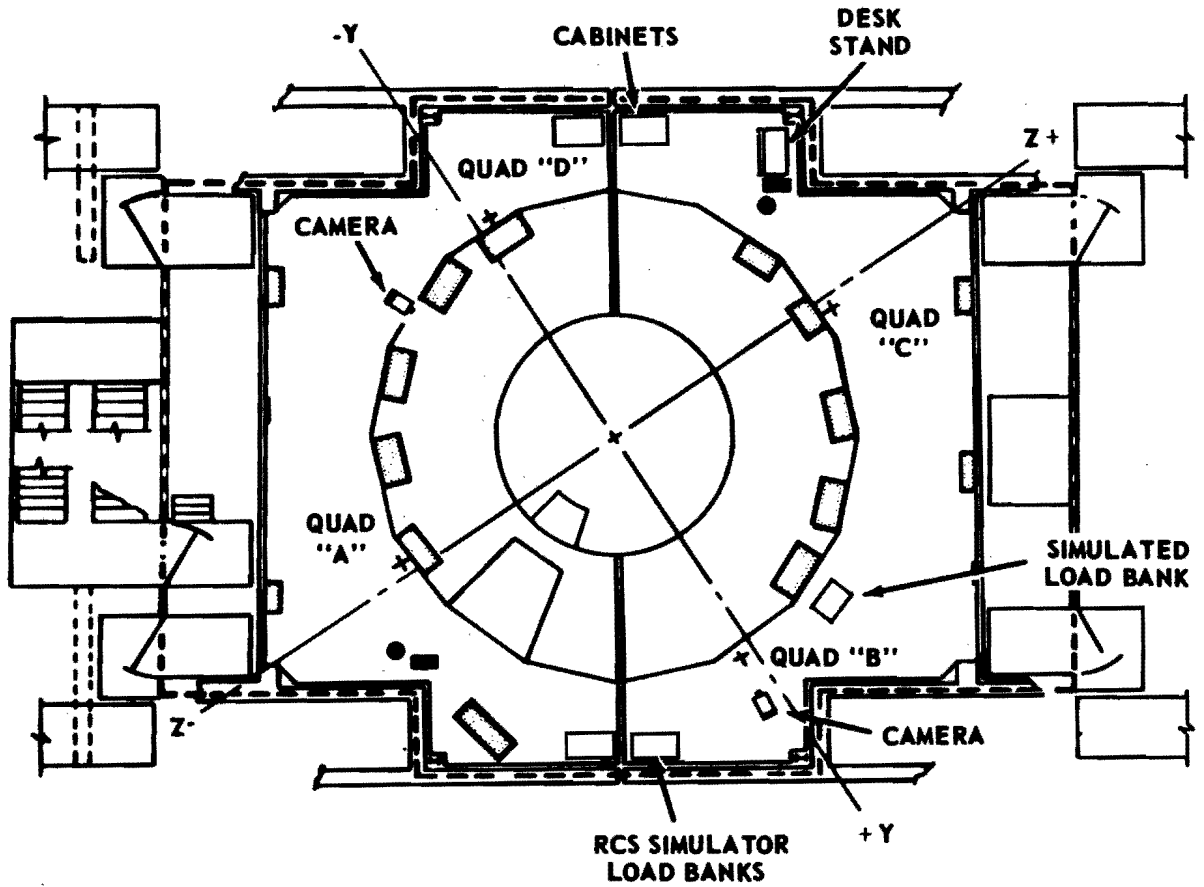
D-12-16

LC-34 SERVICE STRUCTURE ADJUSTABLE LEVEL 8 PLATFORM

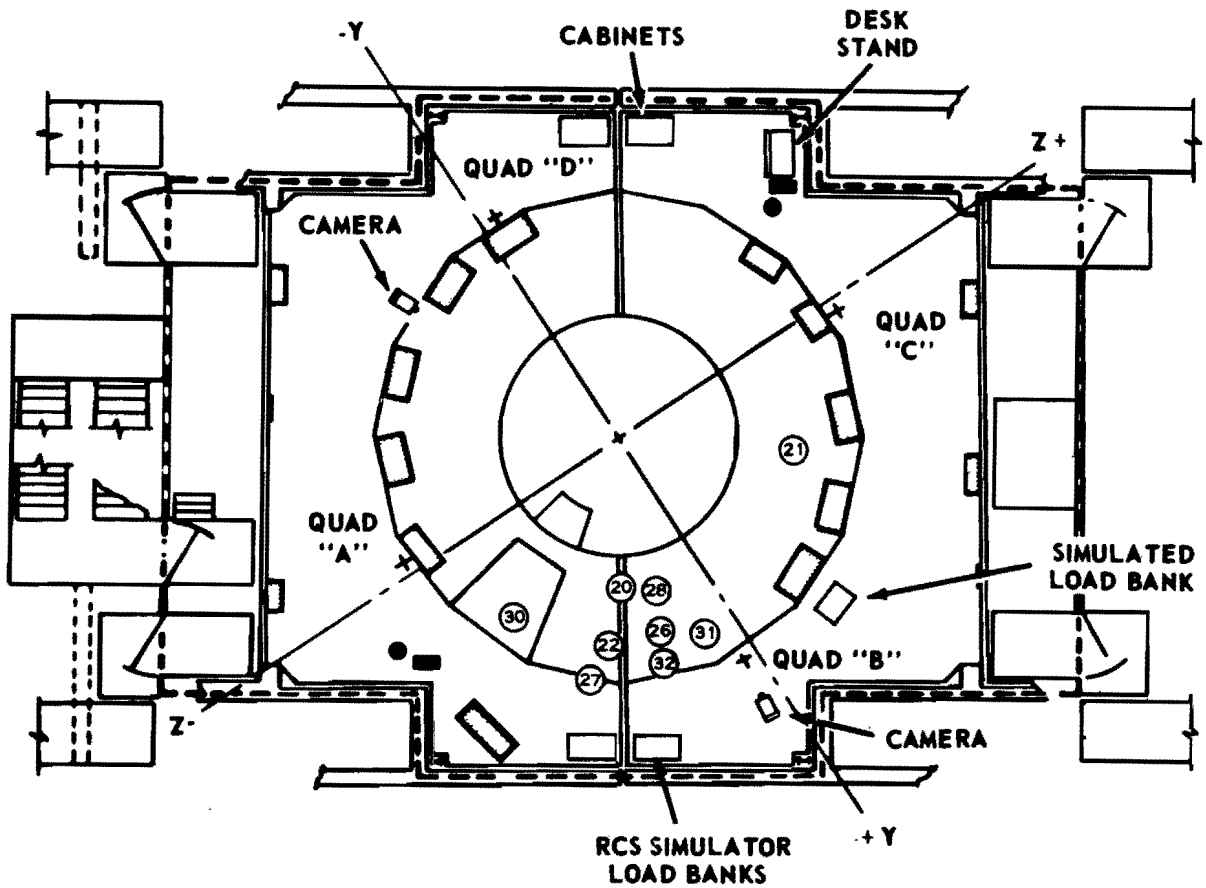


- | | |
|-----------------------------------|--------------------------------|
| 1. DONALD O. BABBITT, NAA | 12. JERRY W. HAWKINS, NAA |
| 2. JAMES D. GLEAVES, NAA | 13. W. DONALD BROWN, NAA |
| 4. L. D. REECE, NAA | 14. JESSIE L. OWENS, NAA |
| 5. RICHARD A. HAGAR, NAA | 15. ROBERT C. HEDLUND, NAA |
| 6. RICHARD L. BACHAND, NAA | 16. JOHN E. MARKOVICH, NASA |
| 7. STEPHEN B. CLEMMONS, NAA | 17. JOSEPH L. STOECKL, NASA |
| 9. JOSEPH H. PLEASANT, NAA | 18. HENRY H. ROGERS, JR., NASA |
| 10. BRUCE W. DAVIS, NAA | 19. CREED A. JOURNEY, NAA |
| 11. FRIEND DALE HICKENBOTTOM, NAA | 33. WILLIS M. MEDCALF, NAA |

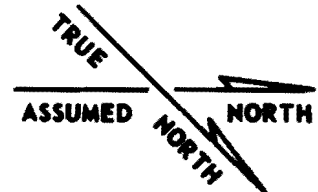
LC-34 SERVICE STRUCTURE ADJUSTABLE LEVEL 7 PLATFORM



LC-34 SERVICE STRUCTURE ADJUSTABLE LEVEL 7 PLATFORM

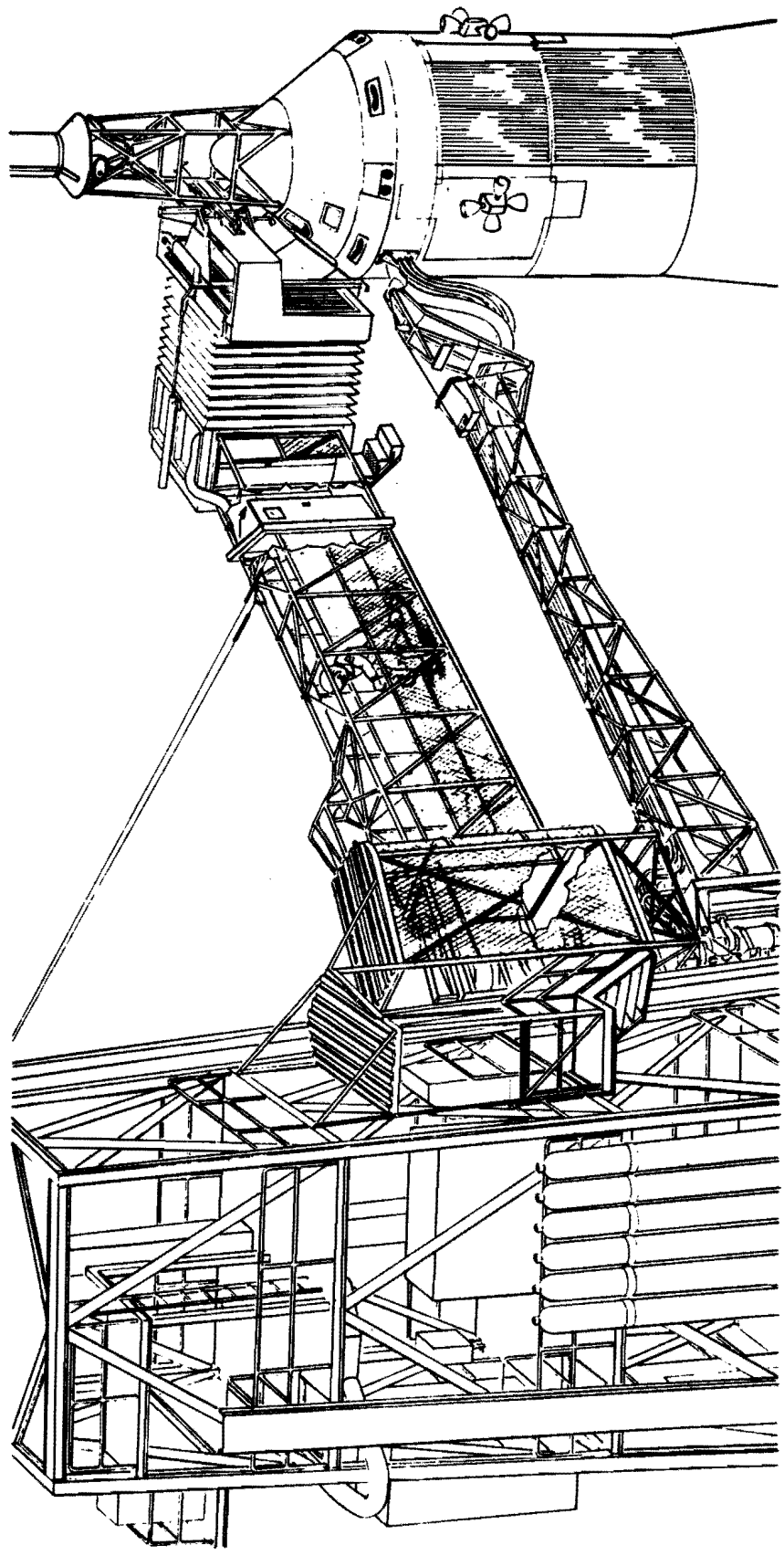


- 20. WILLIAM J. SCHNEIDER, NAA
- 21. DAVE E. HOWARD, NAA
- 22. J. C. SCOTT, NAA
- 26. GEORGE W. RACKLEFF, NAA - TULSA
- 27. SAMUEL WILLIAMS, NAA
- 28. FORREST R. ROOKER, NAA
- 30. MARVIN L. NELSON, NASA
- 31. PATRICK E. MITCHELL, NASA
- 32. WILLIAM C. DEAVER, NAA



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LC-34 EGRESS ROUTE FOR ASTRONAUTS



ENCLOSURE 12-5

D-12-21

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DETAILED NARRATIVE DESCRIPTION OF THE SEQUENCE OF EVENTS

The following is a description of the events surrounding the Apollo 204 incident, as determined by the Apollo 204 Review Board Counsel. This narrative is based upon witness statements (Appendix B), a recording of the communications on the OIS channel Black 3, and re-interviews (non-recorded) of the principal participating witnesses. The re-interviews (March 28, 29, and 30, 1967) were done by the Review Board Counsel with the Witness Statements Panel 12 chairman and one Panel 12 member present. The following was reviewed by the chairman of Panel 12 and in his opinion is a true representation of the facts.

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It should be recognized that during the attempt to remove the various hatches, visibility within the working areas was virtually non-existent. At the same time, some individuals were wearing gas masks making identification extremely difficult. It is possible that individuals have been improperly placed during the description of a particular sequence. Care has been taken to reconstruct the scene as accurately as human memory will allow. In an effort to identify the individuals involved during the various hatch removals, participants ran through an experiment on a mock-up spacecraft. The experiment tended to clarify the sequence of events and is relied upon in this narrative as being a reliable indication of the actions involved in the crew rescue attempt.

Complex 34 consists of the Service Structure containing adjustable levels which completely surround the vehicle and the Command Module and an umbilical tower. Work on the vehicle during erection and preparation for launch, is carried out on the various enclosed adjustable levels. Prior to launch, the entire service tower is moved away from the erected vehicle.

The umbilical tower is a fixed installation containing an elevator, umbilicals to the Launch Vehicle, and an environmental control assembly (called a "white room"), at the end of a swinging access arm. The "white room", which is relatively small, swings against, and surrounds the hatchway of the Command Module. It is separate from adjustable Level 8 which completely surrounds the Command Module, until the service tower is pulled away. When the service tower moves away, the "white room" stays in position, pressed against the Command Module hatch, until 30 minutes prior to launch. It is through the white room, the access arm and the elevator, that crewmen can escape from the Command Module in the event hazardous conditions are discovered. After the access arm and the white room swing away from the vehicle, escape from hazardous conditions on the pad would be via the Launch Escape System (LES). It contains a solid fuel rocket motor, capable of pulling the Command Module clear of the complex. Prior to the Plugs Out Test, the Launch Escape System, with its rocket motor, was erected on top of the Command Module. While the wires activating the LES were shorted, there nevertheless remained the possibility that if sufficient heat were generated, the solid fuel could explode or the motor ignite. This would cause wide spread destruction to the adjustable levels of the service tower and to the Launch Complex itself.

The "white room" is completely separate from the service structure since it is an integral part of the umbilical tower. However, the "white room" and the access arm, swing into Level A-8 where the Command Module is situated. In this configuration, the "white room", the access arm and the umbilical tower appear to be part of the service structure.

The "white room" is attached to the Command Module by an hydraulically operated adapter boot. The boot fits against the Command Module, it's flexible material forming a seal around the Command Module hatch. From inside the rectangularly shaped "white room", the adapter boot presents a ramp-like appearance to the Command Module hatch; the floor of the white room being elevated above the hatchway. A door opens from the access arm into the "white room". Another white room door directly opposite the access arm doorway leads into Level A-8. This second door was sealed shut at time of the accident. The door is sealed as a safety precaution to prevent use once the service structure is pulled away from the Command Module. Until that time, access into Level A-8 is possible from the access arm itself.

ENCLOSURE 12-6

D-12-24

Four corner elevators on the service structure serve the various levels.

The count on OCP-FO-K-0021, the Plugs Out Test, was at T-10 minutes and holding. Efforts were being made to correct communications difficulties which had existed throughout the test. However, the communications difficulties, while still existing, were not deemed important enough to halt the test. The count was due to resume within minutes when the first report of fire was heard.

The report from inside the Command Module is believed by the witnesses on Level A-8 to have been made by the Pilot. Some heard the report over their headsets, others heard it over speakers installed on Level A-8.

After the initial shock of the report of fire, followed within seconds by the rupturing of the Command Module with flames pouring out of the failed area of the Command Module, efforts were begun to remove the three hatches of the Command Module.

At the instant of the report of fire, J. D. Gleaves, standing on the access arm, immediately began moving toward the "white room". He heard pressure escaping from the cabin relief valve and recalls thinking at the time, that the Command Pilot had dumped the pressure of the Command Module in accordance with the fire emergency procedures. It was his feeling that since the cabin was being depressurized he would have no difficulty in removing the inner hatch. As Gleaves started to step into the white room, he saw a very bright flash of light emanating through the porthole of the Command Module. He turned around. With him at this time was J. W. Hawkins. As they neared the door on the access arm, Gleaves recalls feeling a pressure and seeing tongues of flame escaping from the failed portion of the Command Module. The force of the pressure pushed him against Hawkins. With some difficulty they opened the door, which opened toward them. Their first thoughts after seeing the Command Module rupture and the flames spread across Level A-8, was that Pad Leader D. O. Babbitt and the others must have been killed. It was only after Babbitt and others joined them on the swing arm, that they realized that no one on Level A-8 had been seriously injured as a result of the rupture of the Command Module. Hawkins secured a fire extinguisher, entered the "white room" and put out two localized fires. Babbitt and Gleaves immediately returned to the white room area and began the job of removing the boost protective cover (BPC) hatch, which is the Command Module's outermost hatch. Though the BPC hatch had not been fully installed, that is, dogs which attach it to other portions of the boost protective cover surrounding the Command Module had not been engaged, it was necessary to insert a tool into the hatch in order to secure a hand hold. Babbitt and Gleaves report that the BPC hatch itself had been distorted, probably by the fire and rupturing of the Command Module. The hatch, which normally would have been easily removed, had to be forced. During this period of time, the "white room" continued to fill with smoke.

While some individuals had working gas masks, others did not. Even when the gas masks, primarily designed for use in toxic atmospheres, became operative, they were unable to work efficiently except for very short periods of time in the dense smoke-filled atmosphere of the white room.

Visibility was virtually zero. The various crews working in relays had to proceed primarily by the sense of touch.

After removal of the boost protective cover by Babbitt and Gleaves, they left the "white room". Gleaves had no gas mask and was obviously feeling the effects of the dense smoke. He was beginning to gag and choke, and yet, in spite of his physical condition, was able to complete, with Babbitt's assistance, the complete removal of the boost protective cover hatch. The tool used to remove this hatch is the same tool used to remove the ablative hatch and the inner hatch of the Command Module. As Babbitt and Gleaves left the "white room", Gleaves recalls handing the tool to Hawkins. Hawkins does not recall who handed him the tool. He knows someone did.

With Hawkins were S. B. Clemmons and L. D. Reece. During the ablative hatch removal, Babbitt

was also in the "white room". Within one minute and 30 seconds of the first report of fire, Babbitt had entered the "white room" at least once and perhaps twice. He had recovered his headset and was able to contact the blockhouse and describe the conditions as they were developing.

The removal of the ablative hatch was relatively simple. After the tool was inserted, the hatch was lifted off and carried out of the white room by Reece who threw it on the floor of adjustable Level 8 once he was clear of the "white room".

Hawkins remained in the "white room" after the ablative hatch was removed. Continuing to use the removal tool, he began work on the inner hatch. With him were Clemmons and Reece, though the witnesses at this point, because of the dense smoke, do not recall seeing all others in the "white room" at the time. Hawkins and Clemmons were apparently nearest the hatch, Hawkins using the tool to unlock the hatch while Clemmons was attempting to secure a hand hold on it.

There are two handles on the exterior of the inner hatch which, when installed, are wired down with safety wire. Whether or not Clemmons broke the safety wires holding the handles flush to the hatch, he does not recall. Once the hatch was unlocked, both men pushed it upward to relieve it from the dogs. Once the inner hatch was free, they attempted to drop it down onto the Command Module door. The hatch went only part way down.

The pad crew realized that it was not necessary to completely remove the inner hatch in order to provide access to the interior of the Command Module. During the scheduled egress exercise the inner hatch would have been unlocked by the crew and placed on the floor of the Command Module. While a small portion of the hatch cover extends above the lower rim of the hatch, access to and from the Command Module is possible.

When the inner hatch was unlocked, intense heat and smoke came out of the open hatchway. No flames were visible on the inside. Two floodlights installed on the couches were barely visible through the smoke.

Hawkins attempted to examine the interior of the Command Module. He called out to the crewmen. He remembers there was an unusual silence from the Command Module interior.

Babbitt too had examined the Command Module's interior. Concerned about reporting over the wide communications net that he was then using that the astronauts were dead, he simply advised the ground that he would not describe what he had seen.

Babbitt and H. H. Rogers, Jr., returned to the "white room" after the inner hatch had been unlocked and partially lowered into the Command Module. During the efforts to lower the hatch, it dropped further down into the Command Module. Babbitt and Rogers then returned for fresh air to the swing arm.

Shortly, thereafter, Babbitt, suffering from smoke inhalation in the efforts of the attempted rescue, was relieved as Pad Leader by L. Curatolo.

Gleaves who had at various times been forced to the swing arm by the smoke, returned, saw that the hatch was part way down and gave it a kick. As a result of the kick, the hatch fell even further into the Command Module. Gleaves had secured a flashlight from his tool box during one of his entries into the white room and peered into the dark smoke and soot-covered interior of the Command Module. He could see nothing except the faint glow of the floodlights mounted near the couches. The lights were within inches of his position, but they appeared to be small candles very far away.

W. M. Medcalf entered the "white room" and began his attempt to remove the inner hatch completely from the Command Module.

Members of the regular fire department began arriving at Level A-8. The pad egress team, which had been standing by at the fire station, also responded to the call, but in much slower M113 Armored Personnel Carriers. The team was scheduled to participate in the egress exercise, scheduled at the end of the plugs out test.

Fireman B. Dawes arrived at Level A-8 through a service elevator and went to the "white room". He recalls seeing the hatch laying inside the Command Module. Fireman J. A. Burch, Jr., upon his arrival at the "white room" saw people working around the hatch. He joined them and began to pull at the inner hatch in an effort to remove it completely from the Command Module. He began to feel the effects of the smoke and had to run out of the "white room" to the access arm. On the access arm he found a gas mask, donned it, and returned to the "white room" to continue in his attempt to remove the hatch from the Command Module. Once again he was not successful. He was forced out of the "white room" by the smoke. He replaced his gas mask, and returned for a third attempt at the inner hatch removal. This time with the aid of Medcalf, he was successful. With the exception of Assistant Chief J. C. Mooney, who was a member of the pad egress team, none of the firemen were familiar with the configuration of the Command Module. They had received no training in the removal of the various hatches, since it was felt that the pad egress team would be available to perform this function during hazardous tests or launches. The pad egress team did have knowledge of the Command Module configuration and had appropriate tools to remove the three hatches. Chief Mooney arrived at "white room" after the inner hatch cover had been completely removed from the Command Module.

After the hatch was removed, Burch leaned into the Command Module. Everything was black. He could not see any bodies. He secured a flashlight but even with its assistance he was unable to see anything. As he was crawling out of the open hatchway, he did notice one body. He attempted to pick it up, but he was unable to move it. He then left the Command Module. In the meantime, Fireman B. H. Batts with others was removing the panel that sealed the second door of the "white room", which led directly onto Level A-8. This was necessary in order to vent the "white room" and the Command Module. The use of fans to blow the smoke out of the Command Module was considered unwise, since the fans could possibly re-ignite substances within the Command Module. Chief Mooney, a member of the pad egress team which had planned to participate in the egress exercise scheduled for the end of the Plugs Out Test, also made an effort to remove crewmen from the Command Module. This activity was stopped, confirmed by physicians who had arrived at the Command Module, that all three astronauts were dead, and that an investigation of the Command Module as it was found after the hatches were open would be important in attempting to determine the cause of the fire.

Photographs were then taken of the Command Module, of Level A-8, and other portions of the service structure.

Witnesses reported seeing firemen on the complex without firefighting equipment. Since each level contains fire extinguishers as well as hose lines, it was not necessary for them to bring equipment from the ground in order to fight fires. The hose lines were working and lines were charged, though not used. Fire extinguishers from Level A-8 and other levels of the service structure were used to control blazes outside the Command Module and at other locations on the service structure.

Because of the proximity of fires, workers removed their nylon work smocks. Examination of the smocks after the incident showed that some of them had been burned, apparently from fire brands erupting onto Level A-8 when the Command Module ruptured.

The access arm was the closest position to the "white room" in the Command Module where fresh air was available for the workers. While a few witnesses reported that their gas masks were operative, a majority indicated they were of little assistance during the rescue attempt, because of the density of the smoke.

J. E. Cromer, on duty at the Umbilical Tower elevator, reported that the elevator was at Level 200, which corresponds with Level A-8, at the time the fire began. While the elevator could be remotely controlled from the blockhouse, Cromer could also control it from his position on the umbilical tower. The elevator remained at Level 200 until Gleaves, choking and gagging from the smoke inhaled in his repeated entries into the "white room", had to be sent to the ground. Cromer reports that the first indication that he received of the fire was the sensation that there was an explosion on Level A-8. He also reports seeing a tongue of flame emanating from the "white room". Immediately after the explosion, personnel from the inside of Level A-8 came out on the access arm. After reporting there was a fire to his control point within the blockhouse, Cromer broke out a box containing gas masks. Cromer reports that personnel on the access arm immediately began re-entering the "white room" in their efforts to remove the hatches and effect crew rescue.

Gary Propst, an RCA technician, stationed in the blockhouse and responsible for controlling remote television cameras installed on Level A-8 and in the "white room", first became aware of the fire through the report heard on his headset. He immediately looked at the "white room" monitor. He saw light in the Command Module emanating from a point on its left side. At the same time he saw hands reach above the hatch, and movement of the crew inside of the Command Module. With the light increasing in intensity inside of the Command Module, Propst immediately adjusted the camera to the light levels within the Command Module. This action may have caused television monitors to show what appeared to be an explosion of white light, but was in reality an adjustment of the camera's sensitivity to the light.

Propst is convinced that the time of the accident, from the moment he first learned of the fire, until the "white room" filled with smoke, was much longer than data indicates. He recalled engaging in a conversation with others in the blockhouse as to when the crew would blow the hatches. Propst was not aware that the hatches on the Command Module could not be exploded off. He recalls, by viewing other monitors at Level A-8, that the "white room" did not fill with smoke until visibility was almost impossible on Level A-8 itself. As the fire progressed, smoke did fill the "white room" making detailed viewing through the TV camera impossible. However, Propst could tell that there was activity going on in the "white room" as individuals would stand in front of lights installed for the TV cameras, thus varying the light intensity. While he could discern that something was going on, he could not see in detail, what was happening.

While arrangements can be made to video tape the television monitors, facilities for doing this are not located within the blockhouse, and a video tape does not exist of what the monitors showed during the fire period.

Propst viewed a motion picture of a test fire in a boilerplate Command Module taken in Houston, Texas, after the incident. He states that the film showing fire through the boilerplate hatches, at 16.4 pounds per square inch pure oxygen, were very close to what he viewed through the monitor. At one point in the film, bright white flames sweep across the hatch. Propst does not believe that this happened the night of the fire, though the quality of flickering light was similar to what he observed. It should be noted that in the boilerplate fire test, the vessel was vented at a different point than where rupture occurred on Spacecraft 012 during the night of the fire.

The report of fire was radioed to the fire station by G. C. Meyer, Pad Safety Officer. As the fire trucks approached the complex in response to Meyer's call, firemen looked at the top of the launch complex and saw very little smoke. Thinking that the area would be relatively clear, they did not take air packs with them, which were available on the truck. Later, after the smoke conditions were discovered by the firemen, the air packs were taken to the fire scene.

The total elapsed time from the report of fire to the opening of the inner hatch into the Command Module could not have exceeded five minutes, 27 seconds. This is based upon a timing of the tapes

made of voice transmissions during the incident. The timing is verified by a log maintained by W. H. Schick from within the Blockhouse. Schick's log is based upon reports he heard over the communications network. While the GMT timer he was using did not show "seconds" he was able to discern minutes and record them in his log. He shows the first report of fire as having been received at 6:31 p.m. and the first report that the hatches were off at 6:36 p.m. Since he did not have a "seconds" display he was unable to record the exact second the fire report was heard, nor the exact time of the report that the hatches were off.

None of the men working on the hatch removal believed the crew could have survived the fire. The heat was described as intense, the destruction considerable. Despite their belief that the crew was lost, and their knowledge of the hazard which existed because of the rocket motor above them on the Launch Escape System, they proceeded under almost impossible conditions to open the Command Module in a desperate effort to save the crew. That the hazard was real in their minds, is shown by the statement of one witness, that he considered jumping from the tower immediately after the Command Module erupted. He felt that death was imminent in any event. He, nevertheless, stayed at Level A-8 and worked in the "white room" to remove the hatches.

Curatolo, who had relieved Babbitt, was relieved by J. Murphy at 8:00 p.m. By then, all of the fires had been extinguished for some time.

Removal of the crew was to begin only after complete photographic coverage of the Command Module had been completed. The exact configuration of the Command Module, the position of its switches, and the evidence of what lights were burning, were considered to be important for further investigation.

By 2:00 a.m. Saturday morning, the crew had been removed from the Command Module.

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REQUIREMENTS PLACED ON PANEL 12

From	Subject
1. Dr. Floyd Thompson, Board Chairman	Required memorandum regarding Baron and Parker reports.
2. Col. Charles F. Strang, Board Member	Requested information from witnesses on Levels A-7 and A-8 on whether they touched or caused movement of the Command Module or Service Module in the five-minute interval immediately preceding the incident.
3. Mr. George C. White, Jr., Board Member	Requested a statement from LeRoy G. West (NAA) regarding placement of gas chromatograph plug.
4. Board Panel Coordination Committee	Requested copies of extracts of witness statement information be sent to the Committee members.
5. Board Panel Coordination Committee	Required Panel 12 to submit a status report to the Committee at the daily 5:00 p.m. meeting.
6. Board Panel Coordination Committee	Requested Interim Report on Panel activities.
7. Board and Panels 6, 8, 11, 14, 17, 18, and 19	Required copies of all published witness statements and extracts.
8. Dr. George E. Mueller, NASA Headquarters	Requested number of people located on Levels A-7 and A-8 of the Service Structure and on the Umbilical Tower at LC 34 at the time of the incident.
9. Panel 1	Requested statements from personnel involved in pre-crew ingress, crew ingress, cabin close-out, and cabin purge.
10. Panel 2	Requested a set of witness statements for temporary perusal.
11. Panel 3	Requested copies of Bendix Gas Analyses.
12. Panel 5	Required further statement from James F. Terry (NASA-KSC) regarding times in relation to indications of fire versus TV monitor image.
13. Panel 7	Requested information on documents that went into and out of Spacecraft 012 prior to hatch closure.
14. Panel 8	Required: (a) Information concerning astronaut placement of loose articles. (b) Interview of ingress and hatch close-out crew. (c) Interview of witnesses regarding knowledge of solvents used and/or strange odors detected.

- (d) A list of personnel who visited Levels A-7 or A-8 on LC 34 for the 24-hour period prior to the incident.
- (e) Certain witnesses to participate in a sniff test.
15. Panel 10 Requested statements regarding cabin relief valve operation, or times of explosive or popping noises during the first 15 to 20 seconds of the fire.
16. Panel 11 Requested:
(a) A PAA Dispensary list including medication given to personnel involved in the incident.
(b) All information regarding astronaut body positions.
17. Panel 13 Requested witness comments regarding emergency equipment.
18. Panel 14 Required:
(a) List of all personnel who were on LC 34 from 5:30 p.m. EST to 7:30 p.m. EST on January 27, 1967.
(b) Copies of statements made by Thomas R. Baron (self-employed), Donald O. Babbitt (NAA), James D. Gleaves (NAA), and Rocco A. Petrone (NASA-KSC).
(c) Copies of any statement that comments on security or lack of security.
(d) Copy of Arthur E. Vreeland (Federal Electric Corporation) statement.
19. Panel 16 Requested certain witnesses observe the TV simulation film to obtain witnesses reaction regarding clarity and detail of the simulation.
20. Panel 17 Requested Panels 3, 11, and 12 prepare a final "Time Line" from onset of T-10 minutes hold through medical determination of deaths.
21. Panel 18 Requested:
(a) Certain primary witnesses view the Panel 16 TV simulation film and note any changes in, or verify, the witness observations and time correlations.
(b) Interviews of Richard A. Hagar (NAA) and Richard L. Bachand (NAA) regarding movement of any article in the Spacecraft during crew removal.

**REPORT OF PANEL 13
GROUND EMERGENCY PROVISIONS
APPENDIX D-13
TO
FINAL REPORT OF
APOLLO 204 REVIEW BOARD**

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GROUND EMERGENCY PROVISIONS

A. TASK ASSIGNMENT

The Apollo 204 Review Board established the Ground Emergency Provisions Panel, 13. The task assigned for accomplishment by Panel 13 was prescribed as follows:

This task involves an orderly review of planned ground emergency procedures relative to their adequacy, as well as a review to determine that emergency procedures, in fact, exist for all appropriate activities. This review should concentrate on activity at the launch site, and should include recommendations to the Board for changes in existing procedures and for the creation of new emergency procedures if deemed necessary.

B. PANEL ORGANIZATION

1. MEMBERSHIP

The assigned task was accomplished by the following members of the Ground Emergency Provisions Panel:

Mr. G. F. Page, Chairman, Kennedy Space Center (KSC), NASA
Mr. L. A. Barnett, Kennedy Space Center (KSC), NASA
Mr. N. M. Carlson, Kennedy Space Center (KSC), NASA
Mr. J. H. Chappee, Manned Spacecraft Center (MSC), NASA
Mr. R. W. Cunningham, Manned Spacecraft Center (MSC), NASA
Mr. R. S. Sayers, Manned Spacecraft Center (MSC), NASA
Col. H. G. Russell, U. S. Air Force, Office of Manned Space Flight (OMSF), NASA
Mr. R. Rochester, North American Aviation (NAA), Downey, California
Mr. G. F. Smith, North American Aviation (NAA), Downey, California
Mr. K. C. Wishon, North American Aviation (NAA), Downey, California
Mr. H. H. Luetjen, Consultant, McDonnell Company, Kennedy Space Center (KSC)

2. COGNIZANT BOARD MEMBER

Colonel Frank Borman, U. S. Air Force, Board Member, Manned Spacecraft Center (MSC), NASA, was assigned to monitor the Ground Emergency Provisions Panel.

C. PROCEEDINGS

1. The Panel approached the assigned task in two phases. First, a review and evaluation of the emergency provisions at the time of the accident. This review included investigations of:
 - a. The emergency procedures in the published documents;
 - b. The emergency equipment internal and external to the spacecraft;
 - c. The emergency training of the flight crew and checkout test team personnel.

The second phase was a review of the existing methods used to identify hazards and insure adequate documentation of appropriate safety procedures and applicable emergency instructions in the operational test procedures.

2. PUBLISHED EMERGENCY PROCEDURES

- a. The Apollo Crew Abbreviated Checklist (Reference 13-1) was prepared by the contractor under the direction of the Manned Spacecraft Center (MSC) Flight Crew Support Division. The document includes flight crew emergency procedures for:
 - (1) Fire or smoke in the cockpit in flight; and,
 - (2) Pad egress from T-30 minutes to lift-off.

The in-flight fire or smoke procedures considered in (1) above are not appropriate for the situation involving internal fire during ground operations. (Reference report by Panel 20.) The unaided Command Module (C/M) egress instructions provided in (2) above were applicable for

actions required by the crew to effect egress from the C/M for any reason. A minor change to the unaided crew procedure was documented during the course of a briefing given to the AS-204 Flight Crew by members of the Apollo Emergency Egress Working Group (Enclosure 13-1) on January 23, 1967. This change reflected an agreement to maintain suit oxygen flow and crew communications until the hatches were removed.

b. The Apollo Operations Handbook (AOH) (Reference 13-2) is prepared by the contractor under the direction of MSC and contains flight crew emergency procedures similar to those described above in paragraph a. In practice, the emergency procedures developed and documented in the abbreviated crew checklist are subsequently included in the AOH so that ground control personnel are made aware of the crew actions to be followed in the event of an emergency.

c. The Apollo Flight Crew Hazardous Egress Procedures Manual (Reference 13-3) is prepared by the Emergency Egress Working Group of the Apollo Launch Operations Committee (Enclosure 13-2). This manual is the definitive document concerning spacecraft and pad egress procedures and represents the combined efforts of Kennedy Space Center (KSC), MSC, and the Air Force Eastern Test Range (AFETR). The scope of this document is limited to cover only the terminal 30 minutes of a launch countdown or countdown demonstration. The procedures defined concern only the actions involved in unaided, aided, or incapacitated crew egress during that time period. Actions required to cope with the contingencies which could require crew egress are specifically excluded.

The procedures in this manual which define flight crew actions involved in unaided egress agree with those documented in the Crew Checklist and the AOH. The time line on Page 25 (Enclosure 13-3) of the egress manual indicates 60 seconds are required for the flight crew to open the spacecraft hatches and egress once the cabin pressure is vented. Practice runs under ideal conditions involving non-flight spacecraft configurations indicate that estimate to be correct. (A practice run involving a fully suited flight crew, venting cabin pressure, removing the three flight configuration hatches and egressing the spacecraft has never been performed.) Although there are no documented data available, the portion of the unaided egress time (60 seconds) involved in hatch removal by the flight crew is considered to be 40 to 50 seconds.

Incapacitated flight crew egress procedures defined in the egress manual are intended for use by the trained members of the Pad Egress Team. The time lines on Pages 26 and 27 of the manual (Enclosure 13-4) indicate 10 minutes is required from initiation of the operation to completion of crew removal. However, the portion of that time required to remove all three hatches from the outside is 70 seconds, assuming cabin pressure is already vented. Numerous practice runs by Pad egress personnel have verified that time to be correct under ideal conditions.

At the time of the AS-204 accident, the trained Pad Egress Team was not on station at Launch Complex 34. Their presence during the Space Vehicle Plugs Out Integrated Test had not been required since the operation was not previously identified as hazardous. However, the entire egress team was due on station following completion of the test in support of an unaided egress practice operation.

d. The spacecraft checkout procedure for the AS-204 Space Vehicle Plugs Out Integrated Test was OCP FO-K-0021-1 (Reference 13-4). This document, like all spacecraft test documents at KSC, was prepared by the contractor and approved by NASA-KSC-Spacecraft Operations (SCO). The document did not contain emergency procedures other than two pages of instructions for emergency shutdown of spacecraft direct current (DC) and alternating current (AC) power. The safety requirements included in the Operational Checkout Procedure (OCP) do not designate any portion of the test procedure as hazardous. (Enclosure 13-5).

The test objectives listed for the procedure include:

(1) To verify overall Spacecraft/Launch Vehicle (SC/LV) compatibility and demonstrate proper function of Spacecraft (S/C) systems with all umbilicals and Ground Support Equipment (GSE) disconnected.

(2) To verify no electrical interference at time of umbilical disconnect.

(3) To verify astronaut emergency egress procedures (unaided egress).

Objective (3) required suited crew operations in a closed cabin with a pressurized 100 percent oxygen atmosphere. This was the first time this third objective was combined with a Space Vehicle Plugs Out Integrated Test.

e. The Launch Vehicle Checkout Procedure being used for the AS-204 Space Vehicle Plugs Out Integrated Test was I-20015-SA204 (Reference 13-5) prepared by Chrysler (CCSD) and approved by NASA-KSC-Launch Vehicle Operations (LVO). This document contains emergency procedures (Section AW) which provide instructions for recycling the Launch Vehicle following a cutoff or a hold at any point in the final 30 minutes of the count. No reference is made to any hazardous operations being involved in the LV portion of the test other than standard safety procedures for handling LV ordnance items.

f. The only other published procedure involved in the AS-204 Space Vehicle Plugs Out Integrated Test was the Integrated Space Vehicle Procedure I-41001-204 (Reference 13-6) prepared and approved by NASA-KSC-Launch Operations Directorate (DLO). This document was used by the NASA-KSC Test Supervisor to coordinate LV-to-S/C interface activities and all off-site real-time support functions. The procedure does not contain any emergency procedures.

g. Published emergency procedures are of limited value to a flight crew in the presence of an extremely time critical emergency. In such instances, they must resort to those procedures committed to memory or instinctive action. Such procedures are developed by the crews as a result of intimate knowledge of the written procedures coupled with a real-time awareness of spacecraft configuration.

For time critical egress from the C/M, the flight crew would have eliminated all unnecessary steps from the documented procedures. Reaction would have been by reflex to the following minimum escape procedures:

- (1) Initiate cabin pressure dump
- (2) Unfasten restraint harnesses
- (3) Release inner hatch dogs
- (4) Wait for pressure decay
- (5) Remove inner hatch
- (6) Release and push out ablative hatch and boost protective cover
- (7) Disconnect umbilicals and cobra cables
- (8) Exit spacecraft

Post-accident investigation (Reference Panel 11 report) indicates that the AS-204 flight crew accomplished very little, if any, of the above minimum procedures before being incapacitated by the fire.

3. EMERGENCY EQUIPMENT INSIDE THE COMMAND MODULE

a. Spacecraft Cabin Depressurization Equipment:

As established in paragraph 2.g., the initial requirement for S/C egress is cabin depressurization. The Apollo Block I spacecraft incorporates no provisions for emergency cabin depressurization. Three depressurization methods are possible from within the cabin:

(1) The normal and documented method of cabin depressurization requires activation of one of the cabin relief valves. It has an effective venting area of 1.5 square inches and would accomplish venting from 16.4 pounds per square inch absolute (psia) to 14.8 psia in approximately 18 seconds (Enclosure 13-6, Figure 4).

(2) Activation of the post-landing cabin vent fans would also initiate cabin depressurization. This method, designed for use after water impact, opens two sliding valves in the tunnel area, each of which has an effective opening of 19.5 square inches. The specification limit for operation of these valves is 0.75 pounds per square inch differential (psid), although they have been demonstrated to 5 psid. There are no available data to indicate time of venting through these valves into the closed forward deck area (prelaunch configuration). Venting by this method was not included in the documented emergency egress procedures.

(3) As a last resort, emergency depressurization could be accomplished by breaking one of the cabin windows. This method has never been demonstrated and there are no data indicating the

venting time involved.

There is no indication that the AS-204 flight crew was able to initiate cabin depressurization following the outbreak of the fire. In the presence of the rapidly increasing cabin pressure which resulted from the fire, activation of the normal vent would have had no noticeable effect.

b. Quick Release Crew Restraint Harness:

Each crewman is provided with an individual restraint harness. The harness assembly consists of two shoulder straps and one lap belt. The shoulder straps and lap belt are connected together by means of a three-point locking/release mechanism attached to one side of the lap belt. Release of both the shoulder straps and the lap belt is accomplished by pulling a release lever located on the top of the lap belt buckle.

c. Internal Spacecraft Hatch Release Equipment:

The main hatch assembly provides the only means of crew egress on the pad. The hatch assembly consists of three separate covers or hatches (Enclosure 13-7). The inner hatch serves as a spacecraft structural load carrying member and crew compartment pressure seal. It has an effective area of 1200 square inches. The ablative (middle) hatch provides thermal protection for entry. Over this fits the boost protective cover (outer) hatch. Removal of all three hatches was essential for crew egress. Removal of the inner hatch requires rotation of a wrench counter-clockwise through approximately 220 degrees to release six latch assemblies located on the bottom edge (outer side) of the hatch (Enclosure 13-8). A prerequisite to inner hatch removal is the lowering of cabin pressure to approximately ambient. A crewman may then lift the inner hatch (approximately 55 pounds) up and in for stowage in the spacecraft.

The Boost Protective Cover (BPC) is released by the crewman striking a push-type plunger which extends through the middle hatch and is attached to the BPC. The middle hatch is then released by pulling on a cable arrangement. Both middle and outer hatches may then be pushed out of the egress path permitting crew egress.

d. Flight Crew Protective Clothing:

The protective clothing worn by the AS-204 crew at the time of the fire were Pressure Garment Assemblies (PGA) (P/N A 1936). They were essentially the same as the non-Extravehicular Activity (EVA) suits used on Gemini missions. The suit is fabricated of an outer layer of HT-1 nylon, a nylon webbing layer, a neoprene inner-pressure vessel, and a nylon comfort liner. Each crewman also wore a cotton constant wear garment (P/N A 1912-003) under the spacesuit.

Tests conducted at MSC in late 1965 (Enclosure 13-9) using six-inch-square swatches of similar suit material indicate its fire protective qualities. The swatches were tested in a 100% oxygen, 14 psia environment for high temperature flame impingement effect.

Samples were exposed to the pure oxygen environment following two evacuation periods at a pressure of 5 millimeters of mercury (mmHg) to allow out-gassing. A 30-minute soak at 14 psia, 100% oxygen was then made. At the end of this soak, a propane flame was then brought into contact with the swatches. The results were:

- (1) No scorching occurred in three seconds.
- (2) Burning occurred after five seconds flame exposure.

e. On-Board Communications:

Reliable and clear communications are a significant requirement in support of any emergency operation. The status of the communications system therefore requires consideration. In addition to an on-board intercom system there are two Radio Frequency (RF) systems for voice transmission from crew-to-ground personnel during pad testing. These two systems are the Very High Frequency (VHF) and S-band. A single hardline communication line using the on-board intercom system is also available. Voice transmission by the crew-to-ground support and test personnel is controlled by the switch configuration on the three individual crew communications center panels, panel 20 on the main display console, and the individual cobra cable switches. Voice distribution between the ground personnel and crew is controlled through the capsule communicator's console located in the Launch Complex 34 Blockhouse.

