Bendix

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FIRST CLASS MAIL

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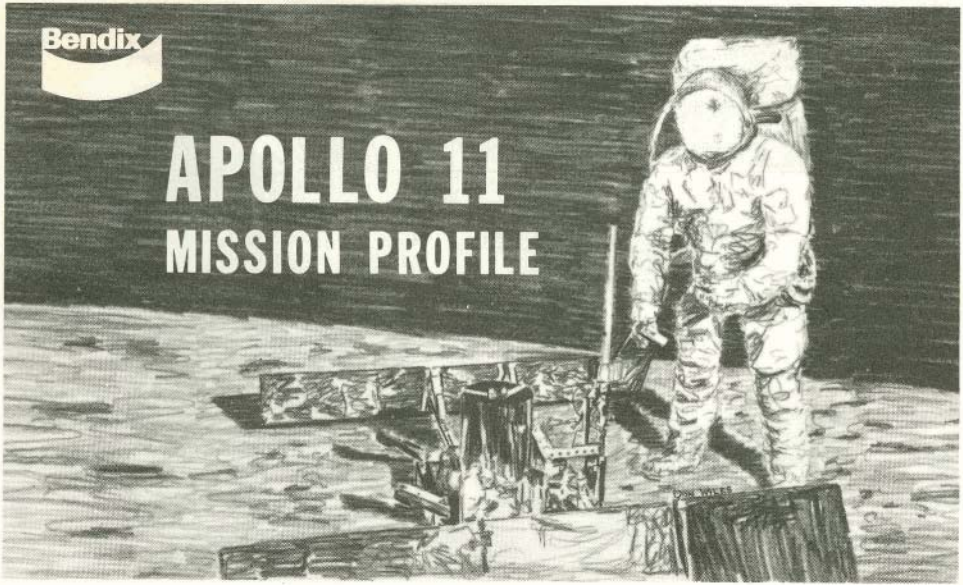
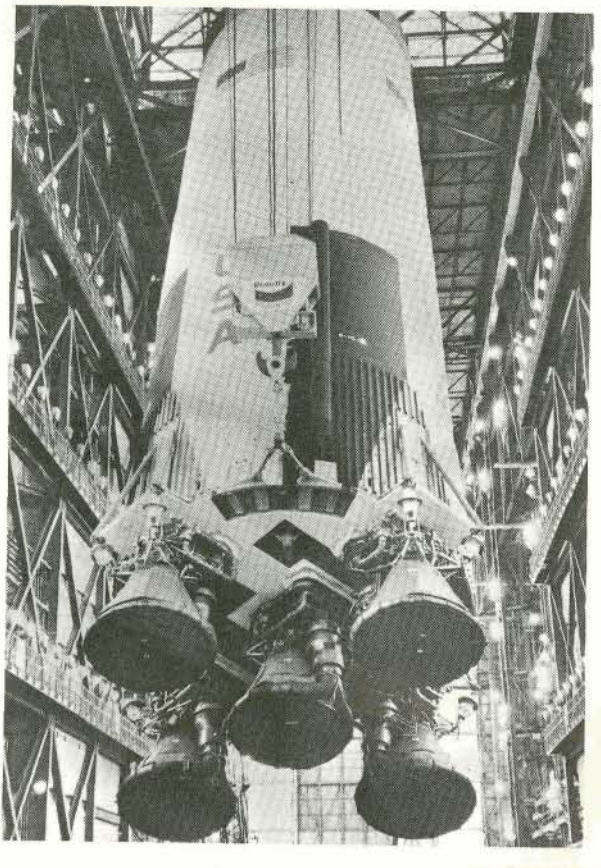
Apollo 11
Mission Profile

III. 3

1969





STACKING - Bendix cranes lift the 294,900-pound first stage of the Saturn 5 with ease, preparing to place it atop the mobile launcher in the high bay of the VAB. Launch Support Division is responsible for the stacking operations of all stages and the spacecraft, in preparing it for "roll out" to the launch pad.

INTRODUCTION

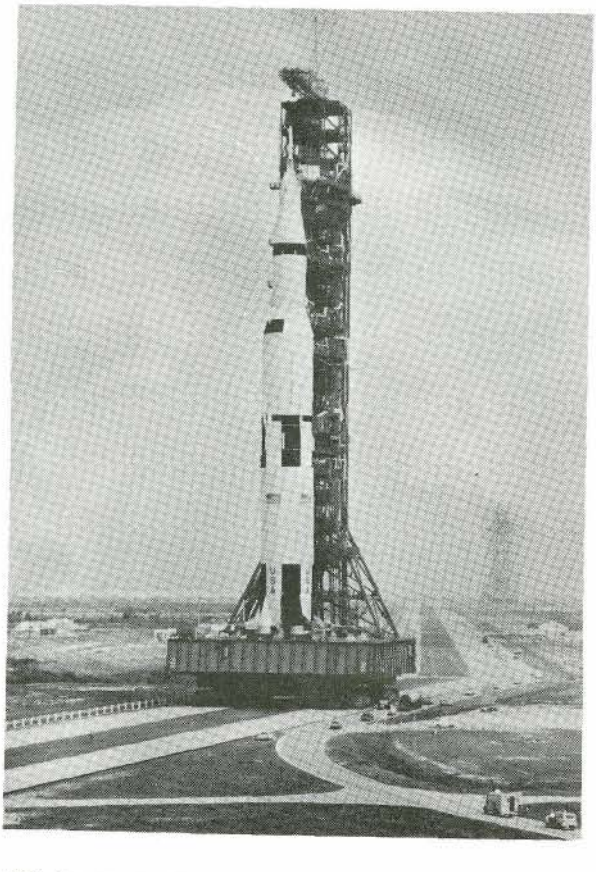
If you have been fortunate in this historic hour to watch the events surrounding the pre-launch and launch of Apollo 11 unfold, either from a vantage point at the Kennedy Space Center, or along the banks of the Indian and Banana Rivers, or from motel rooms along the Florida East Coast, then you have been privileged to see first hand the greatest human achievement in the annals of mankind.

