Guide to the Apollo Collection

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Descriptive Summary

Title: Apollo Collection

Collection number: Special Collections Apollo Collection

Creator: Charles Lundquist

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Preferred Citation: [Identification of item] Apollo Collection, Dept. of Archives/Special Collections, M. Louis Salmon Library, University of Alabama in Huntsville, Huntsville, AL.

Scope and Content

The Apollo Collection (9 linear ft.) includes approximately 300 documents, books, letters, and film. Subjects covered within this collection include lunar exploration planning and material about each Apollo mission.
Background

The Group for Lunar Exploration Planning (GLEP) was established by NASA during a conference on lunar missions held in Santa Cruz, California from July 31 to August 13, 1967. GLEP had its first meeting during the final three days of the conference. The GLEP met frequently in the following years to formulate recommendations for Apollo landing sites on the Moon and for objectives of the Apollo missions. The Apollo Collection contains the minutes of the several GLEP meetings and various working papers used and generated by the group. The documents associated with a specific meeting are in one or more binders with an index in the front of each binder. The binders are shelved chronologically by the dates of the meetings.

During the Apollo Program, there were eleven rocket flights or missions that carried astronauts. These missions with human passengers are designated as Apollo 7 through Apollo 17. This collection contains eleven individual series corresponding to the eleven missions, namely the Apollo 7 Series through the Apollo 17 Series. As the name implies, each series has documents from preparation for the numbered mission, execution of that mission, and results from it.

Notes to the Researcher

The Guide to the Apollo Collection is divided into 17 major subjects, or series. These series are listed in the Table of Contents as:

- **Series 1** --- Lunar Exploration Planning, which contains the documents relating to the planning prior to the 1965 Summer Conference on Lunar Exploration and Science at Falmouth, Massachusetts;
- **Series 2** --- Lunar Exploration Planning, which contains the documents relating to the planning at the 1965 Summer Conference and prior to the 1967 Summer Study on Lunar Exploration and Science at Santa Cruz, California;
- **Series 3** --- Lunar Exploration Planning, which contains the documents related to the 1967 Summer Study on Lunar Exploration and Science at Santa Cruz, California;
- **Series 4** --- Lunar Exploration Planning, which contains the documents from the meetings and activities of the Group for Lunar Exploration Planning beginning with the meeting in Houston on November 13-14, 1967 and continuing through the Apollo lunar landings;
- **Series 5** --- Saturn Apollo-Saturn 2 and 3 suborbital missions with Project High Water;
- **Series 6** --- Saturn orbital missions SA-8, SA-9, and SA-10 with Pegasus Satellites;
- **Series 7** --- Apollo 7 manned mission;
- **Series 8** --- Apollo 8 manned mission;
- **Series 9** --- Apollo 9 manned mission;
- **Series 10** --- Apollo 10 manned mission;
- **Series 11** --- Apollo 11 manned mission;
- **Series 12** --- Apollo 12 manned mission;
- **Series 13** --- Apollo 13 manned mission;
- **Series 14** --- Apollo 14 manned mission;
- **Series 15** --- Apollo 15 manned mission;
- **Series 16** --- Apollo 16 manned mission;
- **Series 17** --- Apollo 17 manned mission.

The Guide is available in print and also online from the Archives website at [www.uah.edu/library](http://www.uah.edu/library). All materials of this collection---books, documents, letters, and films---are to be used in the Archives Dept. and may not circulate outside of the Library. Copies may be made and used with the proper citation: [Identification of item] Apollo Collection, Dept. of Archives/Special Collections, M. Louis Salmon Library, University of Alabama in Huntsville, Huntsville, AL.
Apollo Collection
Series 1 Lunar Exploration Planning pre-1965

Location 1.01 Series 1 Lunar Exploration Planning pre-1965
Document Title Minutes of Meetings of Working Group on Lunar Exploration
Author Jastrow, Robert, working group chair
Source NASA appointed working group Date 2/5/1959
Abstract This working group is formed for accomplishing the NASA lunar surface exploration project. The intent of this meeting was to arrive at tentative decisions regarding the best choice of scientific experiments to be put aboard the lunar exploration vehicles which may be launched during the next five years.

Location 1.02 Series 1 Lunar Exploration Planning pre-1965
Document Title Summary Minutes Lunar Science Subcommittee
Author Jastrow, Robert, chair
Source NASA Headquarters Date 4/13/1960
Abstract Dr. Jastrow outlined the purpose of this meeting and proceeded immediately to the first item on the agenda; a review and up-dating of the NASA Office of Space Sciences Ten-Year Program.

Location 1.03 Series 1 Lunar Exploration Planning pre-1965
Document Title Memorandum: Ranger (Agena) Spacecraft S-3 to S-5.
Author Hibbs, A.R.
Source JPL memo to Subcommittee on the Lunar Program Date 4/15/1960
Abstract A design study on the second series of Ranger spacecraft is nearing completion. This spacecraft has two major parts (1) the "bus" and (2) a separable rocket stage called the "capsule" capable of landing a survivable package on the lunar surface.

Location 1.04 Series 1 Lunar Exploration Planning pre-1965
Document Title Memo for internal use only, Estimated Lunar Spacecraft Capabilities
Author Eimer, M.
Source JPL Date 4/15/1960
Abstract The spacecraft listed are A) Atlas Centaur, B) Saturn C-1 and C) Saturn C-2.
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<th>Location</th>
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<th>Abstract</th>
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<tr>
<td>1.05</td>
<td>1 Lunar Exploration Planning pre-1965</td>
<td>Rough Draft: Lunar Program</td>
<td>Meredith, L.H.</td>
<td>NASA Headquarters</td>
<td>4/29/1960</td>
<td>If one goal were to be selected which would most influence the overall NASA program during the next decade it would be manned flight to the moon. The manned space flight program, the program of unmanned lunar exploration and the booster development program are all oriented toward this goal.</td>
</tr>
<tr>
<td>1.06</td>
<td>1 Lunar Exploration Planning pre-1965</td>
<td>Revision for NASA Program Planning, Part II,G, &quot;Lunar Sciences&quot;</td>
<td>Hibbs, A.R.</td>
<td>JPL</td>
<td>5/2/1960</td>
<td>Objectives: The program of lunar sciences contains all the research on the moon and its environment, with the objective of understanding the nature and origin of the moon.</td>
</tr>
<tr>
<td>1.07</td>
<td>1 Lunar Exploration Planning pre-1965</td>
<td>Rough Draft 10 Yr Plan for Lunar Study Committee</td>
<td>Hibbs, A.R., Eimer, M., Buwalda, P.</td>
<td>JPL</td>
<td>5/12/1960</td>
<td>The objectives of the lunar exploration program are to obtain data leading to the understanding of the Moon as it exists today and as it was in the past and ultimately to establish scientific laboratories and observatories on the lunar surface.</td>
</tr>
<tr>
<td>1.08</td>
<td>1 Lunar Exploration Planning pre-1965</td>
<td>Trip Report; Meeting of Lunar Sciences Sub-Committee</td>
<td>Bucher, George C.</td>
<td>MSFC</td>
<td>5/16-17/1960</td>
<td>A review of the 10-year Plan for the Lunar Sciences Program was not completed due to lack of time, although a JPL version was presented by the JPL representatives. The relative scientific merits of various unmanned SATURN flights were discussed.</td>
</tr>
</tbody>
</table>
The Subcommittee discussed manned space flight and its value to the scientific program. Dr. Newall commented that the Subcommittee should determine the scientific objectives and then decide whether the steps leading to these objectives included manned circumlunar flights.

The Problem: Are the present and projected astronomical facilities and capabilities in the U.S. adequate to support the NASA Space Program for the period 1960-1970?

The committee heard status reports on current activities. Also, George Low gave a brief presentation on Project Apollo, the follow-on program to Mercury.

The meeting had as its principal purpose the discussion of several methods which have been proposed for analysis of the surface composition of the moon.

A complete review of the Surveyor soft-landing program was presented by JPL personnel.
In order to establish a fixed set of design parameters for the Surveyor spacecraft, a set of instruments has been studied and their characteristics used for the purpose of spacecraft specification.