On the afternoon of the accident, the test had been plagued with communication difficulties. Communications had been sometimes good, generally poor, and occasionally intermittent. At the time of the accident, the spacecraft test personnel thought that the communications problems had been "worked around". Voice quality was still poor, however, and it was subsequently discovered that the Command Pilot's communications were continuously keyed. Post-accident inspection disclosed discrepancies between all three communications panels with respect to positions of the VHF and intercom switches.

f. On-Board Fire Fighting Equipment:

There were no provisions for extinguishing a fire within the spacecraft at the time of the accident. This statement is based on the on-board crew stowage list in effect for the AS-204 Space Vehicle Plugs Out Integrated Test. No procedures existed at the time of the fire for on-board fire fighting by the crew.

g. On-Board Fire Detection Equipment:

The primary means of fire detection available to the crew were the physiological cues of smell, sight and touch. With helmet visors closed (as was the case) they were limited to sight and touch only. No instrumentation other than normal spacecraft systems instruments were available for fire warning. Depending upon the source of ignition, the normal spacecraft systems instrumentation could indicate a hazardous condition such as excessive electrical current flow. However, the normal instruments apparently did not provide any warning to the crew in the case of this accident.

4. EMERGENCY EQUIPMENT EXTERNAL TO THE SPACECRAFT:

a. Fixed Facility Fire Extinguishing Equipment:

Launch Complex 34 is supplied by two separate water systems, Potable Water and Industrial Water. The potable water supplies the safety showers, eye baths, and two 1¼ inch diameter 50-foot reel hose lines on each of the spacecraft work levels. This system was operable during the emergency.

The Firex Water System (deluge) supplies industrial water to four spray nozzles on each spacecraft level. Local push-button controls are at all exits to the elevators. However, these controls were not operable during the time of the accident because the system was being modified and had not been functionally tested as a complete system. Had water deluge been necessary on the Command Module level, two valves on the Service Module level (A-7) would have had to be manually operated. There is no remote (from the blockhouse) activation capability for this system.

On the Service Module (S/M), a Gaseous Nitrogen (GN₂) Deluge System is used to inert the S/M in the event of Hydrogen leakage during or after Liquid Hydrogen (LH₂) servicing. The GN₂ system was not active for the Space Vehicle Plugs Out Integrated Test since LH₂ servicing activities were not involved.

b. Portable Fire Fighting Equipment at the S/C Work Levels:

The Pan American Aviation (PAA) Fire Department inventory calls for two 50-pound wheel Carbon Dioxide (CO₂) units and two 15-pound hand-held CO₂ units on each S/C work level. The latest Fire Department inspection of these units was not within the 30-day inspection schedule. (Enclosure 13-10). Under full flow conditions (outlet valve wide open), all of the above units have a specification flow time of 10 to 35 seconds.

An inventory following the accident shows that two 50-pound wheeled CO₂ units, sixteen 15-pound CO₂ units and one 30-pound dry powder unit were expended on the C/M fire. Two 15-pound CO₂ units were used on the Service Module. The additional units were carried to the S/C levels to aid in extinguishing the fire.

c. Auxiliary Breathing Apparatus:

There were 80 masks available at the S/C work levels at the time of the accident. The masks were packed in sealed boxes (20 masks to a box) located as follows: One box on the lower S/M work level (A-6); two boxes on the C/M work level (A-8); and one box on the S/M work level (A-7). Of the available masks, 76 were Mine Safety Appliance (MSA) Rocket Propellant Fuel

Handler's Gas Masks incorporating M-15A1 type canisters. These canisters are designed for use in the presence of toxic vapors and are not suitable for use in high smoke density situations. The remaining four masks were Wilson masks containing LG-6-RTGD canisters which include smoke filters as well as toxic vapor protection.

Witness statements (Reference report by Panel 12) indicate that the dense smoke concentration in the White Room was a major deterrent to the rescue effort. Investigation indicates that 15 of the MSA masks and 3 of the Wilson masks had been used in the rescue attempt.

d. Protective Clothing:

The test in progress was not classified as hazardous; therefore, no special protective clothing was required to be available. S/C technicians on station were clothed in the normal white coveralls or smocks over street clothes.

e. External Hatch Removal Equipment:

No special emergency provisions were available for rapid cabin depressurization and hatch removal from the outside. Tools normally used for installing and removing the hatches were in the hatch close-out kit along with 34 other associated items. This kit was located in the White Room to the left of the access arm entry door. A special heavy duty hatch removal tool had been developed by the Emergency Egress Working Group for use by the Pad Egress Team. It is more rugged and easier to use than the standard tool and is normally available in the White Room only during launch countdown or countdown demonstration when the Pad Egress Team is on station; therefore, it was not there at the time of the AS-204 accident.

Cabin depressurization, if required from outside the S/C, can be accomplished by removing the plug from the inner hatch purge fitting. Venting is then accomplished through an effective opening of 0.378 square inches. Figure 3 of Enclosure 13-6 indicates that 80 seconds would be required to vent by this method from 16.4 psia to a pressure that would allow inner-hatch removal. An alternate venting method of breaking the inner-hatch window had been approved for use in Pad Egress Team operations, if required.

f. Ventilation Equipment for Smoke Removal:

There is no ventilation equipment in the White Room that would remove smoke. Filtered conditioned air is supplied to the White Room from the facility conditioning air plant. There are two exhaust ventilating fans on the C/M work level. These were operating during the time of the accident. Two exhaust fans were being installed on the lower S/M level, (A-6) but at the time of the accident, they were not operable. There are no exhaust fans on the upper S/M level (A-7) for the removal of smoke.

g. Test Team Personnel Evacuation Equipment:

There are two means of access or escape; elevators and stairs. There are five elevators and two stairways from ground level to Level 9 (one level above S/C level). The stairways are located on the outer structure, one on the North side and one on the South side. There is also one inner-structure stairway from Level 9 to Level A-6 where it is possible to reach the South outer-structure stairway. On other S/C levels, there is not direct access to the outer-structure stairways.

There are five doorways to the inner-structure on the C/M and S/M levels. All doors are equipped with inside panic bars and open out. For security reasons, all doors except one were locked from outside (could be opened from the inside but not from outside). However, the only means of escape from any of the elevator bridges, if the elevator is not available, is to re-enter the inner-structures. A personnel hazard resulted during the subject accident when one member of the test team was locked out and reached a stairway by climbing out across structural members. The access arm door which must be used for ingress or egress to the umbilical tower is an inward (toward the White Room) swing door. It has a pull latch on the inside and a push button latch on the outside.

h. Communication Equipment:

Communications to the S/C levels are provided by four standard black phones, operational intercom (OIS), hard lines and the public address (PA) system. The OIS hard lines provide for

communications to the blockhouse, support building, necessary NAA and NASA trailers, control center, and crew members on board the spacecraft.

The PA system is controlled from the blockhouse and any OIS station can be patched in for transmitting PA announcements. For this test, the Test Supervisor's console was the only transmitting station patched in.

i. Emergency Lighting:

There are no fixed or portable emergency battery lights on the S/C work levels or in the White Room. The only auxiliary lighting available during the emergency was a limited number of personal flashlights.

j. Stand-by Emergency Equipment at Launch Complex 34:

Due to the non-hazardous classification of the S/C test operation, there were no medical or fire equipment or personnel on standby at the Launch Complex in support of the operation. AFETR disaster team and fire fighting equipment arrived at the Launch Complex within five minutes of the first indication of the emergency. The first firemen to arrive at the spacecraft were not equipped with self-contained breathing apparatus. One fireman had to return to the bottom of the gantry to obtain suitable equipment.

k. Complex 34 Egress Facilities:

The facilities for flight crew egress at Complex 34 include the Apollo Access Arm and Environmental Enclosure (White Room) as depicted on Enclosure 13-11. During post-accident investigation, the following undesirable features of these facilities were noted:

(1) The fiberglass ledge at opening between the White Room (W/R) and S/C makes egress difficult.

(2) A low step in the W/R leading to the S/C entry hatch is a tripping hazard.

(3) The combination hinged and sliding door normal exit from the W/R is very difficult to operate.

(4) Two steps along the access arm (one at the pivot point and one at the W/R entrance door) could cause a fully suited crewman to trip.

(5) The access arm entry door at the juncture of the work level is hinged inward and incorporates no means for emergency escape.

5. FLIGHT CREW EMERGENCY TRAINING:

a. AS-204 primary crew spacecraft egress training was conducted in the mockup building at NAA-Downey, utilizing Block 2 mockup on July 13, 1966. The mockup was equipped with flight type couches, restraint system, and pressure and ablative hatches. A White Room adapter mockup similar to the one on Launch Complex 34 was used. The training included a 30-minute lecture on procedures and equipment and an examination of the hatches and latching mechanisms. Following crew ingress, the hatches were installed and a total of four practice egress runs were performed in street clothes. Several improvements to the egress procedures were made as a result of this session.

b. Further crew training specifically for purposes of effecting spacecraft egress was conducted at the Manned Spacecraft Center and in the Gulf of Mexico as a part of water egress training. A total of four egress exercises were conducted as a part of this training. Pressure Garment Assemblies were worn by the crew in all of the egress runs. The boilerplate vehicle used was in a near-flight configuration with all significant geometry, couches, and pressure and ablative hatches installed. The boost protective cover was not used. Its use would be inappropriate for water egress.

c. On January 24, 1967, the Emergency Egress Working Group of the Apollo Launch Operations Committee briefed the AS-204 flight crew for approximately two hours. As a result of this briefing, several minor changes were made to the procedures in order to make them more compatible with pad egress requirements (Reference Paragraph C.2.a.).

The egress exercise to be conducted at the end of the Space Vehicle Plugs Out Integrated Test on January 27, 1967, was to be the most valid run-through of the procedure up to that time. It was to be the first egress demonstration with the actual spacecraft in prelaunch configuration and with full flight equipment utilized by the crew.

6. CHECKOUT TEST TEAM EMERGENCY TRAINING:

- a. The spacecraft test team personnel most closely associated with emergency operations involved in the AS-204 accident were the technicians at the spacecraft. They were responsible for external removal of the spacecraft hatches under normal circumstances. The NAA personnel primarily assigned this function were the Pad Leader (who has the responsibility for all technicians working on or around the spacecraft), the mechanical engineer, and his two assigned mechanical technicians. None of the NAA personnel on duty at the time of the accident had ever been given training in hatch removal operations under emergency conditions. Hatch technicians on station at the time of the accident had all performed hatch installation and removal operations under normal conditions on numerous occasions and were familiar with the procedures involved.
- b. The NASA-KSC Test Supervisor stationed in the firing room of the blockhouse has overall test team responsibility during test operations on Launch Complex 34. Detailed spacecraft test functions are delegated by the Test Supervisor to the S/C Test Conductor also stationed in the firing room. The Test supervisor and S/C Test Conductor on duty at the time of the AS-204 accident were both experienced in hazardous egress practice operations. They had both participated in similar egress operations on numerous manned Gemini and Mercury operations. The Test Supervisor had conducted the only previous Launch Complex 34 hazardous egress exercise on Apollo which was performed during the AS-202 Countdown Demonstration Test in August 1966.
- c. There is no record of any type of emergency training exercises pertinent to general launch pad hazardous operations having been conducted on Launch Complex 34. Personnel assigned to pyrotechnic, hypergolic, and cryogenic handling operations do receive specific training in the hazards involved in those activities. However, there are no regular emergency drills to insure that all pad personnel are familiar with the location and use of the available emergency equipment.

7. INVESTIGATION OF THE METHODS PRESENTLY USED TO IDENTIFY HAZARDS AND DOCUMENT EMERGENCY PROCEDURES:

- a. Spacecraft ground test operations at KSC are primarily documented in Operational Checkout Procedures (OCP) prepared by the contractor and approved by NASA-KSC-SCO personnel. Special non-repetitive type test operations are documented on Test Preparation Sheets (TPS) which are originated by contractor system engineers and also approved by KSC-SCO. The process by which test requirements from MSC are transferred into specific OCP's is defined in detail in the Panel 7 report. The following discussions are confined to the hazard identification and emergency procedure provisions of that process.
- b. Primarily, the documented instructions for determining hazardous and emergency procedures for S/C test documents are contained in the Apollo Pre-Flight Operations Procedure (APOP). As defined in APOP G-100 (Enclosure 13-12), this document is the instrument by which joint contractor / NASA management directives are documented, approved and levied upon the S/C operations conducted at KSC. APOP 0-202 (Enclosure 13-13) is the pertinent directive concerning the generation of test procedures and the associated safety considerations. The KSC document defining the overall safety program at KSC is Kennedy Management Instruction (KMI) 1710.1 (Reference 13-7) which includes general guidelines concerning the generation and approval of hazardous test documents. A third documented source of instructions concerning this subject is a NAA internal directive (Enclosure 13-14).
- c. Review of these three sources reveals a certain amount of specific instructions, but very little in the form of an overall plan for insuring adequate safety considerations and emergency procedures in the test documents. In actual practice, those features of the S/C OCP's are developed as defined in the following paragraphs.
- d. The Test Outline (Reference Panel 7 Report) for each spacecraft defines, in outline form, all of the tests planned for that vehicle at KSC. The Contractor Safety Office reviews the outline and establishes a list of the operations considered hazardous. The criteria for determination of the hazardous tests is based upon guidelines established in Reference 13-7. The list of hazardous OCP's and all of the test outlines are reviewed by the KSC and AFETR Safety Offices. They, in turn, release a letter establishing the official KSC and AFETR Safety Review Requirements List designating the OCP's for that S/C which must be reviewed and approved by those offices.

e. OCP's are prepared by contractor operations support personnel in conjunction with contractor system engineers. The OCP writer, or originator, is responsible for including all references to safety, hazardous situations and emergency instructions. The instructions defining the scope of this responsibility are completely general and in many instances vague. As a result, the specific test procedures reflect a lack of definitive instructions in these areas.

f. Copies of the draft release of procedures identified as hazardous are reviewed by the Contractor Safety Office and the systems engineers. Significant comments or inputs from the Contractor Safety Office are incorporated in the master-draft copy which is then approved by KSC-SCO, and published as the released document.

g. Copies of released test procedures are forwarded to the KSC Safety Office. Those procedures specified on the list created in paragraph 7.d require review and approval by KSC Safety. Procedures involving hazardous operations at AFETR are forwarded by KSC Safety to AFETR Safety for comments and approval. Approval by KSC Safety is made in writing to the contractor after AFETR Safety has signified their formal approval. Receipt of formal KSC Safety Office approval (after the procedure is released) is a constraint upon initiating the test operation involved.

h. Revisions to procedures originally reviewed by the KSC Safety Office require the same review and approval as the basic document. The AFETR Safety Office must also approve revisions to procedures which will be conducted under their jurisdiction. Real-time deviations required during the performance of a test procedure are orally approved by the responsible on-site Safety Supervisor to the NASA Test Conductor.

i. There is no formal review requirement in the area of S/C safety or emergency procedures between KSC and MSC. As described in Panel 7's report, the existing procedure review system between the two Centers is loosely defined. There is no approval requirement from the MSC Flight Crew Operations Directorate on those procedures involving flight crew participation.

j. TPS's as defined in paragraph 7.a do not presently require review or approval by either Contractor or KSC Safety Offices. The TPS originator is responsible for determining safety or emergency considerations and for soliciting Safety Office review.

D. FINDINGS AND DETERMINATIONS

1. FINDING

The applicable test documents and flight crew procedures for the AS-204 Space Vehicle Plugs Out Integrated Test did not include safety considerations, emergency procedures or emergency equipment requirements relative to the possibility of an internal spacecraft fire during the operation.

DETERMINATION

The absence of any significant emergency preplanning indicates that the test configuration (pressurized 100 percent oxygen cabin atmosphere) was not classified as a potentially hazardous operation.

2. FINDING

There are no documented safety instructions or emergency procedures in existence which are applicable to the possibility of a serious internal spacecraft fire.

DETERMINATION

The occurrence of an internal spacecraft fire of the magnitude and intensity experienced in this accident was not considered to be a significant possibility under any operational circumstances.

3. FINDING

The propagation rate of the fire involved in the AS-204 accident was extremely rapid (Reference report by Panel 5). Removal of the three spacecraft hatches to effect emergency egress from either the inside or outside involved a minimum of 40 and 70 seconds respectively under ideal conditions.

DETERMINATION

Considering the rapidity of propagation of the fire and the time constraints imposed by the existing

spacecraft hatch configuration, it is doubtful that any amount of emergency preparation would have precluded injury to the crew prior to crew egress.

4. FINDING

Procedures for unaided egress from the spacecraft were documented and available. The AS-204 flight crew had participated in a total of eight egress exercises employing those procedures.

DETERMINATION

The AS-204 flight crew was familiar with and well trained in the documented emergency crew procedures for effecting unaided egress from the spacecraft.

5. FINDING

The Apollo Flight Crew Hazardous Egress Procedures Manual contains procedures relative to unaided, aided and incapacitated flight crew egress. By scope and definition, this document is concerned only with evacuation of the flight crew from the spacecraft and the pad under hazardous conditions occurring primarily external to the spacecraft during a launch operation.

DETERMINATION

The Apollo Flight Crew Hazardous Egress Procedures Manual does not contain adequate emergency provisions for significant emergency conditions internal to the spacecraft any time the crew is on board.

6. FINDING

The spacecraft pad work team on duty at the time of the accident had not been given emergency training drills for combating fires in or around the spacecraft or for emergency crew egress. They were trained and equipped only for a normal hatch removal operation.

DETERMINATION

The spacecraft pad work team was not properly trained or equipped to effect an efficient rescue operation under the conditions resulting from the fire.

7. FINDING

There was no equipment on board the spacecraft designed to detect or extinguish a cabin fire.

DETERMINATION

The flight crew had to rely upon physiological cues to detect the presence of a fire. When all face masks were closed, the cues were limited to sight and touch. Once detected, there were no means by which the fire could have been contained or extinguished.

8. FINDING

Frequent interruptions and failures had been experienced in the overall communications system during the operations preceding the accident. At the time the accident occurred, the status of the system was still under assessment.

DETERMINATION

The status of the overall communication system was marginal for the support of a normal operation. It cannot be assessed as adequate in the presence of an emergency condition.

9. FINDING

Emergency equipment provided at the spacecraft work levels consisted of portable CO₂ fire extinguishers, Rocket Propellant Fuel Handler's Gas Masks and 1-1/4-inch diameter fire hoses.

DETERMINATION

The existing emergency equipment was not adequate to cope with the conditions of the fire. Suitable breathing apparatus, additional portable CO₂ fire extinguishers, direct personnel evacuation routes

and smoke removal ventilation are significant items which would have improved the reaction capability of the personnel involved.

10. FINDING

There are steps and doorways on the Launch Complex 34 Apollo Access Arm and in the environmental enclosure (White Room) which constitute safety hazards, particularly under emergency conditions.

DETERMINATION

The present configuration of the access arm and White Room is not compatible with emergency personnel evacuation requirements or with fast, safe flight crew egress.

11. FINDING

During the preparation of S/C test procedures at KSC, safety considerations for hazardous operations and documentation of applicable emergency procedures are limited in most cases to routine safety reference notations and emergency power-down instructions.

DETERMINATION

Insufficient emphasis is applied by the test procedure originator upon documenting emergency procedures and identifying specific hazards and applicable safety requirements.

12. FINDING

Under the existing method of test procedure processing at KSC, the cognizant Safety Offices review only those procedures which are noted in the OCP outline as involving hazards. Official approval by KSC and AFETR Safety is accomplished after the procedure is published and released.

DETERMINATION

The scope of contractor and KSC Safety Office participation in test procedure development is loosely defined and poorly documented. Post-procedure-release approval by the KSC Safety Office does not insure positive and timely coordination of all safety considerations.

13. FINDING

Criteria for defining hazardous test operations are not complete.

DETERMINATION

A positive method does not exist for insuring identification and documentation of all possible hazards involved in test operations.

14. FINDING

Requirements for the review and concurrence of KSC S/C test procedures by MSC are not well defined.

DETERMINATION

The present review system does not insure that MSC concurs with released KSC test procedures.

E. SUPPORTING DATA

Enclosure

- 13-1 Memo dated Nov. 19, 1965, containing minutes of the First Apollo Emergency Egress Working Group Meeting and a copy of the Charter of that group.
- 13-2 KSC KMI 1150.8 dated Oct. 11, 1966, defining the Charter of the Apollo Launch Operations Committee.

- 13-3 Time line for unaided flight crew egress. Page 25 of the Apollo Flight Crew Hazardous Egress Procedures Manual.
- 13-4 Time line for aided and incapacitated flight crew egress. Pages 26 and 27 of the Apollo Flight Crew Hazardous Egress Procedures Manual.
- 13-5 Page 0-8 of OCP FO-K-0021-1 showing documented safety instructions for the AS-204 Space Vehicle Plugs Out Integrated Test.
- 13-6 BELLCOM, INC. report concerning C/M depressurization during terminal countdown. Case 330, dated Jan. 20, 1967.
- 13-7 Figure 1-4 of Apollo Operations Handbook (AOH) showing spacecraft hatch arrangement viewed from the outside.
- 13-8 Drawing of spacecraft inner hatch showing emergency handle, viewed from inside.
- 13-9 MSC memo dated Jan. 26, 1965, concerning the results of Gemini suit flammability test.
- 13-10 Memo dated Mar. 8, 1967, concerning inspection of the fire extinguishers used at the time of the AS-204 incident.
- 13-11 Drawing of Apollo Access Arm and environmental chamber. Page B-10 of the Apollo Flight Crew Hazardous Egress Procedures Manual.
- 13-12 Definition of the Apollo Preflight Operations Procedures APOP G-100, dated Nov. 4, 1966.
- 13-13 Instructions for processing test procedures APOP 0-202, dated May 13, 1966.
- 13-14 NAA Florida Facility Implementing Instruction, II 12-5, dated Jan. 27, 1966, titled, Safety Criteria for Apollo C/M and S/M and S II Operations.
- 13-15 List of reference documents

UNITED STATES GOVERNMENT

Memorandum

TO : Distribution

DATE: November 19, 1965
Memo No. SCO33-65-214

FROM : Chairman, Apollo Emergency Egress Working Group

SUBJECT: Minutes of the First Apollo Emergency Egress Working Group Meeting

1. The first meeting of the Apollo Emergency Egress Working Group was held at Kennedy Space Center (KSC) on 18 November 1965. The charter was read and approved and a copy has been enclosed. Per Section 3 of the charter, each member organization is requested to furnish the chairman the names of a primary member and an alternate.

2. The following action items were given to the Working Group and were discussed:

a. A discussion was centered on the access arm and environment room mock-up procurement, and the design of a mock-up with flight weight equipment. It was decided that a suited-astronaut-run with flight type equipment would be mandatory to obtain adequate time motion studies to develop the operational procedures. An action item was placed on the Apollo Launch Operations Panel (ALOP) Emergency Egress Sub-panel through Frank W. Horn to have a suitable mock-up review as soon as possible for both the Block I and Block II versions.

b. It was also decided that air packs are needed in the environment controlled room on the access arm for each crew member and should be in place for launch. Safety showers are needed at level A on the LUT (Complex 39); a survey will be made by Norris Gray of SOP-22 to determine the need for additional showers.

c. ALOP asked this Working Group to decide on placement of the pyro bus arm switch, elevator control, and access arm controls. To properly place the switches and controls it will be necessary to define the relationship between the Launch Director, Test Supervisor, and Test Conductor. The KSC Test Conductor Office has been assigned this as an action item to report on by December 15, 1965.

d. The manning of the emergency armored vehicles was discussed with the three (3) M113's each being manned by a Pan American Airways Pad Safety Supervisor, two (2) PAA firemen, and two (2) DOD medical technicians. The M59 armored fire fighting vehicle manning will be determined by Norris Gray and the rescue personnel.



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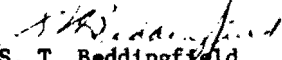
ENCLOSURE 13-1

D-13-15

3. Cleanliness requirement was discussed by L. Miller of Bellcom and an air lock or other cleanliness requirement changes to the access arm may be made. Any changes to the access arm will be reviewed by this group to determine the emergency egress impact.

4. There is a need to define what criteria is to be used for determining hazardous and emergency conditions. This will be discussed at the next meeting.

5. The next meeting will be held after the mock-up review discussed above.


S. T. Beddingfield
Chairman

Distribution:

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PAA

Pad Safety, Mail Unit 5260, Elmer Brooks

AFETR

ETORS-1/Capt. C. D. Parker

OMSF

MSS/MAS (Bellcom)/L. G. Miller
MO-1/C. H. Bolender

List of Attendees:

Lewis G. Miller, MAS (Bellcom)
Ryborn R. Kirby, FL/MSO Houston
Capt. C. D. Parker, ETORS-1, PAFB
F. J. Powell, NAA/Cape
Ralph Wilson, SOP-21
F. W. Horn, PPR-71
N. C. Gray, SOP-22
W. F. Williams, PAA Pad Safety
C. C. Williams, MSC/CB
S. T. Beddingfield, SCO-33

CHARTER

APOLLO EMERGENCY EGRESS WORKING GROUP

1. Purpose.

The Apollo Emergency Egress working group is established by the Apollo Launch Operations Committee to develop and integrate spacecraft crewman egress procedures for the pad areas of the Saturn Apollo Operations.

2. Function.

The Working Group will be the direct link between the Apollo Launch Operations Panel and the various organizations performing special activities in the egress-rescue area.

The Working Group will recognize existing organizations, provide guidelines, make recommendations, and formulate procedures as necessary to coordinate and integrate all elements of the egress operation.

3. The formal membership of the Working Group consists of the following:

NASA KSC-SCO Chairman
NASA MSC - APO
NASA - MSC - FCSD
NASA - MSC Landing Recovery Division
NAA - NAA-21
NASA - KSC LVO
AFETR - ETORS-1 - PAFB
PAA - Pad Safety
NASA - MSF/MAS (BELLCOMM)
NASA - LSEED
NASA - LVO

One permanent member and one alternate member will be designated by each member organization and will represent their organization in all Working Group functions.

4. Meetings will be held as necessary to accomplish the function of the Working Group. Authority for calling meetings rest with the chairman.

Reports: Minutes of all Working Group Meetings will be provided by chairman for distribution to members and the chairman of the Apollo Launch Operations Committee.


P. C. Donnelly


S. T. Beddingfield

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TRANSMITTAL SHEET

TO:

"H"

October 11, 1966

MATERIAL TRANSMITTED

KMI 1150.8, "Apollo Launch Operations Committee"

This is a new Instruction.

FILING INSTRUCTIONS

File in a standard 3-ring binder in numerical sequence, in accordance with the alphabetic prefix which identifies the type of issuance.

TRANSMITTAL SHEET

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KMI 1150.8
October 11, 1965
Effective Date

JOHN F. KENNEDY SPACE CENTER, NASA
MANAGEMENT INSTRUCTION

SUBJECT : APOLLO LAUNCH OPERATIONS COMMITTEE

1. PURPOSE

This Instruction incorporates into the KSC Issuance System as Attachment A the charter establishing the Apollo Launch Operations Committee.



Simon J. Burttschell

Chief, Administrative Services Office

Attachment:

A. Charter--Apollo Launch Operations Committee

Distribution "H"

CHARTER

APOLLO LAUNCH OPERATIONS COMMITTEE

1. PURPOSE

This charter establishes an Apollo Launch Operations Committee at KSC and assigns certain responsibilities and authorities to it. The ALOC is a NASA-Contractor Management Team responsible to the Director, Launch Operations.

2. OBJECTIVES & RESPONSIBILITIES

The objective of the Apollo Launch Operations Committee (ALOC) is to provide the KSC, Launch Operations Directorate, a management tool for assuring coordination of Apollo prelaunch/launch interorganizational operational activities at the Kennedy Space Center. The primary responsibilities of the ALOC are to:

- a. Serve as a point of input into the Launch Operations Directorate for Apollo prelaunch/launch operational problems which affect the working interfaces between the various elements in the total launch team,
- b. Develop problem definitions, propose solutions, and forward to the cognizant KSC organizations for decision and/or action,
- c. Receive reports, status information, and recommended solutions on problem areas from supporting working groups and operational organizations,
- d. Serve as a policy reviewing group; providing guidance and policy advice for assuring coordination and effective solution to problem areas.
- e. Serve as a mechanism for the Director of Launch Operations to implement management policy that has been established by the Center Director of a prelaunch/launch operational nature, and
- f. Provide input to the Space Vehicle Planning & Supervision Office such that Launch Operation Plans, Space Vehicle Test Sequences, and Space Vehicle Test Catalogues may be developed in compliance with the test requirements.

ATTACHMENT A to
KMI 1150.8

3. CHAIRMAN

The Chairman of the Apollo Launch Operations Committee will be the Director, Launch Operations or his designated representative.

4. ORGANIZATION

The Apollo Launch Operations Committee will be supported by two management subcommittees, Saturn IB and Saturn V.

5. MEMBERSHIP

Membership on the Apollo Launch Operations Committee will consist of representatives from appropriate management elements of KSC, other NASA elements and interfacing organizations. A list of members of the Apollo Launch Operations Committee and the industry representatives of the Saturn IB and Saturn V subcommittee is as follows:

APOLLO LAUNCH OPERATIONS COMMITTEE MEMBERSHIP

Chairman Director, Launch Operations
Space Vehicle Test Supervisor
Saturn IB Operations Manager
Saturn V Operations Manager
Technical Planning & Scheduling Office
Apollo Spacecraft Operations Manager
LEM Spacecraft Operations Manager
Chief Spacecraft Test Conductor
Representative, Assistant Director for Information Systems, KSC
Representative, Assistant Director for Support Operations, KSC
Representative, Director, Plans, Programs, & Resources, KSC
Representative, Apollo Spacecraft Program Office, MSC
Representative, Saturn Industrial Operations, MSFC
Representative, Assistant Director for Flight Operations, MSC
Representative, Assistant Director for Flight Crew
Operations, MSC
Representative, NASA Hdqts. Apollo Flight Operations
Representative, Apollo Support Planning Office, DOD
Representative, Assistant Director for Administration
Recorder

SATURN IB SUBCOMMITTEE INDUSTRY REPRESENTATIVES

Representative - Chrysler
Representative - Douglas

Representative - North American (Spacecraft)
Representative - Grumman
Representative - IBM (IU)

SATURN V SUBCOMMITTEE INDUSTRY REPRESENTATIVES

Representative - Douglas
Representative - North American (Spacecraft)
Representative - Grumman
Representative - Boeing
Representative - North American (Launch Vehicle)
Representative - IBM (IU)
Representative - Bendix

Attendance at the subcommittee meetings will be based on the agenda of each meeting and could possibly include, in addition to the attendance of appropriate members of the ALOC, and the above assigned industry representatives, additional representatives from industry and the government at the discretion and invitation of the subcommittee chairman.

6. MEETINGS

The Apollo Launch Operations Committee will have periodic meetings which will be called by the Chairman as necessary. Normally, meetings will be held on a bi-weekly basis.

a. Agenda

Agendas will be provided to all members of Apollo Launch Operations Committee by the Chairman prior to each meeting.

b. Minutes

Minutes of Apollo Launch Operations Committee meetings will be taken by an Apollo Launch Operations Committee recorder provided by the Chairman. Minutes of Apollo Launch Operations Committee meetings will be made available to all members.

7. RELATIONSHIP TO KSC ORGANIZATIONAL ELEMENTS

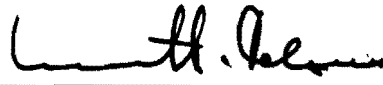
The creation of the Apollo Launch Operations Committee does not change in any respect the responsibilities of KSC organizational

ATTACHMENT A to
KMI 1150.8

elements as currently assigned. The Committee Chairman, therefore, shall assure that the Committee conducts its activities with full regard for the assigned functions of other elements of the Kennedy Space Center.

The Apollo Launch Operations Committee will consider items assigned by the Director of Launch Operations and report its findings to him.

APPROVED:

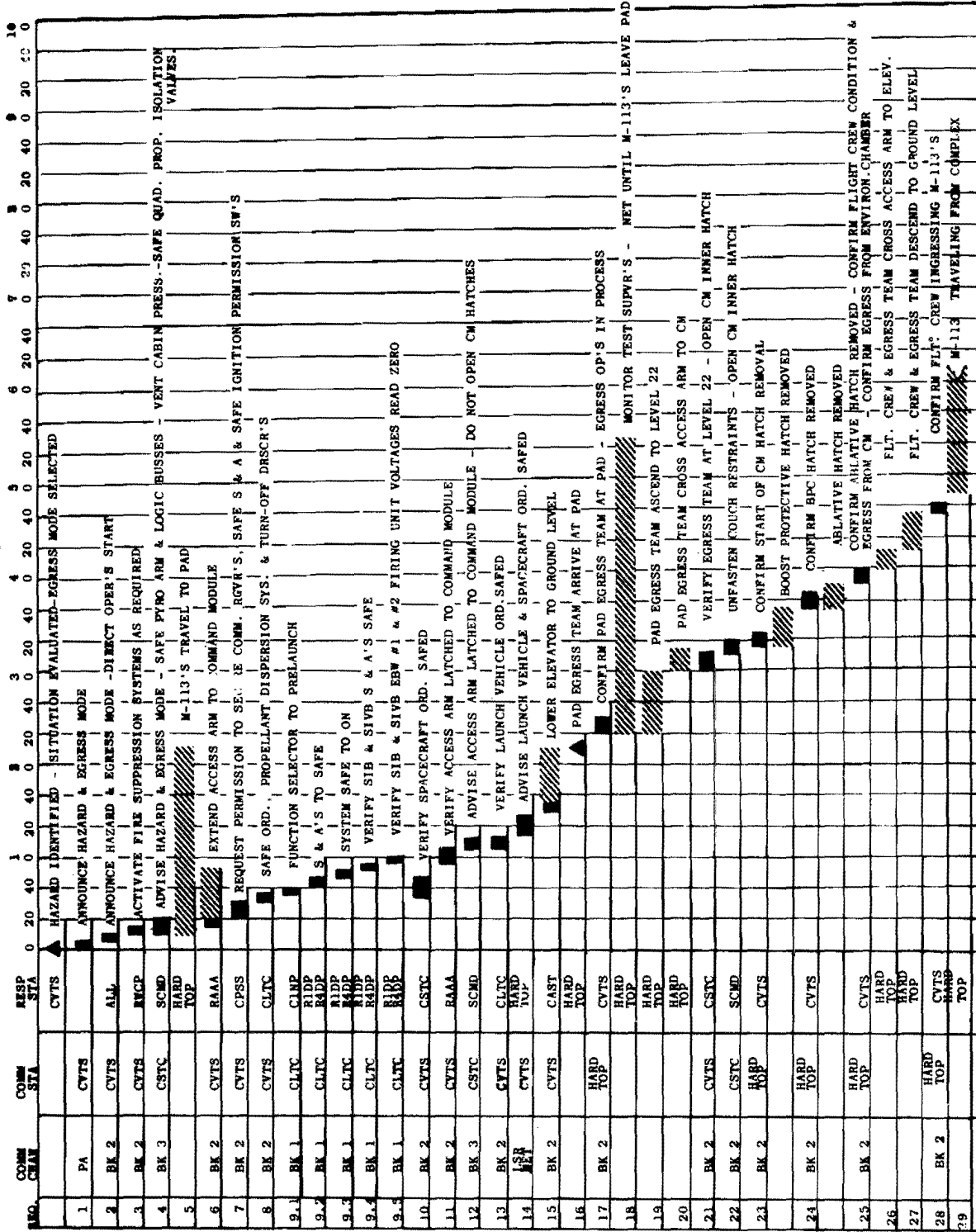


Kurt H. Debus

Director, Launch Operations

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AIDED EGRESS



INCAPACITATED FLT. CREW EGRESS

1 THRU 24 SAME AS AIDED FLIGHT CREW EGRESS

SEQ	COMM CHAN	COMM STA	RESP STA	3	4	5	6	7	8	9	10	11	12
25	BK2	CVTS HARD TOP	CSTC										
26	BK2	CVTS TOP	CVTS		VERIFY CABIN PRESS. OK TO REMOVE INNER HATCH CONFIRM ABALATIVE HATCH REMOVED - VERIFY CABIN PRESSURE OK								
27	BK2	HARD TOP	CVTS		INNER PRESSURE HATCH REMOVED CONFIRM INNER HATCH REMOVED/CONFIRM PRO ARM & LOGIC BUSS & QUAD. PROP. ISOL. VALVES SAFED. CONFIRM FLIGHT CREW CONDITION & REMOVAL STARTED								
28	BK2	HARD TOP	CVTS		CENTER ASTRO. REMOVED FROM CM CONFIRM 1ST ASTRO REMOVED FROM CM								
29	BK2	HARD TOP	CVTS		1ST ASTRO CARRIED TO ELEV. CONFIRM 1ST ASTRO DESCENDING TO GND. LEVEL								
30	BK2	HARD TOP	CVTS		1ST ASTRO DESCENDING TO GND. LEVEL CONFIRM 1ST ASTRO AT GND. LEVEL								
31		HARDTOP			SEND ELEVATOR TO LEVEL 22								
32	BK2	HARD TOP	CVTS		CONFIRM 1ST M-113 LEAVING PAD AREA WITH 1ST ASTRO								
33	BK2	HARD TOP	CVTS		2ND ASTRO REMOVED FROM CM CONFIRM 2ND ASTRO REMOVED FROM CM								
34	BK2	HARD TOP	CVTS		2ND ASTRO CARRIED TO ELEVATOR CONFIRM 2ND ASTRO CARRIED TO ELEVATOR								
35	BK2	HARD TOP	CVTS HARD TOP		2ND ASTRO DESCENDING TO GND CONFIRM 2ND ASTRO AT GND								
36					SEND ELEVATOR TO LEVEL 22								
37	BK2	HARD TOP	CVTS		CONFIRM 2ND M-113 LEAVING PAD AREA WITH 2ND ASTRO 3RD ASTRO REMOVED FROM CM								
38	BK2	HARD TOP	CVTS		CONFIRM 3RD ASTRO REMOVED FROM CM								
39			HARD TOP		PAD EGRESS TEAM & 3RD ASTRO CROSS ACCESS ARM PAD EGRESS TEAM & 3RD ASTRO DESCEND								
40	BK2	HARD TOP	CVTS		CONFIRM PAD EGRESS TEAM AND 3RD ASTRO LEAVING PAD								
41			HARD TOP		LAST M-113's LEAVES PAD AREA								

24 JANUARY 1967
SC - 012

APOLLO

0-8
K-0021-1

- 5.0 SAFETY REQUIREMENTS
- 5.1 SUPERVISION IS RESPONSIBLE FOR PROVIDING COMPLIANCE WITH ALL NASA/NAA APPLICABLE SAFETY RULES AND REGULATIONS.
- 5.2 THE TEST CONDUCTOR SHALL COORDINATE DEVIATIONS FROM ACCEPTED SAFETY STANDARDS, WITH NAA AND NASA SAFETY REPRESENTATIVES.
- 5.3 ALL PERSONNEL WILL BECOME FAMILIAR WITH THE FOLLOWING DOCUMENTS:
 - A. AFETRM 127-1 RANGE SAFETY MANUAL
 - B. APPLICABLE SAFETY STANDARD AND SAFETY SUPPORT PLAN.
 - C. AFETR PAD SAFETY PLAN FOR LC34
 - D. SOP FOR LC34
 - E. KSC GENERAL SAFETY PLAN KMI-1710.1 ATTACHMENT - A
- 5.4 ALL PERSONNEL WILL BECOME FAMILIAR WITH THE EMERGENCY SHUTDOWN PROCEDURE.
- 5.5 THE EMERGENCY PROCEDURE SHALL BE UNFOLDED AND REMAIN VISIBLE THROUGHOUT THE TEST.
- 5.6 PERSONNEL INVOLVED IN TESTING WILL BE INFORMED OF THE SPECIFIC HAZARDS OF EACH TEST.
- 5.7 INSTALLED PYROS SHORTED PER OCP'S K-2016 AND 4617.

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BELLCOMM, INC.

SUBJECT: Final Report: Command Module
Depressurization During Terminal
Countdown - Case 330

DATE: January 20, 1967
FROM: L. G. Miller

ABSTRACT

For some time, there has been concern about the time required to effect on-pad depressurization of the CM sufficient to permit hatch opening. Because of their specific interest in astronaut pad egress under hazardous conditions, the Emergency Egress Working Group of ALOC had instituted an action item to define the scope of the problem. In connection with this effort, a previous memorandum recommended that the times associated with cabin venting under various conditions be determined experimentally. Such a test was recently performed and is reported herein.

To verify experimental findings, an analytical solution was attempted. A computer program was developed which simulates CM depressurization both in flight and on the ground. The program is described and compared with one being prepared by NAA. Results are presented in a form which should aid preplanning for on-pad contingencies, and future application of the program is briefly described.

The combination of experimental and analytical findings was sufficient to close the action item.

MEMORANDUM FOR FILE

INTRODUCTION

In a previous memorandum¹ it was concluded that the times associated with cabin venting under various conditions should be verified experimentally in order to facilitate planning for on-pad contingencies during final countdown. If the experiments had shown that excessive time was required to vent the cabin using the cabin pressure relief valve, it was proposed that specific methods of improving performance be explored. These consisted of (1) using the post landing ventilation system, (2) using the purge fitting on the side pressure hatch, and (3) determining the time required to open the side pressure hatch under a number of overpressure conditions.

A cabin venting test was subsequently performed at MSC and is described herein. Although little data was obtained, it was sufficient to establish the order of magnitude of the time required to vent the CM cabin. To extend this knowledge, attention was focused on the mathematical basis for predicting depressurization times. In order to make use of this theory, it was necessary to employ a digital computer. Therefore, a FORTRAN IV computer program which theoretically calculates CM depressurization times under various conditions was developed by the writer and Miss P. A. Cavedo of Department 2013. The program, named DEPRES, is described and compared with a similar program prepared at North American Aviation.

¹"Command Module Pressurization During Terminal Countdown - Current Status," Case 330, by L. G. Miller, Bellcomm Memorandum for File, dated October 14, 1966.

ENCLOSURE 13-6

D-13-33

DEPRESSURIZATION TEST ON S/C 008

A test, in which the CM cabin was partially depressurized via the cabin pressure relief valve, was performed in conjunction with the S/C 008 Thermal Vacuum (T/V) Test #3 at MSC. At an initial cabin pressure of 5 psig (vacuum chamber pressure = Opsig), a valve which simulates a ½ inch diameter micrometeoroid puncture was opened. Cabin pressure decreased to 3 psig in 80 seconds at which time the micrometeoroid valve was closed. The cabin pressure relief valve was then placed in its "manual dump" position, and the cabin pressure fell from 3 psig to 0 psig in 20 seconds. Pressure was reported to have been measured with a large diameter (approximately 25-30 inches) pressure gage having a scale of from zero to 15 psig.

SIGNIFICANCE OF TEST RESULTS

Flight crew hazardous egress procedures require that the CM cabin be vented as soon as the egress decision has been announced. Since (1) NAA has indicated that it is quite unlikely that the CM cabin pressure will be in excess of 2 psig after CM closeout and (2) it takes approximately 40 seconds for the CM Access Arm to extend and attach to the LES tower, the time reported in the T/V test is considered to be compatible with egress requirements for aided and unaided egress during the period following spacecraft closeout. This leaves two cases unresolved.

The first case is for "Incapacitated Flight Crew." In order for difficulties to arise, all three crewmen would have to be incapacitated². In this unlikely case, any cabin overpressure would have to be vented through a purge fitting on the inner side crew hatch (i.e. the side pressure hatch).

The second case, which could occur prior to spacecraft closeout, is the possibility of a hazardous condition during the CM cabin leak check. Cabin pressure could be as high as 6.2 psig, and depressurization times using either the cabin pressure relief valve or the purge fitting would be of interest.

The lack of data for the two cases cited above prompted an investigation of the theoretical basis for predicting depressurization times. If the available data could be duplicated, the formula would then be used to predict depressurization times for the remaining cases. The iterative nature of the calculation called for the use of a digital computer in performing the work. Hence, DEPRES came into being. The mathematical theory behind this FORTRAN IV program and the program itself are described in Appendix A.

USE OF THE DEPRES PROGRAM

An early version of DEPRES³ was used to simulate CM depressurization on the launch pad from overpressures of 3.00 and 6.20 psig. The results, plotted in terms of absolute pressure, are shown in Figures 1 and 2 for three different values of orifice coefficient. Since

²Ordinarily, the crewman in the left hand couch would open the cabin pressure relief valve. It is possible, though, that the other crewmen could reach over or crawl over and perform the task.

³See Appendix B.

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the area is a constant in the iteration formula, varying K corresponds with varying the effective area of the orifice used for depressurization (cf. Appendix A where effective area is defined as the product KA). Figure 1 shows the data point obtained during the #3 T/V test. Both figures show the value predicted by a conservative method of calculation contained in a Bellcomm Memorandum for File⁴ by T. A. Bottomley.

Information obtained from NAA specifies an effective area for the cabin pressure relief valve of 1.5 sq. in. in the manual dump mode. Hence, for the cases shown in Figure 1, the data point should fall between the curves for $K = .7$ and $K = .8$. Considering the asymptotic nature of the curves, agreement is quite good. If we extend this level of confidence to the curves of Figure 2, it can be seen that depressurization from an overpressure of 6.2 psia should take about 28 seconds, a time which is quite reasonable with respect to egress requirements.

A round of discussions followed which probed the need for a computer program with broader capabilities. Interest was expressed in acquiring the in-house (i.e. Bellcomm) capability for calculating depressurization times in flight; this called for a program which could duplicate the response of the Environmental Control System (ECS) to both intentional and unintentional cabin depressurizations. A number of other refinements were also considered. The subsequent changes are described in Appendix A, and the program itself will be found in Appendix C.

This refined version of DEPRES, without the ECS option, was used to compute on-pad depressurization times with an area corresponding to that of the purge fitting on the inner side crew hatch. Overpressures ranging from 6.2 to 0.3 psi were used, the results being shown in Figure 3. The curve represents time required to depressurize to 0.1 psig from various values of cabin overpressure. The data is most useful for planning purposes when presented in this form. A companion curve, representing depressurization through the cabin pressure relief valve, is shown in Figure 4.

