SATURN V APOLLO LUNAR ORBITAL RENDEZVOUS PLANNING GUIDE (DOWNLOAD ONLY)

Apollo Experiments Guide

Developments of America's first heavy lift space rocket Saturn I, the Saturn IB and Saturn V propelled America's space program during the Apollo and Skylab eras. First launched in 1966, Saturn IB replaced the Saturn I's S-IV second stage with the more powerful S-IVB. It could carry a partially fueled Apollo Command / Service Module or fully fueled Lunar Module into low Earth orbit, allowing critical testing of these systems to be conducted long before the Saturn V was ready. It also flew one orbital mission without a payload, with the extra fuel used to demonstrate that the S-IVB's J-2 engine could be restarted in zero gravity - a critical operation for translunar injection. The Saturn IB produced thrust equivalent to 1.6 million pounds force, and could carry 46,000 pounds of payload to low Earth orbit. Saturn IB flew nine times, including three Skylab missions and for the Apollo-Soyuz Test Project. Saturn V was simply the heaviest, tallest, and most powerful rocket ever built, and capable of carrying the heaviest payload. First launched in 1967, the rocket consisted of three stages, with the S-IVB serving as its third stage. Taller than the Statue of Liberty, Saturn V had a mass of 3000 metric tons and five F-1 engines capable of producing thrust thrust of 7.6 million pounds-force. It could take payloads up to 100,000 pounds beyond Earth orbit or 262,000 pounds into low Earth orbit. It flew thirteen times, including eight times to the moon and (in a two-stage version) on the Skylab I mission. Originally prepared by the Missile and Space Systems Division of NASA contractor Douglas Aircraft, this book was created to acquaint payload planners with the capabilities of the Saturn IB and Saturn V rockets. It shows methods by which Saturn vehicles can accommodate payloads of various weights and volumes for different missions, and methods by which they might be modified to allow even greater performance. It's a wonderful reference for the museum docent, researcher, or anyone who ever wondered how these mighty rockets were designed and built.

Enchanted Rendezvous

The evolution of the nominal rendezvous-maneuver plan for the lunar landing missions is presented along with a summary of the significant development for the lunar module abort and rescue plan. A general discussion of the rendezvous dispersion analysis that was conducted in support of both the nominal and contingency rendezvous planning is included.

Saturn Ib / Saturn V Rocket Payload Planner's Guide

Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database.

The Early Years

The feasibility of returning humans to the Moon by 2004, the 35th anniversary of the Apollo 11 landing, is examined assuming the use of existing launch vehicles (the Space Shuttle and Titan 4B), a near term, advanced technology space transportation system, and extraterrestrial propellant--specifically 'lunar-derived' liquid oxygen or LUNOX.

Apollo Experience Report

Full Color reproduction of the original Apollo 11 Flight Plan by NASA. All charts and graphs are included. This manual provided minute-by-minute instructions to the astronauts as they traveled to the moon! Apollo 11 was the first spaceflight that landed humans on the Moon. Mission commander Neil Armstrong and pilot Buzz Aldrin landed the lunar module Eagle on July 20, 1969. Armstrong became the first man to step onto the lunar surface. Broadcast on live TV to a world-wide audience, Armstrong stepped onto the lunar surface and described the event as \"one small step for a man, one giant leap for mankind.\" He and Aldrin spent about two and a quarter hours together outside the spacecraft, and collected 47.5 pounds of lunar material for return to Earth. Michael Collins piloted the command module Columbia alone in lunar orbit while they were on the Moon's surface. Armstrong and Aldrin spent just under a day on the lunar surface before rendezvousing with Columbia in lunar orbit. Launched by a Saturn V rocket from Kennedy Space Center in Merritt Island, Florida, on July 16, Apollo 11 was the fifth manned mission of NASA's Apollo program. The Apollo spacecraft had three parts: a command module (CM) with a cabin for the three astronauts, and the only part that landed back on Earth; a service module (SM), which supported the command module with propulsion, electrical power, oxygen, and water; and a lunar module (LM) that had two stages - a lower stage for landing on the Moon, and an upper stage to place the astronauts back into lunar orbit. After being sent toward the Moon by the Saturn V's upper stage, the astronauts separated the spacecraft from it and traveled for three days until they entered into lunar orbit. Armstrong and Aldrin then moved into the lunar module Eagle and landed in the Sea of Tranquility. The astronauts used Eagle's upper stage to lift off from the lunar surface and rejoin Collins in the command module. They jettisoned Eagle before they performed the maneuvers that blasted them out of lunar orbit on a trajectory back to Earth. They returned to Earth and landed in the Pacific Ocean on July 24. Apollo 11 effectively ended the Space Race and fulfilled a national goal proposed in 1961 by U.S. President John F. Kennedy: \"before this decade is out, of landing a man on the Moon and returning him safely to the Earth.\"