An ad hoc committee on lunar landing sites was constituted on July 3, 1961 as part of the Space Sciences Board with H.C. Urey as chair and H. Hess and Z Kopal as members. The committee met on July 31 with a group of scientists concerned with lunar missions at the Jet Propulsion Laboratory. A set of recommendations was tentatively formulated.

For this meeting, please prepare your list of lunar landing sites for distribution and discussion.

A brief listing of topics discussed and recommendations is given.

One page organization chart for Lunar and Planetary Programs. Major divisions are science and engineering.
### Apollo Collection
**Series 2 Lunar Exploration Planning pre-1967**

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<th>Source</th>
<th>Date</th>
<th>Abstract</th>
</tr>
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<tbody>
<tr>
<td>2.01</td>
<td>2</td>
<td>NASA 1965 Summer Conference on Lunar Exploration and Science</td>
<td>Allenby, Richard J.; Chairman</td>
<td>NASA SP-88</td>
<td>07/19-31/1965</td>
<td>In summer, 1965, NASA conducted a Lunar Exploration and Science Conference in Falmouth, Massachusetts. The conference divided into Working Groups on: Geodesy-Cartography, Geology, Geophysics, Bioscience, Geochemistry, Particles-Fields, Lunar Atmospheres, and Astronomy. The recommended lunar program covers a 10-year period, beginning with the first Apollo flights. The first section of the report outlines conference results according to mission and discipline, and the second section contains the complete report of each working group.</td>
</tr>
<tr>
<td>2.02</td>
<td>2</td>
<td>NASA Lunar Exploration Program Plan</td>
<td>Lunar Exploration Working Group</td>
<td>NASA document 'for internal use only'</td>
<td>11/1/1966</td>
<td>A Lunar Exploration Working Group was established in February, 1966, to examine the objectives and systems associated with its mission area. This document summarizes the considerations of the OMSF, OSSA, OART, and OTDA representatives assigned to the Lunar Exploration Working Group. It is a working paper that illustrates the firm belief of its contributors that an effective lunar exploration plan can result from careful matching of scientific objectives with the capabilities of unmanned systems and Apollo derivitives within a reasonable budgetary level.</td>
</tr>
<tr>
<td>2.03</td>
<td>2</td>
<td>Lunar Orbiter Sites Missions I, II, and III</td>
<td>Mapping Sciences Branch</td>
<td>NASA</td>
<td>1/1/1967</td>
<td>Map of the moon with photographic coverage areas for Lunar Orbiter Missions I, II, III.</td>
</tr>
</tbody>
</table>
In the formulation of plans for future programs, it has been NASA's practice to obtain guidance and critical review from the scientific community. With respect to lunar exploration, guidance has been provided by two studies held during the summer of 1965: The Space Science Board of the National Academy of Sciences and the NASA Conference on Lunar Exploration and Science. In response to invitations by Homer E. Newell, more than 40 leading scientists met at GSFC to review NASA's lunar program planning.

The purpose of this publication is to provide the basic information and bare essentials required for lunar mission planning. Descriptions of the basic lunar space vehicles are provided, including the manned landers, the unmanned trucks, the mobility units and the experiment packages. The payload capabilities of these vehicles are provided, along with operational constraints. The scope of this report is the exploration time period beginning after the first two or three successful lunar landings.

NASA has initiated the Apollo Applications lunar missions program for scientific exploration of the moon. The first operational mission in the series is scheduled for 1970, however this announcement applies to 1971 and 1972 surface missions.

Sixteen sites, concentrated mainly in the northern half of the lunar front face, constitute the potential AAP landing sites proposed for Lunar Orbiter Mission V. Two sites fall within craters. The rest are at least partly in mare material or mare-like blankets, especially at or near contacts with highland terrains.
This binder contains various working papers used at the NASA 1967 Summer Conference on Lunar Exploration and Science. The papers concern particularly the Geodesy and Cartography Working Group and the GLEP meetings. There is a table of contents at the front of the binder.

Working papers and correspondence from Geodesy-Cartography Working Group between Falmouth and Santa Cruz Conferences
Questions to the Santa Cruz Summer Study on Lunar Exploration and Science

The attached group of questions are submitted to the participants in the Santa Cruz Summer Study Conference to provide guidance to the Lunar Working Group in developing program plans and schedules for missions to accomplish lunar exploration and science in the AAP and post-AAP eras.

Group for Lunar Exploration Planning; final meeting at Santa Cruz


Agenda, Final Summary Session, Santa Cruz

Agenda for Final Summary Session of Santa Cruz Summer Conference. The folder also contains the projection transparencies for the Geodesy-Cartography presentation at the Summary Session.

Review Copy: Lunar Exploration Summer Study

This is the review copy of the Lunar Exploration Summer Study at Santa Cruz held July 31 to August 13, 1967. This binder contains various recommended changes to the review copy from members of the Geodesy-Cartography Working Group.
**Document Title**: Newspaper article on Lunar Orbiter accomplishments  
**Author**: Lannan, John  
**Source**: Sunday Herald Traveler  
**Date**: 11/26/1967  
**Abstract**: News report on the five mission Lunar Orbiter Program

**Document Title**: Consistency of Lunar Orbiter Residuals with Trajectory and Local Gravity  
**Author**: Muller, Paul M.  
**Source**: JPL  
**Date**: 1967  
**Abstract**: The fits to earth-based coherent two-way doppler data from Lunar Orbiter have consistently yielded residuals three orders of magnitude larger than the 0.1mm/sec normally observed with spacecraft at lunar distance. The results suggest need for a new or modified approach to the lunar potential model: 1) Higher order spherical harmonics, 2) Point mass grid solutions, or 3) Direct mapping of residual-accelerations to the lunar surface.
**Apollo Collection**  
**Series 4 Lunar Exploration Planning 1967 Houston**

**Location** 4.01  
**Series** 4 Lunar Exploration Planning 1967 Houston  
**Document Title** Group for Lunar Exploration Planning meeting, November 13-14 1967, Houston  
**Author** Hess, Wilmot N. chair  
**Source** Document collection in binder  
**Date** 11/13-14/1967  
**Abstract** This binder contains the agenda, working papers, notes, draft mission plans and other material related to the GLEP meeting in Houston on November 13-14, 1967. It also contains notes on a follow-up Geodesy-Cartography meeting in Washington on November 30. The first page in the binder has a table of contents. Page 9 has a list of the first 5 planned Lunar Landing Missions with their landing sites, objectives and payloads. Subsequent pages give further details of the mission plans.

**Location** 4.02  
**Series** 4 Lunar Exploration Planning 1967 Houston  
**Document Title** GLEP documents and notes from meeting in Washington on January 11, 1968  
**Author** Hess, Wilmot N. chair  
**Source** Document collection in binder  
**Date** 12/8-9/1967 to 1/11/1968  
**Abstract** This binder contains notes from a Site Selection Meeting on Dec. 8 and 9 in Washington. The binder also contains documents from the GLEP meeting on Jan. 11 in Washington. The first page of the binder has a table of contents. Page 232 starts a 'Status Report to the Lunar and Planetary Missions Board'. Page 258 starts 'A Lunar Science Exploration Plan'. It has detailed discussions of proposed landing sites.

**Location** 4.03  
**Series** 4 Lunar Exploration Planning 1967 Houston  
**Document Title** A Lunar Exploration Program  
**Author** Hinners, N.W., James, D.B., Schmidt, F.N.  
**Source** Bellcomm Inc., TM-68-1012-1  
**Date** 1/5/1968  
**Abstract** A Lunar Exploration Program has been developed which covers the period from the first lunar landing to the mid-70's.
This binder contains documents associated with the Group for Lunar Exploration meeting in Washington on February 26, 1968. The first sheet in the binder is a table of contents. Page 70 is a NASA Press Release, "Lunar Site Selection". It states "The first Americans on the Moon will land in one of five three-by-five mile landing areas selected by the NASA Apollo Site Selection Board. Each of the five landing areas satisfies criteria in which astronaut safety is the paramount consideration".

This binder contains documents associated with the Group for Lunar Exploration meeting in Washington on June 4 and 5, 1968. The first sheet in the binder is an agenda and table of contents. The final document in the binder is the Summary Minutes of the June 4-5 meeting.