COMPARISON WITH NAA PROGRAM

Having developed what appeared to be a useful tool for studying depressurization problems, a number of telephone contacts were made at both MSC and NAA in order to determine if the DEPRES program could be profitably applied by those organizations. Some encouragement was offered by ECS personnel from both groups, and a conference was arranged. Thus, the writer had the opportunity to examine and discuss an NAA computer program which, it was learned, has been developed during the past year or so. It differs from DEPRES in two major respects. First, it simulates repressurization of the CM and pressurization of the LM as well as CM depressurization. Secondly, the effects of upstream pressures and temperatures are considered in determining ECS flow rates. This latter difference gives a slightly conservative flavor to DEPRES results when the ECS is used to maintain cabin pressures.

Although a direct comparison of results was not possible, one set of data was examined which seemed to be quite close to the conditions used for a DEPRES run. For a final pres-

⁴"CSM Depressurization Considerations for Astronaut Pad Abort," Case 330, by T. A. Bottomley, Jr., Bellcomm Memorandum for File, dated March 29, 1966.

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sure of 0.1 psia, DEPRES predicted a depressurization time of 1864 seconds with the ECS on whereas the NAA program predicted 1780 seconds. Results for an intentional cabin depressurization, with no attempt to maintain cabin pressure through the use of the ECS, showed very close agreement. The times required to reach 0.1 psia differed by no more than a few seconds.

The two advantages that DEPRES possesses are its clarity and the ease with which changes can be accomplished. The NAA program has been developed and modified by several different engineers and is not yet officially documented. This, when added to the multiple-purpose nature of the NAA program, makes it somewhat more difficult to see what is going on. The fault could be remedied, just as DEPRES could be changed to give it a repressurization capability.

It seems unlikely, though, that NAA will make use of the DEPRES format since it lacks the degree of sophistication which their program contains. Given a continuing need for the calculations, it seems more probable that they will devote some effort toward improving their own program.

It is of interest to note that NAA also has a boost and reentry program for CM pressure. A brief look indicated that it has the same advantages and disadvantages as the pressurization-depressurization program. That is, it is available, fairly sophisticated, but hard to follow.

CONCLUSIONS

Study of on-pad depressurization times for the CM came about as an adjunct to the writer's activities with the Emergency Egress Working Group of the Apollo Launch Operations Committee. As a result of the MSC data and subsequent work with the DEPRES program, it was recommended that an EEWG action item on the subject be closed. This memorandum will serve, in part, as a final report to the Chairman of the EEWG in support of the closure. In addition, Figures 3 and 4 should serve as an adequate planning tool for determining depressurization times under various, non-standard conditions. For a given cabin pressure, they will yield a good estimate of the time required to open the side pressure hatch using either the cabin pressure relief valve or the purge fitting on the hatch.

Further work with DEPRES is planned in support of an investigation of ECS capabilities. Depressurization times will be developed as a function of micrometeoroid puncture size, and impacts on emergency in-flight procedures will be sought.

2032-LGM-gmp

/S/ L. G. Miller

Attachments

Appendixes A-D

Copy to Messrs. F. B. Benjamin - NASA/MM
C. H. Bolender - NASA/MO-1
L. E. Day - NASA/MAT
J. K. Holcomb - NASA/MAO

C. Bidgood
D. R. Hagner
J. J. Hibbert
W. C. Hittinger

BELLCOMM, INC.

T. A. Keegan - NASA/MA-2

S. T. Beddingfield - KSC/KB-4

F. W. Horn - KSC/DK

C. A. Turner - KSC/HC/GE

J. C. Wootton - KSC/DB

R. J. Gillen - MSC/EC9

C. M. Jones - MSC/FL

R. D. Langley - MSC/ES

J. P. Loftus - MSC/PM5

F. H. Samonski, Jr. - MSC/EC9

R. S. Sayers - MSC/CF-24

C. C. Williams - MSC/CB-7

B. T. Howard

P. R. Knaff

J. Z. Menard

I. D. Nehama

T. L. Powers

I. M. Ross

T. H. Thompson

G. B. Trousoff

R. L. Wagner

Department 1023

Department 2032

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APPENDIX A

THEORY OF DEPRESSURIZATION CALCULATIONS

The mass flow of a compressible fluid through an outlet from a reservoir is given by

$$Q = KA \sqrt{2g \left[\frac{\gamma}{\gamma-1} \right] P_1 \rho_1 \left[\left[\frac{P_2}{P_1} \right] \exp \left[\frac{2}{\gamma} \right] - \left[\frac{P_2}{P_1} \right] \exp \left[\frac{\gamma+1}{\gamma} \right] \right]}$$

where

K = orifice coefficient

A = area of the outlet

g = acceleration of gravity

P₁ = pressure of the fluid in the reservoir

ρ₁ = density of the fluid in the reservoir

P₂ = pressure of fluid outside the reservoir

γ = ratio of specific heats of fluid

Putting

$$C = \sqrt{2g \left[\frac{\gamma}{\gamma-1} \right]}$$

$$e = \frac{P_2}{P_1}$$

and

$$m = \epsilon \exp \left[\frac{2}{\gamma} \right] - \epsilon \exp \left[\frac{\gamma+1}{\gamma} \right]$$

we have

$$Q = KAC \sqrt{P_1 \rho_1 m}$$

and the ratio ϵ determines the character of the flow. If

$$\epsilon \leq \epsilon^* = \left[\frac{2}{\gamma+1} \right] \exp \left[\frac{\gamma}{\gamma-1} \right]$$

the velocity of the fluid through the orifice is equal to the velocity of sound, and m is constant and equal to

$$m^* = \epsilon^* \exp \left[\frac{2}{\gamma} \right] - \epsilon^* \exp \left[\frac{\gamma+1}{\gamma} \right]$$

Then, the mass flow depends only upon the parameters of the fluid and of the reservoir. (Dimensional units for this Appendix will be found in Appendix D.)

THE DEPRES PROGRAM

An early version of the DEPRES program is contained in Appendix B. Basically, the program assumes that an outlet of area A is opened at time equal to zero. The CM cabin has a volume of V and is initially at pressure P and temperature T . A 100% oxygen atmosphere is assumed, whence the values for R and GAM (i.e. γ). P_0 is the pressure of the fluid outside the cabin, and G is the acceleration of gravity. A final value for density of the fluid in the cabin ($RHOF$), corresponding to a cabin pressure of 14.8 psia for the present case, is used to determine when the calculation should end.

When the computer is instructed to execute the program, an initial value of fluid density in the cabin (RHO) is calculated. If RHO is less than or equal to $RHOF$, the value of N (i.e. elapsed time in tenths of a second), RHO and P are printed. If not, a mass flow rate (QN) through the outlet is computed, and a new value of RHO is obtained, assuming that the flow rate holds constant for a time interval (DLT) of .1 second⁵. RHO is then tested again and iterations continue until the termination criteria is met. N , RHO and P are printed every second.

⁵Use of a .01 second time interval did not affect results significantly.

Appendix C contains a more recent version of DEPRES. While the basic iterative process is the same, a number of refinements have been added. These are listed as follows:

1. The constant orifice coefficient was replaced by $K = .85 - .22 \text{ EPSLON}$ (i.e. $.22\epsilon$), this being a linear approximation of Shapiro's curve* for the variation of orifice coefficient with pressure ratio.

2. A program path was created which approximates the behavior of the Environmental Control System. It includes a cabin pressure regulator with a flow rate (CPREG) which increases, linearly, from zero to full flow between pressures P_1 and P_2 and is turned off at P_5 . An emergency inflow regulator, with flow rate EIREG, opens in a similar fashion between P_3 and P_4 and stays on until pressure P_6 is reached. The Environmental Control System can be shut off at any pressure by setting a variable named PSTOP. TOTAL is the maximum flow rate from the Service Module Regulator. It is used to replenish the amount of oxygen (OTANK) in the surge tank when EIREG is on. If the quantity OTANK falls below a certain amount (EMPTY), then the total flow from the Environmental Control System (QP) equals TOTAL, assuming that the system has not previously been shut off. Losses due to normal cabin leakage (QLEAK) and metabolic usage (QMETA) are also considered.

3. A test was included to see if the value of EPSLON is such that sonic flow exists in the orifice. If sonic flow exists, m (i.e. M in the program) assumes a constant value, corresponding to m^6 , in the calculation of QN.

4. A variable (IECS) was included to specify whether the Environmental Control System is turned on (=1) or off (=0). When IECS = 1, values for QP, OTANK and QN are printed at time intervals of one second.

The net result of these refinements is to give DEPRES the capability of simulating conditions not only on the launch pad but in outer space as well. There is a large amount of flexibility built into the program. The values of both constants and variables can be changed quickly and easily.

⁶Ascher H. Shapiro, "The Dynamics and Thermodynamics of Compressible Fluid Flow," Volume I. The Ronald Press Company, New York, 1953, page 100.

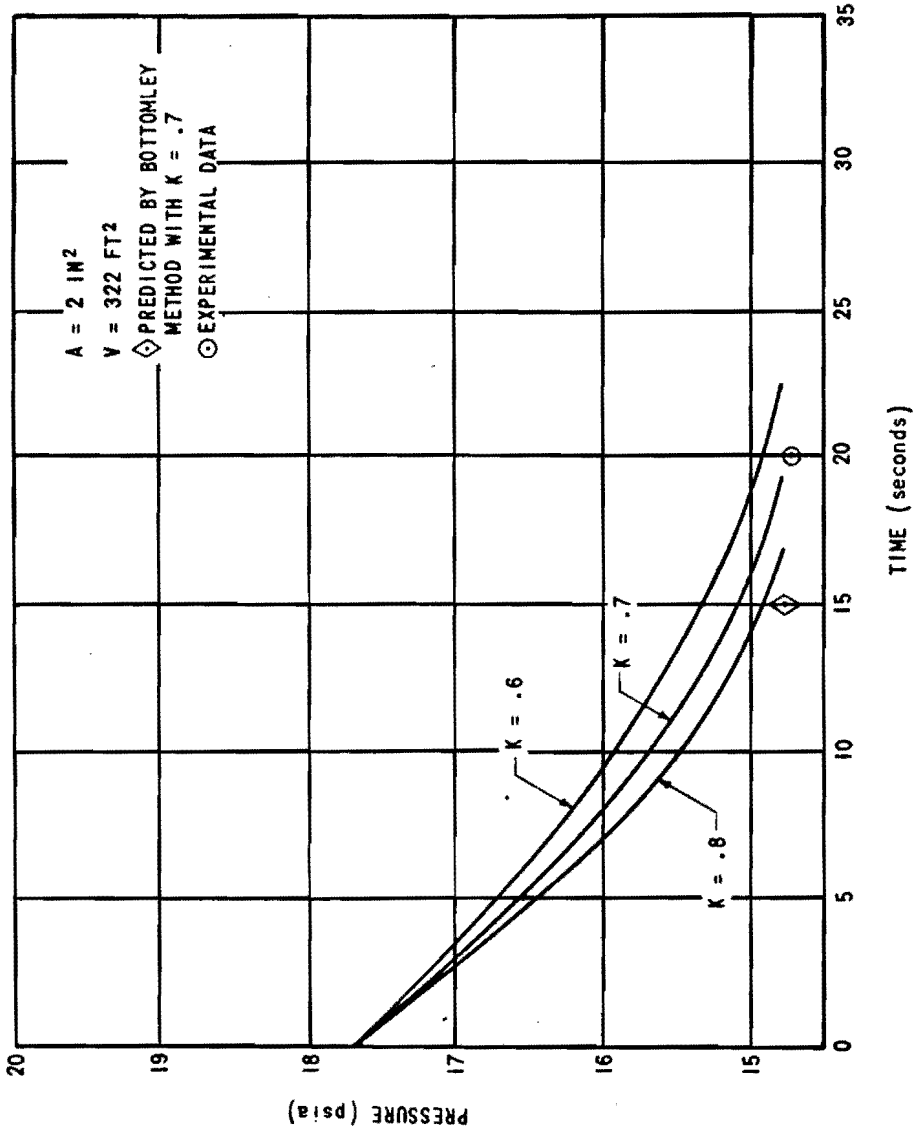


FIGURE 1: DEPRESSURIZATION CURVE WITH 3.0 PSI OVERPRESSURE
 (DEPRESSURIZATION ASSUMED TO BE COMPLETE
 AT AN OVERPRESSURE OF 0.1 psi.)

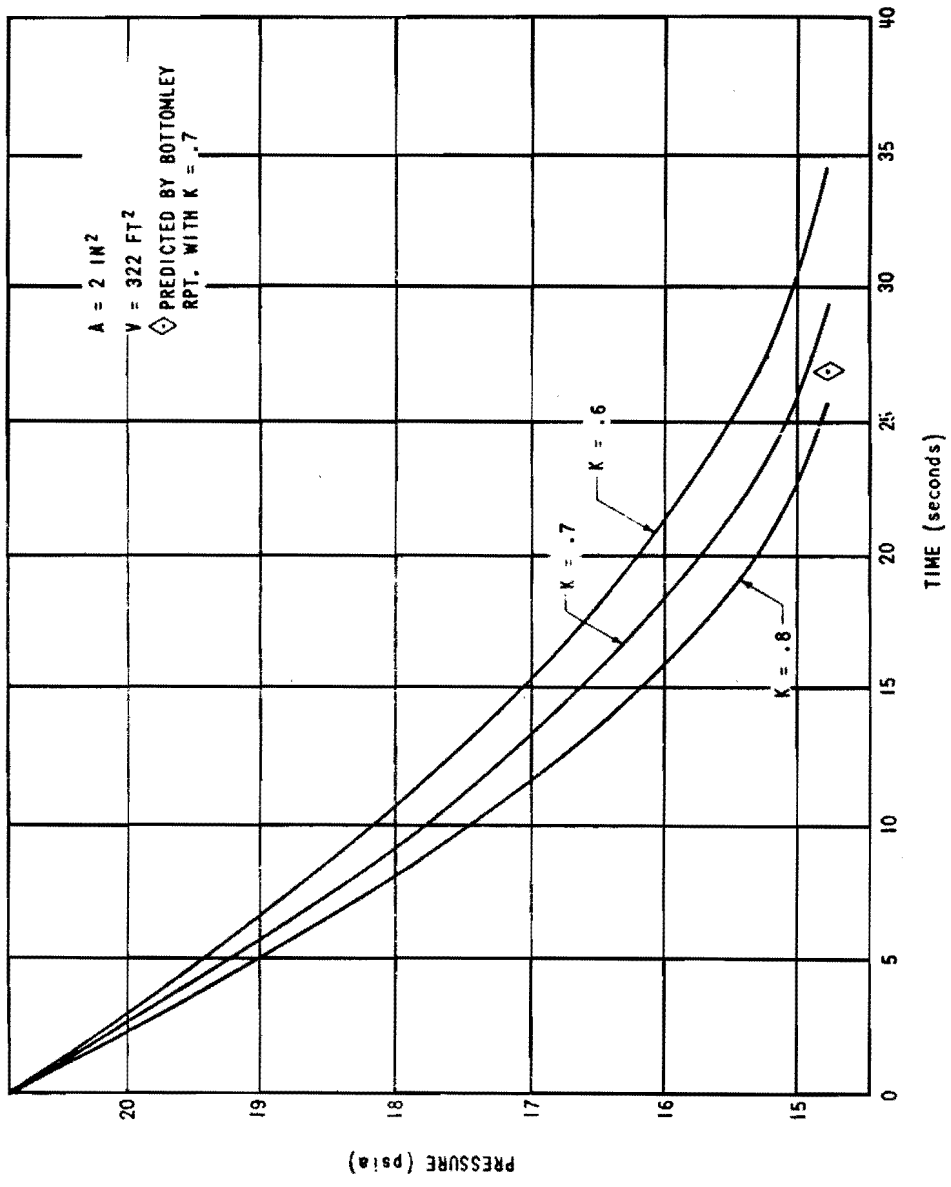


FIGURE 2: DEPRESSURIZATION CURVE WITH 6.2 PSI OVERPRESSURE
 (DEPRESSURIZATION ASSUMED TO BE COMPLETE
 AT AN OVERPRESSURE OF 0.1 psi.)

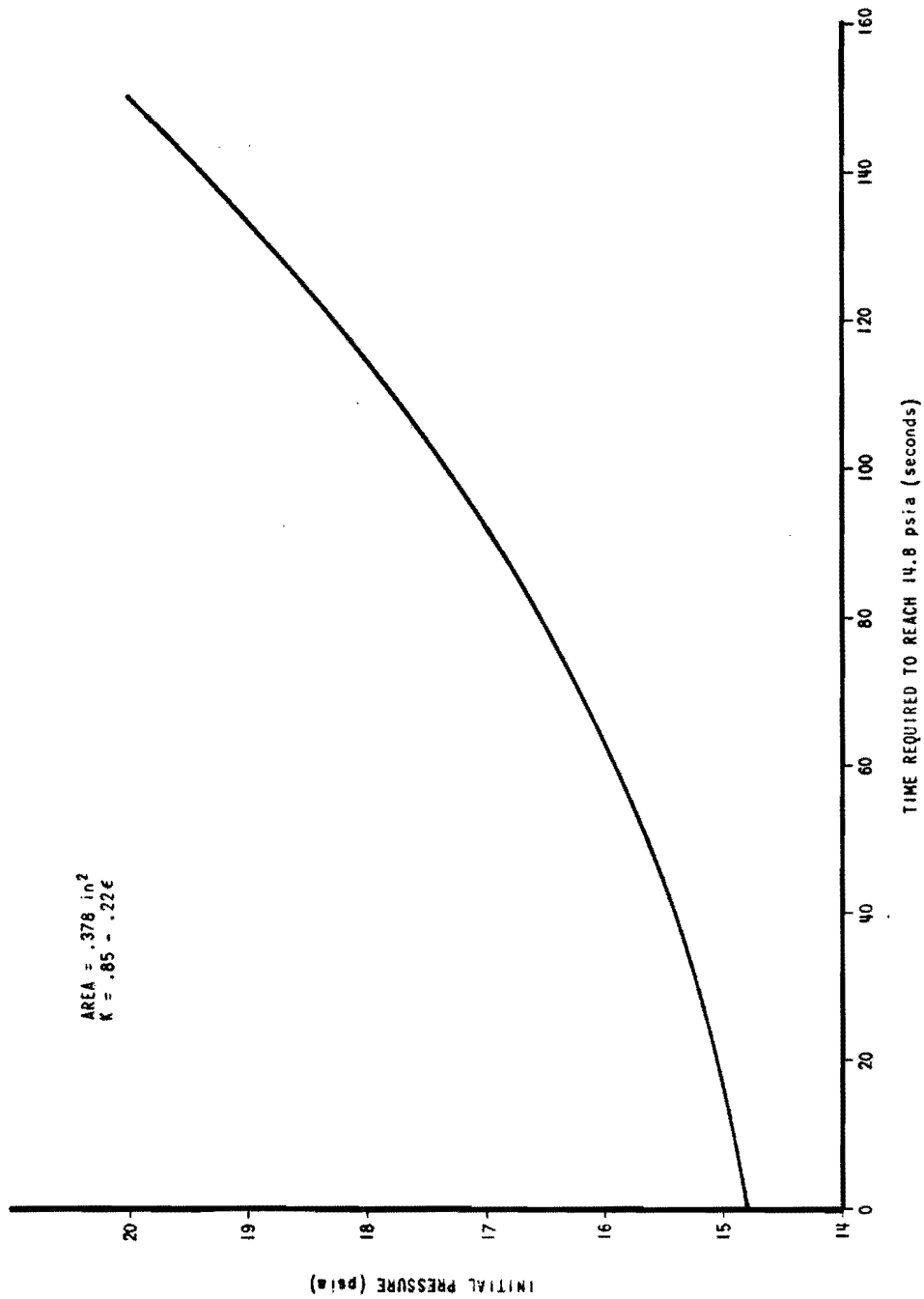


FIGURE 3: TIME REQUIRED TO DEPRESSURIZE TO 14.8 psia THROUGH PURGE
FITTING AS A FUNCTION OF INITIAL CH CABIN PRESSURE
(DEPRESSURIZATION ASSUMED TO BE COMPLETE
AT AN OVERPRESSURE OF 0.1 psi.)

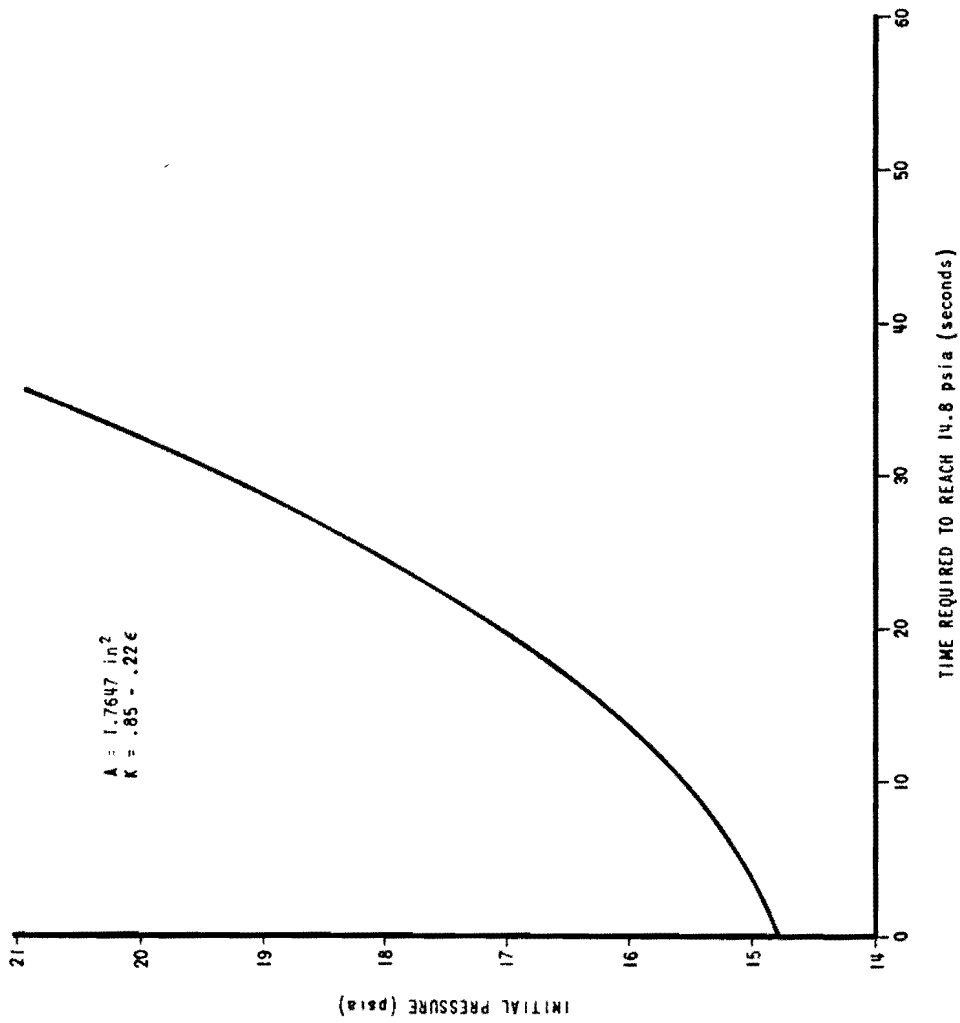
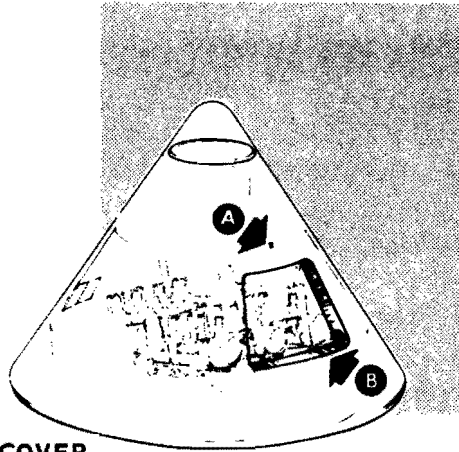
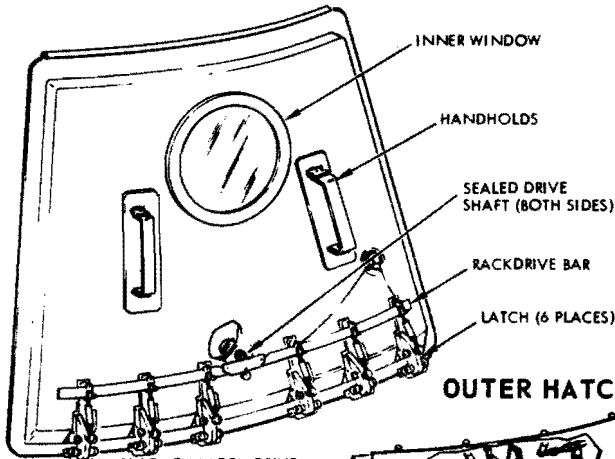


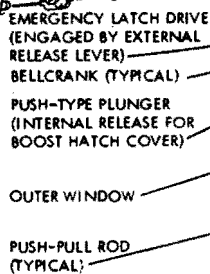
FIGURE 4: TIME REQUIRED TO DEPRESSURIZE TO 14.8 psia THROUGH CABIN PRESSURE RELIEF VALVE AS A FUNCTION OF INITIAL CM CABIN PRESSURE
 (DEPRESSURIZATION ASSUMED TO BE COMPLETE AT AN OVERPRESSURE OF 0.1 psi.)

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INNER HATCH COVER



OUTER HATCH COVER



VIEW B

CREW ACCESS HATCH (LOOKING INBOARD)

LANYARD HANDLE (INTERNAL QUICK RELEASE)

LATCH DRIVE SHAFT (OUTER DRIVE COVERED BY ABLATIVE PLUG)

TYPICAL LATCH (22 PLACES)

BOOST HATCH COVER



EXTERNAL RELEASE LEVER (EXTENDS 1-3/4 INCHES INTO FWD COMP)

LATCH DRIVE ROD

BOOST HATCH COVER WINDOW

TYPICAL LATCH AND RETAINER (22 PLACES)

LOCKWIRE

LATCH FITTING (TYPICAL)

HATCHWAY FRAME

OUTER STRUCTURE (REF)

INNER STRUCTURE (REF)

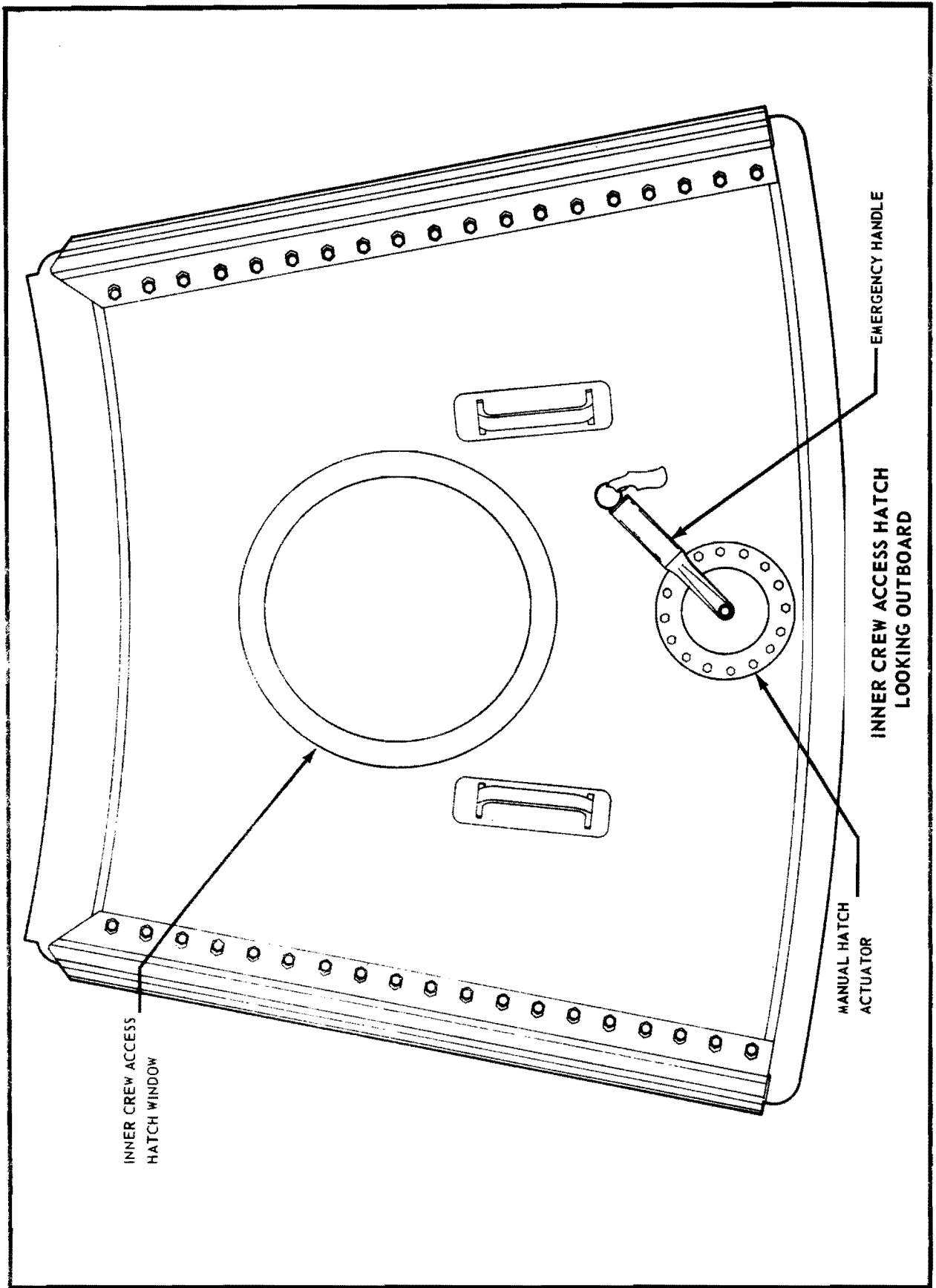
BELLCRANK (TYPICAL)

VIEW A

OUTER HATCH COVER EMERGENCY EXTERNAL RELEASE (VIEW ROTATED 180 DEG)

COMMAND MODULE MECHANICAL CONTROLS

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INNER CREW ACCESS
HATCH WINDOW

EMERGENCY HANDLE

INNER CREW ACCESS HATCH
LOOKING OUTBOARD

MANUAL HATCH
ACTUATOR

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UNITED STATES GOVERNMENT

Memorandum

TO : GA/Gemini Program Office

DATE: Jan. 26, 1965

FROM : CA/Assistant Director for Flight Crew

In reply refer to:
CF23-5M-5

SUBJECT: Ejection seat catapult rocket fire flash effects on Gemini suit material

Before a full scale 100 percent O₂, 14 psi "off-pad" abort test is conducted on the tower at China Lake, it was decided to conduct a series of pilot tests in one of the small chambers at MSC. Five 6-inch by 6-inch swatches were made using the materials in the Gemini thermo integrated space suit (outer layer HT-1 nylon, 7 layers of mylar and interpressure vessel). One 6-inch by 6-inch swatch of the outer parachute pack and a miniature parachute pack were tested in the same manner.

The 7 swatches of materials, 5 similar to the Gemini space suit, 1 similar to the parachute pack, and 1 the outer parachute pack covering, were tested in a 100 percent O₂, 14 psi environment for high temperature flame effect. Each swatch was tested separately in a small chamber. The swatches were placed in the chamber and the chamber was evacuated to 5 mm Hg and left for 5 minutes to insure complete out-gassing of the swatches. The chamber was brought to ambient with 100 percent O₂ and the swatches were soaked for 5 minutes. At the end of the 5-minute soak, the chamber was again evacuated to 5 mm Hg for 5 minutes. The chamber was brought to 14 psi with 100 percent O₂ and the swatches soaked for 30 minutes. At the end of 30 minutes, a propane flame with a flame temperature above 1,800°F was brought into contact with the swatches. Each of the 5 suit swatches were brought into contact with the flame for 0.5 second, 1 second, 2 seconds, 3 seconds, and 5 seconds respectively. The parachute pack outer material was in the flame for 7 seconds and the simulated parachute pack-age for 2 seconds.

The results were:

- a. No scorching occurred before 3 seconds in the flame.
- b. Burning occurred after 5 seconds for the suit material.
- c. Smoldering occurred after 7 seconds for the parachute outer pack material.
- d. No effect was noted to either the parachute canopy or the pack during a 2-second flame contact duration.



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

ENCLOSURE 13-9

The attached photographs show the results of the above test. All the materials were in contact with the flame considerably longer than the suit or parachute would be during an "off-pad" ejection. The maximum duration that the man is partially engulfed in the flame in an "off-pad" abort will be 0.01 second (10 milliseconds).

The results of these tests indicate that during an ejection, the fire flash of the ejection seat catapult is not of sufficient duration to cause the space suit to burn. Therefore, the test recommended in paragraph 1 is no longer considered mandatory and a decision to run the test must be based on program considerations.

/s/ D. K. Slayton

Donald K. Slayton

Enclosures 2

cc:

AM/D. O. Coons

AM2/G. F. Kelly

CB/A. B. Shepard

A. L. Bean

CF23/J. C. Joerns

EC/R. S. Johnston

EC4/F. S. Dawn

EC8/E. M. Tucker

CF23:CDWheelwright:bsf 1/22/65

UNITED STATES GOVERNMENT

Memorandum

TO : Mr. S. Beddingfield, KB-4

FROM : KSC Fire Protection Officer, RF-1

SUBJECT: Fire Extinguishers used on 204 incident.

DATE: March 8, 1967

1. Attached is a copy listing the conditions found on each extinguisher used on the 204 incident.
2. All extinguishers were out of date in accordance with the last date of inspection according to AFM 92-1 dated 15 January 1964, Section D, Paragraph 6-16 (1), Page 6-6, which states all extinguishers should be inspected monthly.
3. We are holding these extinguishers under bond until notified in writing by proper authority to release them.
4. Some of the discrepancies noted might have occurred during or after their use, (i. e., pins bent or missing, defective plunger, etc.).


N. E. Gray



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 202	Tag No. 93	15 lb. CO ₂	Used
1. Factory stamp number		15-2060378	
2. Hydrostatic		10/65	
3. Stencil Inspection date		9/13/66	
4. Last Inspection date		12/1/66	
5. Empty weight		27-1/4 lbs.	
6. Full weight		44-5/8 lbs.	
7. Weighed at KSC		31 lbs.	
8. Discrepancies		Out of date.	
9. Useable remaining CO ₂		Empty (18 seconds gas only)	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 203	Tag. No. 93	15 lb. CO ₂	Used
1. Factory Stamp number		15-224028	
2. Hydrostatic		1/65	
3. Stencil Inspection date		8/1/66	
4. Last Inspection date		No tag	
5. Empty weight		27-1/2 lbs.	
6. Full weight		44-7/8 lbs.	
7. Weighed at KSC		30 lbs.	
8. Discrepancies		Out of date	
9. Useable remaining CO ₂		Totally empty	
10. Recharged discharge time		28 seconds, good CO ₂	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 204	Tag No. 93	15 lb. CO ₂	Used
1. Factory stamp number		14-352929	
2. Hydrostatic		8/66	
3. Stencil Inspection date		2/27/66	
4. Last Inspection date		2/27/66	
5. Empty weight		26-1/2 lbs.	
6. Full weight		41-5/8 lbs.	
7. Weighed at KSC		37-1/2 lbs.	
8. Discrepancies		(none) or date	
9. Useable remaining CO ₂		(none) (14 seconds, gas only)	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 205	Tag No. 93	15 lb. CO ₂	Used
1. Factory stamp number		15-220110	
2. Hydrostatic		12/64	
3. Stencil Inspection date		12/22/66	
4. Last Inspection date		12/1/66	
5. Empty weight		27-1/4 lbs.	
6. Full weight		44-5/8 lbs.	
7. Weighed at KSC		31 lbs.	
8. Discrepancies		Out of date, horn split badly	
9. Useable remaining CO ₂		Empty (12 seconds, gas only)	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 206	Tag No.	15 lb. CO ₂	Used
1. Factory stamp number		HH 26940	
2. Hydrostatic		11/62	
3. Stencil Inspection date		8/22/66	
4. Last Inspection date		12/1/66	
5. Empty weight		Not legible	
6. Full weight		Not legible	
7. Weighed at KSC		32 lbs.	
8. Discrepancies		Out of date, defective trigger plunger	
9. Useable remaining CO ₂		Empty (20 seconds, gas only)	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 207	Tag No. 93	15 lb. CO ₂	Used
1. Factory stamp number		USA-16535BN	
2. Hydrostatic		1/64	
3. Stencil Inspection date		9/66	
4. Last Inspection date		12/1/66	
5. Empty weight		25 lbs.	
6. Full weight		40 lbs.	
7. Weighed at KSC		39-1/2 lbs.	
8. Discrepancies		Out of date, defective trigger plunger	
9. Useable remaining CO ₂		21 seconds, good CO ₂	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 208	Tag No. 94	15 lb. CO ₂	Used
1. Factory stamp number		15-224214	
2. Hydrostatic		1/66	
3. Stencil Inspection date		8/1/66	
4. Last Inspection date		12/1/66	
5. Empty weight		27 lbs.	
6. Full weight		44-3/4 lbs.	
7. Weighed at KSC		29-1/2 lbs.	
8. Discrepancies		Out of date , band broken	
9. Useable remaining CO ₂		Empty	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 209	Log No. 94	15 lb. CO ₂	Used
1. Factory stamp number		15-39-926	
2. Hydrostatic		8/63	
3. Stencil Inspection date		8/9/66	
4. Last Inspection date		9/30/66 - on tag	
5. Empty weight		23-3/4 lbs.	
6. Full weight		38-3/4 lbs.	
7. Weighed at KSC		35-1/2 lbs.	
8. Discrepancies		Out of date	
9. Useable remaining CO ₂		19 seconds, good CO ₂	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 210	Log No. 94	50 lb. CO ₂	Used
1. Factory stamp number		TC-2807	
2. Hydrostatic		10/59	
3. Stencil Inspection date		12/1/66	
4. Last Inspection date		12/1/66 - Wood	
5. Empty weight		137 lbs. (cyl.) - with cart 160 lbs.	
6. Full weight		187 lbs. (cyl.)	
7. Weighed at KSC		205 lbs (cyl. and cart)	
8. Discrepancies		Out of date, discharge lock pin missing	
9. Useable remaining CO ₂		Empty (1 min. 42 sec. gas only)	
1. Actual empty weight at KSC		104-1/2 lbs. (cyl.)	
2. Actual empty weight at KSC		45.5 lbs. (cart)	
3. Actual empty weight at KSC		150 lbs. (cyl., cart and hose)	
10. Recharged discharge time		1 min. 46 sec., good CO ₂	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 211	Log No. 94	30 lb. Dry Chem.	Used
		Ansul, Met-X	
1. Factory stamp number		None	
2. Hydrostatic		5/64	
3. Stencil Inspection date		8/10/66	
4. Last Inspection date		12/1/66	
5. Empty weight		Not marked	
6. Full weight		Not marked	
7. Weighed at KSC		42 lbs.	
8. Discrepancies		Cartridge punctured, Cylinder marked by stencil "ABC Dry Chemical"	
9. Useable remaining Dry Chem.		Visual inspection - approximately 2/3rds full of agent	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 212	15 lb. CO ₂	Used
1. Factory stamp number	15-223723	
2. Hydrostatic	10/60	
3. Stencil Inspection date	8/1/66	
4. Last Inspection date	12/1/66	
5. Empty weight	27-3/4 lbs.	
6. Full weight	45-1/8 lbs.	
7. Weighed at KSC	31 lbs.	
8. Discrepancies	Out of date, no band or horn clamp	
9. Useable remaining CO ₂	Empty (6 seconds gas only)	
10. Recharged discharge time	29 seconds, good CO ₂	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 213	Log No. 94	15 lb. CO ₂	Used
1. Factory stamp number		15-223653	
2. Hydrostatic		1/65	
3. Stencil Inspection date		8/1/66	
4. Last Inspection date		No tag	
5. Empty weight		27-5/8 lbs.	
6. Full weight		45 lbs.	
7. Weighted at KSC		31-1/2 lbs.	
8. Discrepancies		Out of date	
9. Useable remaining CO ₂		Empty (21 seconds gas only)	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 214	Log No. 95	15 lb. CO ₂	Used
1. Factory stamp number		HSC-27898F	
2. Hydrostatic		6/63	
3. Stencil Inspection date		11/3/66	
4. Last Inspection date		No tag	
5. Empty weight		Not legible	
6. Full weight		46 lbs.	
7. Weighed at KSC		31-1/2 lbs.	
8. Discrepancies		Out of date	
9. Useable remaining CO ₂		Empty	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 215	Log No. 95	50 lb. CO ₂	Used
1. Factory stamp number		TT 7128	
2. Hydrostatic		1/57	
3. Stencil Inspection date		8/1/66	
4. Last Inspection date		12/1/66	
5. Empty weight		Cyl. - not legible, with cart 148-1/2 lb.	
6. Full weight		183 lbs. (Cyl.)	
7. Weighed at KSC		194-1/2 lbs. (Cyl. and cart)	
8. Discrepancies		Out of date, Hose pitted near connection to bottle, defective trigger pin	
9. Useable remaining CO ₂		Empty (1 min. 56 seconds, gas only)	
1. Actual empty weight at KSC		98 lbs. (Cyl.)	
2. Actual empty weight at KSC		143-1/2 lbs (Cyl. , cart and hose)	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr	Tag No. 95	15 lb. CO ₂	Used
1.	Factory stamp number	USA-61538BL	
2.	Hydrostatic	11/64	
3.	Stencil Inspection date	12/1/66	
4.	Last Inspection date	12/1/66	
5.	Empty weight	26 lbs.	
6.	Full weight	41 lbs.	
7.	Weighed at KSC	27-1/2 lbs.	
8.	Discrepancies	Out of date	
9.	Useable remaining CO ₂	Empty (10 seconds gas only)	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 218	Tag No. 96	15 lb. CO ₂	Used
1. Factory stamp number		223584	
2. Hydrostatic		1/65	
3. Stencil Inspection date		12/1/66	
4. Last Inspection date		12/1/66	
5. Empty weight		28 lbs.	
6. Full weight		45-3/4 lbs.	
7. Weighed at KSC		32-1/2 lbs.	
8. Discrepancies		Out of date	
9. Useable remaining CO ₂		Empty (16 seconds gas only)	
10. Recharged discharge time		35 seconds, good CO ₂	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

Pirr 219	Tag No. 96	15 lb. CO ₂	Used
1. Factory stamp number		F-458277	
2. Hydrostatic		8/60	
3. Stencil Inspection date		7/26/66	
4. Last Inspection date		12/1/66	
5. Empty weight		Not legible	
6. Full weight		52 lbs.	
7. Weighed at KSC		38 lbs.	
8. Discrepancies		Out of date	
9. Useable remaining CO ₂		Empty	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

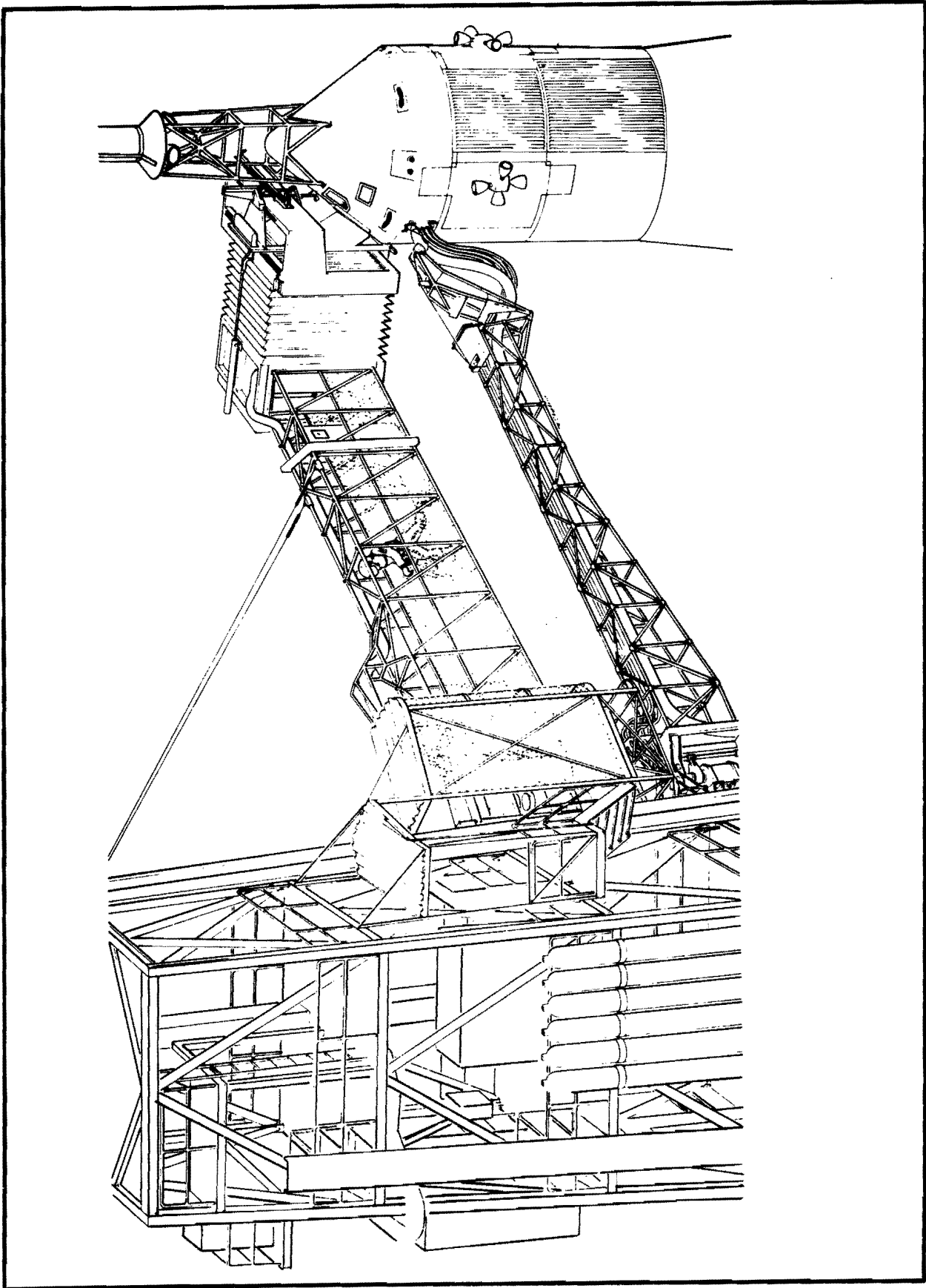
Conditions Found

Pirr	Tag No. 227	15 lb. CO ₂	Used
1.	Factory stamp number	15-176031	
2.	Hydrostatic	2/65	
3.	Stencil Inspection date	7/1/66	
4.	Last Inspection date	2/1/66	
5.	Empty weight	30-3/4 lbs.	
6.	Full weight	45-5/8 lbs.	
7.	Weighed at KSC	33-1/2 lbs.	
8.	Discrepancies	Out of date, pin bent in head	
9.	Useable remaining CO ₂	Empty	

LC-34 - - 204
Bonded Extinguishers
Examined by KSC Fire Service
2/28/67 by Inspectors Weber and Olsson

Conditions Found

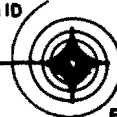
Pirr	Tag No. 228	15 lb. CO ₂	Used
1.	Factory stamp number	15-210863	
2.	Hydrostatic	12/64	
3.	Stencil Inspection date	8/1/66	
4.	Last Inspection date.	12/1/66	
5.	Empty weight	27-5/8 lbs.	
6.	Full weight	45 lbs.	
7.	Weighed at KSC	44-1/2 lbs.	
8.	Discrepancies	Out of date	
9.	Useable remaining CO ₂	25 seconds good CO ₂	
10.	Recharged discharge time	31 seconds good CO ₂	



ENCLOSURE 13-11

D-13-71

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PRE-FLIGHT OPERATIONS PROCEDURE

NO. G-100

DATE: November 4, 1966

TITLE: Originating and Changing Apollo Pre-Flight Operations Procedures

1. PURPOSE

This procedure establishes the method of initiating, coordinating, publishing, and distributing new and revised Apollo Pre-Flight Operations Procedures (AFOP's).