Scientific and Technical Aerospace Reports

\"This publication details the arguments of John C. Houbolt, an engineer at the Langley Research Center in Hampton, Virginia, in his 1961-1962 campaign to support the lunar-orbit rendezvous (LOR). The LOR was eventually selected during Project Apollo as the method of flying to the Moon, landing on the surface, and returning to Earth. The LOR opted to send the entire lunar spacecraft up in one launch, enter into the lunar orbit, and dispatch a small lander to the lunar surface. It was the simplest of the various methods, both in terms of development and operational costs, but it was risky. There was no room for error or the crew could not get home; and the more difficult maneuvers had to be done when the spacecraft was committed to a circumlunar flight. Houbolt was one of the most vocal people supporting the LOR.\"--NTIS Web site.

Lunar Orbit Rendezvous: News Conference on Apollo Plans at NASA Headquarters on July 11, 1962

The compact and concise design of this guide to the Apollo missions belies its enormous content, with pertinent facts and colour images for each mission -- from Apollo 1 to Apollo 10. Providing an overall picture of the Apollo program, this guide includes sections on astronauts, mission patches, launch vehicles, command vehicles, landing vehicles, launch dates, mission objectives, flight plans, space suits, life support systems, and triumphs and failures. Both seasoned space buffs and young adults nurturing their interest in the space program will find this a perfect resource for the first 10 Apollo missions.

NASA Lunar Orbit Rendezvous Decision

This illustrated history by a trio of experts is the definitive reference on the Apollo spacecraft and lunar modules. It traces the vehicles' design, development, and operation in space. More than 100 photographs and

illustrations.

Suddenly, Tomorrow Came--

evolution of the Apollo Guidance Computer, Mr. Hall contends that the development of the Apollo computer supported and motivated the semiconductor industry during a time when integrated circuits were just emerging. This was the period just before the electronics revolution that gave birth to modern computers. In addition, the book recalls the history of computer technology, both hardware and software, and the applications of digital computing to missile guidance systems and manned spacecraft. The book also offers graphics and photos drawn from the Draper Laboratories archives that illustrate the technology and related events during the Apollo project. Written for experts as well as lay persons, Journey to the Moon is the first book of its kind and a must for anyone interested in the history of science and the relevance of computer technology to space exploration.

High Leverage Space Transportation System Technologies for Human Exploration Missions to the Moon and Beyond

This work is a unique collection of valuable statistical information about Project Apollo. It includes a chapter (about 20 pages each) for Apollo 1 through Apollo 17. There are several data tables for each mission, plus a 50-page section with additional statistics and tables that merge data for each mission so you can easily make comparisons. Tables include launch and ascent data, fuel consumption, stage impact locations, very detailed mission timelines, and much more.

Apollo 11 Flight Plan

This book offers a comprehensive look at the history of space exploration, the technology that makes it possible, and the continued efforts that promise to carry us into the future. It goes through the history of space exploration, from the earliest sub-orbital and orbital missions to today's deep-space probes, to provide a close look at past and present projects, then turns its attention to programs being planned today and to the significance of future exploration. Both the novice and the advanced student of space exploration stand to profit from the author's engaging and insightful discussion.

Apollo: A Retrospective Analysis

\"An investigation has been made of some of the problems associated with abort from landing and return to an orbiting vehicle in a 50-mile lunar orbit. For this study the landing module was considered capable of direct return to the orbiting vehicle from a hovering position at the lunar surface. The investigation was divided into two parts, an analytical study and a simulation study. The results of the analytical study indicate that, for an economical return to the orbiting vehicle, the landing maneuver should be chosen such that the orbiting vehicle is almost directly above the landing module at the touchdown point. This requirement places limitations on the angular travel of the landing vehicle around the moon prior to touchdown. Results of the simulation study indicate that a pilot can control the abort maneuver by using visual information.\"--Summary.