This binder contains documents associated with the Group for Lunar Exploration meeting in Washington on July 25, 1968. The first sheet in the binder is an agenda and table of contents. Page 194 is the Title Page for the Summary Minutes of the July 25 meeting.

The third GLEP Site Selection Subgroup meeting was held November 13-14, 1968. There is now no pressing reason to hold a GLEP meeting other than consideration of the Site Selection Subgroup report. Dr. Hess has asked therefore that you review the minutes of the Subgroup and convey your approval or suggested changes by Monday, January 26, 1969.
### Document 1

**Document Title:** Agenda and Presentations from GLEP meeting in Houston on March 27, 1969  
**Author:** Hess, Wilmot N. chair  
**Source:** Document collection in binder  
**Date:** 3/27/1969  
**Abstract:** This binder contains the agenda and presentations from the GLEP meeting in Houston on March 27, 1969. Presentations were: Review of Lunar Exploration Plan Options - Stoney and Loftus, Status Report - Hinners and Sasser, Status of Lunar Exploration Program - Hess, and Status of Orbital Science Planning - Hess.

### Document 2

**Document Title:** Fourth GLEP Site Selection Subgroup Meeting on Jun 17, 1969  
**Author:** Hinners, N.W.  
**Source:** Bellcomm Inc memos  
**Date:** 6/23 and 8/4, 1969  
**Abstract:** The Apollo Site Selection Board would like us to recommend a mission assignment for the sites. The Site Selection Subgroup met on June 17 in order to prepare tentative mission assignments which could be discussed and possibly accepted. The resulting recommendations are given in Attachment A. Hinners reported the recommendations on July 10 to the Apollo Site Selection Board, who approved the site recommendations. Site selection to Apollo 12 has settled down to the Surveyor-III site which will be known as Apollo Site 7.

### Document 3

**Document Title:** GLEP Meeting in Houston on August 23 and joint meeting, Sep 29-30, 1969  
**Author:** Calio, Anthony J. chair  
**Source:** Document collection in binder  
**Date:** 8/23 and 9/29-30/1969  
**Abstract:** This binder contains documents associated with a GLEP meeting in Houston on August 23, 1969 and a joint meeting of the NASA Science and Technology Advisory Committee and of the Lunar Panel of the Lunar and Planetary Missions Board in Flagstaff on September 29-30. The binder has a table of contents. Page 63 and following have notes and documents on the Apollo 11 science results.

### Document 4

**Document Title:** Apollo Lunar Exploration Program Science Objectives and Mission Plans  
**Author:** Bellcomm staff  
**Source:** Bellcomm Inc. document  
**Date:** 9/4 and 9/9/1968  
**Abstract:** This plan was presented to the MSC Management on September 4, 1969 and to the Manned Space Flight Management Council on September 9, 1969. The purpose of this document is to present the scientific objectives of the Apollo Lunar Exploration Program and to describe a set of ten lunar landing missions to achieve those objectives. The document contains material on the mission objectives and on the selected sites and their associated mission plans.
This binder contains the agenda, a table of contents, and documents from the GLEP meeting on October 16-18. It also contains some follow-up documents dated after the meeting. One document distributed at the meeting was NASA SPD-9P-052, Program and Mission Definition, Apollo Lunar Exploration DATED aUG 15, 1969 (see page 261 in binder).

This binder contains the agenda, a table of contents, and documents from the GLEP meeting in Houston on February 6-7, 1970. Page 183 and following are the minutes of the meeting.

This binder contains the agenda, a table of contents, and documents from the GLEP meeting in Houston on April 30, 1970. The principal topic of the meeting was recommended landing sites for Apollo 14 and 16.

This binder contains the agenda, a table of contents, and documents from the GLEP meeting in Houston on June 23, 1970. The objectives of the meeting was to select a recommended site for Apollo 15 and 16, and to consider the remaining sites for J missions.
The Lunar International Observers Network program has been conducted on a mission-by-mission basis since Apollo 11. An informal session was scheduled in Houston on July 29, 1970 for a thorough evaluation of the program. Page 42 of the binder begins an Interim Report - The LION Program which was distributed at the meeting for the information of the attendees, including several members of GLEP.

The goal of landing man on the surface of the moon and returning him to earth has been reached. On the assumption that broad national policy will entail a continuing commitment to manned spaceflight, this study has addresses itself to the question of how best to utilize the manned lunar-landing capability to realize the scientific objectives of lunar exploration.
Highwater Project

Location  AP 5.01  Series  5 High Water Project
Date  9/29/1961

Document Title  Information Plan, Launch of Saturn SA-1 Test Vehicle.
Author  Lloyd, O.B.; Mittauer, R.T.; Slattery, Bart J.
Source  NASA Headquarters and MSFC
Abstract  The Saturn C-1 Heavy space vehicle will be launched experimentally this fall for the first time. In this first firing of the three stage rocket, only the booster will be "live" and it will be operating at a thrust somewhat lower (12%) than that planned for later Saturns.

Location  AP 5.02  Series  5 High Water Project
Date  7/27/1961 - 7/27/1961

Document Title  Minutes: Astronomy Subcommittee of Space Sciences Steering Committee
Author  Roman, Nancy G., Chairperson
Source  NASA Headquarters
Abstract  Under Action Items on page 2: "Lundquist will investigate the possibility of carrying as ballast, the gaseous constituents of a comet in the form of, say, salt water and will report at the next meeting." This was an origin of what became the High Water Experiment.

Location  AP 5.03  Series  5 High Water Project
Date  11/8/1961

Document Title  Release of Saturn Water Ballast
Author  Memo for Record; M-RP-P
Source  MSFC Research Projects Division - Physics
Abstract  It is now possible to say unequivocally that the release of the ballast water on a Saturn R&D firing would be of very great scientific interest. A no-interference with Saturn R&D missions is the basis on which this experiment is proposed.
### Organization of Water Release Experiment

**Author**
Lundquist, Charles A; M-RP-P,

**Source**
MSFC Research Projects Division - Physics

**Abstract**
On Monday, Nov 13, Dr. Nancy Roman discussed the proposed release of the Saturn Ballast water with the Space Science Steering Committee. In a subsequent telephone conversation between Dr. Roman and C.A. Lundquist, it was agreed that an ad hoc working group should be organized to draft an analysis and operational plan for the experiment.

### Weekly Notes to Director, (Dr. von Braun)

**Author**
Stuhlinger, Ernst

**Source**
MSFC Research Projects Division

**Abstract**
Dr. Lundquist held preliminary discussions with SSO, G&C, P&VE and others regarding the possibility of releasing the ballast water carried on one-stage Saturn C-1 vehicles near the apex of their trajectories. Injecting water of this vast amount at high altitudes, and observing ionosphere and atmospheric effects, would represent a scientific experiment of great value to many scientific groups. (reply in margin from vB; "Request more detailed plan."")

### Release of Saturn Water Ballast.

**Author**
Knothe, A.H.; M-LOD-TS

**Source**
MSFC-Launch Operations Directorate

**Abstract**
The only steps to be taken to enable this experiment are: a. Installation of prima cord in the second and third dummy stages, b. Information to pad safety, c. Furnishing of revised drawings and diagrams to Range Safety and d. Establishment of written agreement with Range Safety concerning transmission of the destruct command.
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</thead>
<tbody>
<tr>
<td>AP 5.07</td>
<td>5 High Water Project</td>
<td>11/1961</td>
<td>Remarks on the Proposal to Release 200,000 lbs. of Water at 150 km</td>
<td>Potter, Andrew E.</td>
<td>MSFC Reaction Kinetics Section</td>
<td>About one-sixth of 33,000 lbs of water will evaporate adiabatically and explosively from the liquid water released at 150 km. The remainder, or about 167,000 lbs. will freeze to form an ice cloud.</td>
</tr>
<tr>
<td>AP 5.08</td>
<td>5 High Water Project</td>
<td>11/21/1961</td>
<td>Water Ballast Release Experiment on Block I Saturn C-1</td>
<td>Lange, Oswald H., Director</td>
<td>MSFC Saturn Systems Office</td>
<td>In a discussion with Dr. von Braun it was decided to make preparations to release the water ballast at apex on the remaining flights of Block I vehicles. The decision as to which particular flights will include this experiment will be made at a later date.</td>
</tr>
<tr>
<td>AP 5.09</td>
<td>5 High Water Project</td>
<td>11/27/1961</td>
<td>Configuration Control Action # 160</td>
<td>Palaoro, H.R.</td>
<td>MSFC Saturn Configuration Control Board</td>
<td>It has been decided that SA-2 shall be modified so as to extend the existing primacord and to rupture vehicle SA-2 at apex on command. It was further agreed that this secondary mission for SA-2 would and shall not interfere with the prime mission.</td>
</tr>
</tbody>
</table>
**Location**  AP 5.10  
**Series**  5 High Water Project

**Date**  12/18/1961

**Document Title**  Letter to Dr. Robert F. Fellows, NASA Headquarters  
**Author**  Johnson, William G.

**Source**  MSFC Research Projects Division  

**Abstract**  I am enclosing a Plan for the Saturn Water Release Experiment. You will note that it is not a detailed programatic document. However, it does cover the program of measurements that we think can be done in a reasonable manner.