2. FORMS

Apollo Manual Change Request (AMCR, KSC Form 4-33NS - 7/66)

3. DEFINITIONS

Apollo Pre-Flight Operations Procedure: A basic procedure necessary to manage the technical operations performed at the Kennedy Space Center which requires joint and/or concurrent action by NASA and NAA/S&ID. "Joint and concurrent action" as delineated herein refers to: direct participation by NASA and NAA in signature approval or acceptance stamping of a disposition, operation, or document. Examples that do not constitute joint and concurrent action are: (a) independent review and evaluation of prior actions, (b) receipt of documents, and (c) need-to-know without direct participation.

4. RESPONSIBILITY AND HANDLING

∅ 4.1 Cognizant NASA/NAA employees may propose a new procedure or a revision to an existing one. Proposals will be transmitted by preparing an AMCR in triplicate. NASA initiated AMCR's will be signed by the originator and approved by his supervisor. NAA initiated AMCR's will be signed by the originator and approved by his manager. One copy will be retained on file and two copies will accompany the procedure and be forwarded to NASA Spacecraft Operations Procedures Control Office or the NAA Procedures Representative as applicable. A clearly stated reason for the proposal will be included on the AMCR.

∅ 4.1.1 Proposed new procedures or revisions will be reviewed by NASA Spacecraft Operations Procedures Control, or the NAA Procedures Representative, to determine if they (1) contain joint or concurrent action as outlined in paragraph 3 above, (2) duplicate or conflict with existing procedures, (3) conform to established format. Proposals that are not valid will be returned to the originator with reasons for the rejection stated on the AMCR.

Revision: Remove and destroy APOP G-100, dated December 13, 1965, and replace with this issue. ∅ indicates revisions. Retain Appendix "A" dated December 13, 1965. Revised to update signature requirements, organizational titles and provide for the use of Addendums.



Subj: Originating and Changing Apollo Pre-Flight
Operations Procedures
Date: November 4, 1966

No. C-100
Page 2

- ∅ 4.1.2 NASA Spacecraft Operations Procedures Control will forward coordination copies of NASA originated procedures to the NAA Procedures Unit and applicable NASA coordination points requesting comments be returned on the due date specified. NAA Procedures Unit will forward copies to applicable NAA coordination points.
- ∅ 4.1.3 The NAA Procedures Unit will forward coordination copies of NAA originated procedures to the NASA Operations Procedures Control Office, and applicable NAA coordination points requesting comments be returned on the due date specified.
- 4.1.4 Comments submitted will be clearly stated, referencing specific paragraphs, giving reasons, and offering alternate instructions where possible.
- 4.1.5 Comments to the draft must be returned by the due date. If comments are not returned, concurrence with proposals will be assumed.
- 4.1.6 When the coordination period has expired, the comments received will be reviewed and coordinated with the affected groups. Those deemed applicable will be incorporated into the procedure. An attempt will be made to resolve conflicting comments by means of telephone calls, meetings, etc. If conflicting comments cannot be resolved, they will be brought to the attention of NASA/NAA management for decision.
- ∅ 4.1.7 When coordination is complete and conflicts resolved or management decision made, the procedure will be typed by NAA for publication, signed by the NASA Spacecraft Operations Procedure Control and the NAA Procedures Representative, and forwarded to the NASA Manager, Test and Operations Management Office and the NAA Director of Apollo CSM Operations for approval signatures.
- 4.2 Minor Revisions
- ∅ Minor revisions (i.e., grammatical corrections, format corrections, and word changes that have only a minor effect on the intent of the procedure), may be issued as pen and ink changes upon approval of the NASA Spacecraft Procedures Control and the NAA Procedures Representative.



4.3 Interim Procedures

∅ 4.3.1 APOP's may be published on an interim basis upon approval by NASA/NAA Management. Requests will be forwarded on an AMCR to the NASA Spacecraft Procedures Control or NAA Procedures Representative as applicable; however, action may be initiated by a verbal request and confirmed in writing on an AMCR prior to publication. NAA originated AMCR's for interim publication must be signed by a NAA/FF manager or above.

∅ 4.3.2 NASA Spacecraft Procedures Control and NAA Procedures Representative will obtain preliminary approvals of interim procedures by the most rapid means available.

4.3.3 When preliminary approvals are obtained, the procedure will be distributed as an interim procedure with a life span of 30 to 60 days. The expiration date will be noted on the first page under the publication date. Approval signatures will be the same as for a regular procedure or revision.

4.3.4 The life span will serve as the coordination period. At the end of this interim period, the procedure will be issued as a regular procedure incorporating changes or published as is, if no comments are received. If an interim procedure is unresolved, conflicting points will be referred to NASA/NAA management for decision.

∅ 4.4 Addendums

4.4.1 Certain key procedures require frequent revisions to accurately reflect the latest change in the NASA/NAA operations. These revisions include both minor and major changes in procedure, and, depending upon the circumstances, may need to be issued on an emergency basis. To expedite this kind of procedural updating and to avoid the frequent and time consuming retype and reissue of lengthy procedures, such revisions may be published as addendums. However, addendums will be used only as a last resort and under emergency conditions when time will not permit a normal revision or interim publication.

4.4.2 The addendum will normally be a one or two page statement of the changes being adopted. The paragraphs affected will be clearly referenced and the new or revised information will be clearly stated.

4.4.3 Requests for publication of revisions as addendums will be processed in the same manner as other proposed revisions (see paragraph 4.1). However, action may be initiated by a verbal request and confirmed later in writing on an AMCR.



Subj: Originating and Changing Apollo Pre-Flight
Operations Procedures
Date: November 4, 1966

No. C-100
Page 4

4.4.4 NASA Spacecraft Procedures Control and the NAA Procedures Representative will coordinate the proposed addendum and obtain necessary approvals. Normally addendum changes will receive regular coordination. However, when operational requirements dictate immediate publication, coordination similar to that for interim procedures will be used. (Reference paragraph 4.3.2).

4.4.5 When approvals are obtained, the addendum will be typed on multilith mats and signed by NASA Manager, Test and Operations Management Office and the NAA Director of Apollo CSM Operations.

4.4.6 Following the publication of an addendum, the procedure affected will be revised as soon as practical, incorporating the revisions outlined in the addendum.

4.5 Distribution and Control

ø 4.5.1 Request to be placed on distribution for the APOP's will be made by memorandum and submitted to the NASA Spacecraft Procedures Control or the NAA Procedures Representative, as applicable.

4.5.2 The NAA Procedures Unit will maintain complete history files of all APOP's and will be responsible for the publication and distribution.

4.6 Format

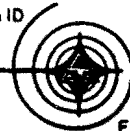
4.6.1 When preparing a draft for a proposed procedure, the originator should organize the material into a format as shown in Appendix "A". Paragraphs should be numbered using the decimal system, and when possible, four decimal places should not be exceeded. Information such as lengthy Forms Guide Instructions, Flow Charts, List of Names, Categories, etc., should be omitted from the basic instructions and included as an Appendix.

Coordinated by: Sam Bridgman, Jr.
Procedures Unit
NAA/S&ID Florida Facility

Coordinated by: Ann Parry
NASA Spacecraft Operations
Procedures Control

Approved by: J. L. Pearce
J. L. Pearce, Director
Apollo CSM Operations
NAA/S&ID Florida Facility

Approved by: J. Jambuti
for NASA Manager, Test and
Operations Management
Office



PRE-FLIGHT OPERATIONS PROCEDURE

NO. 0-202

DATE: May 13, 1966

TITLE: Operational Checkout Procedure

1. PURPOSE

This procedure establishes the methods for the preparation, processing, release, and use of Operational Checkout Procedures.

2. REFERENCE DOCUMENTS

- 2.1 Apollo Pre-Flight Operations Procedure T-501, "Work Authorization - TPS"
- 2.2 Apollo Documentation Procedure No. 2
- 2.3 Apollo GSE Plan S&ID 62-1410
- 2.4 ACPG 0-201, "Access Control of Test and Work Areas"

3. FORMS

- 3.1 Operational Checkout Procedure (OCP, Form KSC 11-16A)
- 3.2 Parts Installation and Removal Record (NAA Form FLA-62)
- 3.3 Apollo Launch Operations Test Summary Sheet (KSC Form OT-109)

4. DEFINITIONS

- 4.1 OPERATIONAL CHECKOUT PROCEDURE (OCP) - An engineering document which provides detailed instructions to personnel for operational checkout and verification of equipment during site activation, pre-launch, launch, or post-launch operations.
- 4.2 OPERATIONAL CHECKOUT PROCEDURE CHECKLISTS - A checklist especially designed to supply the necessary information to accomplish routine tasks in a particular order, prepared on an 11 x 17 sheet and providing for inspection buy-off.
- 4.3 INTEGRATED OPERATIONAL CHECKOUT PROCEDURES - An OCP which unites two or more Apollo Command and Service Module (CSM) systems or unites CSM systems with the booster.
- 4.4 DEVIATIONS - A change to a published OCP, such as changes in equipment lists, test parameters, sequences added or deleted or modified by order of occurrence or content to permit accomplishment of the test. Obvious errors, such as typographical errors, wrong page numbers, etc., are not considered deviations.

Revision: Remove and destroy APOP 0-202, dated February 4, 1966, and replace with this issue. \emptyset denotes revisions. Retain Appendix A and B, dated February 4, 1966.



- 4.5 REVISION - Technical changes including permanent deviations published in page form for insertion into a published OCP.
- 4.6 RE-ISSUE - A complete re-write of an OCP published to supersede a previously released OCP.
- 4.7 APOLLO OCP CONTROL GROUP - A joint NASA/NAA Management Committee responsible to assure timely and technically adequate OCP's and to establish policy concerning NAA Florida Facility (FF)/Kennedy Space Center (KSC) OCP's.

5. GENERAL REQUIREMENTS

- 5.1 OCP's are based on NAA Process Specifications. Those applicable should be referenced in the OCP by document number.
- 5.2 A series of OCP's for each vehicle will be prepared and released at the Florida Facility in accordance with OCP requirements as specified in this and referenced documents.
- 5.3 OCP's will (1) provide detailed step-by-step delineation of required personnel activity for the operation, assembly, handling, or test of the equipment and for system(s) involved, (2) provide for insertion of program requirement record data, (3) provide NASA/NAA Engineering and Inspection acceptance, (4) provide for safety of personnel and equipment.
- 5.4 Ground Support Equipment (GSE) nomenclature will be standardized in accordance with Reference 2.3. The GSE model number and title will be listed in the special equipment section. In the procedure section, the model number and abbreviated title will be used.
- 5.5 All OCP's will include the following statement: "NAA supervision and the responsible NAA test engineer are directly responsible for the safety of all NAA personnel, safe working conditions, and implementing all safety requirements".
- 5.6 All safety requirements will be considered in the preparation of OCP's, and the OCP originator will coordinate the procedure with the NAA/KSC Safety Offices and affix his signature to the FF "Safety Office Sign-off Statement" (file card) prior to publication.
- 5.7 Any OCP which involves any of the critical operations described in Reference 2.4 will be designated on the front page as follows: "This Test Procedure Is a Critical Operation"
- 5.8 Emergency shutdown procedures (sequentially if necessary) will be included for all equipment.



- 5.9 Applicable KSC/NAA Safety Directives will be referenced and complied with or waivers will be obtained, prior to commencing the test to ensure safe operations.
- 5.10 Notes, Cautions and Warnings will not be numbered within the OCP, but will be set apart from the text by placing them in the center of the page above the procedural step as shown below:

NOTE

An operation or special requirements, etc., in which no danger exists but which, if not accomplished, may cause inconvenience, delay, or invalidation of test.

CAUTION

Operational step practice, etc., which, if not strictly adhered to or observed, could result in damage of equipment.

WARNING

Operational step practice, etc., which, if not strictly adhered to or observed, could result in personal injury.

- 5.11 Illustrations will be used only to aid in the overall clarity of the text when necessary and will be referenced in the text, but in no case will they be used as directives for accomplishing work.

6. RESPONSIBILITIES AND HANDLING

6.1 Preparation, Processing and Release

- 6.1.1 OCP's to accomplish work tasks are developed to support a specific Florida Operations Flow Plan. Titles and numbers are provided for the OCP Control Group for review and approval.
- 6.1.2 OCP outlines are prepared by the NAA Systems Engineer, reviewed by the NASA Engineers, and submitted to the OCP Control Group for review and approval.
- 6.1.3 Rough drafts for each individual OCP are prepared with text and illustrations as outlined in Reference 2.2.
- 6.1.4 Rough drafts are forwarded through the NASA to Electronic Data Processing (EDI) for processing in flimsy print-out form.



- 6.1.5 Flimsies are forwarded to the NAA Documentation Support Group, who send copies to Systems Engineering, NAA Quality Engineering, NAA Safety, Downey, Engineering, and NASA Technical Library for distribution to CSC Engineering, NASA QC, Safety, and Manned Spacecraft Center (MSC) Houston.
- 6.1.6 Review comments from those agencies listed in 6.1.5 are returned to the responsible NAA Systems Engineer. The responsible Systems Engineer then develops a master review copy which is reviewed and signed by the input agencies. On integrated procedures, a formal review is held for final comments and sign-off.
- 6.1.7 NAA Documentation Support Group attaches a cover sheet and releasing Field Engineering Order (FEO) - see Appendix A - to the signed master flimsy, and obtains appropriate NAA signatures. Following NAA sign-off, the signed FEO is released by NAA Configuration Control, and a copy of the released FEO is provided for Documentation Support at the time of release. The master flimsy and cover sheet are then given to the NASA for procurement of appropriate signatures as directed by the NASA/NAA OCP Control Group. The released FEO is maintained by Documentation Support until the OCP is submitted to Technical Services (TS) for publication.
- 6.1.8 When all signatures are affixed to the cover sheet, and the package is returned to NAA Documentation Support, the master flimsy is forwarded through the NASA to EDP for processing of final offset masters for printing.
- 6.1.9 The finalized offset masters, the signed-off cover sheet, and the released FEO are provided to TS for publication and distribution 30 days prior to test.
- 6.1.10 TS is responsible for OCP distribution directed by the NASA/NAA OCP Control Group; in addition, three (3) published copies will be forwarded to each Test Site OCP Coordinator.
- 6.2 Deviations to OCP's
 - 6.2.1 All deviations will be recorded on pre-printed deviation sheets and will become an official part of the record copy OCP. Pretest deviations will be written by the Systems Engineers; the deviation sheets will be assigned a deviation number (one number per item); and a copy will be given to Inspection prior to starting the test.



6.2.2 Deviations that occur during the test will be recorded by the Systems Engineers or NAA OCP writer if one is assigned to the test (integrated tests only). When the requirements for a deviation become known, the Systems Engineer will be notified. The Systems Engineer or writer will assign a deviation number and inspection will record the number in the record copy OCP. If no writer is assigned, the Systems Engineer will red line his OCP, issue deviation numbers, and notify Inspection who will record the number as stated above. At no time will a test be held up to record deviations on an official deviation sheet. This can be done upon completion of the test.

6.2.3 Upon completion of the test all deviation sheets will be completed and signed as shown in Paragraph 6.2.5 and turned over to Inspection to be placed in the record copy OCP. Deviation sheets are self-releasing and do not require an FEO.

6.2.4 It is the responsibility of the Systems Engineer to assure that properly approved deviation sheets are supplied to Inspection and to NAA Documentation Support following completion of the test. No OCP will be bought by Inspection until official deviations are provided by engineering for ALL deviations noted during performance of the OCP.

6.2.5 Approval signatures for deviation sheets will be as follows: for Systems test of specific systems sections of integrated OCP's - NAA and NASA System Engineers; for control sections of integrated OCP's - NAA Test Project Engineer (TPE) and NASA Spacecraft Test Conductor (STC); for electrical and mechanical check lists - NAA and NASA system engineers.

∅

6.2.6 Deviations that should be incorporated in like OCP's for future CSM should be marked PERMANENT and later incorporated by NAA Documentation Support into the applicable OCP and released in accordance with Paragraphs 6.1.6 through 6.1.9. Deviations that are "one time only" items are recorded on the deviation sheet as Temporary Deviations. No further action is required on Temporary Deviations.

6.3 Open Item Review

∅

6.3.1 NAA service engineering will maintain current TAIR Book status and will publish a daily status report ("pink sheet"). Only TPS's, DR's and DRSS's will be statused.

∅

6.3.2 Completed OCP's that are still open will be reviewed for constraints. Special attention will be given to the open, non-transferred IDI's.



- ∅ 6.3.3 Review of open PIRR's and TIR's and shortage sheets will be accomplished by the NAA Systems Engineer prior to the Open Item Review. Any constringing shortages, PIRR's, or TIR's will be listed by the Systems Engineer and submitted to the Test Project Engineer (TPE)/Spacecraft Test Conductor (STC) at the Open Item Review.
- ∅ 6.3.4 The open items review will be conducted from the status report, and constringing items will be listed on a separate sheet, or the status report may be marked up accordingly. The determined constraints will be listed, signed by the TPE and STC, and published to insure that concentrated effort is applied to those items.
- ∅ 6.3.5 NAA and NASA engineering will sign the cover of the reviewed status report along with the TPE and STC. The signed copy of the status report will be filed with the record copy of the OCP upon completion of the test.
- ∅ 6.3.6 NAA Project Engineering and NASA Engineering must approve the Open Item Review Sheet by signature, prior to beginning the test. The original signed copy of the review sheet will be filed with the record copy of the OCP upon completion of the test.
- ∅ 6.3.7 NAA Technicians will work required constraints for NASA/NAA Inspection Acceptance.
- 6.4 All tests will be conducted by the NAA TPE and NASA STC. The TPE and STC may delegate their duties as necessary.
- 6.5 Quality Control Responsibilities during Test
- 6.5.1 Quality Control responsibilities after satisfactory completion of an OCP step or operation are as follows:
- 6.5.1.1 NAA Inspection will enter acceptance stamp impression and date after each operation requiring verification on each horizontal line designated for NAA inspector and at the bottom of each completed page of the OCP.
- 6.5.1.2 NASA Inspection will conformance stamp each line item requiring NASA inspection verification during all CSM testing and on GSE testing designated as NASA Mandatory Inspection Points (MIP).



- 6.5.1.3 When NASA NIP's have not been entered in the NASA block for a GSE OCP, NAA Quality Control will double stamp, date and enter N/R in each NASA Quality Control Block after stamping the NAA Inspector block.
- 6.5.1.4 When an inspection stamp entry is required for verification or witnessing of an operation occurring at a remote area, which is removed from the location of the Quality Control buy-off copy of the OCP, the inspector will verify over the Operation Intercom System (OIS) the satisfactory completion of an operation, and will affix a functional test inspection stamp impression to the verified step in the OCP. The NAA final acceptance stamp will not be used for verification over the OIS.
- 6.5.1.5 Recycles, shutdowns at the end of shift or subsequent re-starting of test at the beginning of the next test shift do not require deviations since these situations do not exceed nor change the scope of the test as specified by OCP, e.g., CSM power may be removed at the end of a shift to secure from the test until the next shift starts. At that time CSM power may be reapplied and the test resumed where it was terminated. No deviation is required for either the power down or power up. However, the point and time of events will be recorded in the record copy and will be noted in the OCP Test Summary Sheets.
- 6.5.1.6 The following time entries will be required on certain OCP's as specified. During the test, the NAA Inspector will record the time, using the 24-hour clock system, in the OCP as follows: (a) in the time column adjacent to the first sub-sequence entry on each page, (b) at stop and restarts due to test "holds." (In addition, a reference to the problem causing the hold will be noted: IDR Number, Deviation Number, etc.), (c) at the start and completion of sequences. (d) at intervals of 5 minutes as an objective, but not more than 15 minutes between sub-sequences. (If the duration of a sub-sequence does not exceed 5 minutes, the time need only be recorded once for that particular sub-sequence. The date is not required for this item).

NOTE: (1) Additional time recording may be necessary for critical points in the OCP. The above time requirements are to be considered as minimum.

Revision: Remove and destroy pages 7 and 8 ONLY of APOP O-202, dated May 13, 1966 and replace with this page. Revised to incorporate the Functional Inspection Stamp. Ø denotes changes.



- (2) The date will be included with the first and last time entry during each 24-hour period and at the end of the OCP.

- 6.5.2 All deviation entries on the Quality Control buy-off copy of the OCP will be verified by the responsible NAA inspector affixing the double stamp and date adjacent to the entry.
- 6.5.3 If an OCP is to be rerun, a new copy of the OCP will be used. "Inspection Copy" will be entered on the front cover of the OCP along with the notation "Run Number 2" and authority.
- 6.5.3.1 Sequence reruns will be indicated by the notation Run #2 or Run #3, etc. as applicable, entered on the upper right portion of the page.
- 6.5.3.2 As deemed practicable, use one of the following methods for documentation of sequence reruns and for the run time involved: (a) File duplicate OCP pages in the OCP, indicate rerun as in paragraph 6.5.3.1, and proceed in the normal manner; (b) File a rerun time record adjacent to the OCP page being rerun, indicate rerun as in Paragraph 6.5.3.1, and log time as indicated on the rerun time record. (Indicate acceptance of each rerun sequence on the OCP page).
- 6.5.4 When an OCP is discontinued before completion the NAA Inspector will
- 6.5.4.1 Enter "Discontinued" and reason for discontinuance after the last entry, and double stamp and date beneath the entry.
- 6.5.4.2 When a discontinued test is resumed, the NAA TPE and NASA STC will be responsible for determining the step at which testing should resume; however, all Interim Discrepancy Records and/or Discrepancy Records which will remain open against the previous run are valid until dispositioned and satisfied.

6.6 OCP Test Summary Sheet

After each OCP Test, the NAA TPE or his designated alternate will prepare a Test Summary Sheet (signed by the NASA counterpart engineer) providing the information listed below.



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DATE: May 13, 1966

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NOTE: Test Summaries for integration systems tests will be prepared for individual systems by Systems Engineering and will be approved by the TPE and STC.

6.6.1 Summary of major problem indicating:

- 6.6.1.1 Corrective action
- 6.6.1.2 Time of occurrence
- 6.6.1.3 Sequence
- 6.6.1.4 Applicable TPS's and IDR's

6.6.2 Summary of re-runs necessary to accomplish a given sequence of test successfully.

6.6.3 A listing of all IDR's that are transferred but not closed.

6.6.4 Bar Chart to indicate the actual order in which testing was accomplished, including actual test time.

6.7 OCP Acceptance Criteria

Following the completion of each OCP, NASA/NAA Inspection will close out the record copy OCP after all of the following steps have been completed by stamping each Summary Sheet and by signature on the last Summary Sheet.

6.7.1 The checklist PIRR forms have been recapped for subsequent tests or operations.

6.7.2 Sequences in the OCP have been verified as complete.

6.7.3 Deviations have been recorded and approved per Paragraph 6.2.

6.7.4 OCP Test Data Summary Sheets have been completed and signed by NASA/NAA.

6.7.5 Test Summary Sheets have been completed and approved.

6.7.6 The Bar Chart has been completed in accordance with Paragraph 6.6.4 above.

6.7.7 IDR's that have been assigned to CSM or GSE categories are either closed out or specifically dispositioned to:

- 6.7.7.1 Eliminate restraint on the next scheduled test.



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- 6.7.7.2 Reflect the subsequent test which will be restrained.
- 6.7.7.3 Retest requirements following any planned rework to insure system readiness.
- 6.7.8 "Other" category IDR's have been closed out (sold).
- 6.7.9 A copy of the IDR log, each IDR, all deviations and open item recap have been filed with the closed out OCP.

Coordinated by: K. Alfred Ahl
Procedure Unit
NAA/S&ID Florida Facility

Coordinated by: Karl A. Kemmer
NASA APOB Coordinator

Approved by: J. G. Hazard
J. G. Hazard, General Manager
NAA/S&ID Florida Facility

Approved by: Seay T. Linsen
NASA Manager of Apollo,
Spacecraft Operations



IMPLEMENTING INSTRUCTION

FOR

NO. 12-5

THE FLORIDA FACILITY

DATE 27 Jan 1966

- REFERENCE:**
- (a) Florida Facility Implementing Instruction 12-1, "Florida Facility Safety Program"
 - (b) Operations Systems Safety Notice 1-65, dated 21 July 1965
 - (c) Apollo Documentation #2 (NASA/MSC)
 - (d) Operations System Safety Handbook
 - (e) S&ID Policy E-401, "Crew Qualification and Environmental Readiness for Critical Tests"
 - (f) S&ID Policy E-402, "Employee Qualification/Certification for Critical Job Assignments"

SUBJECT: Safety Criteria for Apollo Command & Service Module and Saturn S-II Operations.

1. PURPOSE

This procedure identifies certain operational areas that shall be considered hazardous or critical. It establishes requirements to insure that all such administrative procedures, test procedures, work processes, methods, work authorizations and corrective action documents are reviewed to insure the inclusion of the necessary safety criteria.

2. SCOPE

The requirements established in this procedure are applicable to all programs at the S&ID Florida Facility and will be implemented as appropriate by all operational activities.

3. GENERAL

3.1 The following categories of Apollo Command & Service Module and Saturn S-II operations are designated critical. These operations will require specific safety reviews and must include certain specific requirements in preparation of procedures and related documents.

3.1.1 Ordnance Systems - any operation involving the handling, transport, installation and checkout of live ordnance devices. Also any operation or checkout of an ordnance system after live ordnance items have been installed.

3.1.2 Propellants - any operation involving the loading, downloading, or system activation with operating propellants.

3.1.3 Cyrogenics - any operation involving the loading and/or downloading of the test vehicle and system activation with cyrogenics.

3.1.4 Environmental Tests - any environmental tests conducted in an environmental chamber when combustible gases or fluids are being utilized in the test vehicle, or when an altitude chamber is at altitude with personnel in the chamber or vehicle.

New Procedure

Form 955-B-1 New 7-63

- 3.1.5 Hi-Energy Potential Systems - operations designated by the Systems Safety Engineer involving the operations of pressure systems or operation of gaseous systems utilizing tanks or reservoirs.
- 3.1.6 Handling Operations - any operation involving the lifting, hoisting, loading or transporting of an end item flight vehicle and such other items as may be specifically designated by the Systems Safety Engineer.
- 3.2 All safety requirements will be considered in the preparation of all test procedures and work authorization documents: Operational Checkout Procedures (OCP), Detailed Operating Procedures (DOP), Detailed Installation Procedures (DIP), General Operating Procedures (GOP), General Work Orders (GWO), Test Preparation Sheets (TPS), and Discrepancy Records (DR). Safety requirements will also be considered in revisions to OCP's, DOP's, DIP's, and GOP's. The originator will coordinate test procedures (OCP's, DIP's, DOP's and GOP's) with the Florida Facility Safety Office and affix his signature to the Florida Facility "Safety Office Sign-off Statement" (file card) prior to publication.
- 3.3 The responsible systems engineer will coordinate with the Florida Facility Safety Office for all test procedures (OCP's, DOP's, DIP's, and GOP's) for operations that have been designated as critical.
- 3.4 Safety checklists will be used in the preparation of test procedures (OCP's, DIP's, DOP's, GOP's) and work authorization documents (TPS's, DR's and GWO's). Safety checklists will also be used in conducting the pre-operation review described in paragraph 4.7. These checklists will be developed by the Florida Facility Safety Office in coordination with representatives from Operations, Quality Assurance, Project Engineering and KSC Safety.
- 3.5 The Florida Facility Safety Office will submit safety reports in accordance with Reference (a).
- 3.6 It is the responsibility of supervision to ensure that all personnel are certified or qualified to perform assigned tasks in accordance with References (e) and (f).

4. INSTRUCTIONS

- 4.1 Any test procedure which involves any of the critical conditions described in paragraphs 3.1.1 through 3.1.6 will be designated on the front page as follows: "This test procedure is a critical operation".
- 4.2 When a test procedure has been designated as "critical", cautions and warnings shall be used as necessary and precede critical steps. This will ensure that the instruction is received prior to actual need. The words CAUTION and WARNING shall be centered on the page.

- 4.2.1 CAUTION: Used prior to any operation that could result in damage to equipment if not followed.

Example: CAUTION

If C14-075 gage PG12 exceeds 170 PSIG report condition to test conductor.


- 4.2.2 WARNING: Used prior to any operation that could result in injury or death to personnel if not followed.

Example: WARNING

High pressure gas will now be in lines G14017793 and G14-17798.

- 4.3 The Operations Department will be responsible for informing the Safety Office of any simultaneous operation to be performed in the same area as a critical operation.
- 4.4 Emergency shutdown procedures for all equipment will be included in all test procedures.
- 4.5 Applicable KSC and NAA safety directives will be referenced and complied with or waivers obtained prior to commencing the test to ensure safe operations.
- 4.6 It is the responsibility of the Test Project Engineer to brief all personnel involved in the test, prior to participation, on all cautions and warnings contained within the procedure.
- 4.7 Before each test designated as critical, the responsible systems or test engineer will conduct a safety review of the operation with all test team members. Those present to include not only personnel actually engaged in the operation but also any others that may be required, depending upon the nature of the operation (Project Engineer, Safety, Quality Assurance, NASA Representatives, etc.). The review shall consist of a "talk through" of the operation, a "walk through" inspection of the area, and a dry run of the operation by the personnel involved.

For the General Manager



W. S. Ford
Assistant General Manager
Florida Facility

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LIST OF REFERENCES

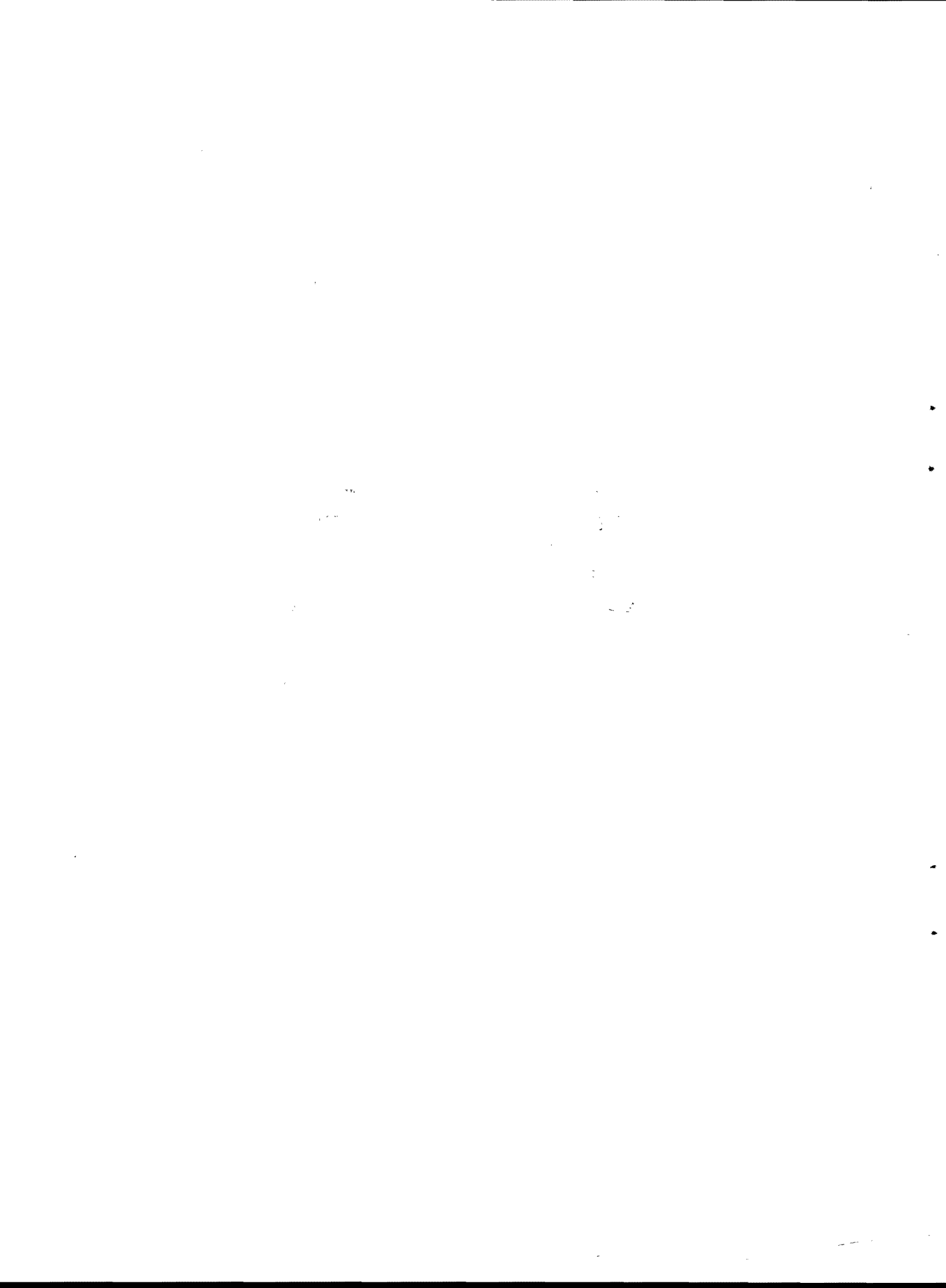
The following documents, referenced in the Ground Emergency Provisions Panel Report, are contained in the AS - 204 Review Board permanent file:

REFERENCE

- 13- 1 The Apollo Crew Abbreviated Checklist SM 2A-03-SC012/CL, dated 23 January 1967.
- 13- 2 The Apollo Operations Handbook, SM 2A-03-SC012, dated 12 November 1966, revised 30 November 1966.
- 13- 3 The Apollo Flight Crew Hazardous Egress Procedures Manual, dated 1 November 1966, revised 7 November 1966.
- 13- 4 Operational Checkout Procedure, OCP FO-K-021-S/C012/14, dated 13 December 1966, revised 24 January 1967.
- 13- 5 Launch Vehicle Test Procedure I-20015-SA 204, dated 18 January 1967, revised 23 January 1967.
- 13- 6 Space Vehicle Test Procedure I-41001-204, dated 12 January 1967, revised 23 January 1967.
- 13- 7 KSC Management Instruction, KMI 1710.1, dated October 4, 1966, defining KSC Safety Program.

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**REPORT OF PANEL 14
SECURITY OF OPERATIONS
APPENDIX D-14
TO FINAL REPORT OF
APOLLO 204 REVIEW BOARD**



SECURITY OF OPERATIONS

A. TASK ASSIGNMENT

The Apollo 204 Review Board established the Security of Operations Panel, 14. The task assignment by Panel 14 was prescribed as follows:

This group shall review existing security practices for adequacy. This includes such things as access control, personnel sign-in requirements, buddy systems, background investigation requirements, etc. They shall also make responsible recommendations to the Board on changes to existing practices.

B. PANEL ORGANIZATION

1. MEMBERSHIP

The assigned task was accomplished by the following members of the Security of Operations Panel:

Mr. Charles L. Buckley, Jr., Chairman, Kennedy Space Center (KSC), NASA
Mr. William J. Horner, Jr., Kennedy Space Center (KSC), NASA
Mr. Charles A. Buckel, Manned Spacecraft Center (MSC), NASA
Mr. Howard G. Maines, Headquarters, NASA
Mr. S. Drake Ellis, Marshall Space Flight Center (MSFC), NASA
Mr. Robert W. Gaines, Lewis Research Center (LeRC), NASA
Lt. Col. William Dugan, U. S. Air Force

2. COGNIZANT BOARD MEMBER:

Colonel Charles F. Strang, U. S. Air Force, Board Member, was assigned to monitor the Security of Operations Panel.

C. PROCEEDINGS

1. In response to the Board directive of February 1, 1967, the Panels' task was outlined in detail, as follows:

a. Conduct review of physical security practices at Kennedy Space Center and other appropriate locations supporting the mission. This review would include, but would not be limited to, the following:

(1) Launch Complex, including blockhouse, pad, and white room, access control system before and during the accident.

(2) Sign-in procedures which were in effect for persons having access to various critical locations during the pre-accident time period.

(3) Escort requirements that were in effect at the Launch Complex.

b. Examine the efforts of participating NASA management and security organizations aimed toward assuring the integrity and reliability of persons having critical access to key locations prior to and during the mission period.

2. The Panel prepared a tentative detailed schedule/agenda and established milestones for the Security Panel's deliberations and activities.

3. The Panel accumulated pertinent background data, such as guard orders, access lists, samples of

badges, back-ground documentation, etc., for use by the Panel upon its initial convening.

4. Attended to necessary security administrative duties in support of the Board and other Panels. These reviews were conducted during the course of the Panel deliberations, reviews, analyses and interviews aimed toward determining whether a security-related factor caused or contributed to the accident.

5. A concurrent and detailed analysis of the general security posture prior to and at the time of the accident was accomplished. The plans for subsequent operations and tests were also reviewed.

6. The entire Panel visited Launch Complex 34 (LC 34) area for direct observation of security posts, including observation of the eighth adjustable level of the service structure, white room, and spacecraft.

7. Interviews and discussions were conducted with representatives of supervisory and operational elements of the KSC Security Office and uniformed security (guard) forces to establish:

a. The responsibility for (1) establishing security principles and guidelines and (2) monitoring implementation.

b. The responsibility for implementation of principles and guidelines.

c. The effectiveness of the management, structural, and communications relationships between the KSC Security Office and the implementing organizations.

8. An analysis was conducted of the various principles and guidelines designed to provide physical security and personnel access control involved in Apollo missions and their implementation by the uniformed security forces.

9. Reviewed and discussed the KSC and Air Force Eastern Test Range (AFETR) regulations concerning the "controlled area" personnel access concept at Cape Kennedy Air Force Station. Analyzed and discussed the North American Aviation, Inc. (NAA) instruction concerning the "controlled area" concept.

10. Interviewed the KSC Security Office representative concerning the concept and function of the access controls provided through use of the Apollo/Saturn Operations Area Permit and the mechanics of implementing the "controlled area" concept at LC 34.

11. Reviewed security post requirements, post orders, badge and access control systems for the arrival and movement of flight hardware at Cape Kennedy and KSC; the KSC Industrial Area locations, the Astronaut Quarters and Suiting Room at KSC; the Astronaut Van; and LC locations such as the main gate, the blockhouse, and various work levels of the Space Vehicle at the pad.

12. The NASA representative in charge of the Astronaut Support Office at KSC (Astronaut Quarters, Suiting Room, etc.) was interviewed concerning access controls; control of the Astronaut Van; purchase, handling and preparation of astronauts' food (non-flight); occupational health examinations of Support Office personnel (e.g. maids, cooks, stewards, etc.); kitchen and dining facilities; and the investigative program concerning the Support Office personnel and the information resulting therefrom.

13. The Panel:

a. Analyzed the NASA/NAA Apollo Prelaunch Operations Procedures concerning access control of test and work areas.

b. Interviewed the NASA Apollo 204 Test Supervisor concerning physical security and personnel access controls at LC 34.

c. Interviewed the NAA pad leaders concerning the NAA system of administrative access control of personnel to the service structure spacecraft work areas, including the white room and Command Module.

d. Reviewed the Command Module Ingress/Egress Log maintained by NAA personnel.

e. Interviews, analyses, and reviews conducted by the Panel (it should be noted that Panel 6 is also conducting an inquiry in this area) reflected that:

(1) In some cases, individuals over whom the contractor had not exercised access control gained

entry to the spacecraft areas on the fifth, sixth, and seventh adjustable levels;

(2) No "off shift" log exists;

(3) The Command Module Ingress/Egress Log in some cases failed to reflect:

(a) the names of all individuals who entered the Command Module;

(b) whether or not equipment or tools were taken into the Command Module;

(c) that all equipment or tools were taken out or otherwise disposed of;

(d) the time individuals ingressed and/or egressed the Command Module;

(e) the authorization basis for individuals entering the Command Module;

(f) sufficiently legible writing to determine the identity of individuals entering the spacecraft.

14. An analysis was conducted of the investigative program which formed the basis for access to LC 34. A similar analysis was conducted of the system in effect at the Mission Control Center/Houston. An inquiry was conducted to verify the clearance and investigative status of a representative sampling of all persons who were at selected locations on the Launch Complex, in the Command Module, on the eighth adjustable work level of the service structure, etc., prior to the accident. The Panel analyzed the benefits which can reasonably be expected to result from measures suggested in a letter of December 30, 1966, from NASA Office of Manned Space Flight (OMSF) to selected Apollo contractors, emphasizing the need to be exceedingly selective in the placement of reliable and trustworthy persons at the launch facility during the critical period immediately prior to launch. The analyses reflected the degree to which a prior standard National Agency Check (NAC) investigation was a reasonable precaution in controlling unescorted access to the Launch Complex. In most cases, the standard NAC relied upon was the one which had been conducted in the processing of the individual's industrial security clearance for access to classified information. In these cases, the results of the NAC were not furnished to NASA. The last Government-conducted NAC Investigation relied upon for access varied from being current to in excess of ten years old. A sampling of such NAC's on individuals at LC 34 on the day of the accident established that a standard NAC is apparently not designed to include a check of pertinent files of all appropriate Federal agencies. These agency files contain information, some of which would be relevant in evaluating individual trustworthiness and reliability.

15. Reviewed and analyzed the uniformed security force's General guard orders.

16. Interviewed PAA Security policemen who performed security post duties at LC 34 to establish the individual officer's comprehension and understanding of his responsibilities, and the extent to which actual performance matched assigned duties. Interviewed supervisory and patrolmen personnel concerning their actions on the day of the accident.

17. Reviewed disciplinary action cases concerning uniformed security personnel resulting from minor instances of noncompliance with their security post responsibilities at LC 34 in order to establish the degree of discipline at the Launch Complex.

18. Representatives of the Federal Bureau of Investigation were interviewed concerning their prior investigations of various types of incidents (thefts, fraud, malicious damage to Government property) at Cape Kennedy and KSC with emphasis on LC 34. They were also interviewed regarding their participation in the activities at LC 34 immediately following the accident.

19. The Panel reviewed all statements taken by the Witness Panel for any items having a security implication.

20. An analysis was conducted of pertinent incident reports and daily log sheets (prior to and at the time of the accident) maintained by the KSC Patrol and the PAA Security Police.

21. Reviewed and discussed the NASA Headquarters Apollo Mission Failure Contingency Plan, and the KSC Apollo/Saturn 1B Failure Investigation Plan.

22. Discussed approaches to personnel security investigative program to be used in future Apollo missions.

D. FINDING AND DETERMINATIONS

1. FINDING

a. The KSC Security Office:

(1) Developed security principles and guidelines, concept for badge, access control systems, and security post requirements, and furnished them to the uniformed security forces.

(2) Provided technical direction to the uniformed security forces and published physical and personnel security regulations, instructions, and notices.

(3) Developed security procedures for each Apollo mission and issued a security plan setting forth prelaunch, test, and launch security requirements.

(4) Periodically inspected the uniformed security forces.

(5) Frequently surveyed the field and security post operations of the uniformed security forces.

b. By contract, the uniformed security forces (PAA Security Police at Cape Kennedy, and the KSC Patrol at Kennedy Space Center) were responsible for the implementation of established security principles and guidelines.

DETERMINATION

The KSC Security Office adequately established security principles and guidelines and effectively monitored implementation of same. Uniformed security forces properly implemented these principles and guidelines. The KSC Security Office, in a timely fashion, effectively emphasized with the uniformed security forces, the importance of the forthcoming Apollo manned missions.

2. FINDING

Current written orders were in existence for all established security posts related to the AS-204 mission. The orders were furnished to uniformed security forces in a timely manner. The interviews and analysis of pertinent records revealed no significant instances reflecting a failure by uniformed security personnel to comply with their post orders.

DETERMINATION

Uniformed supervisory security personnel were knowledgeable concerning their responsibilities. Uniformed security policemen understood their duties and performed satisfactorily. Operational security requirements placed on PAA were timely and adequate. Security post orders were realistic and adequate.

3. FINDING

KSC Security personnel and/or uniformed security personnel were assigned to all locations requiring safeguarding measures, including Launch Vehicle stages and spacecraft from the time of arrival at KSC to time of the accident.

DETERMINATION

The number of KSC Security personnel and uniformed security personnel utilized was adequate.

4. FINDING

Apollo Preflight Operations Procedures (APOP) 0-201, dated October 17, 1966, and January 24, 1967, concerning access control of test and work areas, required that: (1) access controls to spacecraft work areas be exercised by the contractor; (2) the contractor maintain a log of all personnel permitted access during "off-shift"/non-work periods; (3) the contractor control Command Module ingress-egress, and maintain a log concerning same.

DETERMINATION

The procedures established in the APOP were not followed in that: (1) the contractor failed to exercise adequate access controls on the fifth, sixth, and seventh spacecraft levels; (2) the contractor failed to maintain an "off-shift" log; (3) the Command Module ingress/egress log was inadequately

maintained.