Enchanted Rendezvous

Designed by Wernher von Braun and Arthur Rudolph at NASA's Marshall Space Flight Center, the Saturn V rocket represents the pinnacle of 20th Century technological achievement. The only launch vehicle in history to transport astronauts beyond Low Earth Orbit, the Saturn V delivered 24 men to the moon. To this day it holds records as the tallest (363 feet), heaviest (nearly 7 million lbs.) and most powerful (over 7.6 million pounds-force of thrust) launch vehicle ever produced. It also remains one of the most reliable, achieving 12

successful launches with one partial failure - the unmanned Apollo 6 which suffered vibration damage on lift-off, resulting in a sub-standard orbit. The Saturn series of rockets resulted from Von Braun's work on the German V-2 and Jupiter series rockets. The Saturn I, a 2-stage liquid-fueled rocket, flew ten times between 1961 and 1965. A uprated version the 1B carried the first crewed Apollo flight into orbit in 1968. The Saturn V, which first flew in 1967, was a three-stage rocket. The first stage, which burned RP-1 and LOX, consisted of five F-1 engines. The second stage used five J-2 engines which burned LOX and liquid hydrogen (LH2). The third stage, based on the second stage of the Saturn 1B, carried a single J-2. The Saturn V could carry up to 262,000 pounds to Low Earth Orbit and more critically, 100,000 pounds to the Moon. Created by NASA as a single-source reference as to the characteristics and functions of the Saturn V, this manual was standard issue to the astronauts of the Apollo and Skylab eras. It contains information about the Saturn V system, range safety and instrumentation, monitoring and control, prelaunch events, and pogo oscillations. It provides a fascinating overview of the rocket that made \"one giant leap for mankind\" possible.

Project Apollo

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Astronautics Information Abstracts

One of the most critical technical decisions made during the conduct of Project Apollo was the method of flying to the Moon, landing on the surface, and returning to Earth. Within NASA during this debate several modes emerged. The one eventually chosen was lunar-orbit rendezvous (LOR), a proposal to send the entire lunar spacecraft up in one launch. It would head to the Moon, enter into orbit, and dispatch a small lander to the lunar surface. It was the simplest of the various methods, both in terms of development and operational costs, but it was risky. Since rendezvous would take place in lunar, instead of Earth, orbit there was no room for error or the crew could not get home. Moreover, some of the trickiest course corrections and maneuvers had to be done after the spacecraft had been committed to a circumlunar flight. Between the time of NASA's conceptualization of the lunar landing program and the decision in favor of LOR in 1962, a debate raged between advocates of the various methods. John C. Houbolt, an engineer at the Langley Research Center in Hampton, Virginia, was one of the most vocal of those supporting LOR and his campaign in 1961 and 1962 helped to shape in a fundamental way the deliberations. This monograph is an important contribution to the study of NASA history in general, and the process of accomplishing a large scale technological program (in this case Apollo) in particular. In many ways, the lunar mode decision was an example of heterogeneous engineering, a process that recognizes that technological issues are also simultaneously organizational, economic, social, and political. Various interests often clash in the decision-making process as difficult calculations have to be made and decisions taken. What perhaps should be suggested is that a complex web

or system of ties between various people, institutions, and interests brought forward the lunar-orbit rendezvous mode of going to the Moon in the 1960s.

Chariots for Apollo

This book takes the reader on a journey through the history of extremely ambitious, large and complex space missions that never happened. What were the dreams and expectations of the visionaries behind these plans, and why were they not successful in bringing their projects to reality thus far? As spaceflight development progressed, new technologies and ideas led to pushing the boundaries of engineering and technology though still grounded in real scientific possibilities. Examples are space colonies, nuclear-propelled interplanetary spacecraft, space telescopes consisting of multiple satellites and canon launch systems. Each project described in this book says something about the dreams and expectations of their time, and their demise was often linked to an important change in the cultural, political and social state of the world. For each mission or spacecraft concept, the following will be covered: • Description of the design. • Overview of the history of the concept and the people involved. • Why it was never developed and flown • What if the mission was actually carried out – consequences, further developments, etc.

The Influence of Precession of Earth Rendezvous Orbits on Lunar Mission Requirements

Saturn V Flight Manual, SA 504