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**Location**  AP 5.11  
**Series**  5 High Water Project

**Date**  1/5/1962

**Document Title**  TWX to Director MSFC Huntsville Ala  
**Author**  Newell, Homer E. and Rosen, Milton W.

**Source**  NASA Headquarters  

**Abstract**  $20,000 is being transferred to MSFC to cover cost of equipping Saturn Test Vehicle number two to release water ballast at apex of trajectory. It is our understanding that Dr. Charles Lundquist and Dr. W. S. Johnson are responsible for coordinating the experiment and the observational program.

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**Location**  AP 5.12  
**Series**  5 High Water Project

**Date**  1/9/1962

**Document Title**  Memorandum to Distribution; Saturn Water Release Experiment  
**Author**  Lundquist, Charles A.

**Source**  MSFC Research Projects Division  

**Abstract**  Enclosure 1 is a copy of the technical sections of the Plan for Saturn Water Release Experiment submitted to the Office of Space Sciences on December 18, 1961. This document was prepared by Dr. William G. Johnson. Enclosure 2 is a copy of the NASA Headquarters action accepting the Plan, citing transfer of funds and assigning responsibility for the project to MSFC.
The conditions in your teletype of January 5 concerning the release of the water ballast carried by Saturn (SA-2) are agreeable to the Marshall space Flight Center. Within MSFC the following individuals have been designated roles in the project (list of individuals and roles follows). For brevity, the code name "High Water" is recommended for this project.

A teletype has been received from Dr. Newell and Mr. Rosen which authorizes MSFC to proceed with the preparation for the release of the Saturn ballast water. Within MSFC the following individuals are designated roles in this project; (list of individuals and roles follows).
It is requested that the Launch Operations Directorate prepare the necessary planning for initiation of command destruct on SA-2 when the vehicle reaches an altitude of 105 km.

The enclosed document contains requirements similar to the Saturn Block I Flight Test Data Requirements document dated June 15, 1961 and is a revised version of that document.

The High Water project is now established as a recognized NASA Space Sciences project, however, permission to execute the actual release has been withheld pending the completion of plans for the observational program and a study of expected effects. The study of expected effects is being conducted by a committee under the chairmanship of Dr. W. W. Kellogg of the Rand Corporation.
Status Report on Project High Water

Responsibility for planning and coordinating the experimental program was assigned to MSFC. Membership of the working group to identify expected effects of the experiment is listed. GSFC is planning to conduct two water release experiments with Nike-Cajun rockets as preliminary investigations of the behavior of water when released in the ionosphere. Tentative launch dates are March 1 and 2.

Working paper following meeting at NASA Headquarters

Planning for the Project High Water Observational Program advanced quite rapidly as a result of a meeting held 13 February at NASA Headquarters. Three related efforts are in progress. The first is Project High Water. The second is a small scale water release experiment being planned by Dr. Bertram Donn at GSFC. As the third of the related efforts, MSFC has begun some laboratory model studies of the explosive release of water under vacuum conditions.

Photochemistry of the Saturn Water Release

The vapor clouds in the Saturn water release will be photolysed to yield H and OH at an appreciable rate. The OH will react rapidly with ambient O to yield more H and O2.
**Abstract**

On February 16, 1962 an ad hoc Panel met at NASA to consider the effects likely to occur from the release of about 100 tons of water in the ionosphere. It is now possible to describe roughly what will occur, and it can be said with some assurance that no major change in the atmosphere will take place that will hinder human activities.

**Abstract**

A meeting was held on 15 March 1962 at the Air Force Missile Test Center to discuss operational planning to complete the Project High Water experiment to be conducted on the SA-2 flight test. Dr. Bertram Donn of GSFC gave a description of a miniature high water test recently performed at Wallops Island. After a discussion period on the Wallops Island experiment, Mr. Abercrombie presented to the group all planning requirements which had been submitted to Atlantic Missile Range requiring their support. Mr. Fred Bohlen, PAA Saturn Program Manager, stated that the range would be able to meet all requirements as presented.

**Abstract**

The review of the results of the entire planning program for the High Water project was presented. In view of this status, it was recommended that permission to proceed with the experiment as now planned be granted.
Document Title: Weekly Notes to Director, (Dr. von Braun)

Abstract:
Saturn Water Dump: On March 15, a meeting of agencies participating in the High Water project on SA-2 was held at Patrick Air Force Base. An instrumentation list and a refined statement of scientific objectives was forwarded to the Office of Space Sciences on Mar 22. Would you like to have detailed information on the experiments? (Note in margin from vB; yes, please, 1/2 hour briefing) Annotation at top of page "Briefing made Thursday Apr 12".

Date: 3/26/1962

Location: AP 5.25

Series: 5 High Water Project

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Document Title: Letter to MSFC Attn Dr. Wernher von Braun

Abstract:
In view of the report of Dr. Kellogg's study group that there is no foreseeable basis to expect any deleterious change in the atmosphere, and the widespread scientific interest in participating in the experiment as evidenced by the summary report of the proposed observational program and scientific objectives prepared by Dr. W. G. Johnson, the Office of Space Science approves and authorizes the conduct of the experiment.

Date: 3/29/1962

Location: AP 5.26

Series: 5 High Water Project

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Document Title: Project High Water Observational Program and Scientific Objectives

Abstract:
A review of the entire planning program for the project indicates that 1. Release of 86,000 kg of water at an altitude of 105 km will introduce a perturbation in the concentrations of the naturally occurring constituents of the atmosphere sufficient to permit a worthwhile study of the system as it returns to its equilibrium state. 7. Permission to execute the release of the water has now been granted.

Date: 4/7/1962

Location: AP 5.27

Series: 5 High Water Project
**News Release; NASA to Launch Second Saturn Vehicle**

**Author:** NASA Public Affairs personnel  
**Source:** NASA Public Affairs Office  
**Abstract:** The second Saturn C-1 heavy space vehicle will be launched from Cape Canaveral no earlier than April 25, 1962. The main purpose will be to further test the propulsion system of the booster first state. As a secondary objective, the Saturn vehicle will be deliberately destroyed some 45 seconds after booster burnout. This experiment is known as Project High Water.

**Photographs of SA-2 High Water Experiment**

**Author:** Atlantic Missile Range camera operators  
**Source:** Atlantic Missile Range  
**Abstract:** This folder contains 8 by 10 inch photographs and negatives of the SA-2 High Water Experiment. Some of these were used in the Debus et al paper at the XIII International Astronautical Congress in Varna, Bulgaria.