5. FINDING

The investigative program, which was used as the basis for authorizing access to LC 34, consisted of a determination that a National Agency Check (NAC) investigation had been conducted on each Government or contractor employee. In the absence of a NAC, an escort was required. (Similar provisions existed at the Mission Control Center/Houston.)

DETERMINATION

This practice provides inadequate support for the objective of NASA management that great care be taken to assign reliable and trustworthy persons to perform critical work during mission periods.

6. FINDING

- a. Access to the Astronaut Quarters and the Suiting Room was limited by an access list attached to the Security Post Orders, to those few people having an official reason to be there, i.e., astronauts, biomedical people, suit technicians, etc. Compliance with this procedure was enforced by KSC uniformed security patrolmen. The Van used to transport the astronauts from their Quarters to the Launch Complex was inspected, driven, and remained under the control of KSC Security personnel when astronaut activity was involved. Uniformed security personnel escorted the Van when astronauts were being transported.
- b. The purchase, handling, and delivery of the astronauts' food (non-flight) served in their Quarters is processed through the contractor's routine channels.
- c. Only the results of an NAC are available to NASA management in their evaluation of the reliability and trustworthiness of support personnel in the Astronaut Quarters.

DETERMINATION

The personnel access controls for the Astronaut Quarters, the Suiting Room, and the Van were adequate.

Inadequate safeguards are provided concerning the purchase, handling, and delivery of astronauts' food (non-flight), notwithstanding the fact that it is known by persons coming in contact with it that it is to be consumed by the astronauts.

NASA management has insufficient knowledge to fully evaluate the reliability and trustworthiness of support personnel in the Astronaut Quarters.

E. SUPPORTING DATA

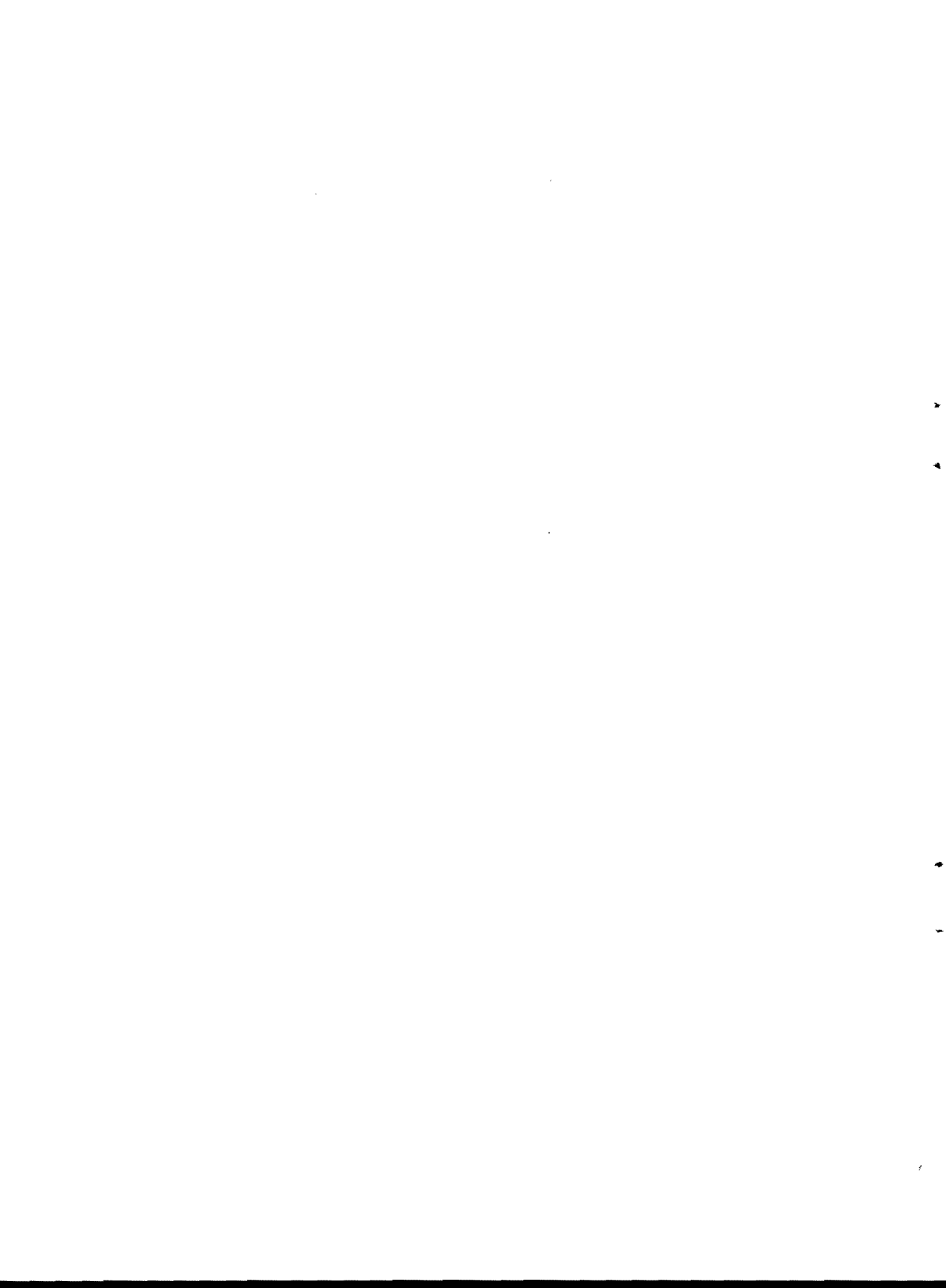
REFERENCES

The following is an enumeration of referenced materials (which are not included as part of this report), copies of which have been submitted to the Board.

- | | |
|-------|--|
| 14-1 | Panel Preliminary Report Number 1, February 1, 1967 |
| 14-2 | Panel Preliminary Report Number 2, February 4, 1967 |
| 14-3 | Summary Panel Report, February 9, 1967 |
| 14-4 | Preliminary Panel Analysis Summary Report, February 16, 1967 |
| 14-5 | Summary of Panel Interview - Buckley |
| 14-6 | Signed Statement - Buckley |
| 14-7 | Summary of Panel Interview - Morford |
| 14-8 | Statement of Chief Merrill |
| 14-9 | Gemini 12 Security Plan, October 14, 1966 |
| 14-10 | AS-201 Security Plan, December 14, 1965 |

14-11 Apollo Launch Operations Committee Meeting Minutes, September 20, 1966
 14-12 Proposed AS-204 Complex 34 Security Controls
 14-13 Apollo Launch Operations Committee Meeting Minutes, November 1, 1966
 14-14 Proposed Security Controls for Complex 34 for AS-204
 14-15 Summary of Interview - Evans
 14-16 Summary of Interview - Matthews
 14-17 Summary of Interview - Tatham
 14-18 Written Statement - Tatham
 14-19 Air Force Eastern Test Range Regulation 125-10
 14-20 Air Force Eastern Test Range Regulation 125-15
 14-21 Summary of Interview - Morford (No. 2)
 14-22 Summary of Interview - Horner
 14-23 KSC Patrol Synopsis of Events
 14-24 APOP Number 0-201, October 17, 1966
 14-25 APOP Number 0-201, January 24, 1967
 14-26 Summary of Interview - Buckel
 14-27 Office of Manned Space Flight letter to Apollo Contractors
 14-28 Summary of Interview - Page
 14-29 Summary of Interview - Babbitt
 14-30 Summary of Interview - Curatolo
 14-31 Sample Pages from Command Module Ingress/Egress Log
 14-32 Summary of Interview - Furgason
 14-33 Summary of Interview - Smith
 14-34 Summary of Interview - Tully
 14-35 Summary of Interview - Graham
 14-36 Summary of Interview - Friedlander
 14-37 Security Post Orders - Altitude Chamber
 14-38 Security Post Orders - Astronaut Quarters
 14-39 Security Post Orders - Astronaut Suit Room
 14-40 Security Post Orders - Complex 34 Main Gate
 14-41 Security Post Orders - Complex 34 Rear Gate
 14-42 Security Post Orders - Complex 34, 1st Floor Blockhouse
 14-43 Security Post Orders - Complex 34, Blockhouse Stairwell
 14-44 Security Post Orders - Complex 34, 4th Level/"IU"
 14-45 Security Post Orders - Complex 34, Roving Guard, 4th- 11th Adjustable
 14-46 Security Post Orders - Complex 34, Roving Guard 27 foot level/Adjustable 3
 14-47 Security Post Orders - Complex 34, Hypergolic Area
 14-48 Statement/PAA Policeman - Allen
 14-49 Statement/PAA Policeman - Billbrey
 14-50 Statement/PAA Policeman - Brewer
 14-51 Statement/PAA Policeman - Darnell
 14-52 Statement/PAA Policeman - Dasse/Lane
 14-53 Statement/PAA Policeman - Hayes, O. B.
 14-54 Statement/PAA Policeman - Hayes, R. E.
 14-55 Statement/PAA Policeman - Hayes, R. E. (No. 2)
 14-56 Statement/PAA Policeman - Hennigan
 14-57 Statement/PAA Policeman - Nicholson
 14-58 Statement/PAA Policeman - Riddle
 14-59 Statement/PAA Policeman - Smith
 14-60 Statement/PAA Policeman - Thomas
 14-61 PAA Security Police Blotter, January 25, 1967
 14-62 PAA Security Police Blotter Log, January 27, 1967
 14-63 Security Section Summary
 14-64 Security Police General Post Instructions

14-65 Memorandum for Record - Disciplinary Actions, February 14, 1967
14-66 APOP G-100, November 4, 1966
14-67 NAA Implementing Instruction 4-4, July 13, 1966
14-68 NAA FRT letter (Moore), December 22, 1966
14-69 NAA FRT letter (Haight), December 22, 1966
14-70 NASA Headquarters Apollo Mission Failure Contingency Plan
14-71 KSC Management Instruction 1610.3 "Personnel Circulation Control and Identification",
November 10, 1966
14-72 Summary of Interview - Turner
14-73 Statement - Turner



**REPORT OF PANEL 15
BOARD ADMINISTRATIVE PROCEDURES
APPENDIX D-15
TO
FINAL REPORT OF
APOLLO 204 REVIEW BOARD**

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BOARD ADMINISTRATIVE PROCEDURES

A. TASK ASSIGNMENT

The Apollo 204 Review Board established the Board Administrative Procedures Panel, Panel 15. The task assigned for accomplishment by Panel 15 was prescribed as follows:

This group shall establish and document administrative procedures for the Board to use. This includes activity such as procedures for the control of spacecraft work, logging and filing of exhibits, maintenance of log of Board activities, scheduling of meetings, preparation of agenda for Board meetings, arrangements for secretarial services, reproduction of material, etc.

B. PANEL ORGANIZATION

1. MEMBERSHIP

The assigned task was accomplished by the following members of the Board Administrative Procedures Panel:

- Mr. A. G. Griffin, Jr., Chairman, Kennedy Space Center (KSC), NASA
- Mr. G. A. Huffines, Manned Spacecraft Center (MSC), NASA
- Mr. W. D. Moody, Kennedy Space Center (KSC), NASA
- Mr. P. C. Reed, North American Aviation, Inc. (NAA), Florida Office

2. COGNIZANT BOARD MEMBER:

Mr. E. Barton Geer, Langley Research Center (LaRC), Board Member, was assigned to monitor the Board Administrative Procedures Panel.

C. PROCEEDINGS

1. APPROACH

To accomplish the basic task of providing Board Administrative Procedures the following approach was developed:

- a. IDENTIFICATION: Specific areas requiring rigid controls, definitive methods, or policy guidelines to be controlled by the Review Board were identified.
- b. ASSIGNMENT: The responsibility for each procedure was assigned to a member of the Panel who assembled the pertinent information, prepared a draft procedure, coordinated with affected elements, and provided a finished procedure ready for implementation.
- c. SUBMISSION: The finished procedure was submitted through the cognizant Board Member to the Board Chairman for his signature.
- d. COORDINATION: Publication and distribution were accomplished through the Administrative and Secretarial Support Office.
- e. REVISION: Existing procedures were revised as required through the same steps as outlined above.

2. SUMMARY OF ACTIVITY

Panel 15 performed the task of providing Board administrative procedures and subsequent revisions as required. In addition, several other tasks were assigned which were performed by the Panel over and above the work statement. Periodic reports of progress were made to the Review Board through the Panel Coordination Committee and the cognizant Board member. Panel activities are discussed in the following paragraphs.

- a. Twenty-five (25) Board administrative procedures were issued to cover all phases of the Review Board's activities. They were developed and processed in accordance with the planned approach discussed in paragraph 1 above. Periodic lists of the procedure titles and the current revision status were issued and distributed. Board administrative procedures are contained in Enclosure 15-1.
- b. The Administrative and Secretarial Support Office was established by Panel 15 in accordance

with Administrative Procedure 4. This support was provided on a two-shift, 7-day per week basis, unless otherwise required, with some third shift support. The support included secretarial services, arrangements for office space, furniture, office supplies, reproduction and graphics, mail service, and messenger service.

c. The Photographic Data Control Center was established by Panel 15. Included were the development of a grid system to correlate photographs with spacecraft area, the handling and distribution of photographs, and the maintenance of a film library. The latter two areas were covered by Administrative Procedure 8. The negative and a print of all photographs are included in the Board's General File. The total grid plan uses the North American Aviation top assembly drawing V14-000003 as a spacecraft base for developing the grid system. A set of photograph books are provided for each major grid area of the spacecraft Command Module and the Service Module. The appropriate individual spacecraft area grid plan is provided in the front section of each photograph book. Following is a breakdown of the major spacecraft areas which have been gridded and book sets provided.

- (1) For the Command Module interior:
 - (a) Left Hand Equipment Bay
 - (b) Lower Equipment Bay
 - (c) Right Hand Equipment Bay
 - (d) Couches
 - (e) Aft Bulkhead (Floor)
 - (f) Upper Bulkhead (At head of couches)
 - (g) Main Display Console
- (2) For the Command Module exterior:
 - (a) Aft Girth Ring Area (Frames 1 through 24)
 - (b) Top Deck
- (3) For the Service Module interior:
Sectors 1 through 4
- (4) For the Service Module exterior:
 - (a) Top Deck
 - (b) Reaction Control System Quad Panels
 - (c) Aft Area (Service Propulsion System Engine)

(5) It was the policy that when any particular functional unit was removed from the spacecraft for further study a separate photograph book was established on that particular unit if warranted by the number of additional photographs. Following is a list of removed units for which separate photograph books have been established.

- (a) Batteries
 - (b) Cobra Cables and Octopus Cable
 - (c) CO₂ Absorbers
 - (d) Inverters
 - (e) Environmental Control Unit
 - (f) Engines (Command Module) (Pitch, Roll, Yaw)
 - (g) Control Panels (Oxygen, Water)
 - (h) Controllers (Rotational and Translational)
 - (i) Floodlights
 - (j) Hatches
- (6) Additional books on special subjects are as follows:
 - (a) Lab Tests (Non-metallic Materials and Flammability)
 - (b) Special Tests (Suits-Static Discharge)
 - (c) Crew Mobility Test in Mockup 2
 - (d) Heat Shields Removals
 - (e) Spacecraft 012 Movement to Pyrotechnic Installation Building
 - (7) Other books available for reference include:
 - (a) Spacecraft 012 before fire
 - (b) Spacecraft 014 interior

(c) Mockups (No. 2 and Non-metallic Materials)

(d) Set of documentary photograph books

(8) A major part of the functional arrangement of the library reference and control system is based on the proper identification of each photograph. Each photograph is captioned on the reverse side and includes the negative number, date and time picture was made, any applicable Spacecraft Test Preparation Sheet Number, and a brief subject description. All photographs are identified as Apollo 204 Review Board Material.

(9) The two key parts of the captions are the negative number and subject description.

(a) The negative number allows all negatives and one set of prints to be filed numerically by the roll and frame number included as the last two parts of the three part negative number. All negative frame numbers are accounted for, including blank frames.

(b) The subject description allows one set of photographs to be inserted in the appropriate photograph books through use of the spacecraft area grid plan. Within any particular subject area of a photograph book the photos are arranged in order of date and time. This allows review of subject configuration at any time since January 27, 1967.

(10) Some photograph captions include the word "Stereo." This indicated that a stereo slide is available for review. All stereo slides are arranged numerically by negative roll number and frame number in identified storage trays.

(11) The original reel and any prints of required motion pictures are arranged in file by subject description. Most of the motion pictures were for documentary purposes.

(12) For control purposes a log book for the Review Board and each Panel was maintained to provide records of all photographs distributed from the library. Each log book includes the photograph negative number, the number of prints, the data and name of the person receiving the photographs for the Review Board or Panel.

d. Panel 15 processed letters, telegrams, and telephone messages offering assistance, recommendations, and comments relative to the Apollo 204 accident. All such correspondence was logged in a master log, and the author's name was placed in an alphabetical file. Material received was reviewed, and, where appropriate, copies were forwarded to other Panels and Board Members for such consideration as they might require. Replies were prepared for the signature of the Board Chairman to all correspondence which had not been previously acknowledged or which required an additional acknowledgement. The log and file of all correspondence processed are included in the Board's General File.

e. Support was provided to the Review Board by periodically issuing approved schedules of work being performed as a part of the Review Board investigation. Information was collected, coordinated, displayed, and, after approval, published for distribution.

f. The Audio Magnetic Tape Library was established by Panel 15 in accordance with Administrative Procedure 22. It provided control of ¼-inch voice transmission tape recordings relative to Spacecraft 012 during the Space Vehicle Plugs-Out Integrated Test January 27, 1967. A storage and playback capability in a centralized area was also established. At the conclusion of Board use, these tapes were filed with other reference data relative to the Apollo 204 investigation.

g. Numerous memoranda and telephone calls were provided by Panel 15 to clarify or interpret Review Board administrative matters where required.

D. FINDINGS AND DETERMINATIONS

Not applicable.

E. SUPPORTING DATA

Enclosure

15-1

Board Administrative Procedures

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**APOLLO 204 REVIEW BOARD
ADMINISTRATIVE PROCEDURES**

- No. 1A Access to the Review Board Meeting Room
- No. 2A Access to Complex 34
- No. 3B Access Control to Pyrotechnic Installation Building
- No. 4A Apollo 204 Review Board Secretariat & Administrative Support
- No. 5C Material testing in support of Apollo 204 Review
- No. 6 Establishment of the Advisory/Group to the Apollo 204 Review Board
- No. 7A Handling of Sensitive Material under the jurisdiction of the Apollo 204 Review Board
- No. 8 Photo Support Service for the Apollo 204 Review Board
- No. 9 Transcribing Apollo 204 Review Board Proceedings
- No. 10A Control of Data and Documents
- No. 11 Categorization and Control of AS 204 Material Required to Support the AS 204 Review Board
- No. 12 Access to Apollo 204 Review Board Office
- No. 13A Preparation of Apollo 204 Review Board Meeting Agenda
- No. 14 Access to Spacecraft 012
- No. 15 Official File for Apollo 204 Review Board
- No. 16 Coordination Policy for Interviewing Witnesses
- No. 17 Response to Offers of Assistance or Recommendation
- No. 18C Use and Control of Task Preparation Sheets (TPS)
- No. 19A Establishment of the Panel Coordination Committee
- No. 20A Establishment of Apollo 204 Review Board Panels
- No. 21 Access Control to Service Module Disassembly Area

- No. 22 Control of Audio Magnetic Tapes
- No. 23 Disposition and Storage of Physical Evidence
- No. 24 Environmental Control System
(ECS) Investigation
- No. 25 Continuation of Testing in
Support of Apollo 204 Review
after recess of Board

/S/ A. G. Griffin, Jr.
Chairman, Task Panel No. 15

APOLLO 204 REVIEW BOARD
FEBRUARY 4, 1967

Administrative Procedure Number 1, Revision A

TITLE: Access to the Review Board Meeting Room

SCOPE: This procedure covers access to the Mission Briefing Room, MSO Building, KSC, which is herein designated the Apollo 204 Review Board Meeting Room for the period of time that the Board shall require its use.

POLICY: 1. Access to the Review Board Meeting Room shall be limited to the following personnel:

- a. Board members (see attached list).
- b. Advisory Group members (per access list).
- c. Designated key personnel (per access list).
- d. Security, communications, and administrative personnel.
- e. Other personnel summoned or approved by designated individuals (designating officials noted by asterisk on access list).

2. Access will be controlled on a full time basis (24 hours per day) by a security monitor.

3. A log of all personnel not on the access list that are permitted entry will be maintained by the security monitor.

PROCEDURES: 1. Personnel will enter and leave the Meeting Room via the main door on the north-south hallway just east of the cafeteria.

2. Personnel will clear through the security monitor prior to entering the inner Meeting Room door.

a. Personnel on the access list will be issued an Apollo 204 Review Board badge with green stripes and may enter and leave the Meeting Room as required. Acquired visitors will be issued a temporary badge with yellow stripes and will be logged in and out at the security desk.

b. Personnel providing security, communications, and administrative support will be issued a temporary Apollo 204 Review Board badge with yellow stripes and will be logged in and out at the security desk.

3. The access list will be changed only by Mr. E. B. Geer or his designated representatives.

/S/ Dr. Floyd Thompson, Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
FEBRUARY 2, 1967

Administrative Procedure Number 2, Revision A

TITLE: Access to Complex 34

SCOPE: This procedure covers access to certain Complex 34 areas for the period of time required by the Apollo 204 Review Board.

POLICY: Access to the Service Structure, Umbilical Tower, AGCS Room, and pad areas adjacent to the structure will be controlled by special security procedures.

PROCEDURES AND RESPONSIBILITIES:

1. The service structure, umbilical tower, AGCS room and pad areas adjacent to the structure will be subject to a special security control as delineated in the paragraphs below. Access to these areas will be subject to the approval of the test supervisor who, through NASA Security, will provide instructions to the security guards concerning logging procedures and escort requirements. Entry into areas other than the spacecraft levels of the service structure will be provided to those NASA and contractor personnel who have a need justified through channels to the test supervisor.

Access to service structure levels A-5, A-6, A-7, and A-8 will be authorized only by a Board Member, a Panel Chairman, R. A. Petrone, P. C. Donnelly, or G. F. Page. Any work on or photographs of the spacecraft must be authorized by a Board Member or a Panel Chairman.

1. Responsibilities of Board Members and Panel Chairmen: Authorize, in writing, access to the spacecraft areas of the service structure for purpose of photographing the spacecraft, or performing any work on the spacecraft.

a. Authorize access to the spacecraft areas of the service structure for the purpose of photography or work only after reviewing written authorization signed by a Board Member.

b. Authorize access to the spacecraft areas of the service structure for normal maintenance or safety functions except for work of this nature on the spacecraft or its GSE.

c. Authorize access to the other portions of the complex under special security controls for work of an essential nature.

d. Provide the necessary instructions to the security guards so that all personnel admitted are properly logged.

e. Maintains a detailed log of all complex activities and personnel movements within the areas under special security control.

f. Briefs personnel who have a need and authorization to enter the restricted areas as to hazards, restrictions and personal conduct.

4. Responsibilities of NAA Pad Leader:

Maintains a control position on platform A - 8 of the service structure for the purpose of coordination of all activities on platforms A - 5, A - 6, A - 7, and A - 8 of the service structure. Also, he will maintain a log of these activities. He is advised by the Test Supervisor as to the mission of all visitors to these platforms.

5. Responsibilities of NASA Security and PAA Security:

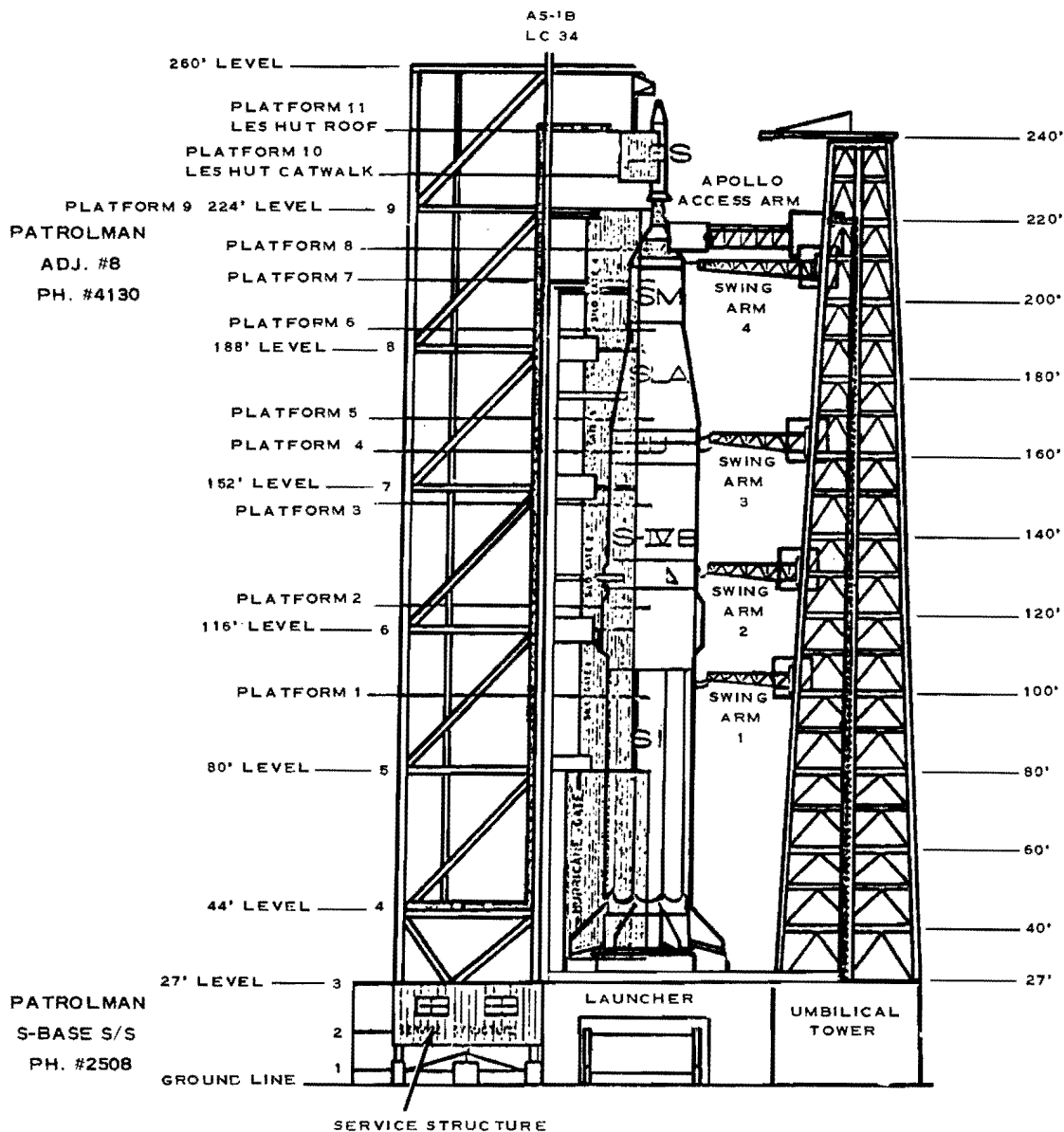
a. NASA Security is provide a Security Specialist to serve as an escort for photographers and other visitors to serve as required. Another security specialist is provided to coordinate overall security matters.

b. PAA will furnish seven (7) patrolmen to be stationed as follows:

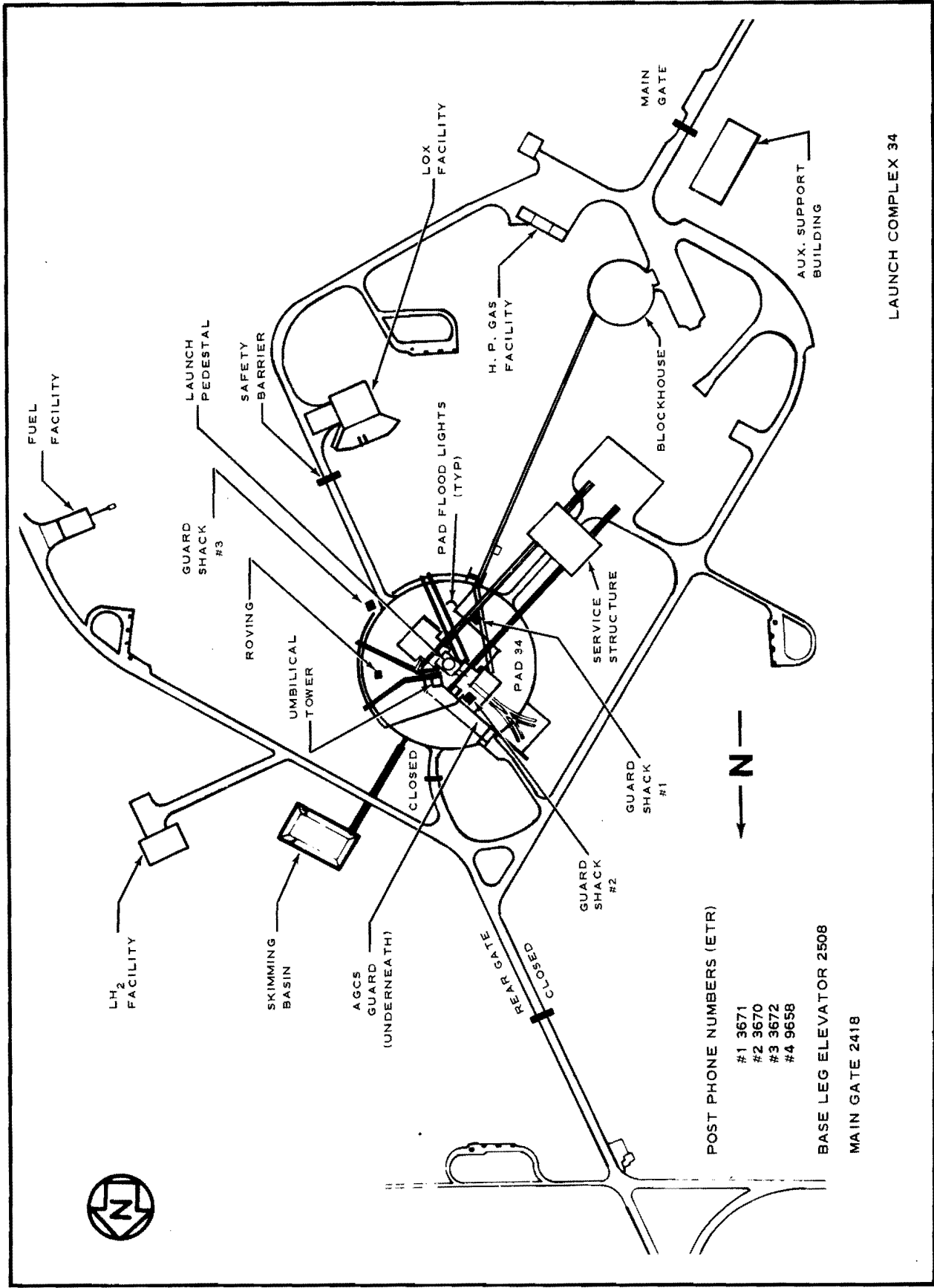
Post 1	S. E. Barricade
Post 2	West Barricade
Post 3	East Barricade
Post 4	AGCS Room
Pad Roving Patrol	
S. E. Base Leg	
Platform A - 8	

PAA will also furnish one patrol supervisor to inspect all posts and coordinate required changes to procedures.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board



ELEVATORS LOCKED OUT EXCEPT #3-4 LOCATED S-LEG S/S



LAUNCH COMPLEX 34

POST PHONE NUMBERS (ETR)
 #1 3671
 #2 3670
 #3 3672
 #4 9658

BASE LEG ELEVATOR 2508
 MAIN GATE 2418

APOLLO 204 REVIEW BOARD
FEBRUARY 6, 1967

Administrative Procedure No. 3, Revision A

TITLE: Access Control to Pyrotechnic Installation Building

SCOPE: This procedure covers access control to the bonded area and Room 106 of the Pyrotechnic Installation Building, herein after abbreviated PIB, for spacecraft work during the period of time required by the Apollo 204 Review Board.

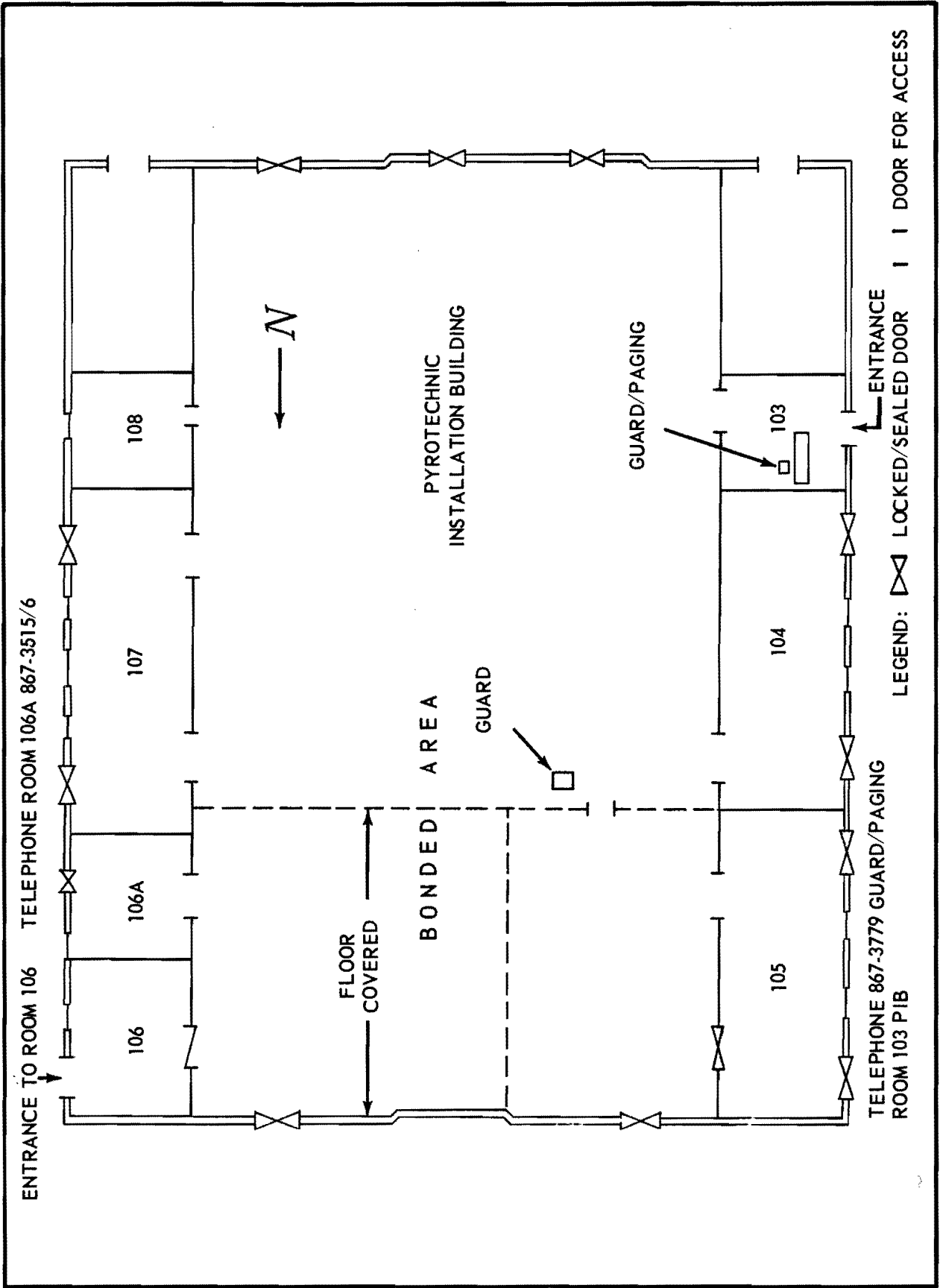
- POLICY:**
1. Access to the PIB bonded area shall be limited to the following personnel:
 - a. Members of Task Panel No. 4, Disassembly Panel (per access list).
 - b. Board Members and designated key personnel (per access list).
 - c. Other personnel requested and approved by designated individuals (designating officials noted by asterisk on access list).
 2. Access to the PIB bonded area will be controlled on a full time basis (24 hours per day) by a security monitor.
 3. A log of all personnel not on the access list that are permitted entry into the PIB bonded area will be maintained by the security monitor.
 4. Access to PIB Room No. 106 shall be limited to the following personnel:
 - a. Dr. G. Kelly
 - b. Other personnel requested and approved by Dr. G. Kelly.
 5. Access to PIB Room No. 106 will be controlled at all times by Dr. G. Kelly who is sole custodian of the key. Full time security monitor is provided.

- PROCEDURES:**
1. Personnel will clear through the security monitor prior to entering the PIB bonded area.
 - a. Personnel on the access list will be issued a serialized PIB badge with blue stripes and may enter and leave the PIB bonded area as required.
 - b. Other personnel requested and approved by the asterisked individuals on the list will be issued a temporary serialized PIB badge with black stripes and will be logged in and out by the security monitor. Such personnel will be escorted except for Government and North American Aviation personnel.
 2. Personnel will enter and leave the PIB bonded area via the outside door of room 103 (see attached sketch). All other doors to the bonded area will be maintained in a locked condition except as required for equipment handling covered in paragraph 3.
 3. Equipment will be moved in and out of the PIB under the control of personnel on the list via the equipment door and located inside the PIB bonded area.

4. Personnel will not be permitted to enter PIB Room No. 106 except in the presence of and with the express permission of Dr. G. Kelly.
5. Changes to the attached access list can be made only by Mr. E. B. Geer or his designated representative.

/S/ Dr. Floyd L Thompson
Chairman
Apollo 204 Review Board

Attachments: Sketch of PIB



APOLLO 204 REVIEW BOARD
MARCH 8, 1967

Administrative Procedure No. 4, Revision A.

TITLE: Apollo 204 Review Board Secretarial and Administrative Support

SCOPE: This procedure covers the arrangements for providing secretarial and administrative support for the Apollo 204 Review Board and task panels.

POLICY: Secretarial support will be provided on a two-shift, sixteen hour per day basis (0800 to midnight) near the Apollo 204 Review Board Meeting Room. (This support will be decreased to a one shift basis (0800 to 1630) when the workload is consistent with this period.)

- PROCEDURES:**
1. Apollo 204 Review Board Members and members of the Board Advisory Group will request secretarial and administrative support at Room No. 1805, MSO Building, telephone 867-5628/5611.
 2. Requests will be made to Mr. Dave Allen, the Administrative Officer in control of administrative and secretarial support, and in his absence, his designated representative. The requests will consist of notes, drafts, special instructions, tapes, letters and reports. Stenographic and dictograph capability will also be provided.
 3. The administrative officer will provide an estimate regarding completion time and will make whatever reasonable adjustments are necessary to meet deadlines.
 4. The administrative officer will notify the requester upon completion of the work.
 5. Other services that will be made available include arrangements for office space, furniture, office supplies, telephones, reproduction, graphic, mail and messenger services.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
MARCH 3, 1967

Administrative Procedure No. 5, Revision C

TITLE: Testing in Support of Apollo 204 Review

SCOPE: This procedure is applicable to all elements of the AS-204 Review Board which require testing and/or analysis of sub-systems, components, and sample materials removed from Spacecraft 012 in support of the AS-204 investigation. This procedure applies to Apollo 204 material and components leaving the KSC area and testing which is required on-site. This procedure applies to Category A and B material as defined in Administrative Procedure No. 11.

POLICY:

1. Task panel chairmen are responsible for initiating requests for testing required in their areas. The requests will be submitted in accordance with procedures as outlined in the procedure section below.
2. All proposed Spacecraft 012 hardware testing will be approved by the Apollo 204 Board Chairman. The Apollo 204 Review Board Chairman will decide on a case by case basis if a S/C 012 hardware test is to be performed at other sites such as a vendor plant, on-site at KSC, or both.
3. Wherever possible, two independent agencies will be required to perform analysis on sample materials. Whenever the quantity of material is insufficient to allow two tests, a single test may be conducted at KSC provided the test is witnessed by a representative of an independent agency. Examples of independent agencies available are:
 - a. U. S. Bureau of Mines
 - b. Air Force Materials Laboratory,
Wright-Patterson Air Force Base
 - c. NASA facilities other than Kennedy Space Center
4. Examples of sample materials which may require independent testing and/or analysis are protective equipment, fuel, lubricants, metals, non-metals, electrical components, fabrics, and gases.

PROCEDURE: Apollo 204 material procedure is shown in Attachment 1

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

TESTING IN SUPPORT OF APOLLO 204 REVIEW

ATTACHMENT 1

MARCH 2, 1967

- PROCEDURE:
1. This procedure establishes the S/C 012 Equipment Screening Committee and delineates the Committee's authority. This procedure also establishes the system to be utilized in acquiring Board approval for the testing and analysis of all S/C 012 Category A&B equipment for both off-site and KSC testing.
 2. The Screening Committee shall consist of the following personnel:

T. Sasseen	Chairman (KSC)
D. Mayhew	(MSC)
D. Levine	(NAA)
 3. The committee is responsible for reviewing equipment removed from S/C 012 in the sub-system areas as listed in Appendix A and classifying such equipment as category A or B as defined in AS 204 Administrative Procedure No. 11. For the purpose of this procedure, equipment which has evidence of external damage and could be the cause of the fire is specified as category A. Equipment which has evidence of minor fire damage and obviously does not appear to be the fire origin is specified as category B.
 4. The result of this screening activity will be the preparation of an equipment screening authorization form (appendix B) and a Material Release Record (MRR) by the appropriate subsystems engineer (as listed in appendix A) for committee approval. The MRR's will be submitted to the Review Board for ratification on a periodic basis.
 5. That equipment classified as Category B shall be sent to bonded storage after external photographs have been taken.
 6. That equipment classified as Category A shall be subjected to the following actions:
 - a. colored photos of burned or damaged area
 - b. X-ray penetration of damaged area
 - c. removal of external appendage if it will permit better visual examination
 - d. recommend return of equipment to manufacturer by submittal of an Apollo Spacecraft Hardware Utilization Request (ASHUR)
 7. It should be emphasized that all hardware that has identified data glitches from the OCP 0021 shall be fully investigated. In addition, items of equipment that had pertinent open discrepant items shall also require full investigation.
 8. All hardware will remain in the bonded storage at the Pyrotechnic Installation Bldg. (PIB) unless specific instructions have been provided by an approved Apollo Spacecraft Hardware Utilization Request (ASHUR) authorizing off site testing for hardware being returned to the prime contractor, subcontractor, vendor, or other test agency. Testing accomplished on site (KSC) will continue to utilize a TPS in accordance with Administrative Procedure Number 18.

9. An ASHUR may be initiated by an Apollo 204 Panel Member but must have concurrency by the cognizant NAA & NASA subsystems engineer and must be approved by the Chairman of Panel 18 or his designated representative. Final approval by the Apollo 204 Review Board is required.

10. The ASHUR shall specify test requirements necessary to thoroughly analyze the system or component under investigation. The preparation of the test procedure shall be the responsibility of the prime contractor, subcontractor, or vendor in conjunction with the NASA and NAA subsystem engineer. All test procedures shall require an acceptance test, as was originally performed, to be conducted. Government and NAA inspectors are required to witness all testing of category A equipment at the vendor facility with an agent of the Board who is designated to supervise and witness all off-site testing. If the acceptance testing results show no change from previously recorded data, all testing will be discontinued, the data package updated, the results documented on the ASHUR answer sheet and the hardware, with all paperwork, returned to bonded storage at KSC.

11. In the event an anomaly is discovered, a failure analysis shall be conducted to determine exact cause of anomaly and positively explain that it is a result of fire rather than cause. In accomplishing this:

- a. Justify, if possible, continuation of the acceptance testing;
- b. If the acceptance testing cannot be continued, satisfy requirement to (1) stop and test and (2) return, with the properly updated documentation, to bonded storage at KSC.

If, during the process of investigation, the test procedure requires modification, the NASA and NAA subsystems engineers jointly have the authority to change this procedure provided the test requirements, as specified on the ASHUR, are still maintained. Any test or procedural change which alters the ASHUR test requirements must be submitted, by a revision to the original ASHUR, to the Apollo 204 Board for approval.

12. After completion of requested tests, test reports, as follows, are to be prepared by the test agency and signed by that agency, the cognizant NAA subsystem engineer and the NASA monitor:

- a. One report is to cover test and inspection findings associated with the origin and propagation of the fire, the physical and functional condition of the equipment, and any unusual condition which may relate to one of the anomalies, discovered on S/C 012. Twenty (20) copies plus the original of this report are to be transmitted to the Apollo 204 Review Board by the NASA monitor within ten (10) days after the item is received by the supplier, subcontractor or independent test agency.
- b. The second report is to cover other findings such as design, quality and fire survivability information. Two copies of this report are to be sent to each cognizant NASA and NAA Subsystem Engineer and three copies are to be sent to the Panel 9 Chairman. The original will be sent to the Panel 17 Chairman.

13. Responsibilities:

a. Originator

- (1) Based on an approved MRR, complete ASHUR form in accordance with Appendix C.
- (2) Obtain signatures of the appropriate NASA and NAA subsystems engineers.
- (3) Forward to Panel 18 for approval.

b. Panel 18

- (1) Approve or disapprove each ASHUR
- (2) Submit ASHUR to the Apollo 204 Review Board via the Panel Coordinating Committee for approval.
- (3) Maintain the Master file, status, and assure implementation of the requirements as specified on the ASHUR.
- (4) Forward Board approved ASHUR to the Action Control Center for transmittal to the prime contractor, subcontractor, or vendor.
- (5) Receive appropriate test data, reports, and related documentation and make available to the Apollo 204 Review Board as required.

c. Action Control Center

- (1) Assure that the business and contractual interfaces between the government, prime contractor, subcontractor, and vendor are compatible.
- (2) Assume responsibility for shipment logistics.
- (3) Supervise the packaging.
- (4) Assure, in conjunction with the Apollo 204 Board and Panel 18, that the couriers accompany the shipment in accordance with Appendix G.
- (5) Assure that an ASHUR accompanies the hardware.
- (6) Assure that a DD 1149 is executed.
- (7) Assure that test data, reports (Appendix D) and related documentation is submitted to Panel 18 in a timely manner.
- (8) A log will be maintained for documenting each item shipped and for providing evidence that the shipped component was received by the supplier.

d. Couriers

(See Appendix G)

e. Subsystems Engineers

- (1) Approve/disapprove all ASHUR's under his cognizance.
- (2) Reviews his hardware and screen into Category A or B.
- (3) Proposes and submits MRR to Screening Committee for approval.
- (4) Maintain status of all activities concerning hardware authorized for testing.