NASA and its team of aerospace contractors are now reaching for just one of their goals -- landing a man on the surface of the moon and returning him safely to earth. There are yet other space conquests in America's exploration of outer space which will call for even more determined spirit which has been the backbone of NASA's space program.

The pages of this booklet are designed to acquaint you with facts of the Saturn 5, the Apollo spacecraft and the Lunar Module moonship, and to keep you informed of the day-to-day scheduled missions as they are now planned, for the duration of this 8-day mission.

This booklet may also be a souvenir to remind you for many years to come that you were here during the flight of Apollo 11, the greatest adventure story since Christopher Columbus began his perilous voyage into the unknown.

THE BENDIX CORPORATION



ROLL OUT - The Bendix-operated 6 million pound Crawler/Transporter lumbers lowly to the pad carrying its precious cargo, Apollo/Saturn 5. Known as one of the strongest, slowest, noisiest, strangest land vehicles in the world, the giant tractor moves at less than one mile per hour during missions.

SATURN V - APOLLO 11

AS-506/CSM - 107/LM-5

MAJOR OBJECTIVES

1. Perform a manned lunar landing and return to earth.
2. Perform selenological inspection and sampling, including contingency/lunar bulk sample collection.
3. Obtain data to assess the capability and limitations of the astronaut and his equipment in the lunar environment, including: Inertial Measurement Unit (IMU) lunar surface operations and lunar surface EVA operations.
4. Obtain data on characteristics and mechanical behavior of lunar surface.
5. Obtain data on landing effects on LM.
6. Determine position of LM on the lunar surface.
7. Obtain data on effects of illumination and contrast conditions on crew visual perception.
8. Demonstrate procedures and hardware used to prevent contamination of the earth's biosphere.
9. Obtain photographic coverage during lunar landing and lunar stay period.

APOLLO 'GAS STATION' - The Bendix Corporation's Launch Support Division High Pressure Gas Department and the Propellant Section combine to provide the world's largest "gas station", offering high and low pressure gasses and propellant delivery for NASA's Apollo Program.

MISSION OBJECTIVES

10. Obtain television coverage during lunar stay period.

11. Deploy the Early Apollo Scientific Experiments Package (EASEP).

12. Demonstrate operational launch vehicle (LV) capability by injecting a fully loaded Apollo Spacecraft (SC) onto a specific circumlunar conic.

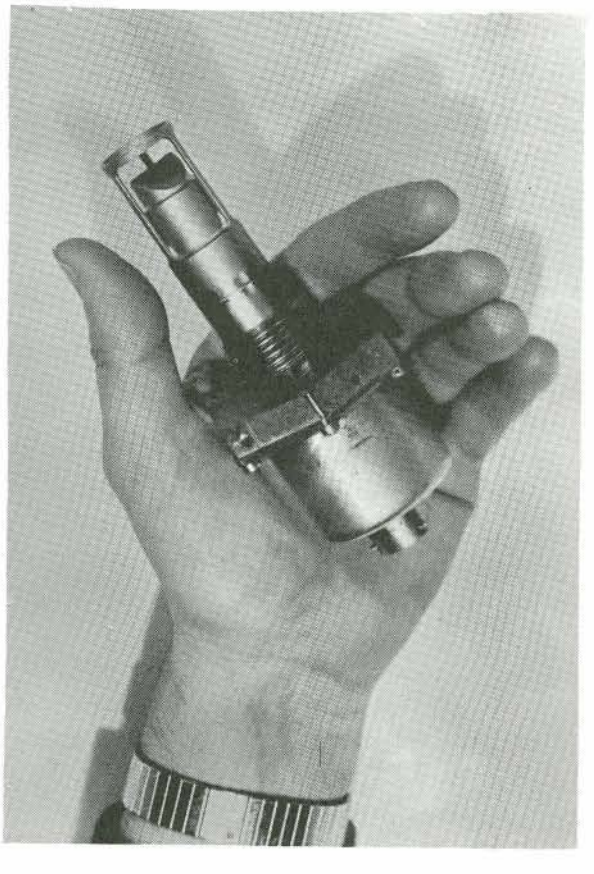
13. Demonstrate the adequacy of all SC systems and operational procedures for translunar and transearth flight.