**Letter to Dr. Robert Fellows, NASA Hqrs.**

**Author:** Johnson, William G.  
**Source:** MSFC Research Projects Division  
**Abstract:** Data now being gathered from the High Water experiment indicates that in addition to being a mildly spectacular display, there was indeed some quite worthwhile science involved.
<table>
<thead>
<tr>
<th>Location</th>
<th>AP 5.31</th>
<th>Series</th>
<th>5 High Water Project</th>
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<tbody>
<tr>
<td>Date</td>
<td>5/25/1962</td>
<td></td>
<td></td>
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<tr>
<td>Document Title</td>
<td>Project High Water Tape Recording Transcription</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Carter, James W.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>MSFC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>This is a transcription of the sequence of events during the observation of the High Water Experiment by the pilot and copilot of an Air Force airdraft.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>AP 5.32</th>
<th>Series</th>
<th>5 High Water Project</th>
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<tr>
<td>Date</td>
<td>5/1962</td>
<td></td>
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<tr>
<td>Document Title</td>
<td>Map of western end of Atlantic Missile Range.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Atlantic Missile Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>This map shows the location of Atlantic Missile Range instrumentation involved in High Water measurements.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>AP 5.33</th>
<th>Series</th>
<th>5 High Water Project</th>
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</thead>
<tbody>
<tr>
<td>Date</td>
<td>6/1962</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document Title</td>
<td>Draft for Comment, Saturn SA-2 Water Experiment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Debus, Kurt; Johnson, William; Hembree, Ray; Lundquist, C.A.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>NASA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>This is the draft for comment of a paper to be presented at the XIII International Astronautical Congress in September, 1962</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### A Preliminary Review of the Upper Atmosphere Observations Made during the Saturn High Water Experiment

**Document Title:** A Preliminary Review of the Upper Atmosphere Observations Made during the Saturn High Water Experiment  
**Author:** Debus, Kurt; Johnson, William; Hembree, Ray; Lundquist, C.A.  
**Source:** Proceedings of the XIII International Astronautical Congress, p182-196  
**Abstract:** A secondary objective of the second flight test of the Saturn booster stage was to observe phenomena associated with the release of a large quantity of water into the lower ionosphere. Visually, a rapidly expanding cloud was observed which reached a diameter of the order of 10 km in about 3 sec. Photographic, radio and radar observations of the event were made and analyzed.

### Analysis of Photographic Coverage of the Saturn SA-2 Water Experiment on April 25, 1962

**Document Title:** Analysis of Photographic Coverage of the Saturn SA-2 Water Experiment on April 25, 1962  
**Author:** Edwards, H.D.; Young, L.C.; Kustus, C.G.  
**Source:** Georgia Institute of Technology, Engineering Experiment Station  
**Abstract:** This is Tech.Report No 1 on Project A-637. It describes the results obtained from photographic studies of a release of 86,000 kg of water from the SA-2 space vehicle at an altitude of approximately 105 km.

### News Release; Third Saturn Rocket to be Launched

**Document Title:** News Release; Third Saturn Rocket to be Launched  
**Author:** NASA Public Affairs personnel  
**Source:** NASA Public Affairs Office  
**Abstract:** NASA will launch its third Saturn C-1 Space vehicle (SA-3) from Cape Canaveral within the next few days, no earlier than November 16. As in the SA-2 flight, the booster and water-laden upper stages will be destroyed following completion of other missions in a bonus scientific experiment called "Project High Water". About 95 tons of water will be released in the ionosphere at the apex of the trajectory - about 104 miles.
**Document Title:** Radiation Measurements for Project High Water  
**Author:** Tori, J. J.  
**Source:** Martin Company, Orlando Florida; Aerospace Division of Martin Marietta  
**Abstract:** The objective was to detect and measure electromagnetic disturbances caused by the release of water from the Saturn vehicles fired on November 16, 1961.

**Document Title:** High Water, Roll of 16mm movie film.  
**Author:** various  
**Source:** various  
**Abstract:** This film contains motion pictures of the clouds generated by the High Water experiments.

**Document Title:** Letter to William G. Johnson, MSFC, with attached report.  
**Author:** Gulick, J.R. (MIC, Miami Unit)  
**Source:** US Dept. of Commerce, Project Mercury Weather Support Group  
**Abstract:** Three Weather Bureau radar stations participated in the Project Hiogh Water experiment conducted November 16, 1962. Each Station observed at least part of the experiment although the range was near the upper limits of capability of the WSR-57 radar.
<table>
<thead>
<tr>
<th>Location</th>
<th>AP 5.40</th>
<th>Series</th>
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<tr>
<td>Date</td>
<td>11/1961 - 4/1963</td>
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<td></td>
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<tr>
<td>Document Title</td>
<td>High Water Note Binder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>various</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>various</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>This binder contains various notes, many hand written, and incidental documents related to the High Water experiments. Items are in chronological order.</td>
<td></td>
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</tbody>
</table>

<table>
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<tr>
<th>Location</th>
<th>AP 5.41</th>
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<th>5 High Water Project</th>
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<tr>
<td>Date</td>
<td>10/25/1963</td>
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<tr>
<td>Document Title</td>
<td>An Analysis of the Second Project High Water Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Woodbridge, D.D.; Lasater, J.A.; Fultz, B.M.; Clark, R.E.; Wylie, N.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>International Space Corporation, Melbourne, Florida</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>An analysis has been performed of the optical, ELF-VLF radiofrequency and radar data obtained in conjunction with the second Project High Water experiment.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>AP 5.42</th>
<th>Series</th>
<th>5 High Water Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>3/6/1965</td>
<td></td>
<td></td>
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<tr>
<td>Document Title</td>
<td>An Analysis of Project High Water Data.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Woodbridge, David D. and Lasater, James A.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>International Space Corporation, Melbourne, Florida</td>
<td></td>
<td></td>
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<tr>
<td>Abstract</td>
<td>The two Project High Water experiments have produced optical, ELF, radiofrequency, and radar data essential to understanding the effects of release of large quantities of water in the ionosphere. These data have been analyzed and a physical model of the expansion process has been developed.</td>
<td></td>
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<tr>
<td>Location</td>
<td>Series</td>
<td>Document Title</td>
<td>Author</td>
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</tr>
<tr>
<td>AP 5.43</td>
<td>5 High Water Project</td>
<td>Letters to Charles A. Lundquist, UAH</td>
<td>Rather, John D. G.</td>
</tr>
<tr>
<td>AP 5.44</td>
<td>5 High Water Project</td>
<td>Release of Liquid Water from the Space Shuttle</td>
<td>Pike, C.P. and 14 additional authors</td>
</tr>
<tr>
<td>AP 5.45</td>
<td>5 High Water Project</td>
<td>Project Waterhole</td>
<td>Yau, A.W.; Whalen, B.A.; Creutzberg, F.</td>
</tr>
</tbody>
</table>
Pegasus Satellites and Apollo Missions

Location 06.01 Series 6 Apollo Collection
Document Title NASA Facts, Pegasus
Author NASA Educational Programs and Service Office
Source NASA Headquarters Date 1965
Abstract Pegasus collects data on the particles of matter in space called meteoroids. Plans call for three Pegasus launches.

Location 06.02 Series 6 Apollo Collection
Document Title Press clippings on Pegasus
Author News reporters
Source Newspapers Date 1965
Abstract This folder contains several press clippings on the Pegasus launches by the Saturn rocket.

Location 06.03 Series 6 Apollo Collection
Document Title Recent NASA Meteoroid Penetration Results from Satellites
Author D'Aiutolo, C.T.; Kinard, W.H.; Naumann, R.J.
Source NASA SP-135, pages 239 – 251 Date 1967
Abstract This is a paper from the Proceedings of a Symposium, Meteor Orbits and Dust held August 9-13 at the Smithsonian Astrophysical Observatory. The proceedings are also Volume 11 of the Smithsonian Contributions to Astrophysics, editor Gerald S. Hawkins.

Location 06.04 Series 6 Apollo Collection
Document Title Bibliography of Pegasus results
Author Naumann, Robert J.and others
Source One page bibliography Date 1966 - 1973
Abstract This is a nine entry bibliography of some Pegasus results. Three Pegasus satellites were launched by Saturn 1 vehicles SA-8, SA-9 and SA-10. The objective of the Pegasus satellites was to determine the meteoroid flux in Earth orbit to support planning for later Apollo missions.

Location 07.01 Series 7 Apollo Collection
Document Title Chariots for Apollo, A History of Manned Lunar Spacecraft
Author Brooks, Courtney G.; Grimwood, James M.; Swenson, Loyd S.
Source NASA SP-4205 Date 1979
Abstract Apollo was America's program to land men on the moon and get them safely back to earth, This book begins with the creation of NASA and with the definition of the manned space flight program to follow Mercury. Manned Apollo missions began with the Apollo 7 earth orbital mission. The book ends with Apollo 11 when America attained its goal for the 1960's. The focal points of this story are the spacecraft - the command and service modules and the lunar module.