14. Special attention to careful handling of all S/C 012 parts will be provided in the following manner:

- a. Parts will not be moved from one area to another within KSC without being accompanied by a NAA or NASA courier.
- b. A parts tag will be attached to each component and the reverse side of the tag will be stamped, "Apollo 204 Review Board Material." Each component will be "D" stamped.
- c. NAA/NASA Quality personnel will witness all packaging operations to insure good packaging and handling practices. Where special attention to packaging is required, NAA Engineering will be requested to provide special instructions.
- d. Prior to shipping, each package or container will be sealed and stamped by both NAA and NASA Inspection with words "NOT TO BE OPENED WITHOUT CONTRACTOR AND GOVERNMENT AGENCY INSPECTION WITNESS." All material shall also be accompanied by a representative (witness) appointed by the Board unless otherwise specified by the Board. A NAA or ACED or NASA Quality Control courier may be assigned to accompany each shipment to its destination.
- e. The Local Government Inspection Agency shall provide continuous (24 hour) inspection coverage while the hardware is being tested and/or analyzed.
- f. Prior to shipping, NAA and NASA will notify the appropriate contractor and government agency Quality Assurance representative at the destination of anticipated arrival of the parts.
- g. Each shipment will contain a copy of the updated acceptance Data Package, ASHUR, and DD-1149 (shipping document). The courier accompanying the parts will hand-carry a copy of the DD-1149 for signature by the delegated contractor's representative upon receipt of the component.
- h. The properly negotiated DD-1149 master will be returned to the MSC Action center by the courier.
- i. Whenever possible, NASA aircraft or commercial aircraft will be chartered or reserved for shipment of these items to assure expeditious and safe handling.

**SUBSYSTEM ENGINEERS
APPENDIX A**

	MSC	KSC	NAA
Steering	D. Mayhew	T. Sasseen	D. Levine
Communication	L. Luse	T. Broughton	G. Covington, III
Instrumentation	F. Rotrammel	W. Glusing	G. Covington, III
Guidance & Navigation	R. Gardner	J. Tadich	ACED
Stabilization & Control	R. Burt	J. Stilley	C. Conrad
Environmental Control	F. Samonski	R. Hunnings	M. Stelzreide
Electrical Power System	R. Munford	M. Guidry	L. Updegraff
Controls & Displays	C. Creech	NONE	C. Fischer
	D. Grimm		
Sequential	G. Johnson	M. Guidry	R. Hartley
Reaction Control System	R. Taueber	R. Butterworth	J. Montgomery
Structures & Mechanical (Incl. LES)	P. Glynn	H. Shoaf	P. Hanifin
Secondary Propulsion System	N. Townsend	R. Butterworth	D. Levine
Earth Landing	R. West	H. Shoaf	R. Hartley
Crew Equipment	F. McAllister	J. Thomas	J. Montgomery
Experiments	C. Vaughn	J. Thomas	G. Covington, III
Pyrotechnics	W. Simmons	E. Timmons	R. Hartley
SLA/Service Module (Panel 21)	W. Petynia	D. Carothers	B. Haight

EQUIPMENT SCREENING AUTHORIZATION

SUBSYSTEM SCS
ITEM HAND CONTROLLER
P/N XXXXXXXXXX
S/N XXXX

JUSTIFICATION FOR CATEGORY B CLASSIFICATION

Reference TPS's XXX-XX-XX, XXX-XX-XX

_____ NASA KSC SUBSYSTEM	_____ NASA MSC SUBSYSTEM	_____ NAA SUBSYSTEM
_____ T. SASSEEN	_____ D. MAYHEW	_____ D. LEVINE
_____ FIRE PANEL	_____ MAB	

APPENDIX C

INSTRUCTIONS FOR PREPARATION OF ASHUR

A. ASHUR (MSC FORM 1148)

Numbers correspond to the numbers shown on each block.

1. Spacecraft Number. Insert the spacecraft number to which the request applies (i.e., CSM 012 or 014).
2. System(s) Affected. Indicate the spacecraft system(s) affected.
3. ASHUR Number. Identification number of the ASHUR will be filled in by Panel 18. The ASHUR shall be identified by a series of numbers which reflect spacecraft number. Those ASHUR's initiated on Spacecraft 012, Mission 204 shall be numbered consecutively from 012500 to 012999 or Spacecraft 014, i.e., 014500 to 014999.
4. Purpose. Specify the purpose of the ASHUR, i.e., one of the following:
 - a. To investigate a suspect anomaly or malfunction.
 - b. To insure that function or operation of the system or component was adequate for the mission.
 - c. To initiate a test and/or analysis of a system or component in support of Apollo 204 Review Board investigation.
 - d. Other - specify.
5. Justification. This space will be utilized for the concurrency, by signature, of the NASA Subsystem Engineer, the NAA Subsystem Engineer, and Panel #18.
6. Description. The initiator of the ASHUR shall describe the test requirements, inspection, analysis, and disposition in detail. Sufficient detail should be indicated to convey exactly what is required. The description shall include, but not be limited to, the following, where applicable:
 - a. Specify conditions.
 - b. Instrumentation requirements, including both spacecraft and GSE.
 - c. Environmental requirements.
 - d. Type or types of data required, i.e., magnetic tapes, strip charts, etc.
 - e. Input parameters to be varied and to what degree.
 - f. Parameters to be measured.
 - g. Specify time reference if applicable.
 - h. Events to be simulated.
 - i. Special test procedures or instructions (or supplemental instructions as required).

7. To Be Accomplished By. Indicate which contractor or special facility is to accomplish this test. Indicate where the test is to be accomplished or the disposition location. If a failure analysis is to be conducted, indicate where this is to be accomplished. If it is a location other than those listed specifically, check "Other" block and indicate by name on line provided to the right. It is recognized that some facilities are better equipped for disassembly and/or failure analysis than others. Each case must be assessed as it occurs as to where the analysis will be performed and the recommendations must be based on a thorough assessment of the best possible combination of disassembly and analysis capabilities. The spacecraft contractor and the vendor of the failed component should be consulted prior to determining the locations for the various phases of failure analysis. Regardless of where each phase of the failure analysis is performed, it is required that NASA, contractor, and the vendor be represented.

8. Name of the individual assigned as the point of contact at the facility where the work is conducted. J. C. Campbell, PIB, ext. 3515, 3779; will be MSC/KSC contact.

9. Disposition of hardware after requested action has been completed.

10. Requested By. Insert signature of individual preparing the ASHUR and panel number.

11. Not applicable for purposes of this procedure.

12. or 13. Signature of KSC/MSK action control authority is required.

14. Type of Action. Check the block which describes the type of action requested. There will be only one block checked for each ASHUR initiated. The testing block should have "Project X" typed by it.

15. Sheet ___ of ___. Indicate the sheet number and total number of sheets.

B. ASHUR Continuation Sheet (MSC Form 1148A)

Numbers correspond to numbers shown on sample continuation sheet.

1. Spacecraft Number - same as paragraph A.1.

2. System(s) Affected - same as paragraph A.2.

3. ASHUR Number - same as paragraph A.3.

4. NAA TPS Number - Appropriate NAA TPS number(s) assigned to hardware designated, if appropriate.

5. Not applicable.

6. Photograph Number - Applicable NASA photograph numbers, if known.

7. Description - Continuation of information detailed in the description of the ASHUR, MSC Form 1148, if required (see paragraph A.6.). In addition, the ASHUR continuation sheet shall be used to document the summary results of the tests, inspection, or analysis. These results shall be documented as soon as they are known and shall constitute a summary of the results. If the results are final, a statement shall be made to that effect, i.e., "This ASHUR is considered closed." Care should be taken to assure this has been done prior to being submitted to Action Control. For example, if the intent of the ASHUR is to disposition hardware, the continuation sheet should reflect the action taken with reference to applicable shipping documents. Action Control will be responsible for assuring that all ASHUR's are answered and closed out, interfacing with the Integration Panel 18 and the Disassembly Panel 4, and the Board, as necessary.

8. Signature of ASHUR Contact - Signature of person whose name appears in Block 8 on ASHUR, MSC Form 114B. This space will be used to document the contractor or test administrator signature. In that case, it will be signed and dated by the contact at the facility where the investigation was conducted. This signature is not a validation of the test results, but is an indication of the source of the information and is accurate documentation of the information obtained via the ASHUR system.

9. Sheet ___ of ___. Indicate the sheet number and the number of sheets.

APOLLO SPACECRAFT HARDWARE UTILIZATION REQUEST					
SPACECRAFT NUMBER (1)	SYSTEM(S) AFFECTED (2)			ASDR# NUMBER (3)	
PURPOSE (4)					
JUSTIFICATION (5)					
DESCRIPTION (6)					
TO BE ACCOMPLISHED BY: (7) <input type="checkbox"/> NAA <input type="checkbox"/> KSC MAB <input type="checkbox"/> VENDOR <input type="checkbox"/> GAEC <input type="checkbox"/> MSC <input type="checkbox"/> OTHER				CONTACT FOR STATUS (8)	
LOCATION OF WORK ACTIVITY:				FINAL DISPOSITION OF HARDWARE (9)	
REQUESTED BY (10)		ORGANIZATION	DATE	TYPE OF ACTION <input type="checkbox"/> TEST REQUEST Project X <input type="checkbox"/> REUSE REQUEST (14) <input type="checkbox"/> DISPOSITION REQUEST	
CHIEF ANALYST (11) N/A		DATE			
ASDR# APPROVED (12)		DATE	ASDR# DISAPPROVED (13)		DATE
ORGT (15)					OF

MSC FORM 1148 (REV JAN 67)

(Previous editions are obsolete)

APOLLO SPACECRAFT HARDWARE UTILIZATION REQUEST (Cont'd)		
SPACECRAFT NUMBER (1)	SYSTEMS AFFECTED (2)	ASBMS NUMBER (3)
REQ TPS NUMBER (4)	REQ STR NUMBER (5) N/A	PHOTOGRAPH NUMBER (6)
(7)		
SIGNATURE OF ASBMS CONTACT (8)	DATE	SHEET (9) OF

MSC FORM 1148A (OCT 66)

APOLLO SPACECRAFT HARDWARE UTILIZATION REQUEST				
SPACECRAFT NUMBER 012	SYSTEM(S) AFFECTED SCF Pitch ECA		ARMOR NUMBER 012502	
PURPOSE To investigate for possible anomaly				
JUSTIFICATION NASA Systems Engr. _____ Panel #18 NAA Systems Engr. _____				
DESCRIPTION 1. Remove the SCF Pitch ECA - from the PIB and hand carry to Minneapolis Honeywell, for analysis. 2. Upon arrival, visually inspect, externally, and photograph all four sides, as well as top and bottom. 3. Conduct a low level continuity check. 4. Perform an electrical/mechanical functional check, utilizing the BME, as per the PIA procedure. 5. Remove the covers and visually inspect internally, taking photographs as appropriate. 6. Any area of difficulty disclosed during functional check shall require a failure analysis to be performed. Controlled disassembly shall be exercised and such x-rays as are deemed necessary shall be taken. 7. Upon completion of all tests and failure analysis, the hardware shall be reassembled and returned to bonded storage, PIB, KSC.				
TO BE ACCOMPLISHED BY: <input type="checkbox"/> NAA <input type="checkbox"/> KSC MAB <input checked="" type="checkbox"/> VENDOR <input type="checkbox"/> GAEC <input type="checkbox"/> MSC <input type="checkbox"/> OTHER			CONTACT FOR STATUS J. CAMPBELL, PIB EXT. 3515	
LOCATION OF WORK ACTIVITY: MINNEAPOLIS HONEYWELL, MINNEAPOLIS, MINNESOTA			FINAL DISPOSITION OF HARDWARE Return to bonded storage, PIB, KSC	
REQUESTED BY R. BURT	ORGANIZATION PANEL 18	DATE 3/1/67	TYPE OF ACTION <input checked="" type="checkbox"/> POINT TO POINT TEST REQUEST PROJECT X <input type="checkbox"/> REUSE REQUEST <input type="checkbox"/> DISPOSITION REQUEST	
CHIEF ANALYST N/A		DATE		
ARMOR APPROVED	DATE	ARMOR DISAPPROVED	DATE	SHEET OF

MSC FORM 1148 (REV JAN 67)

(Previous editions are obsolete)

CONTRACTOR REPORT FORMAT RECOMMENDED FOR
S/C 012 REVIEW

SUBJECT: Type of work, location, systems and job No.

RELATED DOCUMENTATION: Include known failure reports, discrepancy reports, deviations, etc., drawing numbers, pertinent specs, and technical information.

WITNESSES:

1.0 Foreword

1.1 Identify requestor, requestor organization, state general problem and when submitted.

1.2 State analysis or evaluation requested. Detail in steps if required.

1.3 Briefly cite known failure history and/or previous tests performed.

1.4 Other pertinent items.

2.0 Configuration Verification (Part Numbers, Drawing Numbers, Specification Numbers).

Investigation Procedures (Dealing with device itself)

Evaluation Procedures (Dealing with related materials)

Analytical Procedures (Dealing with chemical analysis)

Describe field examinations, samples taken, equipment employed, consultations with outside personnel and other activities. Each distinct action shall be defined in a separate paragraph.

3.0 Analytical Test and Results

Describe results and relations between the various analytical tests. Correlation between chemical/physical findings and problem being considered should be clarified.

4.0 Conclusions

Concise statements in a natural order based on investigative and analytical procedures. If conclusions are assumptive in nature, so state and give reasoning for assumptions. In all cases provide a specific conclusion.

5.0 Recommendations

Should be applicable, constructive in nature and workable. Applicability to other Apollo hardware should be identified.

Signatures:

Investigator: (Not above
first level
of Super-
vision For
Board Inter-
rogation when
necessary).

Concurrence: (Knowledgable
of All Steps
in Investiga-
tion).

Approval: _____

Witnesses: _____
(Government
Agency)

(Contractor)

NOTE: APPENDICES AND PHOTOS SHOULD BE REFERENCED IN TEXT AND RELATED TO NARRATIVE TEXT.

APPENDIX E



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
APOLLO 204 REVIEW BOARD

IN REPLY REFER TO

COURIER INSTRUCTIONS

The courier is appointed by the Apollo 204 Review Board to accompany the shipment of a specified piece of hardware to its predetermined destination as outlined in the Administrative Procedure 5 and revisions thereto.

The courier will report to the MSC Action Office at the PIB where he will be briefed by the MSC ASHUR Action Control, J. C. Campbell, PIB Room 106A, phone 867-3515 or 3779.

The courier will receive the package or container in the presence of the MSC Hardware Control Officer and the designated NASA Quality Control Representative.

The courier will sign for the package(s) and/or container(s) received on the DD 1149 and will receive an ASHUR, MSC Form 1148, approved by the MSC Hardware Control Officer.

The courier will maintain positive control of the package(s) and/or container(s) entrusted to him. Special precaution must be taken if unchartered commercial transportation is utilized.

The courier will notify MSC Action Center of his arrival by telephone AC 305, phone 867-7163, 3779, or 3515.

The courier will witness the opening of the package(s) and/or container(s) in the presence of the receiving agencies and the Government Agency Inspection (Quality Control) Representative.

The courier will insure that the DD 1149 master is properly negotiated and returned to the MSC Action Center, KSC, Room 2130.

The courier will deliver a copy of the updated Acceptance Data Package to the Government Agency Inspection (Quality Control) Representative.

The courier will notify the Government Agency Inspection (Quality Control) Representative at the destination to telephone the Action Center, KSC, MSOB, telephone 867-7163, to verify the final disposition stated on the ASHUR before compliance.

**APOLLO 204 REVIEW BOARD
FEBRUARY 3, 1967**

Administrative Procedure No. 6

TITLE: Establishment of the Advisory Group to the Apollo 204 Review Board

SCOPE: This procedure is an implementation of the Deputy Administrator's memorandum of February 3, 1967.

POLICY: 1. The Apollo 204 Review Board was established by the Deputy Administrator, NASA, on January 28, 1967, pursuant to NASA Management Instruction 8621.1. By memorandum dated February 3, 1967, the Deputy Administrator amplified and documented verbal instructions given to the Chairman of the Review Board as follows:

a. The Chairman shall establish such procedures for the organization and operation of the Board as he finds most effective. Such procedures shall be part of the Board's records.

b. Board members shall be appointed or removed by the Deputy Administrator after consultation with the Chairman as necessary for the Board's effective action.

c. The Chairman may establish procedures to assure the execution of the Chairman's responsibility in his absence.

d. The Chairman shall appoint or designate such representatives, consultants, experts, liaison officers, observers or other officials as required to support the activities of the Board. The Chairman shall define their duties and responsibilities as part of the Board's records.

e. The Chairman shall keep the Deputy Administrator advised periodically concerning the organization and operations of the Board and its associated officials.

f. The Chairman shall assure that the Counsel to the Board develops and maintains memoranda records covering possible areas of litigation.

2. Pursuant to paragraph 1.d., the Chairman has established an Advisory Group, the membership of which is set forth in Attachment A. The duties and responsibilities of the members are:

Representative - An individual representing a major element of NASA or other Government agency having programs and activities associated with the Apollo program who participates in general meetings of the Board.

Consultant - An individual who serves as an advisor to the Apollo 204 Review Board. It is the responsibility of the consultant to give his views or opinions on problems or questions presented by the Board or Panels. Consultants will, as appropriate, recommend to the Board or cognizant Panels, courses of investigative action to be undertaken in the field of their competence.

Liaison - An individual representing an activity having a recognized interest in the Apollo 204 Review who attends general meetings of the Board for the purpose of familiarizing himself with the current status of the Apollo 204 Review. Liaison personnel are empowered to coordinate with Panel Chairmen or Board Members, as appropriate, in areas of interest to acquire data that is of interest to the activity represented by the liaison individual.

Panel Chairman - An individual designated by the Board to serve as a manager to direct and coordinate the activities of the Panel to which appointed in accordance with the statement of work prescribed for the Panel by the Board. The Panel Chairman reports directly to the appropriate Board monitor. Panel Chairmen will report to the Board, when required, on the progress of work and obtain Board approval of work plans.

Observer - An individual who attends general meetings of the Board for the purpose of familiarizing himself with the current status of the Apollo 204 review, particularly in the area of his expertise and responsibility. Observers are empowered to enter restricted areas, upon approval, in order to be able to assist the Board or Panels; they shall also be prepared to submit to the Board, either orally or in writing, such reports and recommendations as the Board may require.

Secretariat - Provides administrative, secretarial, clerical and other supporting services to the Board and Advisory Groups.

3. The Board and Advisory Group will conduct business, as a body, in the following manner:

a. A general meeting is a meeting of the Board, Advisory Group and other persons requested to attend for the purpose of conducting the business of the Board, establishing the record, presentations of panels and subcommittees, and such other business as is necessary.

The Mission Briefing Room (MSO Building) is the place where the general meetings of the Board are held.

b. An Executive session of the Board is a meeting limited to Board members, Counsel, and to individuals requested by the Board to attend. These sessions are held for the purpose of determining policy, formulating courses of action, deliberation on matters restricted to Board members, decisions as to the findings of fact, determinations, recommendations and other essential matters to be included in the Final Report to the Administrator.

Executive sessions will normally be held in Room 1814, MSOB, and at such other locations as the Board may designate.

/S/ Dr. Floyd L. Thompson, Chairman
Apollo 204 Review Board

ADVISORY GROUP

Representatives

Gen. C. H. Bolender OMSF, represents Apollo Program Director
Mr. C. Mathews OMSF, Director, Saturn/Apollo Applications
Mr. R. A. Petrone Director, Launch Operations, KSC
Dr. J. Shea MSC, Manager, Apollo Spacecraft Program Office
Lt. Col. W. Baxter USAF, Chief, Range Safety Office, Air Force Eastern Test Range

Consultants

Dr. Frank A. Long Vice President for Research and Advanced Studies, Cornell University
Mr. J. Yardley Gemini Program Technical Director, McDonnell Company
Mr. G. W. Jeffs Chief Engineer, Apollo Program, North American Aviation, Inc.
Alternate:
Mr. R. L. Benner Assistant Chief Engineer, Apollo Program, North American Aviation, Inc.
Mr. Irving Pinkel Chief, Fluid Systems Components, Lewis Research Center
Mr. Thomas G. Horeff Program Manager, Propulsion Engineering and Safety Division, Aircraft
Development Service, Federal Aviation Agency
Dr. H. Carhart Chief, Fuels Branch, Chemistry Division, Naval Research Laboratory
Mr. John S. Leak Chief, Technical Services Section, Engineering Division, Bureau of Safety,
Civil Aeronautics Board

Liaison

Mr. Duncan Collins Special Advisor, Secretary of the Air Force, SL Program

Attachment A
 Apollo 204 Review Board
 Admin. Procedure No. 6
 February 3, 1967

Panel Chairmen

Panel No.	Panel Title	Chairman
1	S/C and GSE Configuration	J. Goree, MSC
2	Test Environments	W. Hoyler, MSC
3	Sequence of Events	D. Arabian, MSC
4	Disassembly Activities	S. Simpkinson, MSC
5	Origin and Propagation of Fire	F. Bailey, MSC
6	Historical Data	J. T. Adams, MSC
7	Test Procedures Review	D. Nichols, KSC
8	Materials Review	W. Bland, MSC
9	Design Reviews	R. Williams, MSC
10	Analysis of Fracture Areas	P. Glynn, MSC
11	Medical Analysis	G. Kelly, MSC
12	Witness Statements	N. Vaughn, MSC
13	Ground Emergency Provisions Review	G. Page, KSC
14	Security of Operations	C. Buckley, KSC
15	Board Administrative Procedures	E. Mathews, KSC
16	Special Tests	G. Stoops, MSC
17	Final Board Report	Lt. Col. K. H. Hinchman, USAF
18	Integration Analysis	A. Mardel, MSC
19	Safety of Investigation Operations	J. Atkins, KSC
20	In Flight Fire Emergency Provisions Review	Capt. J. Lovell, MSC
21	Service Module Disposition	C. A. Chauvin, KSC

Observers

All Astronauts, MSC

Maj. P. A. Butler, USAF

Dr. Kurt H. Debus, KSC

Mr. P. C. Donnelly, KSC

Lt. Col. W. Dugan, USAF

Mr. J. King, KSC

Mr. H. E. McCoy, KSC

Mr. R. E. Moser, KSC

Dr. George Mueller, OMSF

Mr. W. P. Murphy, KSC

Gen. S. C. Phillips, OMSF

Mr. G. M. Preston, KSC

Gen. J. G. Shinkle, KSC

Mr. A. F. Siefert, KSC

Mr. W. Williams, KSC

Secretariat

Ernest Swieda

Executive Secretary

APOLLO 204 REVIEW BOARD
FEBRUARY 13, 1967

Administrative Procedure Number 7, Revision A

SUBJECT: Handling of Sensitive and Non-Sensitive Information and Material Under the Jurisdiction of the Apollo 204 Review Board.

PURPOSE: Information and Material Sensitivity Controls for Apollo 204 Review Board.

POLICY: 1. All information, data, hardware, etc., related to the Review is considered sensitive until one of the following has made an analysis of the information or material and made a determination that it is not sensitive: Chairman of the Board, Board Members (within the areas for which the member is acting as monitor) and Panel Chairmen (in the areas in which they are cognizant).

2. Until analysis and contrary determination, unclassified sensitive material related to the Apollo 204 Review Board will be treated as if it were classified CONFIDENTIAL.

3. Apollo 204 Review Board material classified as SECRET or CONFIDENTIAL by the Apollo or Saturn Security Classification Guide must be first handled according to NASA Security Directives and then according to Board policies.

4. All Apollo 204 Review Board information, material, etc., whether classified or unclassified, sensitive or non-sensitive, will be released (a) only to persons authorized access for official Board purposes, or (b) following the Board's decision that the material is no longer needed for Board purposes, at which time the material will revert to its normal status.

DEFINITIONS: 1. Sensitive Material: Classified or unclassified information or material necessary to the Board, which reflects pertinent data concerning the Apollo 204 accident.

2. Persons Authorized Access to Board Information and Material.

a. Sensitive-Classified: Access will be granted to those appropriately cleared and essential Government and contractor personnel who have been authorized by the Review Board Procedures.

b. Non-Sensitive-Unclassified: As in a. above, except these personnel need not be cleared.

3. Secure Area: An area where sensitive, classified or unclassified, material is housed or stored in approved containers or is under continuous control by cognizant, cleared personnel will be categorized as a Secure Area.

PROCEDURE: 1. Storage

a. Sensitive - All unclassified or classified sensitive Board information or material will be stored in a "Secure Area."

b. Non-Sensitive: All unclassified, non-sensitive Board information or material may be stored in the manner normal for official Government material, or as established by other Board Procedures.

2. Access to and Removal of Sensitive Information

Material. Access to sensitive material and removal of sensitive material from a Secure Area will be in accordance with administrative procedures approved by the Chairman of the Board.

3. Regrading. Sensitive information or material will be regraded from sensitive to non-sensitive only by the authority of those persons indicated in paragraph I,

Policy. Sensitive information or material will be regraded to CONFIDENTIAL or SECRET only by the authority of the Chairman of the Board.

4. Marking of Information or Material

a. Non-Sensitive. All non-sensitive Board information or material will be unmarked, unless classified and marked, originally.

b. Sensitive.

(1) General - All sensitive Board information or material, when removed from a Secure Area, will be identified by use of the Apollo 204 Review Board Material Cover Sheet or stamp as follows:

APOLLO 204
REVIEW BOARD
MATERIAL

Note: The former cover sheet marked "For the Use of Apollo 204 Board Investigation Only" may be used until the supply is exhausted.

(2) Printed or Written Information - All material of this type related to Review Board activities which is susceptible to the secure fastening of a cover sheet need only be identified by the cover sheet in 3a above. Material not susceptible to secure cover sheet fastening should be plainly and conspicuously stamped once on each page.

(3) Photographs, Films, Microfilms.

(a) Negatives - The envelope will be marked.

(b) Slides and Transparencies - The margin will be stamped.

(c) Still Prints - If the quality of the prints will not be reduced, they will be stamped on the lower front of the print. Otherwise, they will be stamped on the back.

(d) Polaroid Prints - As in (c) above.

(e) Microfilm Mounted on IBM Cards - Stamped on front of card.

(f) Motion Picture Film - Reels and reel containers will be individually stamped. Take-up reels will be stamped, unless film is immediately transferred to the original reel following projection.

(4) Magnetic Tapes - The cabinets in which tapes are stored will have cover sheets affixed prominently on the exterior. As tapes are removed for use, the shipping container and the reel will be marked on the labels with the stamp.

(5) Hardware - Parts Tag (KSC Form 4-8 (7/65)) if attached to the hardware will be stamped appropriately on reserve side. Hardware without parts tag will be otherwise tagged and the tag stamped appropriately.

Note: Extreme care must be utilized in properly identifying and marking sensitive information or material lest it fall into the non-sensitive category by merely omitting marking.

5. Transmitting Apollo 204 Review Board Information and Material.

a. Sensitive

(1) External - Apollo 204 Review Board information and material must be transmitted by registered or certified U.S. mail. If hand-carried, it will be securely packaged, and cleared couriers will be used.

(2) Internal - Local mail delivery will require the use of cleared couriers and sealed containers.

Note: Classified-sensitive material will be handled as indicated in Paragraph 3, Policy, Paragraph 7, Procedure, and NASA Security Directives.

b. Non-Sensitive. This information and material may be transmitted in the manner normal for official Government material, unless otherwise specified by Board policies or the sender, or unless classified, when NASA Security Directives pertain.

Note: This material must be forwarded only to those persons indicated in Paragraph 2, Definitions, until released by the Board.

6. Reproduction of Apollo 204 Review Board Information and Material.
 - a. Sensitive - In this category, it may be reproduced only by authority of Board authorized personnel in areas approved for classified reproduction or on apparatus specifically approved for Board use.
 - b. Non-Sensitive - If in this category, it may be reproduced only by authority of Board authorized personnel in the manner normal for unclassified reproduction, unless otherwise specified by Board policy or the holder.
7. Board Classified Information and Material Records System.
 - a. All classified material received by or generated by the Board will be recorded within a system established for the Board by the local NASA Security Office.
 - b. All classified material will immediately be reported to the Chairman, Security of Operations Panel or his designees who will take steps to assure its proper recording and subsequent handling.
8. Destruction of Apollo 204 Review Board Information or Material.
 - a. All Sensitive or Non-Sensitive Unclassified Board information or material (including typewriter tapes, carbon paper, notes, etc.) which requires destruction will be destroyed in devices currently approved for classified destruction, unless released by the Board, at which time normal waste procedures may be used.
 - b. All classified Board information or material will be destroyed by normal classified destruction procedures, but only after being processed through the Board Classified Information and Material Record System for clearance of records.

/S/ Floyd L. Thompson
Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
FEBRUARY 8, 1967

Administrative Procedure No. 8

TITLE: Photo Support Service for the Apollo 204 Review Board

SCOPE: This procedure covers the manner by which photo support is requested, prints are delivered, and negatives and prints are stored in a "Central Film Library" for use by the Apollo 204 Review Board.

POLICY: 1. Only Apollo 204 Review Board members and Task Panel members can authorize a request for photo service. For the purpose of this procedure "photo service" means the taking of pictures, developing film and printing photographs.

2. All photo support requirements will be fulfilled by the KSC Photographic Branch, RH-2, unless specifically authorized by the Review Board.

Unless specifically instructed, four sets of color prints will be made during the initial processing.

For reproduction of existing photos, one set will be made unless specified.

3. A Central Film Library is available at MSO Building, Room 1114, 867-2631, 2632, where existing prints are available for review by authorized personnel.

Prints are arranged in books by spacecraft grid areas, identified on library drawing, by date and time sequence so that any particular spacecraft area may be reviewed in detail desired.

Reproduction from existing negatives may be requested at that library.

All prints released from the Central Film Library will be logged out to the requesting Review Board Member or Task Panel Chairman who will be responsible for maintaining proper internal handling and control.

Before initiating any request for the taking of new pictures, the originator should contact the Photo Library to assure himself that his areas of interest have not been photographed previously.

All Task Panel Chairmen are requested to furnish the library with a list of their personnel who will require access for reviewing photographs.

4. Requests for taking pictures should be the requirements of a TPS.

An authorized photographer is available at the spacecraft site for taking pictures on request from authorized personnel as required by the TPS being worked.

For areas where photographers are not continuously available, telephone KSC Photo Operations at 867-6240, stating that the requirement is for the Apollo 204 Review Board and the location where a photographer is required.

5. Before taking any pictures, the photographer must be furnished with the name of the requesting Board or Panel member, Task Panel Number, whether Spacecraft 012 or Spacecraft 014, the description of each view, the date and time the picture is made, and the TPS number and step number for proper photo identification on his "photo caption log".

All prints and negative jackets are to be identified as Apollo 204 Review Board Material in accordance with Administrative Procedure No. 7.

All prints and negative jackets will be captioned on the back giving the applicable spacecraft, view description, TPS number and step number, the date and time at which the picture was made, the cognizant Board member or Task Panel number, and will be serialized with photographic work order number, film pack number, and frame number.

Negatives will be released only to the Photo Branch, RH-2, for reproduction unless specifically requested by the Review Board.

PROCEDURE: 1. Requests for taking new pictures:

a. The requirement for pictures is established by the TPS.

The requirement should be indicated on the TPS and any particular step requiring a picture should include the Task Panel number, or a member's name as a minimum information.

b. Information for the photographer's photo caption log may be given verbally but is required.

c. The responsible on site person should give verbal instruction to the photographer regarding particular views required and the time sequence involved to satisfy the requirements of the TPS.

2. Delivery of Photo Material:

a. After the required pictures have been taken, KSC Photographic Branch, RH-2, personnel will carry the film to their photo labs for processing in order of arrival by film pack number.

b. Four sets of color prints will be made.

c. After processing, the Photographic Branch, RH-2, will prepare the photo material in a sealed envelope identifying the package as Apollo 204 Review Board Material.

d. The Photographic Branch will then contact the Apollo 204 Review Board Central Film Library at the MSO Building, Room 1114, telephone 867-2631, 2632, and request that the authorized Photo Courier pick up the package and carry it to the Central Film Library for proper disposition.

e. The library will contact the Photo Courier at 867-5628; delivery to be made to the Central Film Library.

f. After arrival at the Central Film Library, disposition will be as follows:

(1) One set of prints will be logged out and carried to the requesting Review Board Members or Task Panel Chairman's mail box in the MSO Building.

(2) One set of prints will be sent to Mr. J. Lobb, PK-2, MSC, Houston.

(3) One set of prints will be filed at the Central Film Library numerically by negative number and will be available for release to authorized personnel.

(4) One set of prints will be permanently filed by spacecraft grid area and subject description into appropriately identified books which will be available for review in the library by authorized personnel.

(5) All negatives will be filed numerically by negative number at the library for future reproduction use.

3. Requests for Reproduction of Prints:

a. When it is determined that additional copies of existing prints are required, the file copy may be released.

b. If a file copy will not meet the requirement, the librarian will prepare a work order listing the negative numbers, whether color is required, size of print, quantity of prints, and the name of the authorized person.

NOTE: Since there may be a considerable number of different prints available for a particular spacecraft zone, careful selection of the individual prints from the library file will provide faster service and be less costly.

c. The librarian will prepare the required negatives and a copy of the work order in a sealed envelope marked "Apollo 204 Review Board Material".

d. The librarian will then contact the Photo Courier at 867-5628 and request that the package be carried to the Photographic Branch who will fulfill the request.

e. After processing, the Photo Branch will prepare the package and have delivery made to the Central Film Library as previously described.

f. The librarian will distribute the prints to the appropriate Review Board members or Task Panel Chairman's mail box and will file the negatives.

/S/ Dr. Floyd L. Thompson, Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
FEBRUARY 3, 1967

Administrative Procedure No. 9

TITLE: Transcribing Apollo 204 Review Board Proceedings.

SCOPE: This procedure covers the recording, transcription, review and distribution of Apollo 204 Review Board Procedures for record in the Review Board Meeting Room, MSOB.

POLICY: The proceedings for record of the Apollo 204 Review Board shall be recorded and provided in written form for Review Board use.

- PROCEDURES:**
1. Upon statement by the Chairman of the Apollo 204 Review Board that the Board actions, testimony, findings, etc., will be stated for record, communications personnel will cue the 1/4 inch magnetic tape voice recorder. The resulting tape is designated the Master Tape.
 2. The recorded material will be reproduced, one copy only, onto 4 - inch IBM tape by the communications personnel.
 3. The Master Tape and the 4 - inch IBM tape will be delivered to the Secretarial Support Room, (Room No. 1805) MSOB by the communications personnel.
 4. The 4 - inch IBM tape will be logged by Secretarial Support personnel with a reference to the Master Tape.
 5. The individual 4 - inch IBM tapes will be transcribed by the Secretarial Pool into a series of first drafts.
 6. The first drafts and the Master Tape will be delivered by the Secretarial Pool to the selected technical personnel for review and correction, and returned to the Secretarial Pool.
 7. The Master Tape will be delivered to Task Panel 17, Final Board Report Panel, Room 1806, MSOB, for storage.
 8. The Secretarial Pool will prepare a second draft of the combined corrected transcripts for one day's proceedings and will distribute them to the Apollo 204 Review Board Members and the Board Counsel.
 9. After the lapse of 24 hours from receipt by the Board Members and Counsel all comments/corrections which may be received by the Secretariat from the Board members will be incorporated into a final copy for record by the Secretariat.
 10. The final copy will be reproduced and copies placed in appropriate covers for the Board Members and Counsel. The original will be delivered to Task Panel No. 17, Final Board Report Panel, for filing.

/S/ Dr. Floyd L. Thompson, Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
FEBRUARY 21, 1967

Administrative Procedure No. 10, Revision A

TITLE: Control of Data and Documents

SCOPE: This procedure covers the control of all documentation and data relative to AS-204 Space Vehicle and associated GSE data.

POLICY:

1. Original copies of all data to include specifications, inspection data, test procedures, test data, drawings relative to all parts, subsystems, and modules in Space Vehicle AS-204 and associated GSE prior to 0600 January 27, 1967, shall be impounded. Access to these data or copies of this data shall not be further restricted than that necessary for normal program control.
2. Original copies of all data to include inspection data, test procedures, test data, tapes, etc., relative to the AS-204 space vehicle and associated GSE after 0600 January 27, 1967, no matter where recorded, as well as duplicates of such data shall be impounded. Access to such data as well as duplicates of such data will be restricted to authorized personnel as included in Attachment 1 or their designees as specified in writing.
3. For purposes of this instruction, impounding means assuring security of such data from alteration or destruction.
4. No release of such information to public sources shall be made without specific approval of the Review Board Chairman.

PROCEDURE: 1. Data will be impounded in areas as follows:

- a. Room 3344, MSO Building (Review Room 3343)
- b. Rooms 2720-21, MSO Building
- c. SCO Tape Library, Room 4410, MSO Building
- d. Flight Crew System Lab, Room 3724, MSO Building
- e. Complex 37A AGCS - (Launch Vehicle Data)
- f. Room 240, Central Instrumentation Facility (CIF)

2. A NASA Security Guard will be posted at the entrance of each impounded area as noted above, except Room 4410, and Room 240, CIF, on a 24-hour basis and shall allow authorized personnel as indicated in Attachment 1 or their designees in writing to have access to impounded area. (Procedures for Room 4410 and Room 240, CIF, are provided in paragraphs 4 and 6 below, respectively.)

3. Control of documentation and data contained in Room 3344, MSO Building, will be as follows:
 - a. Room 3343 will be used for review of documents contained in 3344.
 - b. Access to 3344 shall be restricted to people actually assigned to Spacecraft 012 impounded record control. A list of these personnel will be forwarded from the Task Panel No. 6 Chairman to NASA Security.
 - c. Access to Room 3343 shall be as specified in paragraph 2 above.
 - d. Removal of original documents from Room 3344 is not authorized without prior approval from the Apollo 204 Review Board (Mr. Geer or his alternate) except to Room 3343 for review. Reproduction of documents located in Room 3344 is authorized for persons having access but shall be accomplished by personnel located in Room 3344.
4. Control of documentation and data as contained in Room 4410 will be as follows:
 - a. Data tapes for Spacecraft 012 shall be stored in locked/sealed cabinets. No cabinet containing Spacecraft 012 tapes may be opened unless NASA Quality Control personnel are present when the seal is broken.
 - b. Original data tapes for Spacecraft 012 may only be withdrawn from the SCO Data Handling Facility to make a duplicate copy.
 - c. At the time that the original request is received, Data Handling personnel shall first check to make sure that a duplicate copy has not previously been made before releasing the original copy of data tapes.
 - d. Original and duplicate copies of Spacecraft 012 tape may be withdrawn from SCO Data Handling Facility only when authorized by an AVO signed by J. H. Lane or J. H. Weisner, H. N. French, D. E. Perreton, D. E. New, or F. R. Schilling.
5. Control of Documentation and Data contained in Rooms 2720, 2721, 3724 of the MSO Building, and Complex 37, Pad A, will be as follows:
 - a. Removal of original documents is not authorized without prior approval from the Apollo 204 Review Board (Mr. Geer or his alternate).
 - b. Access shall be as specified in paragraph 2 above. In addition, it is anticipated that Launch Vehicle Operations will require access to the Complex 37, Pad A, data. An LVO access list will be forwarded to NASA KSC Security by the NASA Launch Vehicle Test Conductor's office (853-9917) which is designated as the cognizant Launch Vehicle Operations Office.
6. Control of documentation and data located in Room 240 of the CIF will be as follows:
 - a. The control of tapes and data in this room, which pertains to AS-204, is the responsibility of the KSC Data Office (Mr. Jelen).

b. The KSC Data Office will not reproduce data pertaining to AS-204 unless authorized by the Launch Vehicle Test Conductor's Office (Mr. J. Kelly or his alternate), and/or the Spacecraft Test Conductor's Office (Mr. J. H. Lane or his alternate).

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

**APOLLO 204 REVIEW BOARD
FEBRUARY 11, 1967**

Administrative Procedure No. 11

TITLE: Categorization and Control of AS-204 Material Required to Support the AS-204 Review Board

SCOPE: This procedure defines the various categories of material associated with the AS-204 incident and establishes controls for the reclassification and/or release of such material by the board. Material as used in this procedure includes components and sample material removed from S/C 012; spacecraft GSE, launch vehicle and its associate GSE; support equipment and facilities.

POLICY: 1. The following direction relative to the release of impounded material from Apollo 204 Review Board control has been established by the Board as quoted from the Board action summary list. All material released by actions of the Board previous to 11 Feb. 1966, have been placed into Category C.

GSE, STE AND FACILITY EQUIPMENT ON LAUNCH COMPLEX 34

Equipment of this type not utilized for checkout or servicing on Spacecraft 012 and the AS-204 launch vehicle on Pad 34 should be released for normal operation.

All equipment of this type utilized prior to plugs in and removed prior to plugs in which is still in complex area should be stasured in terms of configuration and released for further use.

All equipment of this type used during plugs in or later will require board approval.

GSE, STE AND FACILITY EQUIPMENT OUTSIDE OF LAUNCH COMPLEX 34

All equipment of this type utilized in buildup prior to arrival at Launch Complex 34 of S/C 012 should be released for further use.

All servicing equipment of this type utilized prior to arrival of S/C 012 at L/C 34 should be checked for configuration status and fluids sampled for future records. Equipment then should be released for usage.

2. All material associated with the AS-204 incident will be classified as follows:

Category A - Material which may have a significant influence or bearing on the results or findings of the Apollo 204 Review Board. This material is considered highly relevant and is to be maintained under rigid control.

Category B - All material other than Category A which is considered relevant to the Apollo 204 Review Board investigation.

Category C - Material released from Board jurisdiction.

3. All category A material will be maintained under the control of the Apollo 204 Review Board through the Panel Coordination Committee and the appropriate Panel Chairmen. All work accomplished on Category A will be by the use of the Test Preparation Sheet (TPS) (Reference Apollo 204 Administrative Procedure 18).
4. Category B material will be documented as to the configuration at the time of the incident and maintained under the control of the cognizant program or line organization.
5. The determination of the category and release of any material currently under impoundment in support of the AS-204 investigation is a responsibility of the Apollo 204 Review Board. The attached form, Apollo 204 Review Board Material Release Record (MRR), is to be used by organizations desiring to release or reclassify any material presently under impoundment by the Apollo 204 Review Board. Instructions pertaining to this form are covered in the procedures section below.
6. Category A material which must be sent off-site for testing, analysis or other reasons to satisfy requirements of the review, will be accompanied by a representative (witness) designated by the Board unless otherwise specified by the Board. Appropriate quality control and contractor personnel may also accompany the Board's representative. In addition, at the discretion of the Board, Category A material which will be tested on-site will be accompanied by a Board-appointed representative. Category B material sent off-site need not be accompanied by a Board-appointed representative.
7. All Category A material which requires testing and/or analysis either on-site or at a location other than KSC will be processed in accordance with Apollo 204 Review Board Administrative Procedure 5b.

PROCEDURE: 1. Completion of the MRR - The MRR will be completed as follows:

Item No. - To be filled in by the Panel Coordination Committee of the Apollo 204 Review Board

Description - Include a brief description of the item to be reclassified by the Board.

Relevance to Accident - Include justification for reclassification action to include why the reclassification of the equipment will not affect the final board findings.

Constraint Prior to Release - To be filled in by the Panel Coordination Committee.

Current Category - If equipment has not been released from the Board by some previous action the current category is "A".

Desired Category - Include desired category based on definitions of categories as specified in Paragraph 2 above.

Board Approval - To be filled in by the Board.

2. Flow of the MRR

a. The MRR will be filled in by the individual or organization desiring to reclassify or release equipment currently under impoundment. The forms can be obtained from the DLO Test Supervisor's Office (Room 2121, MSOB - Phone 867-6230) or Apollo Review Board Administrative Procedures Office (Room 1842, MSOB - Phone 867-6706).

b. For material located in all areas except the Pyrotechnic Installation Building (PIB) area, the completed form will be submitted to the Director of Launch Operations (DLO) Test Supervisor's office. For material located in the PIB area, the completed forms will be forwarded to a Panel 4 member.

c. The DLO Test Supervisor or the Panel 4 Chairman as appropriate will submit the form to the Panel Coordination Committee for review and presentation to the Board.

d. The Board decision will be relayed through the DLO Test Supervisor's office or the Panel 4 Chairman as appropriate to the affected individual or organization.

/S/ Floyd L. Thompson
Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD MATERIAL RELEASE RECORD

Item No.	Description	Relevance to Accident (include Location)	Constraint Prior to Release	Curr. Category	Desir. Category	Board Approval

APOLLO 204 REVIEW BOARD
FEBRUARY 3, 1967

Administrative Procedure No. 12

TITLE: Access to Apollo 204 Review Board Office

SCOPE: This procedure covers access control to the Apollo 204 Review Board Office, Room 1814, MSO Building, KSC, for the period of time that this space is assigned to the Review Board.

POLICY: 1. Access to the Apollo 204 Review Board Office, Room 1814, MSO Building, shall be limited to the following personnel:

a. Personnel wearing the special Apollo 204 Review Board badges issued in accordance with Administrative Procedure No. 1 (Access to the Apollo 204 Review Board Meeting Room).

b. Other personnel approved by occupants of the Apollo 204 Review Board Office, exclusive of secretaries.

2. Access will be controlled on a full-time basis by a security guard.

PROCEDURES: 1. Personnel will clear through the security guard prior to entering Room 1814, MSO Building.

a. Personnel displaying an Apollo 204 Review Board badge with green or yellow stripes may enter and leave Room 1814 as required.

b. Non-badged personnel desiring to visit occupants of Room 1814 will indicate the name of the occupant to the security guard. Contact will be made with the occupant's office and if approved, the security guard will permit access. Logging in and out is not required.

c. Secretarial support personnel will be permitted access into Room 1814 per secretarial access list. Changes to the secretarial access list may be made by Mr. Dave Allen or his designated representative.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

**APOLLO 204 REVIEW BOARD
FEBRUARY 6, 1967**

Administrative Procedure No. 13, Rev. A.

TITLE: Preparation of Apollo 204 Review Board Meeting Agenda

1. Not later than 8:00 p.m. each day, all items desired to be proposed by Board members for inclusion on the following day's agenda should be given in writing to the Secretariat, Attn: Ernest Swieda, MSO Building, Room 1814, telephone 867-6693.
2. The Secretariat will obtain approval or modification from the Board Chairman or his approved representative for this purpose and have the published list of agenda items prior to the next scheduled meeting.
3. In the event there is a modification to or deletion of any item, the Secretariat will so advise the concerned Board member as soon as possible.
4. Distribution to the Board members and other appropriate personnel will be accomplished on an expedited basis.
5. Items not on the published agenda will not be discussed at the Board meeting without approval of the Board Chairman.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

**APOLLO 204 REVIEW BOARD
FEBRUARY 3, 1967**

Administrative Procedure Number 14

TITLE: Access to Spacecraft 012

The Panel Coordination Sub Committee will establish coordination of and priority for all tasks requiring access to the spacecraft. The access to the interior of the spacecraft will be controlled by Colonel Borman or a designated representative.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
FEBRUARY 3, 1967

Administrative Procedure No. 15

TITLE: Official File for Apollo 204 Review Board

SCOPE: This procedure covers the accumulation and filing of all documents required for the official Apollo 204 Review Board file.

POLICY:

1. One copy of all Task Panel and Review Board-generated data shall be provided to Task Panel No. 17 (Final Report Panel), except as noted in paragraph 2 below.
2. The negatives and prints of all photographs made as a part of Review Board or Task Panel activities shall be provided to the Apollo 204 Review Board Film Library for disposition in accordance with Administrative Procedure No. 8, "Control of Film"

PROCEDURES:

1. Each Task Panel Chairman will establish a system of controlling all documents generated by his panel in the performance of its functions. (Documents include, but are not limited to, letters, memoranda, reports, plans, procedures, test preparation sheets, logs, statements, and transcripts.)
2. The Apollo 204 Review Board Secretariat will establish a system of controlling all documents generated by the Apollo 204 Review Board. (Documents include, but are not limited to, letters, memoranda, and transcripts of Board proceedings.)
3. The original of all data resulting from paragraphs 1 and 2 above, will be provided to the receptionist, Task Panel No. 17, Room 1806, MSO Building, by each Task Panel Chairman or representative and the Review Board Secretariat as soon as available.
4. The Chairman, Task Panel No. 17, will establish a system of controlling and filing all documents received from other panels and the Review Board Secretariat. The system will permit identification of that material which will be included in the final report and that material which is supporting or reference data.
5. Negatives and prints of all photographs made as part of Review Board or Task Panel activities will be controlled in accordance with Administrative Procedure No. 8, "Control of Film". Negatives will be catalogued and filed by the Apollo 204 Review Board Film Library in Room 1114, MSO Building. Prints will be provided to Task Panel No. 17 upon written request of the Chairman. Upon completion of the Review Board investigation all negatives will be turned over to Task Panel No. 17 for inclusion in the official file.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

**APOLLO 204 REVIEW BOARD
FEBRUARY 3, 1967**

Administrative Procedure No. 16

TITLE: Coordination Policy for Interviewing Witnesses

A statement, substantially as follows, will be addressed to each individual called before the Panel for Task No. 12 to be interviewed or questioned further:

We appreciate your coming here to assist us further in this investigation in order that the Board may arrive at certain decisions affecting the Apollo Program. The answers you may provide may be a clue to other matters that this Board should look into.

Before we start the questioning, we want you to understand that your appearance is on a voluntary basis and that any statements you make will be kept in strict confidence.

If you are able to answer a question, please do so with language you use with family and friends. It is not necessary to be formal.

If you are unable to answer a question, do not hesitate to say so.

Now, we may proceed.

Where the witness called is deemed by the Panel to have furnished important information in his original statement, Counsel to the Board and cognizant technical personnel in areas to be covered by the interview will be advised beforehand.

Doubtful cases will be resolved by the Chairman, Task 12 Panel, after consultation with cognizant technical personnel and concurrence by Counsel.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
FEBRUARY 8, 1967

Administrative Procedure No. 17

TITLE: Response to Offers of Assistance or Recommendation

POLICY: Offers of assistance or recommendation submitted as a result of the Apollo 204 Review will be answered by the Chairman, Apollo 204 Review Board.

PROCEDURES: 1. All messages (letters, telegrams, and telecon notes) received by the Apollo 204 Review Board members, Task Panel members, other associated personnel, or the Secretarial Support Office (Room 1805, MSO Building) which are identified as suggestions or offers of help pertaining to the task of the Apollo 204 Review Board shall be forwarded to Task Panel No. 15, Room 1842, MSO Building. Task Panel No. 15 will log all incoming messages and review them for content.

2. Task Panel No. 15 will prepare replies to all messages for the signature of the Chairman, Apollo 204 Review Board, unless they have been properly acknowledged by other organizations. Official NASA Apollo 204 Review Board letterhead will be used.

3. Copies of those messages, which, in the opinion of Task Panel No. 15, appear to be relevant to the activities of one or more task panels will be sent to those panels for consideration. In certain cases, comments or other action may be requested. If acceptance of an offer of assistance or if more information is desired, Task Panel No. 15 will be contacted so that arrangements can be made.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD

MARCH 9, 1967

Administrative Procedure No. 18, Revision C

TITLE: Use and Control of Test Preparation Sheets (TPS)

SCOPE: This procedure covers the plan and control by which AS-204 spacecraft hardware will be removed, inspected, analyzed or otherwise modified.

- POLICY:**
1. All work, including inspections, on the AS-204 spacecraft hardware and on the spacecraft GSE that is on or was connected to the spacecraft from the Plugs In Overall Test (0006) until after the incident is to be authorized by Test Preparation Sheets (TPS).
 2. TPS's written to perform work under the control of the Medical Analysis Panel (Panel No. 11) involving equipment located in Room 106 of the PIB will require only the approval signature of a member of the Medical Analysis Panel.
 3. TPS's written to perform work under the control of the Disassembly Activities Panel (Panel No. 4) will be prepared and signed by the applicable NAA Systems Engineer and will be approved by the applicable NASA-KSC-SCO and NASA-MSD Systems Engineers. In addition, approval signatures must be obtained from the appropriate KSC-MAB Engineer, a member of the Origin and Propagation of Fire Panel, a member of the Integration Analysis Panel who will assure that any additional coordination required, such as materials engineers, is accomplished before affixing his signature and a member of the Panel Coordination Committee. Any TPS to be worked at the 012 spacecraft will also be signed by a member of the Disassembly Activities Panel. Any of these listed signatures, except that of the TPS writer, may be obtained per telephone conversation.
 4. TPS's written to perform work under the control of the Service Module Disposition Panel (Panel No. 21) will be handled as in Paragraph 3 except that the signature of a member of the Service Module Disposition Panel is required in lieu of a member of the Disassembly Activities Panel.
 5. Prior to preparation of TPS's, work plans must be presented to the Apollo 204 Review Board through the Panel Coordination Committee for approval.
 6. When a TPS is required to be modified in order to allow continuance of work activity, a TPS mod sheet is required. The TPS mod sheet will be signed by both the Systems Engineers monitoring the work. These engineers will be responsible for proper coordination before signing the mod sheet. (Ref. para. 3h. under procedure.)
 7. Work, examination, testing, or analysis that is to be performed at KSC of equipment removed from the spacecraft must be authorized by a subsequent TPS which is to begin with a statement that authorizes removal of the equipment from the bonded storage area, if required. Testing or analysis that is to be performed at sites other than KSC must be authorized and accomplished in accordance with Administrative Procedure No. 5.
 8. All equipment or material removed from the spacecraft must be documented on a Parts Installation and Removal Record (PIRR).
 9. All equipment or material removed from the spacecraft must be tagged with a parts tag.

10. No task will be initiated until those individuals assigned to accomplish the task are thoroughly briefed by the responsible engineer. No disassembly task will be performed on S/C 012 until the same task has been performed on S/C 014 by the same individual, unless specified on the TPS as "not applicable to S/C 014."

11. Proofing tasks on S/C 014 will be worked to a S/C 012 TPS. These need have only one NAA and one NASA Systems Engineer signature for this task. Work will be authorized by and bought off on a S/C 014 TPS which will state to work the S/C 012 TPS on S/C 014. This TPS will be signed by one NAA and one NASA Systems Engineer. Either one of the above will sign mod sheets. Any of these listed signatures, except that of the writer, may be obtained per telephone conversation.

12. Access to the spacecraft area will be tightly controlled in accordance with applicable administrative procedures.

13. The original of all TPS's will be provided upon completion to Panel No. 17.

14. The Apollo Pre-Flight Operations Procedures Manual (APOP) is the reference document to be used during all work activity on the spacecraft. When differences exist between this procedure and the APOP, this procedure is the ruling document.

PROCEDURE: 1. Flow of the TPS (includes all TPS's except those worked by Panel No. 11)

a. The request for an intended action or work plan will be forwarded to the panel coordination committee which will be responsible for obtaining Board approval.

b. After approval by the Chairman of the Apollo 204 Review Board, the request will be forwarded to the Integration Analysis Panel who will integrate the work into the overall S/C 012 effort.

c. The Integration Analysis Panel will direct NAA Engineering to prepare the TPS for the task. The TPS will be signed by the responsible NASA and/or NAA Engineers and/or panel and committee members, as appropriate.

d. A TPS number will be obtained by the originator from the Apollo Tech Data Services, Room 3197, MSO Building, telephone 867-5365.

e. Original will be taken to Room 1432 for reproduction and distribution. Twenty (20) copies will be taken to Room 2130 prior to the 8:00 a.m. daily meeting.

f. Service Engineering will deliver the buy off copy to the appropriate work area. Modification sheets added to the original TPS will be called into the Apollo Tech Data Services by NAA QC for their records.

g. After the completion of the task, NAA Quality Control will hand carry the original completed bought off copy to Room 3344.

h. QC in Room 3344 will reproduce the completed TPS, place one on file and hand carry 20 copies to Room 2130 prior to 8:00 a.m. daily meeting.

i. Then QC will hand carry the "as worked" buy off copy TPS's to Task Panel No. 17 in Room 1806.

2. Work Support (except as performed by Panel No. 11)

a. Operations Engineering:

(1) The actual removal, disassembly, and analysis work within the local KSC area will be executed through the normal NASA and NAA pad and industrial area organizations.

(2) It is required that NASA KSC-SCO and NAA Operations Engineers be on duty at the spacecraft on the shift and work-week basis specified by the Apollo 204 Review Board.

(3) The Operations Engineers have the responsibility to schedule the daily spacecraft activity in detail. They also have the authority to stop work on the spacecraft when deemed necessary.

(4) The Operations Engineers are responsible to maintain a spacecraft log, which documents all activity on the spacecraft on an hourly basis. A copy of the log is to be provided to the DA Panel and is to be updated on a daily basis.

b. Systems Engineering:

It is required that NASA and NAA Systems Engineering be on duty for all work on their particular system when the work is authorized by a S/C 012 investigation or component analysis TPS. Any deviation to this requirement either must be documented on the appropriate TPS prior to submittal for authorizing signature or authorized by the Chairman of the Disassembly Activity Panel, or his designated representative.

3. TPS Preparation:

TPS's will be prepared as follows: (Note: Only paragraphs a, b, and h apply to Panel No. 11 work.)

a. A specific and complete statement of the "reason for work" is required on each TPS.

b. The TPS's are to consist of step-by-step work items written in a detailed manner that will leave no question as to what is specifically required to be done.

c. No wire bundle electrical connectors are to be disconnected without specific call-out by W/B connector number on the TPS.

d. All work on the spacecraft is to be accomplished by NAA technicians unless otherwise indicated on the TPS.

e. All work is to be witnessed by NASA KSC-SCO and NAA inspection. In addition, it is the responsibility of the Integration Analysis Panel to make sure that the TPS includes the necessary requirements for official observers when required. Upon completion of each TPS work item, the item is to be stamped by NASA/NAA Inspection indicating completion.

f. It is required that TPS's which authorize removal of equipment from the spacecraft while at Complex 34 conclude with the following statement as the last item of work: "Transport equipment to the Pyro Installation Building (PIB) for display or retention in bonded storage."

g. Upon completion of work authorized by a TPS, it is required that a summary statement be made on the last TPS mod sheet by the NASA/NAA Systems Engineer(s). The summary statement is to include all items of a significant nature that were observed during the work activity indicating where follow-up action is needed.

h. When a mod sheet is prepared, a specific and complete statement of the reason for the mod sheet is required on each TPS. Also, the TPS mod sheet must authorize work that is within the intent of the original TPS.

i. Separate investigation (IV), Material Analysis (MA), Component Analysis (CA) TAIR books will be established and all TPS's associated with spacecraft work, including GSE, will be retained in these TAIR books.

4. Parts Installation and Removal Record (PIRR) (Except Panel No. 11)

The information noted on the PIRR consists of a part number (if available or applicable); a description of the equipment or material; and the time and date of removal. The parts installation and removal record will be prepared and used as noted in the APOP with Quality Control required to buy off all entries.

5. Parts Tag:

As stated in paragraph 8 of the policy section above, all material removed from the spacecraft must be tagged with a parts tag (KSC Form 4-8) as follows:

a. The parts tag will be stamped in accordance with Apollo 204 Review Board Administrative Procedure #7.

b. The tag is to be attached to the hardware in such a manner that will not affect the condition of the equipment.

c. The tag is to be attached to the container or bag into which the material is placed.

d. The parts tag is to accompany the equipment or material at all times.

e. It is required that prior to removal of spacecraft hardware, spacecraft system components, disconnect of spacecraft electrical connectors, and disconnect of spacecraft plumbing lines, a short length of silver-gray tape be attached across the mating line between the hardware to be removed and the adjacent hardware remaining in the spacecraft. An indexing line is to be then marked on the tape with a black ball-point pen at right angles to, and across, the hardware mating line. A number correlating to the spacecraft hardware removal form entry is also

to be written on each end of the tape. In order to avoid destruction of valuable evidence, it may be necessary to deviate from this procedure. In these cases, a mod sheet shall be prepared which states the reasons the procedure cannot or should not be followed.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
FEBRUARY 7, 1967

Administrative Procedure No. 19, Revision A

TITLE: Establishment of the Panel Coordination Committee

SCOPE: This procedure covers the purpose and activities of the Panel Coordination Committee and is applicable to all elements of the Apollo 204 Review Board including Board and Panel members.

POLICY: 1. The Panel Coordination committee is hereby established. The committee shall consist of the following:

Mr. John J. Williams, Chairman
Col. Frank Borman, Member
Mr. Charles W. Mathews, Member
Dr. Maxime A. Faget, Member
Mr. George Jeffs, Member
Mr. John F. Yardley, Member
Mr. R. L. Benner, Member
Mr. John Hodge, Member
Mr. Ted Sasseen, Member

2. The purpose of this committee is to coordinate the actions of the constituted panels and bring to the attention of the Apollo 204 Review Board those actions requiring specific approval of the Board.

3. All needs for coordination of activities and requirements that the various constituted panels and other activities cannot satisfy or resolve by direct action between those involved should be brought to the immediate attention of the coordination committee.

4. All requirements to implement activity that comes under the direct control of the Board (such as photograph examination, or disassembly of S/C 012 or the use or disposition of impounded items) will likewise be brought to the attention of the Panel Coordination Committee.

5. A panel coordination review session will be held daily at 5 p.m. in room 2130 MSOB unless otherwise specified. All Panel Chairmen are required to attend. Daily Reports are required to be submitted by the Panel Chairman at that time. A daily meeting will also be held at 9 a.m. in room 2130. Selected Panel Chairmen will attend by request.

6. Matters which require attention of the Panel Coordination Committee should be addressed to the Panel Coordination Committee, room 2130, MSOB/867-6447.

/S/ Dr. Floyd L. Thompson, Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
FEBRUARY 24, 1967

Administrative Procedure No. 20, Revision A

TITLE: Establishment of Apollo 204 Review Board Panels

SCOPE: This procedure officially documents the Apollo 204 Panels and covers the purpose and activities of such panels. This procedure is applicable to all elements of the Apollo 204 Review Board. Working panels were established at the beginning of the AS-204 Review Board investigation and have been in continuous operation. This procedure revises previous documentation relative to these panels.

POLICY:

1. Panels will be utilized by the Apollo 204 Review Board to perform specialized tasks as identified by the Board. Each panel will have a Chairman appointed and approved by the Review Board and a Board Monitor to whom the Panel Chairman is responsible. The official list of panels is contained in Attachment I.
2. The panels will provide reports of their activities as required by the Review Board or the Panel Coordination Committee.

RESPONSIBILITIES/ACTIONS:

1. The Apollo 204 Review Board will appoint a Chairman and a Board Monitor for each of the twenty-one (21) Task Panels. New panels may be constituted by action of the Review Board to perform additional tasks. Attachment I contains the official list.
2. Each Panel Chairman will serve as a manager to direct and coordinate the activities of the Panel within the statement of work prescribed for that Panel as included in attachment I.
3. Each panel chairman will report directly to the appropriate Board Monitor and will report to the Board, when required, on the progress of work. He will obtain Board approval of work whenever required by other applicable Board Administrative Procedures.
4. Each Panel Chairman is responsible for recommending membership on the Panel which must be approved by the cognizant Board Monitor including any changes thereto. The Board Monitor will initial his approval on the list contained in attachment I.
5. Each Panel Chairman is responsible to designate an alternate in case of temporary absence. This alternate must be approved by the respective Board Monitor for each Panel.
6. Panel reports of findings and determinations will be required of all panels. These reports will be signed by the Panel Chairmen only and submitted to the Board through the appropriate Board Monitors. Board Monitors will insure that minority positions relative to panel reports are brought to the attention of the Board.

Apollo 204 Review Board
Admin. Procedure No. 20
February 24, 1967

7. All final Panel reports submitted to the Board will be in the prescribed format as included in attachment 2. Reports from Panel #11 will have limited distribution as determined by the Apollo 204 Review Board Chairman.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

Enclosure

1. Apollo 204 Review Board Panels
2. Outline for Panel Reports

**ATTACHMENT 1
APOLLO 204 REVIEW BOARD
ADMIN. PROCEDURE NO. 20
FEBRUARY 18, 1967**

**APOLLO 204
REVIEW BOARD
PANELS**

PANEL SUMMARY

NO.	TITLE	CHAIRMAN	BOARD MONITOR
1	S/C and GSE Configuration	J. Goree, MSC	J. Williams, KSC
2	Test Environments	W. Hoyler, MSC	G. White, NASA Hqs
3	Sequence of Events	D. Arabian, MSC	M. Faget, MSC
4	Disassembly Activities	S. Simpkinson, MSC	Col. F. Borman, MSC
5	Origin & Propagation of Fire	F. Bailey, MSC	Dr. Van Dolah
6	Historical Data	J. T. Adams, MSC	G. White, NASA Hqs
7	Test Procedures Review	D. Nichols, KSC	J. Williams, KSC
8	Materials Review	W. Bland, MSC	M. Faget, MSC
9	Design Reviews	R. Williams, MSC	G. White, NASA Hqs
10	Analysis of Fracture Areas	P. Glynn, MSC	B. Geer, NASA LaRC
11	Medical Analysis	G. Kelly, MSC	F. Thompson, NASA LaRC
			G. Malley, Counsel
12	Witness Statements	N. Vaughn, MSC	Col. C. Strang, USAF G. Malley, Counsel
13	Ground Emergency Provisions Review	G. Page, KSC	Col. F. Borman, MSC
14	Security of Operations	C. Buckley, KSC	Col. C. Strang, USAF
15	Board Administrative Procedures	A. Griffin, KSC	B. Geer, NASA LaRC
16	Special Tests	G. Stoops, MSC	M. Faget, MSC
17	Final Board Report	Lt. Col. K. H. Hinchman, USAF	Col. C. Strang, USAF
18	Integration Analysis	A. Mardel, MSC	M. Faget, MSC
19	Safety of Investigation Operations	J. Atkins	B. Geer, NASA LaRC
20	In Flight Fire Emergency Provisions Review	Capt. J. Lovell	Col. Borman, MSC
21	Service Module Disposition	W. Petynia	J. Williams, KSC

APOLLO 204 REVIEW BOARD
PANEL

Task No. 1

Task Title S/C & GSE Configuration

Task Description:

Establish and document physical configuration of spacecraft and GSE immediately prior to and during fire incident including equipment configuration, switch positions, and non-flight items in cockpit. By deviation, document configuration differences with respect to expected launch configuration and configurations used in previous testing, (Altitude chamber, for example), as pertinent to this problem. To a lower level of detail, document configurational difference between the spacecraft and other spacecraft as pertinent to this problem.

Room 2301 Phone 6558

Panel Members:

J. Goree, MSC, Chairman R. Murad, NASA Hqs

C. Haines, MSC
R. Larson, NAA-D C. Rouse, KSC

W. Edson, NAA-KSC

C. Gay, KSC

Cognizant Board Member: J. Williams *JW*

APOLLO 204 REVIEW BOARD
PANEL

Task No. 2

Task Title Test Environments

Task Description:

Provide history of all test environments encountered by this spacecraft on a major assembly total assembly basis which are german to validation of systems from fire hazard standpoint. Include appropriate qualification testing of systems and sub-systems. Particular emphasis should be placed on qualification tests in pure O₂ with regard to pressures, temperature, time of exposure, and simulation of equipment malfunction. Indicate any deficiencies in this test program related to the subject problem. Also, include comparison with previous tests of appropriate flight, house, or boilerplate spacecraft. Any problems encountered related to fire hazard shall be documented.

Room 3431

Phone 5217

Panel Members:

W. Hoyler, MSC, Chairman F. Key, MSFC

A. Toeligen, NAA-D

H. Dunham, MSC/GE

C. Nolen, MSC/GE

Cognizant Board Member: G. White *g/w*

APOLLO 204 REVIEW BOARD
PANEL

Task No. 3

Task Title Sequence of Events (anomaly data review)

Task Description:

Analyze data obtained immediately prior to and during the fire incident including digital, analog, voice communications, photography, etc. Data should display significant events as they occurred with precise time tag. Time histories of all continuous or sem-continuous recorded parameters, correlation of parameter variations and events shall be recorded as well as interpretation of the results of said analysis. Where pertinent, normal expected variations shall be compared with those actually obtained.

Room 2721 Phone 6270

Panel Members:

D. Arabian, MSC, Chairman _____

A. Tischler, NAA-D _____

H. Creighton, KSC _____

W. Eckmeier, NAA-KSC _____

W. Jewel, KSC _____

Cognizant Board Member: M. Eaget

APOLLO 204 REVIEW BOARD
PANEL

Task No. 4

Task Title Disassembly Activities

Task Description:

Develop plans and procedures for progressive disassembly of spacecraft for purposes of inspection and failure analysis. Disassembly should be configured to proceed on a step-by-step basis, in a manner to obtain maximum amount of information prior to disturbing evidence. Contents of testing requirements shall also be considered. Disassembly plans should consider both the cockpit and the area outside the pressure hull. Means for cataloging documentary information within spacecraft and for display of removed items shall be a part of these plans and procedures.

Room 1293

Phone 5497

Panel Members:

S. Simpkinson, MSC, Chairman

D. Grimm, MSC

P. Hanifin, NAA-D

H. Shoaf

J. Moore, NAA-KSC

P. Graf

S. Beddingfield, KSC

R. Reed

R. Covel

Cognizant Board Member: F. Borman *FB*

APOLLO 204 REVIEW BOARD
PANEL

Task No. 5

Task Title Origin and Propagation of Fire

Task Description:

Conduct inspections, chemical analyses, spectrographic analysis of spacecraft, parts or rubble or use any other useful techniques to establish point of fire origin, direction and rate of propagation, temperature gradients and extremes. The nature of the fire, the type of materials consumed, the degree of combustion shall be determined.

Room 3229

Phone 7438

Panel Members:

J. F. Bailey, MSC, Chairman

J. Yardley, MAC

I. Pinkel, LeRC

H. Carhart, NRL

T. Horeff, FAA

J. Leak, CAB

J. Craig, MSC

A. Krupnick

Cognizant Board Member: Dr. Van Dolah, BOM *Van Dolah*

APOLLO 204 REVIEW BOARD
PANEL

Task No. _____

Task Title Historical Data

Task Description:

Assemble, review, and summarize historical data on spacecraft and associated systems as pertinent to the fire incident. Data to be analyzed shall include records such as included in spacecraft log, failure reports, other quality engineering and inspection documents. Make interpretation on data as to applicability to subject problem.

Room 1237 Phone 3884

Panel Members:

T.J. Adams, MSC, Chairman J. Hansel, NAA-KSC

D. Buffington, NAA-KSC

J. Dickinson, KSC

Cognizant Board Member: G. White *bx*

APOLLO 204 REVIEW BOARD
PANEL

Task No. 7

Task Title Test Procedures Review

Task Description:

Document test procedures actually employed during day of incident. Indicate deviations between planned procedures and those actually used. Determine from review potential changes that might alleviate fire hazard conditions or that might provide for improved reaction or corrective conditions. Review these changes with respect to applicability to other test sites or test conditions.

Room 2141 Phone 6547

Panel Members:

<u>D. Nichols, KSC</u> , Chairman	<u>F. Bryan, KSC</u>
<u>K. Cuzzupoli, NAA-D</u>	<u>R. Swanson, NAA-D</u>
<u>M. Cahill, NAA-KSC</u>	<u>J. Wright, NAA-KSC</u>
<u>W. Petynia, MSC</u>	<u>H. Luetjen</u>
	<u>C. Harshbarger, NAA-D</u>
	<u>A. Dale, NAA-D</u>
	<u>C. Brooks, MSFC</u>

Cognizant Board Member: J. Williams *JW*

APOLLO 204 REVIEW BOARD
PANEL

Task No. 9

Task Title Design Reviews

Task Description:

Conduct critical design reviews of systems or subsystems that may be potential ignition sources within cockpit or which might provide a combustible condition in either normal or failed conditions. Areas such as glycol plumbing configuration, electrical wiring and its protection, physical and electrical, other potential ignition sources such as motors, relays, and corona discharge. Other areas of review include egress augmentation and basic cabin atmosphere concept (1 vs. 2 gas). Document where applicable pros and cons of design decisions made. Summarize recommended changes for corrective action.

Room 3301 Phone 6270

Panel Members:

R. Williams, MSC, Chairman A. Cohen, MSC

J. McCarthy, NAA-D Fred Sanders

J. Janokaitis, KSC

R. Pyle, NAA-KSC

Cognizant Board Member: G. White, NASA Hq *GW*

APOLLO 204 REVIEW BOARD
PANEL

Task No. 10

Task Title Analysis of Fracture Areas

Task Description:

Inspect spacecraft for structural failures resulting from fire. Analyze these failures from standpoint of local pressure - temperature levels, direction of gas flow, etc.

Room 2308 Phone 7870


Panel Members:

P. Glynn, MSC, Chairman N. Koenig, NASA - KSC

L. Korb, NAA-D

R. Johnson, MSC

D. Root, NAA-D

Cognizant Board Member: Geer 

APOLLO 204 REVIEW BOARD
PANEL

Task No: 11

Task Title Medical Analysis

Task Description:

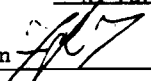
Medical Analysis. A summary of medical facts together with appropriate medical analysis which would be of interest to the investigation. Examples would be cause of death, pathological evidence of overpressure, and any other areas that might be of technical value in determining the cause of accident or in establishing corrective action.

Room 3849

Phone 3541

Panel Members:

<u>G. Kelly, MSC</u> , Chairman	<u>P. Hoffman, USAF</u>
<u>A. Harter, KSC</u>	<u>E. Ferguson, Jr., USAF</u>
<u>N. Pincock, KSC</u>	<u>T. Spann</u>
<u>R. Thompson, PAA</u>	<u>R. Parrish</u>

Cognizant Board Member: Dr. Thompson 

G. Malley, Counsel

APOLLO 204 REVIEW BOARD
PANEL

Task No. 12

Task Title Witness Statements

Task Description:

An orderly process to collect all data from witnesses (includes eye witnesses as well as console monitors). This includes a determination of who to interview, arranging for competent people to conduct the interviews, recording data, and collecting it into a form suitable for publication as an appendix to the formal report. Included also in this task is an analysis of the pertinent sequence of events as reported by the bulk of the witnesses together with a summary of that testimony which is contradictory to the main data.

Room 3229

Phone 7438

Panel Members:

N. Vaughn, MSC, Chairman

Lt. Col. Ravers, USAF

J. O'Donnell, KSC

H. Blackwood, NASA Hq.

C. McNamara, NAA-KSC

C. Netherton, KSC

Cognizant Board Member: Col. C. Strang, USAF

G. Malley, Counsel

APOLLO 204 REVIEW BOARD
PANEL

Task No. 13

Task Title Ground Emergency Provisions Review

Task Description:

This task involves an orderly review of planned ground emergency procedures relative to their adequacy, as well as a review to determine that emergency procedures, in fact, exist for all appropriate activities. This review should concentrate on activity at the launch site, and should include recommendations to the board for changes in existing procedures and for the creation of new emergency procedures if deemed necessary.

Room 2121

Phone 6230

Panel Members:

G. Page, KSC, Chairman

H. Russell, NASA Hq.

G. Smith, NAA-D

W. Cunningham MSC
R. Sayers MSC

J. Chappee, MSC

L. Barnett KSC
R. Rochester NAA-GSE

K. Wishon, NAA-KSC

M. Carlson KSC-LVO

H. Luetjen

Cognizant Board Member: F. Borman ¹²

APOLLO 204 REVIEW BOARD
PANEL

Task No. 14

Task Title Security of Operations

Task Description:

This group shall review existing security practices for adequacy. This includes such things as access control, personnel sign in requirements, buddy systems, background investigation requirements, etc. They shall also make responsible recommendations to the board on changes to existing practices.

Room 1239

Phone 2350

Panel Members:

<u>C. Buckley, KSC</u> , Chairman	<u>R. Gaines</u> <u>Lewis</u>
<u>H. Maines NASA Hq. Vice-Chairman</u>	<u>W. Horner</u> <u>KSC</u>
<u>S. Ellis, MSFC</u>	<u>Col. W. Dugan</u> <u>USAF</u>
<u>C. Buckel, MSC</u>	

Cognizant Board Member: Col. C. Strang, USAF *(Signature)*

APOLLO 204 REVIEW BOARD
PANEL

Task No. 15

Task Title Board Administrative Procedures

Task Description:

This group shall establish and document administrative procedures for the board to use. This includes activity such as procedures for the control of spacecraft work, logging and filing of exhibits, maintenance of log of board activities, scheduling of meetings, preparation of agenda for board meetings, arrangements for secretarial services, reproduction of material, etc.

Room 1842

Phone 6706

Panel Members:

A. Griffin, KSC, Chairman

W. Moody KSC

G. Ruffines, MSC

P. Reed, NAA-KSC

Cognizant Board Member: Geer

APOLLO 204 REVIEW BOARD
PANEL

Task No. 16

Task Title Special Tests

Task Description:

This task involves the coordination of desired tests generated by other groups into an overall integrated test plan. For example flammability testing will probably be done at several locations. This group will assure proper coordination of this activity. Major tests such as mockups of actual configuration, boiler plate destructive combustion tests, etc. would be considered by this group, and appropriate action recommendations would be made to the board. Test results would be collected, reviewed, and edited in a form suitable for inclusion in the final report.

Room 3431

Phone 5371

Panel Members:

G. Stoops, MSC, Chairman

J. Jeter, KSC

E. Gunn, NAA

J. Saunders, NASA Hq.

Cognizant Board Member:


M. Faget

APOLLO 204 REVIEW BOARD
PANEL

Task No. 17

Task Title Final Board Report

Task Description:

This activity involves the organization of the report, the delegation of responsibility to other assigned task groups, the review and editing of submitted material, and the final preparation of the report.

Room 1806

Phone

6505

Panel Members:

Lt. Col. K.H. Hinchman Chairman

J. Ross

R. Smith

Cognizant Board Member: Col. Strang *CS*

APOLLO 204 REVIEW BOARD
PANEL

Task No. 18

Task Title Integration Analysis

Task Description:

This task involves the review of inputs from all task groups, the correlation of all pertinent information, feedback for further study, and the final technical integration of the evidence.

Room 2130

Phone 6722

Panel Members:

<u>A. Mardel, MSC</u> , Chairman	<u>S. Jones</u> MSC
<u>D. Levine, NAA-D</u>	<u>H. Taylor</u> MSC
<u>R. Pyle NAA-MS</u>	<u>D. Moyhew</u> MSC
<u>C. Mars, KSC</u>	<u>A. Cohen</u> MSC
Cognizant Board Member: <u>M. Faget</u>	<u>J. Lobb</u> MSC
	<u>E. Walters</u> MSC

APOLLO 204 REVIEW BOARD
PANEL

Task No. 19

Task Title Safety of Investigation Operations

Task Description:

This group is charged with the responsibility of reviewing all operations performed during the investigation to assure that all personnel safety requirements are adequately maintained.

Room 1427

Phone

7390

Panel Members:

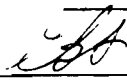
John Atkins, KSC, Chairman

Lt. Col. Jim Rowers, AFETR

D. Karl, PAA Pad Safety

Ralph Walker, Bendix System Safety

John McGough, KSC Operations Safety

Cognizant Board Member: B. Geer 

APOLLO 204 REVIEW BOARD
PANEL

Task No. 20

Task Title In-Flight Fire Emergency Provisions Review

Task Description:

This task involves an orderly review of planned in-flight fire emergency procedures and other provisions relative to their adequacy, as well as a review to determine that emergency procedures, in fact, exist for all appropriate activities. This review should include recommendations to the board for changes in existing procedures and other provisions and for the creation of new emergency provisions if deemed necessary.

Room 3431

Phone 6666

Panel Members:

Capt. J. Lovell MSC, Chairman

T. Loe

Lt. Col. R. Evans MSC

N. Shyken

R. Warren

J. Swigert, Jr.

R. Glover

Cognizant Board Member: F. Borman 73

APOLLO 204 REVIEW BOARD
PANEL

Task No. 21

Task Title Service Module Disposition

Task Description:

This task involves the planning and execution of necessary SM activity beginning at the time of Board approval for CM demate. This task will be performed mainly by appropriate Apollo line organizational elements in accordance with a Board approval plan which identifies the Board requirements for documentation and control of this activity.

Panel Members:

W. W. Petynia, MSC, Chairman

R. D. Carothers, KSC

B Haight, NASA-KSC

Cognizant Board Member: J. Williams *JW*

OUTLINE FOR PANEL REPORTS

This review, as in all accident investigations, will determine a primary or most probable cause of the mishap. Once the primary, or most probable cause has been determined, a recommendation as to corrective action(s) to prevent a recurrence is then agreed upon. Each task panel pursues its course of action and submits a report through the Board Monitor to the Review Board with one (1) copy. This report, while it might not relate to the determined primary cause, could be data that exposes contributing causes to this accident. Each panel, be it test environments, historical data, test procedures review or any other panel has a most important function within the structure of the Apollo 204 Review Board. In addition to determining what caused the accident, a good review board determines what existing designs, technical data, test procedures, etc., did not contribute to the mishap. In other words, a validation process runs concurrently with the accident investigation as a beneficial by-product. It is conceivable that these task panel reports will be referred to in the future for information as to systems operations and/or reliability during adverse conditions.

Certain task panel reports will provide the basis for the "Narrative" of the accident, as well as the input to the Board for the "Investigation and Analysis" portion of the final report.

The desired format of the task panel reports is attached.

FORMAT FOR TASK PANEL REPORT

Part VII - Apollo 204 Review Board

Task Panel Report

Section A. This is the work statement assigned the panel by the Review Board. (Charter of task to be accomplished)

Section B. Proceedings (How assigned work statement was accomplished)

Section C. Findings and Determinations

Findings and determinations should not only be addressed to the proximate cause(s) of the accident. They should also cover any condition discovered which could have caused the accident or which, in any way, could improve the mission of the Apollo Program.

1. Finding:

No overall evaluation(Fact).

Determination:

It is concluded that(Assumption; logical conclusion; considered opinion, etc.)

2. Finding:

Determination:

Section D. Supporting Data

This section will include identified photographs, if appropriate, test results, diagrams, consultant statements, recitals, copies of data, etc.

**APOLLO 204 REVIEW BOARD
FEBRUARY 19, 1967**

Administrative Procedure No. 21

TITLE: Access Control to Service Module Disassembly Area

SCOPE: This procedure covers access control to the Service Module Disassembly Area (herein after called Controlled Areas) located in High Bay of the MSOB. This procedure is effective from the time of entry of the Service Module into the Controlled Areas until release by the Apollo 204 Review Board Chairman.

POLICY: 1. In order not to restrict other concurrent operations taking place in the High Bay of the MSOB, the Controlled Areas will move as the vehicle is processed through the High Bay. The 3 Controlled Areas will be as follows: (see attachment).

- a. CONTROLLED AREA NO. 1: Integrated Stand No. 1 (Duration of control will be approximately 2 days).
- b. CONTROLLED AREA NO. 2: H14-124 Stand (Duration of control will be approximately 1 day).
- c. CONTROLLED AREA NO. 3: H14-134 Stand (Vehicle will remain on this stand until release by Apollo 204 Review Board Chairman).

2. Limited access to the Controlled Areas shall be maintained on a full time basis (24 hours per day) by a security monitor.

3. A log of all personnel not on the access list that are permitted entry into the Controlled Areas will be maintained by the security monitor.

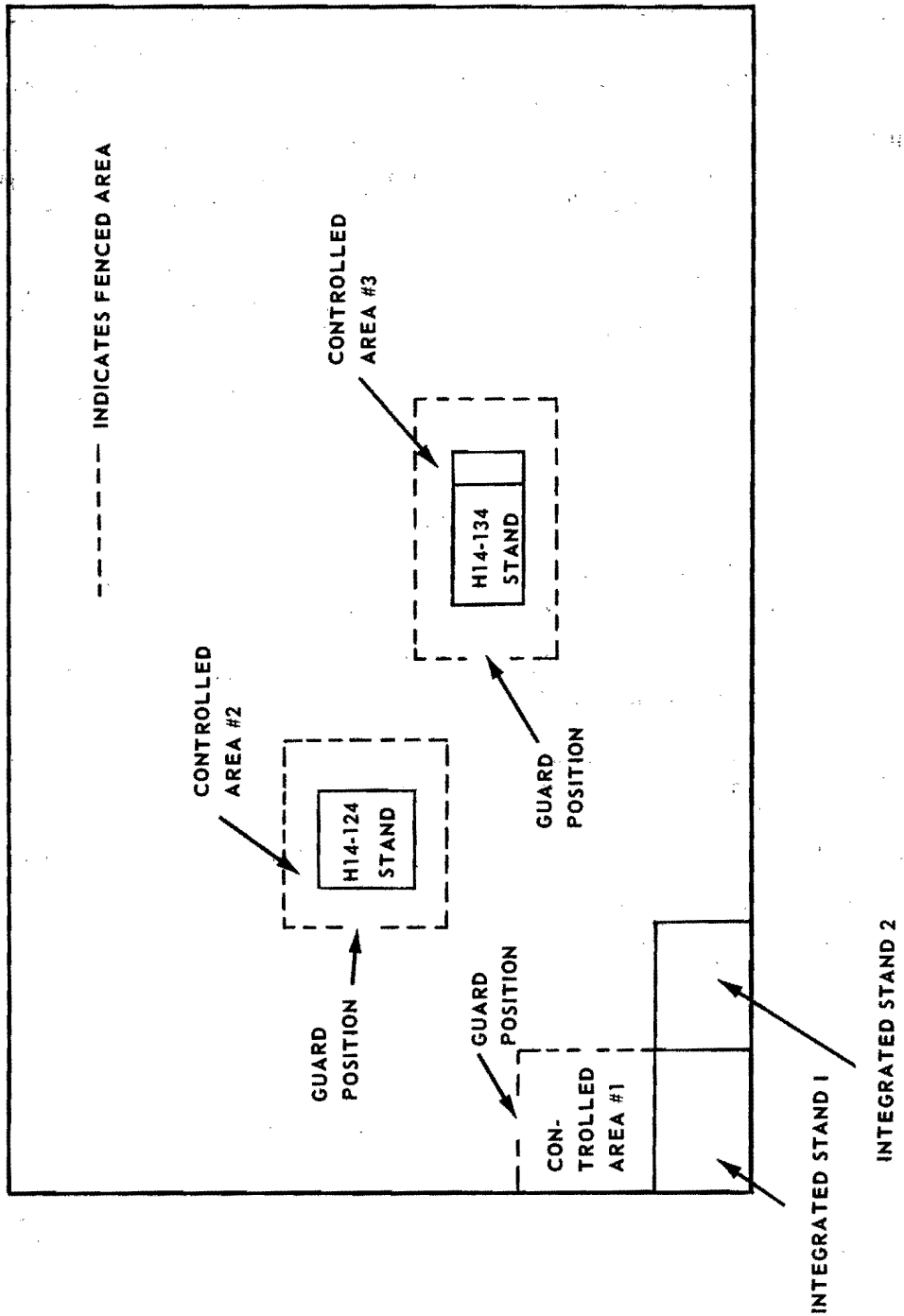
4. Persons authorized to sign in visitors and/or add to the access list are noted by appropriate asterisk(s) on the list.

PROCEDURE: 1. Personnel will clear through the security monitor prior to entering the Controlled Area. No special badging will be provided.

2. Personnel will enter and leave the Controlled Areas as shown in the attached sketch.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

MSOB HIGH BAY



**APOLLO 204 REVIEW BOARD
FEBRUARY 23, 1967**

Administrative Procedure No. 22

TITLE: Control of Audio Magnetic Tapes

SCOPE: This procedure covers the control of all voice transmission recordings relative to spacecraft 012 during the Plugs Out Test on January 27, 1967.

POLICY: 1. All original and duplicate voice recordings on 1/4" magnetic tape relative to S/C 012 after 0600, January 27, 1967 shall be included in this procedure.

2. Access to these voice tapes as well as duplicates shall be restricted to Board Members, Panel Chairmen or their designees as specified in writing.

3. All tapes will be located in a controlled central tape library. Playback of these tapes will be in accordance with the procedure as specified below.

PROCEDURE: 1. All original and duplicate voice tapes will be impounded in Room 2721B, MSOB, Phone: 867-6270.

2. Original tapes will be played back only to make a duplicate.

3. Playbacks will be from a duplicate only.

4. A duplicate can be made from an original only when authorized in writing by a Board member.

5. All originals and duplicates will be maintained in a central tape library located in Room 2721B where recorders will be available for authorized personnel.

6. Mr. G. Huffines or his alternate is the central tape library manager and is responsible for maintaining the tapes in a locked safe and for ensuring that only authorized personnel have access to the tapes. He will schedule and coordinate playbacks to assure efficient use of tapes and recorders. Hours of the library will normally be daily from 8 am to 1630 p.m. Arrangements for use of the library at times other than normal duty hours can be made by contacting the manager.

7. Original tapes containing the time interval 23:25 Z - 23:35 Z will be duplicated in two parts with this time interval or any part thereof being on a separate tape. This time interval requires written AS204 Review Board approval to be played back.

8. Any original may be duplicated at the request of an authorized person, but the duplicate will be retained in the central tape library.

/S/ Dr. Floyd L. Thompson, Chairman
Apollo 204 Review Board

**APOLLO 204 REVIEW BOARD
FEBRUARY 25, 1967**

Administrative Procedure No. 23

TITLE: Disposition and Storage of Physical Evidence

SCOPE: This procedure covers the disposition and storage of Command Module 012 following the completion of the on site investigation by the Apollo 204 Review Board.

POLICY: Except for further testing of components deemed necessary by the Apollo 204 Review Board, the physical evidence, comprised of the Command Module of Spacecraft 012 together with its various components and systems installed therein at the time of the accident occurring on January 27, 1967, shall be placed in the custody of the John F. Kennedy Space Center. When approved by the Board, the systems requiring no further tests shall be reinstalled, as practicable, in the spacecraft. The spacecraft, together with all items, systems and components showing evidence of damage caused by the incident of January 27, 1967, shall be placed in a weather tight, secured container with appropriate locks and seals. Access to the locks and seals shall be controlled by an individual delegated custodial responsibility for the evidence by the Board.

PROCEDURE: 1. In the event it becomes necessary or desirable to reexamine any system or component within the spacecraft, or the spacecraft itself, Board approval for such access shall be obtained, and in accordance with such reasonable precautions as may be necessary to preserve the evidentiary nature of the module, the Custodian shall permit such access.

2. In the event it becomes necessary to remove from the module any item, system or component for further testing, a receipt shall be tendered to the custodian of the module, together with a reference to the test to be performed, and the place of performance. As a necessary part of any further testing procedures, the condition of the item, system or component shall be noted; the exact nature of the test to be performed shall be described; the time, date and place of testing shall be listed; the results of the test shall be documented and the item, system or component shall be returned to the module custodian. Upon receipt of the item, system or component, with documentation in accordance with this procedure, the item, system or component shall be reinstalled, as practicable, in the module, and the documentary results of the test shall be forwarded by the module custodian to the Board's depository at Langley Research Center, Hampton, Virginia; Attention: Apollo 204 Records Custodian.

3. Bonded and sealed storage of the module and its items, systems and components shall be continued for a period of 10 years, unless sooner ordered released from storage by the Board. At the end of a 10 year period of time, providing no further use of the module then appears, the module, its items, systems and components shall be disposed of in accordance with the instructions of the Board.

4. During all times the module and its related equipment is in sealed and bonded storage, efforts shall be maintained to prevent its examination by curiosity seekers and others not having a bona fide interest in the module and its equipment. Final disposition of the module shall be in accordance with such procedures as to prevent its exploitation as a commercial exhibit, or its use as a curiosity.

/S/ Dr. Floyd L. Thompson, Chairman
Apollo 204 Review Board

APOLLO 204 REVIEW BOARD
MARCH 10, 1967

Administrative Procedure No. 24

TITLE: Environmental Control System (ECS) Investigation

SCOPE: This procedure is applicable to all elements of the AS 204 Review Board and authorizes and initiates an investigation of the Spacecraft 012 Command Module ECS. The ECS will be tested, disassembled, and analyzed to the fullest extent to determine:

- a. Possible fire initiators
- b. Possible fire propagators
- c. Suitability and safety of design and fabricated hardware for use in S/C applications.