Location 07.02 Series 7 Apollo Collection
Document Title Press clippings on Apollo 7 mission
Author News reporters
Source News magazines Date 1968
Abstract This folder contains several press clippings on the Apollo 7 earth orbital mission. This was the first manned mission launched by the Saturn vehicle.
**Analysis of Apollo 8 Photographic and Visual Observations**

**Author:** Allenby, Richard J.; introduction

**Source:** NASA SP-201  
**Date:** 1969

**Abstract:** Apollo 8 was the first manned lunar orbiter. The primary purpose of this mission was to further progress toward the goal of landing men on the Moon by gaining operational experience and testing the Apollo systems. However, a great effort was also made to accomplish worthwhile scientific tasks with photography and visual observations by the astronauts.

**Report on Communications Support for Transient Lunar Phenomena during Apollo 8**

**Author:** Citron, Robert

**Source:** Smithsonian Center for Short-Lived Phenomena  
**Date:** 1/5/1969

**Abstract:** The purpose of this report is to document the communications procedures used and the lunar event reports received and transmitted by the Center for Short-Lived Phenomena during the Apollo 9 mission.

**Apollo 8 Binder I**

**Author:** various authors

**Source:** Smithsonian Astrophysical Observatory  
**Date:** 1968-1969

**Abstract:** This first binder contains documents pertinent to the optical tracking and observations of the events of the Apollo 8 mission. The binder has a table of contents in front.

**Apollo 8 Binder II**

**Author:** various authors

**Source:** Several organizations  
**Date:** 1969

**Abstract:** This second binder contains later documents pertinent to the optical tracking and observations of the events of the Apollo 8 mission. The binder has a table of contents in front. In particular the binder holds reports by several organizations giving results of observations of Apollo 8.

**Apollo 8 Photometry**

**Author:** various authors

**Source:** Smithsonian Astrophysical Observatory  
**Date:** 1969

**Abstract:** This binder contains working papers from the photometric analysis of the photographs of Apollo 8 events.

**Lunar Gravity Fields Determined from Apollo 8 Tracking Data**

**Author:** Felsentreger, T.L.; Murphy, J.P.; Ryan, J.W.; Salter, L.M.

**Source:** NASA GSFC; X-552-69-317  
**Date:** 7/1969

**Abstract:** Tracking data from the eight near-circular lunar orbits made by the Apollo 8 spacecraft were analyzed in an attempt to determine spherical harmonic lunar gravity models suitable for use in future Apollo missions. Thirty-one determinations through degree and order six are presented, in addition to test and evaluation results of many of the models.
Document Title: Lunar Mascon Evidence from Apollo Orbits
Author: Murphy, James P. and Siry, Joseph W.
Source: NASA GSFC
Date: 7/1969
Abstract: Apollo VIII tracking data have been analyzed to obtain new evidence for a mascon in the neighborhood of Sinus Aestuum.

Document Title: Dense Material Lunar Deposits
Author: NASA Public Affairs staff
Source: NASA Headquarters Press Release NO. 68-143
Date: 8/16/1968
Abstract: Mass concentrations of dense material have been discovered beneath the surface of the moon by two researchers, Paul M. Muller and William L. Sjogren, at the NASA's Jet Propulsion Laboratory. The mass concentration areas were found to be centered below all five large ringed seas on the near face of the Moon.

Document Title: New Conclusions Concerning the Observation of Faint Sources from a sunlit Spacecraft
Author: Grobman, Warren D. and Buffalano, Charles
Source: Bellcomm Inc., Washington D.C.
Date: 1969
Abstract: We conclude that the outlook for space astronomy in the sunlight is much more favorable than other estimates have indicated.

Document Title: The Temperature and Size Histories of Liquid H2, O2 and H2O Particles in Space
Author: Buffalano, A.C. and Sharma, R.D.
Source: Bellcomm Inc.; TR-70-105-5-1
Date: 3/6/1970
Abstract: Micron-sized droplets of liquid H2, O2 and H2O released in space during Apollo missions quickly freeze and reach equilibrium where the loss of energy from sublimation and emission of radiation just equals the absorption of radiation that is incident from the earth and the sun.

Document Title: A Physical Model of Apollo Oxygen Releases - Case 340
Author: Buffalano, Charles
Source: Bellcomm Inc.; TM-70-1011-3
Date: 4/29/1970
Abstract: During an Apollo Mission, the S-IVB stage propels the Apollo spacecraft into a lunar trajectory. The S-IVB then separates, turns perpendicular to the flight path, and is placed into solar orbit. The thrust for this final maneuver is provided by thousands of kilograms of unburned liquid oxygen which are blown out through the S-IVB's engines. The photographed cloud from this operation is about 45,000 kilometers from the earth.

Document Title: Saturn V/SA-504 Flight Sequence (Mission D)
Author: staff Mission Operations Section, NASA MSFC
Source: Drawing Number 10M30524, Revision D
Date: 2/21/1966
Abstract: The purpose of this document is to present the Saturn V/SA-504 vehicle flight sequence requirements of the Propulsion and Vehicle Engineering Laboratory for the D mission. The flight sequence includes all events from instrument unit umbilical disconnect through the completion of the launch vehicle operations.
Location 09.02  Series 9 Apollo Collection
Document Title Apollo 9 Scheduled Feb 28, NASA Press Release
Author staff NASA public affairs office
Source NASA Headquarters  Date 1/8/1969
Abstract Following insertion into a 109-by-112 nautical mile Earth orbit, the crew will perform a simulated translunar insertion. This will be followed by Command service module separation, transposition, and docking with the lunar module, still attached to the rocket's third stage.

Location 09.03  Series 9 Apollo Collection
Document Title AS-504 Mission D Profile
Author none
Source MSFC  Date 1969
Abstract This is a 2-page document illustrating the AS-504 Mission D Profile and the Dual Restart Flight Sequence

Location 09.04  Series 9 Apollo Collection
Document Title Targets of Opportunity Earth Flight Chart; 1st Edition
Author staff Aeronautical Chart and Information Ctr.
Source U.S. Air Force  Date 1/27/1969
Abstract This is a map of the earth with targets of opportunity defined for possible observations during the Apollo 9 mission.

Location 09.05  Series 9 Apollo Collection
Document Title Apollo 9 Mission D Launch Vehicle Ground Support Plan
Author Golden, Harvey; Hammer, R. Scott; Speer, F. A.
Source NASA Report #1-MO-4-69; MSFC Mission Operations Office  Date 2/1969
Abstract The purpose of this document is to define the launch vehicle ground network support for flight control operations and for post-flight engineering evaluation of the mission. This Ground Support Plan provides additional mission oriented information as a background for the ground support and mission planning.

Location 09.06  Series 9 Apollo Collection
Document Title Saturn V/SA-504/S-IVB Stage Passivation
Author Vaniman, J.L.
Source Brown Engineering  Date 2/13/1969
Abstract An analysis has been conducted to determine propellant tank pressure, dump and venting flow rates, thrusts and impulses during SA-504 stage passivation.

Location 09.07  Series 9 Apollo Collection
Document Title Photography of the Apollo 9 Debris Coma
Author Buffalano, A. C.
Source Bellcomm Inc.  Date 2/24/1969
Abstract The Smithsonian Astrophysical Observatory's Baker-Nunn camera system is capable of photographing some of the components of the Apollo 9 debris coma from the ground. Ice crystals formed during urine dumps and the Environmental Control System's waste water dump will be bright enough to photograph.
**Location 09.08**  
**Series** 9 Apollo Collection  
**Document Title** Baker-Nunn Observations of Apollo 9 S-IVB  
**Author** staff Smithsonian Astrophysical Observatory  
**Source** SAO 903-27  
**Date** 3/7/1969  
**Abstract** As part of its support of the NASA Apollo 9 mission, Smithsonian Astrophysical Observatory photographed the SIVB rocket state after its final burn. The photographs showed clouds due to residual propellant venting.