POLICY:

1. This task will be conducted utilizing existing AS 204 Review Board Procedures.
2. A Board designated agent is herein appointed and is to be supported as required by the S/C Prime Contractor, the pertinent Subcontractors, KSC - Materials Analysis Branch and appropriate quality and support elements.
3. After approval of pertinent general test plans, the designated Board Agent is responsible for the generation, control, and implementation of the detailed plans and activities.

PROCEDURE:

1. This procedure establishes the S/C 012 ECS Investigation Committee and delineates the Committee's authority.
2. The ECS Investigation Committee will consist of:
 - a. D. Hampton, Chairman (Board Designated Agent)
 - b. Robert A. Bruce (Alternate Board Designated Agent)
 - c. E. Wright, KSC - ECS
 - d. D. Evans, KSC - MAB
 - e. W. Hunter, NAA - Downey
 - f. E. Griffith, NAA - F. F.
 - g. D. Nell, Air Research

3. The Board designated Agent will act as Chairman of this Committee and is granted the same authority and privileges as has been defined for Panel Chairman in the existing Administrative Procedures.

4. Each member of this Committee may, at his discretion, call a temporary hold to the operation. An immediate appraisal will be provided with all attempts made to reach a mutually agreeable solution. If such cannot be achieved, work will not progress beyond the point of no return until the Board designated Agent has obtained resolution from higher authority.

5. MAB will act as staff advisors in the Investigation and conduct specialized investigations as required.

6. Air Research will provide engineering advice, planning Procedures, testing and disassembly as required on Air Research supplied subassemblies and components.

7. North American Aviation will provide those normal services such as system level engineering, TPS generation, GSE preparation, testing, QC inspection, etc.

- REPORTING:**
1. Periodic progress reports will be made at pertinent intervals.
 2. A final integrated report will be published upon completion of the effort.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

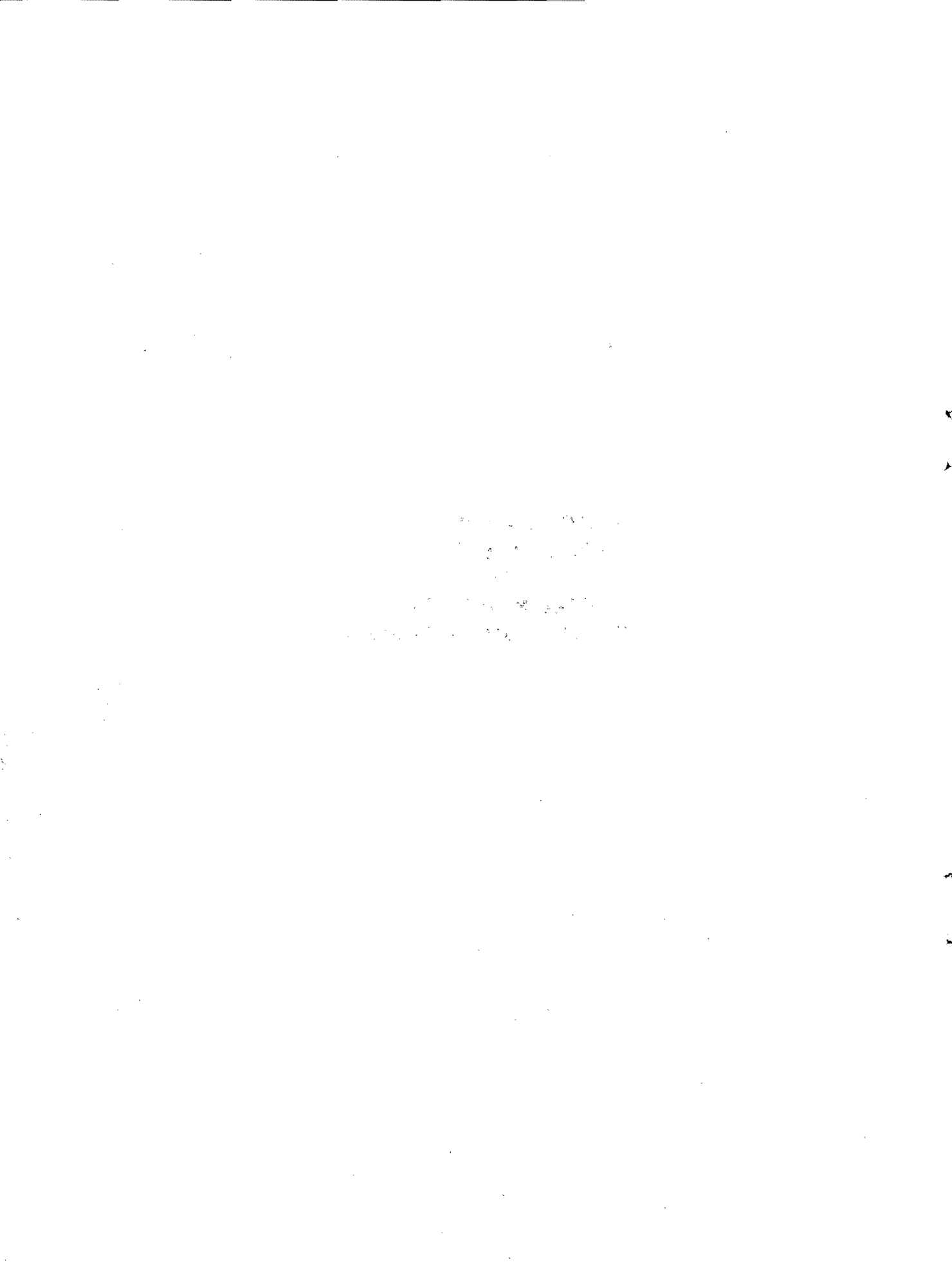
APOLLO 204 REVIEW BOARD
MARCH 13, 1967

Administrative Procedure No. 25

- TITLE:** Continuation of Testing in Support of Apollo 204 Review after recess of Board
- SCOPE:** This procedure is applicable to all elements of the Apollo 204 Spacecraft Program Office, Kennedy Space Center, and Manned Spacecraft Center that require testing and analysis of subsystems, components, and materials of Spacecraft 012 command module in support of the Apollo 204 investigation. This procedure becomes effective when the Apollo 204 Review Board completes its on-site investigation and recesses.
- POLICY:** The policy and procedures set forth in Administrative Procedures 5, 11, and 23, not inconsistent herewith, are applicable. Unless otherwise approved, only non-destructive testing is permissible.
- PROCEDURE:**
1. When a requirement exists for testing, the custodial agent shall be informed thereof.
 2. Laboratory tests and analyses in support of the investigation of the Board will be continued by the appropriate Panel or Panels after recess of the Board, and the results of such tests shall be incorporated serially in Appendix G of the Final Report of the Board and appropriate distribution made.

/S/ Dr. Floyd L. Thompson
Chairman
Apollo 204 Review Board

**REPORT OF PANEL 16
SPECIAL TEST
TO
FINAL REPORT OF
APOLLO 204 REVIEW BOARD**



SPECIAL TESTS

A. TASK ASSIGNMENT

The Apollo 204 Review Board established the Special Tests Panel, 16. The task assigned for accomplishment by Panel 16 was prescribed as follows:

This task involves the coordination of desired tests generated by other groups into an overall integrated test plan. For example flammability testing will probably be done at several locations. This group will assure proper coordination of this activity. Major tests such as mockups of actual configuration, boilerplate destructive combustion tests, etc., would be considered by this group. Test results would be collected, reviewed, and edited in a form suitable for inclusion in the final report.

B. PANEL ORGANIZATION

1. MEMBERSHIP

The assigned task was accomplished by the following members of the Special Tests Panel:

- Mr. G. J. Stoops, Chairman, Manned Spacecraft Center (MSC), NASA
- Mr. J. D. Jeter, Kennedy Space Center (KSC), NASA
- Mr. J. F. Saunders, Office of Manned Space Flight (OMSF), NASA
- Mr. M. E. Gunn, North American Aviation, Inc., KSC

2. COGNIZANT BOARD MEMBER:

Dr. Maxime Faget, Manned Spacecraft Center (MSC), NASA, Board Member, was assigned to monitor the Special Tests Panel.

C. PROCEEDINGS

1. INVESTIGATION APPROACH:

a. The request for special tests were generated by Members of the Board, Panel Chairmen, or Panel members. It was the responsibility of Panel 16 to review these requests to assure that:

- (1) Test duplication did not exist
- (2) The test was relevant to the AS-204 Review.
- (3) The test would contribute significant and meaningful technical results.

b. The Special Test Panel was also responsible for:

- (1) Securing appropriate hardware or materials to accomplish the test.
- (2) Proposing the test facility and/or agency to perform the test.
- (3) Scheduling the test.
- (4) Securing the appropriate approval to implement the test.
- (5) Assuring that test data and reports were submitted by the test agency and delivered to the requester.
- (6) Maintaining a test status.
- (7) Publishing a periodic test summary and status.

c. Panel 16 served as a separate Panel from January 31, 1967, through February 23, 1967. The Panel was dissolved on February 23, 1967, and merged with Panel 18. This merger was accomplished to better support the Apollo 204 Review. The work statement of Panel 16 remained virtually unchanged and at that time continued as a responsibility of Panel 18.

2. SUMMARY OF ACTIVITIES:

a. The accomplishment of the assigned task required that Panel 16 establish a system to receive, maintain status of, and implement special testing. A Request for Special Test (RST) form was devised and issued to all Panel Chairmen on February 13, 1967. The purpose of this form was to permit the requestor of a special test to do so with minimum effort and maximum speed. The RST form also displays the test approval signature, the test location, and the originator.

- b. Panel 16's test files were set up using Special Test Number (STN) as the file index and tracking number. The RST and the STN are synonymous. All correspondence, data, reports and other incidental information was filed by this number.
- c. The Special Test Panel reviewed each test request to establish hardware/material requirements and to determine the test agency or facility who could best accomplish the test. Panel responsibility also required that the procurement or shipment of hardware necessary to perform the test be accomplished. The Special Test Panel fulfilled this responsibility through the use of appropriate contractual channels.
- d. Panel 16 presented the test request with the recommendation of approval or disapproval to Integration Analysis Panel, 18. This recommendation included the proposed test facility, the availability of hardware, and the priority of the test relative to other AS-204 Review testing being done in the same facility.
- e. Test approvals were acquired from either the Review Board or Panel 18. Board approval was required on all tests which utilized Spacecraft 012 hardware or spares or "one of a kind" hardware whose use required control. This assured its availability for AS-204 Review Board usage. Board approval was secured through Panel 18 and the Panel Coordinating Committee. All other testing was approved by Panel 18 prior to implementation.
- f. Implementation of the test was accomplished by either a Test Preparation Sheet (TPS) or an Apollo Spacecraft Hardware Utilization Request (ASHUR). The latter is described in Apollo 204 Administrative Procedure Number 5C (Appendix D-15). The TPS was used for defining the test requirements and procedures for all Kennedy Space Center (KSC) and Manned Spacecraft Center (MSC) testing. The ASHUR defined the test requirements and was used for all Spacecraft 012 hardware testing accomplished at any location other than KSC.
- g. Test data and reports resulting from special tests were submitted to Panel 16. Panel 16 distributed the test results to the originator for his technical evaluation and subsequent inclusion in his final report. Panel 16 was not responsible for performing a technical evaluation of the test data. However, it was responsible for assuring that the data and reports were submitted by the test organization immediately following completion of the test. A summary of pertinent test evaluations resulting from Special Tests is included in the Panel 18 final report.
- h. Panel 16 test files were closed out individually as the tests were completed. Test reports and data were distributed to the test originator. The total file, including originals and working paper, was officially transmitted to Panel 17 for filing.
- i. The first test summary was published on February 4, 1967. Starting on February 14, 1967, the status summary was published each Tuesday and Thursday and has continued through the Apollo 204 Review. The Special Test Summary was distributed to each Panel Chairman and the members of the Panel Coordinating Committee.

D. FINDINGS AND DETERMINATIONS

This section is not applicable to Panel 16. Technical evaluations of tests were performed and reported by other Panels.

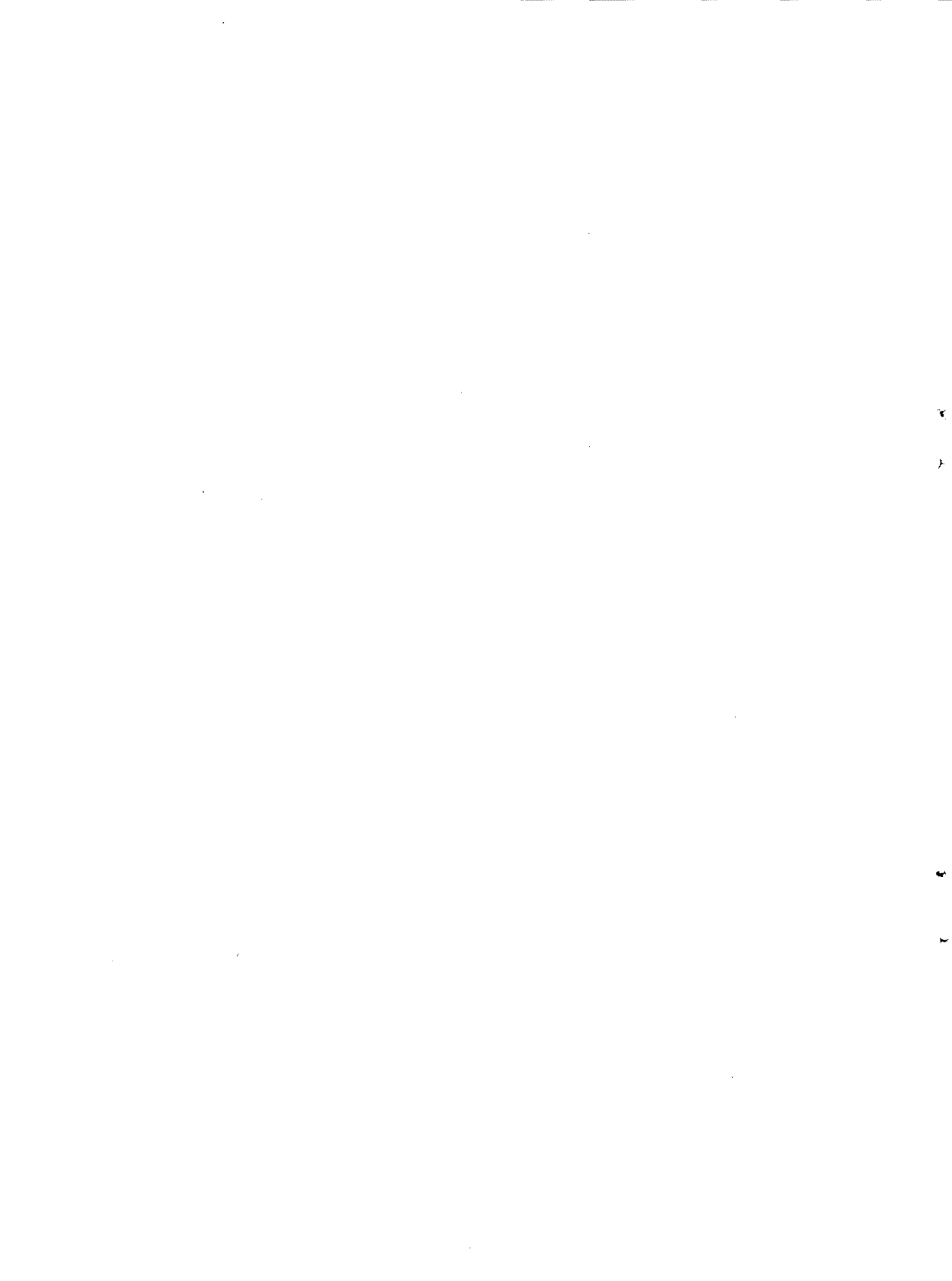
E. SUPPORTING DATA

Enclosure	Description
16-1	Special Test Statistical Summary
16-2	Special Test Synopsis

SPECIAL TEST SUMMARY

MARCH 14, 1967

SPECIAL TEST REQUESTS (TOTAL)			50
DISAPPROVED			11
IN PROCESSING			1
APPROVED			38
IN TEST (TOTAL)			11
KSC	9		
MSC	1		
OTHER	1		
COMPLETED TESTING (TOTAL)			27
RESULTS NOT RECEIVED	7		
RESULTS RECEIVED	20		
RESULTS IN PANEL REVIEW	8		
CLOSED OUT	12		



SPECIAL TEST SYNOPSIS

STN	TEST TITLE	TEST PURPOSE
1.	TV SIMULATION	Substantiate visual resolution expected from a TV monitor system. Test completed on Spacecraft 008 per TPS V16-002-068. Evaluation by Panel 18.
2.	CLEANING FLUID SQUEEZE BOTTLE ANALYSIS	Assure that bottle contents had no causitive relationship to the accident. Analysis per TPS S/C 012-MA-003. Evaluation by Panel 18.
3.	COBRA CABLE — SPARK IGNITION SOURCE	Determine if connecting or disconnecting cobra cable could cause spark or ignition. TPS S/C 012-MA-016 complete. TPS S/C 012-MA-018 waiting parts. Evaluation by Panel 8.
4.	NORTH AMERICAN AVIATION MOCK-UP NUMBER 2 SHIPMENT	Required as a visual reference to support investigation. Arrived February 8, 1967 - No evaluation required.
5.	ONE-HALF SCALE MOCK-UP SHIPMENT	Required to Depict S/C 012 Cabin Interior. Arrived February 8, 1967. No evaluation required.
6.	S/C 014 SHIPMENT	Spacecraft 014 required as a practice and procedure verification vehicle for S/C 012 disassembly activities - Arrived February 1, 1967. No evaluation required.
7.	EMERGENCY EGRESS TEST	Determine force required to break hatch seal at various cabin pressures. Test disapproved because of hatch redesign. No evaluation required.
8.	SPECIAL HANDLING PROCEDURE - S/C 012	Develop procedure to assure proper handling, testing, and disposition of S/C 012 hardware. Administrative Procedure 5B released February 8, 1967; revised to 5C on March 3, 1967.
9.	SPACE SUIT TEST	Determine response of demand regulator to various movements of a suited crew member. Completed on MSC Portable Life Support System (PLSS) console per TPS EC44-0120 and TPS EC44-0121. Evaluation by Panel 3.
10.	BECKMAN OXYGEN ANALYZER - GAS ANALYSIS	Determine whether any clue to the cause of the fire could be found in the gas analyzers - Completed in KSC Materials Analysis Branch (MAB) per TPS S/C 012-S/C 007 - Evaluation by Panel 18.
11.	OXYGEN FLOW RATE SENSOR TEST	Attempt to simulate S/C 012 oxygen flow rate data by subjecting a spare transducer to varying loads - TPS S/C 012-CM-CA 028. Evaluation by Panel 3.
12.	ANALYTICAL STUDY OF FLAMMABILITY OF MATERIAL IN OXYGEN	Provide a basis for a comprehensive fire control program in the spacecraft. Four week study contract awarded to Atlantic Research on February 16, 1967. Evaluation by Panel 8.

ENCLOSURE 16-2

- | | | |
|-----|--|---|
| 13. | QUALIFICATION-TYPE TEST ON LITHIUM HYDROXIDE (LiOH) CANISTER | Determine ability of LiOH canister used during OCP FO-K-0021-1 to meet qualification of flight hardware - Test Disapproved. Information available to verify that canister did not qualify as flight hardware. |
| 14. | GAS CHROMATOGRAPH CABLE ARCING TEST | Determine if connector would arc when dropped onto a metal surface with power applied. Completed on S/C 008 per TPS V16-001-073. Evaluation by Panel 18. |
| 15. | DECOMPOSITION PRODUCTS OF LiOH CANISTER | Determine the composition of the gases generated from the combustion of a LiOH canister. Test requirements incorporated into Special Test No. 50. |
| 16. | GAS CHROMATOGRAPH CABLE: WATER/GLYCOL TEST | Determine reaction of powered gas chromatograph connector to water/glycol vapor and liquid - to be accomplished in KSC-MAB per TPS S/C 012-CM-MA-016. Evaluation by Panel 18. |
| 17. | CHROMATOGRAPH AND ALTERNATING CURRENT (AC) BUS SWITCHING TEST | Attempt to determine spacecraft configuration and operations which could produce conditions found in S/C 012 data - accomplished on S/C 008 per TPS V16-006-064. Evaluation by Panel 3. |
| 18. | MULTIPLE KEYING TEST | Attempt to simulate S/C 012 communications anomalies by performing multiple keying operations on S/C 008. Test cancelled because of questionable value of information that would be obtained. |
| 19. | SMOKE AND FIRE GLOW SIMULATION ON TELEVISION MONITOR | Symbolically simulate the accident by providing smoke and fire glow as described by witnesses. Test disapproved as providing no meaningful information beyond that obtained in the first TV test. |
| 20. | VERIFY PROCEDURES USED TO CLEAN CONNECTORS EXPOSED TO WATER/GLYCOL | Verify adequacy of procedures used to clean connectors on S/C 012 exposed to water/glycol. Combined with special test No. 33 because of similarity. To be accomplished in KSC-MAB. Evaluation by Panel 8. |
| 21. | FLOW MEASUREMENT IN SUIT LOOP UNDER VARYING CONDITIONS | Attempt to duplicate high suit flow rates and possible suit hose disconnect seen in S/C 012 data - accomplished at MSC on breadboard per TPS STB-A-167. Evaluation by Panel 3. |
| 22. | SPACECRAFT ELECTRICAL TESTS | Attempt to simulate electrical anomalies indicated on S/C 012 data at the time of the accident - accomplished on S/C 008 per TPS V16-001-073. Evaluation by Panel 3. |
| 23. | GAS CHROMATOGRAPH CONNECTOR: TREATED VELCRO ARCING TEST | Determine if energized connector rubbing over Velcro treated with glycol and methyl-ethyl-ketone (MEK) would cause ignition. Test disapproved as not providing meaningful information. |

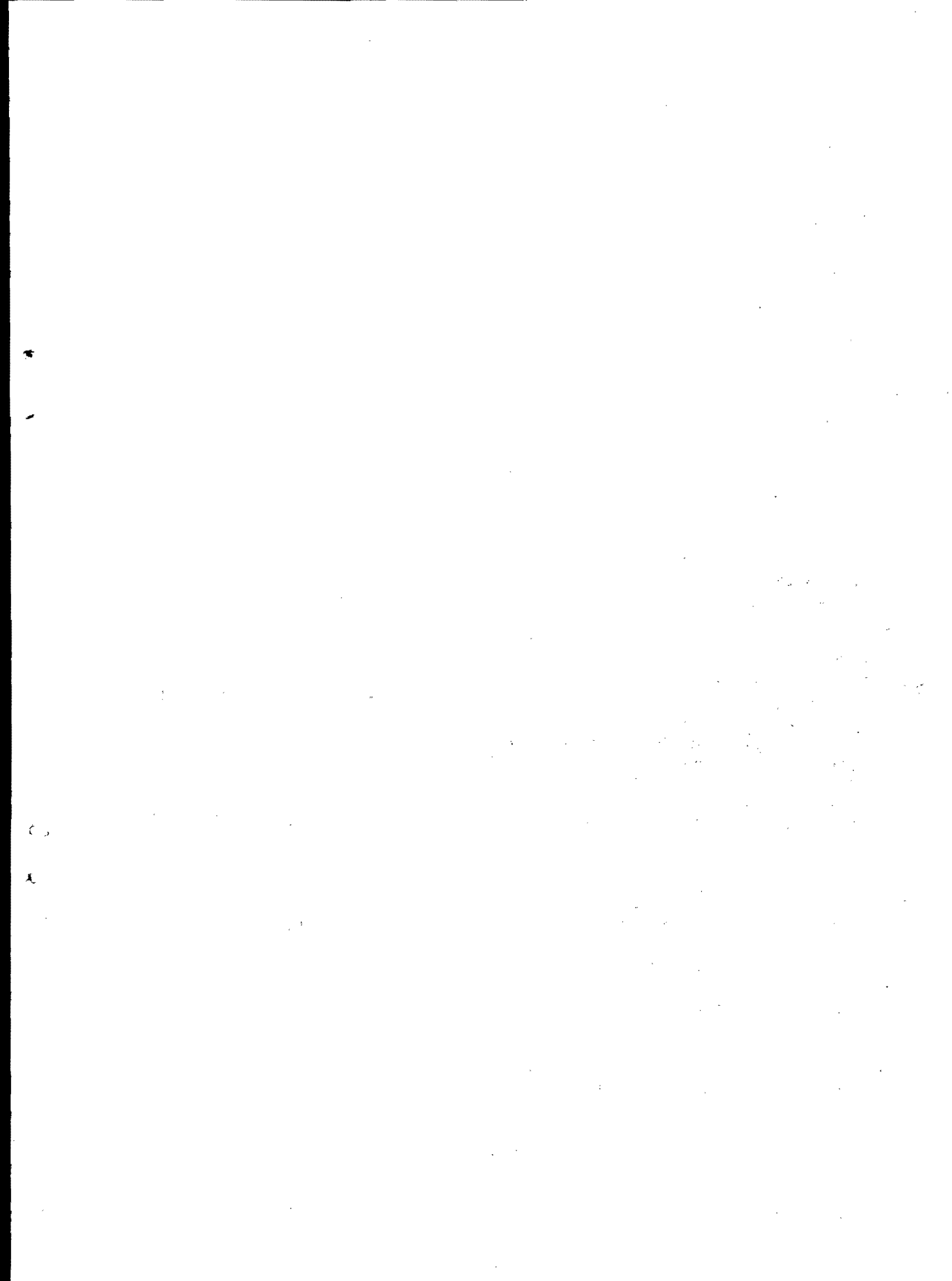
24. ELECTROSTATIC TEST - SPACE SUIT
Determine electrostatic charge that can be developed by a suited crewman in spacecraft atmospheres. Part 1 - TPS Pressure Garment Assembly (PGA) 152 complete - Part 2 - TPS S/C 014-CM 038 pending spacecraft availability. Evaluation by Panel 8.
25. S/C 012 ATMOSPHERE - RELATIVE HUMIDITY
Calculations of S/C 012 atmosphere relative humidity entered in Special Test Log because of its potential use. Technical evaluation not required.
26. VENT VALVE OPERATION
Determine maximum cabin pressure at which vent valve fails to operate. Test disapproved because vent valve was not designed for use in over-pressure conditions.
27. GAS CHROMATOGRAPH CABLE PROCUREMENT
Procurement action to assure availability of spare gas chromatograph cables for test usage. Cables received February 25, 1967.
28. SUIT FLOW TESTS
Obtain additional information for evaluation of S/C 012 suit flow data - test constrained by lack of a properly configured spacecraft. To be performed at MSC. Evaluation by Panel 3.
29. ANALYSIS OF S/C 012 GAS CHROMATOGRAPH CABLE
Determine damage to and involvement of gas chromatograph cable in cause of accident - analysis in progress in KSC-MAB per TPS S/C 012, CM-IV088. MAB report MAB-238-67. Evaluation by Panel 18.
30. ANALYSIS OF LIQUID FROM QUAD ENGINE
Analyze liquid from Quad B, Engine No. 3 to determine composition and source - analyzed in KSC-MAB per TPS S/C 012-SM-MA 001, MAB Report Number MAB-232-67. Evaluation by Panel 18.
31. ANALYSIS OF CONTENTS OF GAS MELON
Attempt to gain further information on contents of melon sampler used to analyze suit gases on January 27, 1967 - analysis performed in KSC-MAB per TPS S/C 012-S/C 017, MAB Report Number MAB 259-67. Evaluation by Panel 18.
32. FLAME RATE OF ETHYLENE GLYCOL/WATER MIXTURES
Determine concentrations of ethylene glycol/water mixtures which could have supported combustion on S/C 012. Accomplished in KSC-MAB. Evaluation by Panel 8.
33. WATER/GLYCOL EFFECTS
Determine if procedure used to clean connectors exposed to water/glycol on S/C 012 was adequate, and effects upon connectors of exposure to water/glycol - to be performed in KSC-MAB. Evaluation by Panel 8.

34. INERTIAL MEASUREMENT UNIT (IMU) TEMPERATURE CONTROL TEST Determine changes in IMU Heater and Blower current as a function of Bus voltage changes, for correlation with S/C 012 data - Test cancelled.
35. PROCUREMENT OF ENVIRONMENT CONTROL UNIT (ECU) CABLE ASSEMBLIES Supply twenty-five (25) cable assemblies to support Special Test No. 33. Twenty-three (23) assemblies available March 10, 1967; three weeks lead time on remaining two. Evaluation not required.
36. LiOH CANISTER TEST Measure temperature and flow characteristics of LiOH canister same as those used on S/C 012 during OCP FO-K-0021-1.

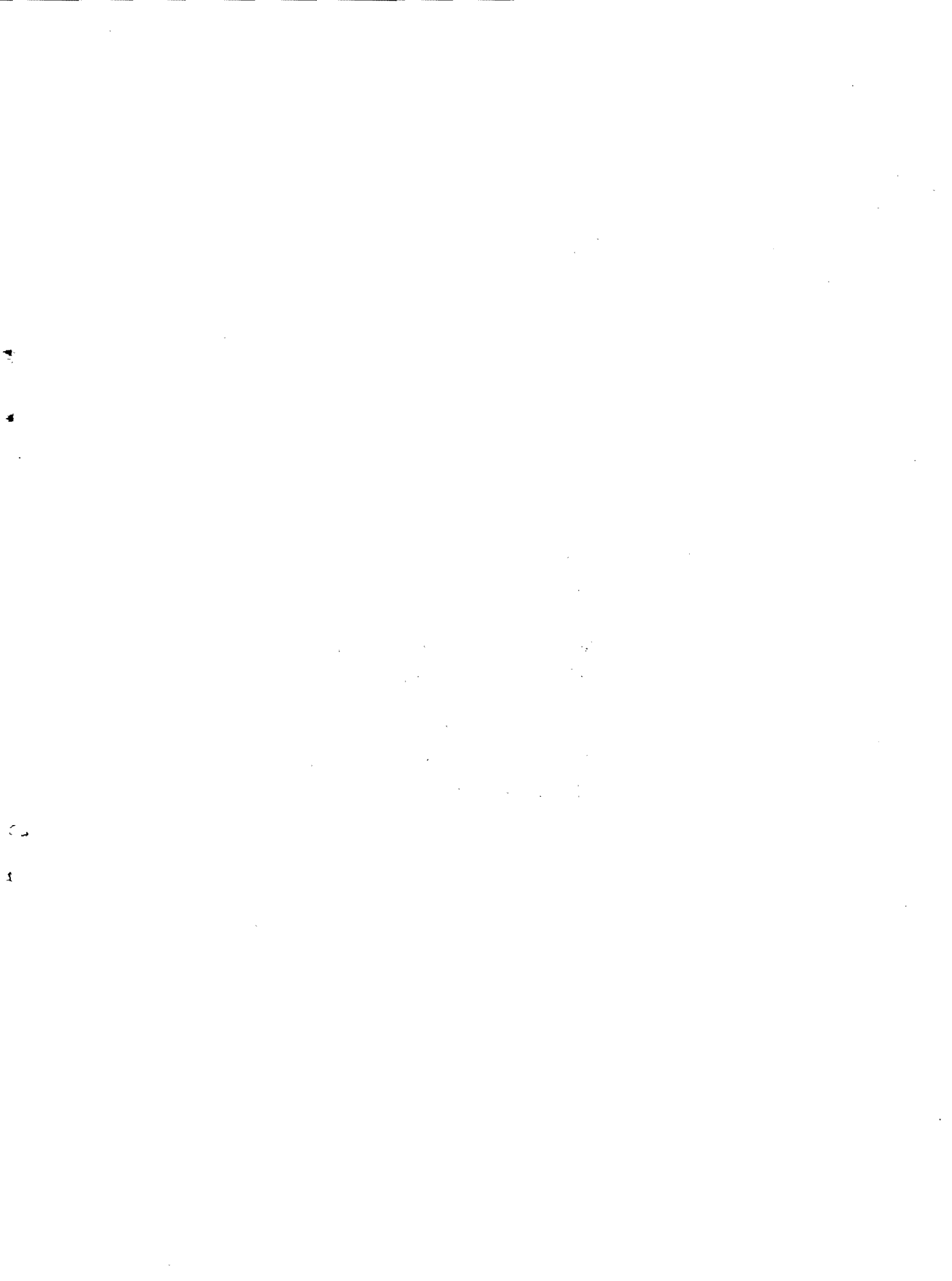
Test Requirements incorporated into Special Test No. 50. Evaluation to be made as part of that test.
37. SOOT COMPARATIVE ANALYSIS Comparative analysis of soot from near cabin relief valve inlet and from steam duct to verify cabin relief valve operation. To be analyzed in KSC-MAB per TPS S/C 012-CM-MA-008. Evaluation by Panel 10.
38. ANALYZE DEPOSIT ON COMMAND PILOT FOOT PAN Analyze deposit on Command Pilot's foot pan to determine its composition and aid in determining its origin.

Performed in KSC-MAB per TPS S/C 012-CM-MA-007, MAB Report Number MAB 311-67. Evaluation by Panel 18.
39. ELECTRICAL SHORT TEST Provide data to support investigation of alternating current (AC) anomaly noted on S/C 012 prior to the accident. Accomplished on S/C 008 per TPS V-16-001-083. Evaluation by Panel 3.
40. COLDPLATE LEAK CHECK Isolate sources of water/glycol leakage which may have contributed to the accident. Included in plan of action for Board Action Item 0107. Evaluation by Panel 18.
41. SPECIAL ECU WITH LiOH CANISTERS Obtain accurate thermal and chemical performance data on LiOH canister under conditions nearly identical to S/C 012-Requirements incorporated into Special Test No. 50. To be evaluated as part of that test.
42. CABIN RELIEF VALVE AND VENT LINE FLOW Determine flow characteristics through vent line with vent valve in abort entry mode for correlation with S/C 012 data - accomplished on Mockup SMD-2B. Evaluation by Panel 10.
43. DIFFERENTIAL PRESSURE (ΔP) vs COUPLING DATA UNIT (CDU) GIMBAL ANGLES Obtain plot of CDU Gimbal Angles at various cabin pressures for comparison with S/C 012 data - accomplished on S/C 008 per TPS V16-001-089. Evaluation by Panel 10.

44. CHROMATOGRAPH CABLE TEST
Reproduce copper flow found on S/C 012 Chromatograph Cable following accident. Performed in KSC-MAB per TPS S/C 012-CM-MA-011. MAB Report Number MAB 297-67. Evaluation by Panel 18.
45. WEIGH LIOH CANISTERS
Determine extent to which canisters had reacted with the surrounding atmosphere during storage. Incorporated into Special Test No. 50. To be evaluated as part of that test.
46. ELECTRICAL SHORT TEST
Conduct electrical shorting tests on a vehicle configured similar to S/C 012 to obtain information relative to cause of ignition. Request withdrawn by originator.
47. AC BUS 2 SHORT ON PHASE A
Provide additional data to support investigation of S/C 012 AC anomaly prior to the accident. Performed on S/C 008 per TPS V16-001-093. Evaluation by Panel 3.
48. OCTOPUS CABLE TEST - S/C 008
Acquire positive data to determine if MDAS would evidence anomalies due to short duration grounding of direct current (DC) Main Bus B. Authorized per ASHUR 012-501 - accomplished on S/C 008 per TPS V16-001-093. Evaluation by Panel 3.
49. ELECTRICAL SHORT TEST
Determine effects of hard shorts on various gage wire circuits within the DC systems. Test to be accomplished March 15, 1967, on S/C 008 at MSC. Evaluation by Panel 3.
50. LIOH CARTRIDGE TEST
Combination of requirements of Special Tests 15, 36, 41, and 45. To be accomplished in KSC-MAB. Evaluation by Panels 2, 5, 8, 11, and 18.



**REPORT OF PANEL 17
FINAL BOARD REPORT
APPENDIX D-17
TO
FINAL REPORT OF
APOLLO 204 REVIEW BOARD**



A. TASK ASSIGNMENT

The Apollo 204 Review Board established the Final Board Report Panel, 17. The task assigned for accomplishment by Panel 17 was prescribed as follows:

This activity involves the organization of the report, the delegation of responsibility to other assigned task groups, the review and editing of submitted material, and the final preparation of the Report.

B. PANEL ORGANIZATION

1. MEMBERSHIP:

The assigned task was accomplished by the following members of the Final Report Panel:

Lt. Col. K. H. Hinchman, U. S. Air Force, Chairman
Mr. R. D. Smith, Kennedy Space Center (KSC), NASA
Mr. J. G. Ross, Langley Research Center (LaRC), NASA

2. COGNIZANT BOARD MEMBER:

Colonel Charles F. Strang, U. S. Air Force, Board Member, was assigned to monitor the Final Report Panel.

C. PROCEEDINGS

In response to the direction of the Apollo 204 Review Board, the Panel derived detailed objectives. These objectives were: preparation of the Apollo 204 Review Board Final Report; review of Panel reports; and the establishment and maintenance of an Apollo 204 Review Board General File.

1. FINAL REPORT PREPARATION:

The Apollo 204 Review Board immediately recognized the Final Report would serve important functions. These functions included: the detailed documentary of the investigation process; the presentation of the rationale which supports the findings and recommendations; and the presentation of validating data used to eliminate specific systems and procedures as possible causative factors. With these functions in mind, the Final Report Panel was designed to document findings, determinations, and recommendations for submission to the Administrator, National Aeronautics and Space Administration (NASA).

To accomplish this objective effectively, it was initially determined that the Final Report Panel would establish a system to insure that every Board proceeding, statement, text, analysis, disassembly action, etc., was documented. Original copies (wherever possible) of each supporting document were obtained by the Panel. Those identified for enclosure in the Final Report were then reviewed, edited, and assembled. The Final Report would lose its readability and effectiveness if every document created during the review was included in the report proper. Therefore, only those documents, photographs and test results considered pertinent to the findings of the Review Board are contained within the covers of the Report. All other references are retained in the General File. Enclosure 17-1 is the outline used in the preparation of the Final Report.

2. PANEL REPORT PREPARATION - APPENDIX D TO THE FINAL REPORT:

Enclosure 17-2 illustrates the procedures employed in the preparation of the Final Panel Reports. Panel Chairmen consulted Panel 17 to obtain detailed requirements for Final Panel Report preparation. Format, enclosures, findings and determinations were discussed, and recommended improvements defined. Each draft of the Panel Reports was edited by Panel 17 and simultaneously, technical reviews were made. Copies were prepared and distributed to Board Members, Counsels to the Board and cognizant Panel Chairmen for individual study. The Apollo 204 Review Board, through meetings with the Panel Chairmen, reviewed the completeness, coordinated the contents with other Panels, and judged the acceptability of the reports. Panel Chairmen advised Panel 15 of their photographic selections for

inclusion in the Final Panel Report. Services for the preparation and reproduction of text, charts, drawings, photographs, and binding of the Final Report were obtained by the Final Report Panel, 17.

3. GENERAL FILE:

The Apollo 204 Review Board General Files were established in accordance with Review Board Administrative Procedure 15. The Final Report is dependent upon this file for much of the supporting documentation. Data relative to fire propagation, materials, systems operation at high temperatures, system and component testing and validation, etc., are some of the by-products of the review and are available in the file. The composition and functions of the Review Board, as well as task assignments of the Panels, are also available therein. The file system is designed to insure that every item entered in the file is reviewed, logged, indexed and cataloged. Major classification is by Panel with specific reference data pertaining to the Panel Report filed in the front of each Panel's file. Test Preparation Sheets (TPS), prepared for each test, disassembly task, investigation technique, etc., are identified by the spacecraft system to which they apply and are cross indexed by TPS number.

All Review Board General Sessions were recorded on tapes designated "original" (Review Board Administrative Procedure 9) and are in the General File. These tapes were then used in transcribing minutes of General Sessions. Verbatim transcripts of these sessions are incorporated in Appendix A along with minutes of the Executive Sessions. Edited copies of original tapes were made and designated "master". The editing process removed extraneous information and periods of silence. Other items in the General File include photographs, diagrams, T.V. tapes and motion picture films.

In accordance with the direction of the Administrator, NASA, February 27, 1967, the Final Report and General File will be maintained by the Director, Langley Research Center, Langley Station, Virginia, for the National Aeronautics and Space Administration, to provide a source of information to inquiries and for research projects of the future.

D. FINDINGS AND DETERMINATIONS

Not applicable.

E. SUPPORTING DATA

Enclosures

- 17-1 Final Report Outline
- 17-2 Task Panel Report Flow Chart

FINAL REPORT OUTLINE

Letter of Transmittal to Administrator, NASA

Preface

Table of Contents

Part 1 - Purpose and Authority

- a. Narrative of Board History
- b. NMI 8621.1 and memoranda of January 28 and February 3, 1967.
- c. Dr. Seaman's letters on appointment of Dr. Van Dolah; letters on deletion of Dr. Long and Mr. Jeffs.

Part 2 - Biographical background on each board member and Counsel to the Board.

Part 3 - Board:

- a. Organization Letter from Board Chairman on appointments of Representatives, Consultants, Liaison to the Board and Task Panels.
- b. Procedures - Explanation of how Board functions, i.e., daily General and Executive Sessions, Task Panel participation, decisions and requests for Panel accomplishments enacted in Executive Session.
- c. Summary of Activities - Record of Board proceedings.
- d. Spacecraft and data custodial responsibilities
- e. Interim Reports from Deputy Administrator, NASA to the Administrator. NASA

Part 4 - History of Accident

- a. Background of Spacecraft 012 together with description of test objectives and sequences up to start of T-10 hold.
- b. Time line from T-10 hold through medical determination of death (summarize events as they occurred).

Part 5 - Investigation and Analysis — a detailed descriptive narrative of the investigation which provides an analysis of the causes or probable causes.

Part 6 - Findings, Determinations, Recommendations

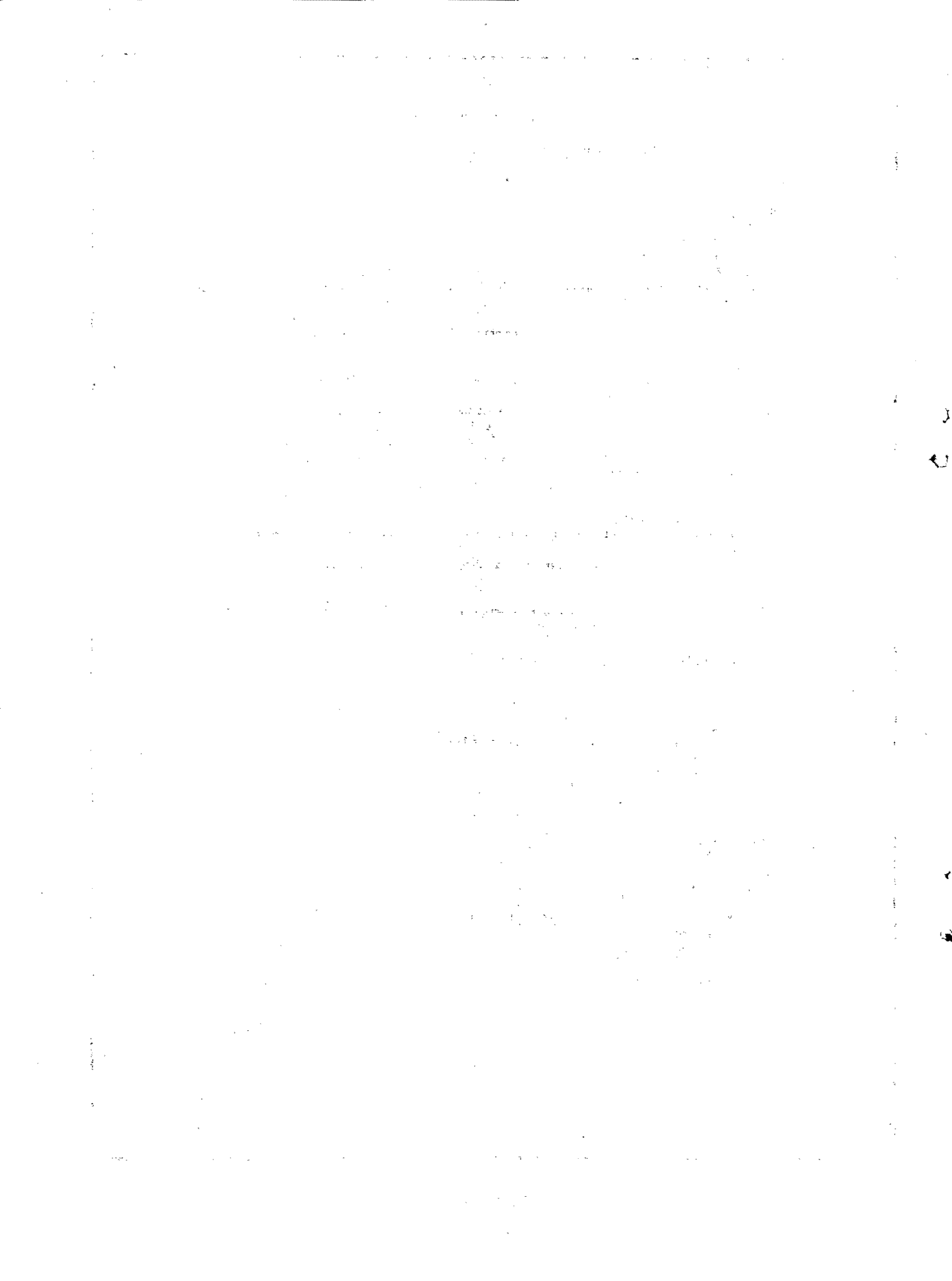
Appendices:

- a. Board Minutes.
- b. Witness statements (with releases).
- c. Apollo Operations Handbook, dated 12 November 1966.
- d. Panel Reports.
- e. Organization and Management.
- f. Schedule of Physical Evidence.
- g. Addenda and Corrigenda.

Board Files not part of report:

General File:

1. Witness statements not relevant.
2. Photographs not used in report.
3. Supplementary analysis and data used in preparation of Report.
4. Working papers.
5. Voice and medical records (filed at MSC).
6. Correspondence from General Public
7. Miscellaneous papers.



PANEL REPORT FLOW CHART