**Location 09.09**  
**Series** 9 Apollo Collection  
**Document Title** Apollo 9 Binder  
**Author** various authors  
**Source** SAO  
**Date** 1969  
**Abstract** This binder contains notes and documents related to the Baker Nunn camera observation program for Apollo 9.

**Location 09.1**  
**Series** 9 Apollo Collection  
**Document Title** Apollo 9 Photometry  
**Author** various authors  
**Source** SAO  
**Date** 1969  
**Abstract** This binder contains working papers from the photometric analysis of the photographs of the Apollo 9 venting clouds.

**Location 10.01**  
**Series** 10 Apollo Collection  
**Document Title** Apollo 10 Binder  
**Author** several authors  
**Source** Binder  
**Date** 1969  
**Abstract** This binder contains a number of documents related to the optical tracking of the Apollo 10 events. The Apollo 10 mission placed a manned spacecraft in orbit around the moon and returned the crew to earth.

**Location 10.02**  
**Series** 10 Apollo Collection  
**Document Title** Communications Support for Transient Lunar Phenomena during the Apollo 10 Mission  
**Author** Citron, Robert  
**Source** Smithsonian Institution, Center for Short-Lived Phenomena  
**Date** 5/28/1969  
**Abstract** This report documents the lunar observing program planned, the communications procedures used, and the lunar event reports received and transmitted by the Center for Short-Lived Phenomena during the Apollo 10 mission.

**Location 10.03**  
**Series** 10 Apollo Collection  
**Document Title** Transient Lunar Phenomena Reports during Apollo 10  
**Author** Staff, Center for Short-Lived Phenomena  
**Source** Smithsonian Institution, Center for Short-Lived Phenomena  
**Date** 6/28/1969  
**Abstract** The purpose of this report is to document the positive and negative reports on transient lunar phenomena received during the period of the Apollo 10 mission, 19-26 May 1969.

**Location 10.04**  
**Series** 10 Apollo Collection  
**Document Title** Apollo 10 Folder  
**Author** several authors  
**Source** Folder  
**Date** 1969  
**Abstract** This folder holds a few incidental documents pertinent to the Apollo 10 mission.
**Location 10.05  Series 10 Apollo Collection**

**Document Title** Proposal to NASA for Apollo Contamination Analysis, Jun 1 1969 - Jun 30, 1970

**Author** Buffalano, Charles and Latimer, James H.

**Source** SAO Proposal P174-4-69  **Date** 4/1969

**Abstract** The proposed experiment is in direct support of the manned space flight program and in particular of the Apollo Telescope Module program. The purpose of the experiment is to determine the size, lifetime and dynamics of small crystals formed from liquids dumped from the S-IVB and Command and Service Module during the Apollo lunar missions.

**Location 11.01  Series 11 Apollo Collection**

**Document Title** Apollo 11 Mission Report

**Author** Low, George and Mission Evaluation Team

**Source** NASA SP-238. Scientific and Technical Information Office  **Date** 1971

**Abstract** The purpose of the Apollo 11 mission was to land men on the lunar surface and to return them safely to earth. The space vehicle was launched on July 16, 1969. Landing on the moon was on July 20, 1969. The command module and crew landed in the Pacific on July 24, 1969.

**Location 11.02  Series 11 Apollo Collection**

**Document Title** Apollo 11 Preliminary Science Report

**Author** Hess, W.N. and Calio, A.J. authors of Summary

**Source** NASA SP-214; Scientific and Technical Information Division  **Date** 10/31/1969

**Abstract** The scientific objectives of the Apollo 11 mission, in order of priority, were the following: (1) To collect early in the extra vehicular activity a sample of approximately 1 kg of lunar surface material. (2) To fill rapidly one of the sample return containers with approximately 10 kg of lunar material. (3) To deploy three experiments on the lunar surface, a) a passive seismometer, b) an optical corner reflector, c) a solar-wind composition experiment. (4) To fill a second sample return container with selected lunar material, including two core tubes with lunar material. The Apollo 11 lunar module landed in the southwestern part of Mare Tranquillitatis. Twenty major findings are indentified in the summary. Ten reports of individual investigations follow the Summary.

**Location 11.03  Series 11 Apollo Collection**


**Author** Staff, Center for Short-Lived Phenomena

**Source** Lunar International Observers Network  **Date** 6/27/1969

**Abstract** This is the Operations Plan and Observing Schedule for the Transient Lunar Phenomena Observing Program during the Apollo 11 Manned Lunar Mission, 16 July-3 August 1969.

**Location 11.04  Series 11 Apollo Collection**

**Document Title** Communications Support for Transient Lunar Phenomena during the Apollo 11 Mission

**Author** Staff, Center for Short-Lived Phenomena

**Source** Smithsonian Institution, Center for Short-Lived Phenomena  **Date** 8/25/1969

**Abstract** 216 astronomical observing stations in 30 countries and 14 states cooperated in keeping the lunar surface under nearly continuous 24 our a day surveillance for 6 consecutive days.

**Location 11.05  Series 11 Apollo Collection**

**Document Title** Transient Lunar Phenomena Reports during Apollo 11

**Author** Staff, Center for Short-Lived Phenomena

**Source** Smithsonian Institution, Center for Short-Lived Phenomena  **Date** 8/25/1969

**Abstract** This report documents the reports of transient lunar phenomena that have been received by the CFSLP during the Apollo 11 mission, 16-24 July 1969.
Operation Lion functioned during the flight period of Apollo 11, to provide evaluation of incoming reports of lunar changes or unusual appearances both from the ground and from the spacecraft.

This is a collection of 19 photographs of the Moon taken during the Apollo 11 mission. The first is identified as AS11-36-5589 and the last as AS11-43-6461.

This binder contains various documents related to the optical tracking of the Apollo 11 spacecraft.

Goddard's role in Apollo 11 centered on the vital tracking and communications links of the Manned Space Flight and NASCOM Networks. During the mission, the MSFN used 17 ground stations, four tracking ships, and eight instrumented aircraft.

Program and abstracts of the Apollo 11 Lunar Science Conference. Welcome by T. Paine, NASA Administrator and by A.J. Calio, Director of Science and Applications, MSC.

The Apollo 12 mission provided the first opportunity in the scientific exploration of the Moon to sample extensively the rocks within a radius of 1/2 km of the landing site, to obtain geological data, to measure the vector components of the lunar magnetic field, to measure the pressure of the lunar atmosphere and to collect seismic data on the interior of the Moon.
Communications Support for Transient Lunar Phenomena during the Apollo 12 Mission

The purpose of this report is to document the lunar observing program planned, the communications procedures used, and the reports received and transmitted during the Apollo 12 mission.

Transient Lunar Phenomena Reports during Apollo 12

This report documents the positive reports of transient lunar phenomena that have been received by the CFSLP during the Apollo 12 mission, 14-24 November, 1969.

Apollo 12 binder, photographic records of mission events

This binder contains various documents related to the optical tracking of the Apollo 12 spacecraft.

Preliminary Results from the Lunar Ionosphere Detector

The performance of the Lunar Ionosphere Detector has been good. This report contains preliminary data analysis.

Interpretation of Visual Observations of Apollo Water Dumps.

James Young visually observed a water dump during the Apollo 12 mission using the 24 inch Cassegrain telescope at the Table Mountain Observatory. He recorded the ice-cloud's size and magnitude for almost an hour.

Mineralogy and Petrology of the Apollo 12 Lunar Sample

We sectioned, examined and classified 499 coarse (>0.6 mm) particles from five of the Apollo soil samples.

Geologic Maps of Fra Mauro Landing Site

These are geological maps of the Fra Mauro landing site planned for Apollo 13. Due to spacecraft problems, no lunar landing was made.
Location 13.02  Series 13 Apollo Collection
Document Title Apollo 13 binder, photographic records of mission events
Author various
Source Smithsonian Astrophysical Observatory  Date 4/11-17/1970
Abstract This binder contains various documents related to the optical tracking of the Apollo 13 spacecraft.

Location 13.03  Series 13 Apollo Collection
Document Title Transient Lunar Phenomena Reports during Apollo 13
Author Staff, Center for Short-Lived Phenomena  Date 4/22/1970
Source Smithsonian Institution, Center for Short-Lived Phenomena
Abstract This report documents the positive reports of transient lunar phenomena that have been received by the CFSLP during the Apollo 13 mission, 11-17 April, 1970.

Location 13.04  Series 13 Apollo Collection
Document Title Letter to Lawrence D. Hoover, Manned Spacecraft Center
Author Citron, Robert
Source Smithsonian Institution, Center for Short-Lived Phenomena  Date 5/26/1970
Abstract Enclosed is a table which is a compilation of LION Transient Lunar Phenomena program statistics for Apollo Missions 8, 10, 11, 12 and 13

Location 14.01  Series 14 Apollo Collection
Document Title Apollo 14 Preliminary Science Report
Author Low, George:Forword; McDivitt, James A. Intro.
Source NASA SP-272  Date 6/1/1971
Abstract Apollo 14, the third mission during which men worked on the surface of the moon explored the Fra Mauro Formation. The topography in the landing area was extremely interesting and the geological and geochemical returns were great.

Location 14.02  Series 14 Apollo Collection
Document Title Apollo 14 Binder
Author various
Source Several organizations  Date 1/1971
Abstract This binder contains various documents related to the observations of the Apollo 12 spacecraft.

Location 14.03  Series 14 Apollo Collection
Document Title Ground Based Observations-Apollo 14 and Salyut Report
Author Bever,H.E.; Brown,C.C.; Ress,E.B.; Harvey,H.J.; Wilson,R.W.
Source Martin Marietta Company  Date 9/30/1971
Abstract The purpose of this document is to discuss data obtained from Apollo 14 Flight by means of Ground Based Observation. Attempts and methods of obtaining similar data from Russia's Salyut Spacecraft and Apollo 15 are also described.

Location 14.04  Series 14 Apollo Collection
Document Title Acceleration Levels on the Heat Flow and Convection Demonstration-Apollo 14
Author Gatewood, E; Morris, M.G.; Holland, R.L.
Source NASA TN X-64644, MSFC  Date 2/11/1972
Abstract The method and data for determining the accelerations on the Heat Flow and Convection Demonstration are presented.
The primary scientific objectives of the Apollo 15 mission were to perform selenological inspection, survey, and sampling of materials and surface features in a preselected area of the Hadley-Apennine region; to emplace and activate surface experiments; and to conduct inflight experiments and photographic tasks from lunar orbit.

The purpose of this memorandum change is to solicit proposals for participation in the analysis of space flight data resulting from photography and auxiliary records acquired on Apollo 15, 16 and 17 Lunar Exploration Missions.

The problem of optical contamination in the form of particulates in the vicinity of a spacecraft has been a source of concern for any astronomical experiment that must be performed in sunlight. This concern prompted a photographic photometric experiment on Apollo 15 to measure the brightness of the residual contamination cloud as well as the cloud produced by dumping waste water overboard.

The conditions for optically observing various stages of the Apollo 15 flight were not good.

The landing site for Apollo 16 was in the lunar highlands north of the crater Descartes. The primary scientific objectives of the mission were to geologically survey and sample surface features in a preselected area of the Descartes region, to emplace and activate surface experiments, and to conduct inflight experiments and photographic tasks from lunar orbit. Ten lunar surface experiments and 12 lunar orbit experiments were conducted.

The purpose of this guidebook is to give in simple terms information about the Apollo 16 mission to the moon so that others can share the excitement of the scientific exploration of the Descartes region of the Moon.
**Location 16.03**
*Series* 16 Apollo Collection

**Document Title** Apollo 16 Event Timeline

**Author** none

**Source** NASA  
**Date** 4/16/1972

**Abstract** This is a one sheet event timeline for the Apollo 16 mission.

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**Location 16.04**
*Series* 16 Apollo Collection

**Document Title** Apollo 16 Ultraviolet Astronomy Observations

**Author** Carruthers, George R.

**Source** Naval Research Reviews  
**Date** 9/1972

**Abstract** The Naval Research Laboratory Far-Ultraviolet Camera/Spectrograph was successfully operated on the lunar surface during the Apollo 16 mission. One of the primary objectives was to obtain imagery and spectrography data on the Earth's upper atmosphere and the outermost extension of it which consists mostly of atomic hydrogen.

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**Location 16.05**
*Series* 16 Apollo Collection

**Document Title** Apollo 16 Subsatellite

**Author** none

**Source** news clipping  
**Date** 1972

**Abstract** The lunar orbiting subsatellite launched by Apollo 16 is rapidly decreasing in altitude and it now appears it will impact the moon June 2.

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**Location 17.01**
*Series* 17 Apollo Collection

**Document Title** Apollo 17 Preliminary Science Report

**Author** Fletcher, James C. forward; Calio, A. J. introduction

**Source** NASA SP-330  
**Date** 1973

**Abstract** The landing site for Apollo 17 was on the south-eastern rim of Mare Serenitatis in a dark deposit between mass is units of the southwestern Montes Taurus. Scientific objectives of the mission include geological surveying and sampling of materials and surface features in a preselected area of the Taurus-Littrow region, deploying and activating surface experiments, and to conducting inflight experiments and photographic tasks during lunar orbit and transearth coast.

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**Location 17.02**
*Series* 17 Apollo Collection

**Document Title** Apollo 17 Binder

**Author** several authors

**Source** Binder  
**Date** 1972

**Abstract** This binder contains several incidental documents pertinent to the Apollo 17 mission.

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**Location 17.03**
*Series* 17 Apollo Collection

**Document Title** Apollo Contamination Analysis,

**Author** Buffalano, Charles

**Source** SAO, Final Report NGR 09-015-105  
**Date** 12/1971

**Abstract** The broad objectives of the Apollo Contamination Analysis project were a quantitative analysis of the clouds formed by liquids vented into space during the Apollo missions and the generation of models representing the behavior of these clouds. The liquids released into space are primarily oxygen, hydrogen or water. In a vacuum, a fraction of the released liquid immediately vaporizes, freezing the remaining material into a cloud of small solid particles.
Visual Sensations Induced by Cerenkov Radiation

Pulses of relativistic singly charged particles entering the eyeball induce a variety of visual phenomena by means of Cerenkov radiation generated during their passage through the vitreous. These phenomena are similar in appearance to many of the visual sensations experienced by Apollo astronauts exposed to the cosmic rays in deep space.

Summary of Earth-Based Observations of Apollo Water Dumps

All known observations of waste water dumps obtained during optical coverage of Apollo missions 9 through 13 are summarized.
Get all Apollo stats and find guides to help you play Smite created by players on SMITEFire. There are none without admiration for Apollo, God of Music. He is brash, cavalier, and dauntless, with the power to bring hope to the hopeless and change the course of battle with a single arrow. Voices of soldiers, mothers, kings and emperors, even Gods rise in glorious melody in honor of him; and he, basking in their adoration, shines victoriously. Though Hera, Queen of Gods, challenged his very birth, sending the great serpent Pylos to slay Apollo, his twin sister Artemis, and their mother Leto, not even she could deny him victory. Merely four days old, Apollo, gifted with a legendary bow, Rob Loukotka is raising funds for The Apollo 11 Collection on Kickstarter! Posters of every item NASA sent to the moon. 69 drawings of gadgets, dehydrated foods, space suits and more! The Apollo 11 Collection. Posters of every item NASA sent to the moon. 69 drawings of gadgets, dehydrated foods, space suits and more! Buy a poster here! Apollo 11 at 50: A Complete Guide to the Historic Moon Landing. By Chelsea Gohd 2019-07-16T11:50:31Z. Relive the drama! Project Apollo ran from 1961 to 1972, even though NASA accomplished Kennedy's goal in 1969. Although other astronauts visited the lunar surface after Apollo 11, the triumphant first landing remains a pinnacle in spaceflight history. The package also held additional scientific instruments and equipment for sample collection on the surface. Apollo 11 carried the first geological samples from the moon back to Earth. In total, Armstrong and Aldrin collected 48.5 lbs. (22 kilograms) of material from the moon, including 50 moon rocks, lunar soil, pebbles, sand and dust.