14. Demonstrate the adequacy of deep space navigation techniques and of guidance accuracy during translunar and transearth midcourse corrections.

15. Demonstrate acceptable service propulsion system (SPS) performance and SC guidance during the lunar orbit insertion boost and the transearth injection boost.

16. Demonstrate acceptable Lunar Module (LM) systems performance during the descent-to-hover boost.

17. Demonstrate acceptable LM systems performance during the ascent and rendezvous mode.



A BIG JOB - Although it weighs less than a pound, this sensor is capable of initiating shut-down of the 1.5 million-pound-thrust engines of the S-IC, the initial booster stage of NASA's Saturn 5. The sensors is built by The Bendix Corporation Instruments and Life Support Division, Davenport, Iowa.

PERTINENT DATA

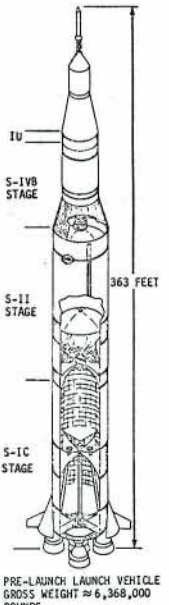
Saturn V Launch Vehicle

SOLID ULLAGE ROCKET AND RETROROCKET SUMMARY				
STAGE	TYPE	QUANTITY	NOMINAL THRUST AND DURATION	PROPELLANT GRAIN WEIGHT
S-IC	RETROROCKET	8	75,800 POUNDS• 0.541 SECONDS	278.0 POUNDS
S-II	ULLAGE	4	23,000 POUNDS† 3.75 SECONDS	336.0 POUNDS
	RETROROCKET	4	34,810 POUNDS‡ 1.52 SECONDS	268.2 POUNDS
S-IVB	ULLAGE	2	3,390 POUNDS† 3.87 SECONDS	58.8 POUNDS

ENGINE DATA					
STAGE	QTY	ENGINE MODEL	NOMINAL THRUST EACH	NOMINAL THRUST TOTAL	BURN TIME
S-IC	5	F-1	1,526,500	7,632,500	150 SEC
S-II	5	J-2	230,000	1,150,000	360 SEC
S-IVB	1	J-2	230,000	230,000	493 TO 505 SEC

STAGE DIMENSIONS			STAGE WEIGHTS	
	DIAMETER	LENGTH	DRY	AT LAUNCH
S-IC Base (including fins)	63.0 FEET	138 FEET	294,900 POUNDS	5,029,900 POUNDS
S-IC Mid-stage	33.0 FEET			
S-II Stage	33.0 FEET	81.5 FEET	84,600 POUNDS	1,071,500 POUNDS
S-IVB Stage	21.7 FEET	59.3 FEET	25,100 POUNDS	262,000 POUNDS
Instrument Unit	21.7 FEET	3.0 FEET	4,203 POUNDS	4,203 POUNDS

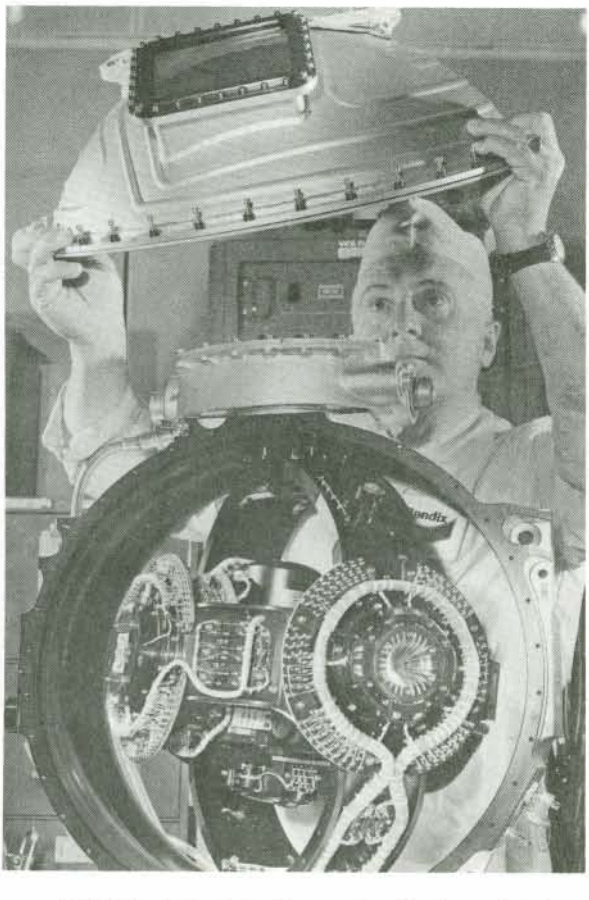
SATURN V STAGE MANUFACTURERS	
STAGE	MANUFACTURER
S-IC	THE BOEING COMPANY
S-II	NORTH AMERICAN-ROCKWELL
S-IVB	McDONNELL - DOUGLAS CORP.
S-IU	INTERNATIONAL BUSINESS MACHINE CORP.



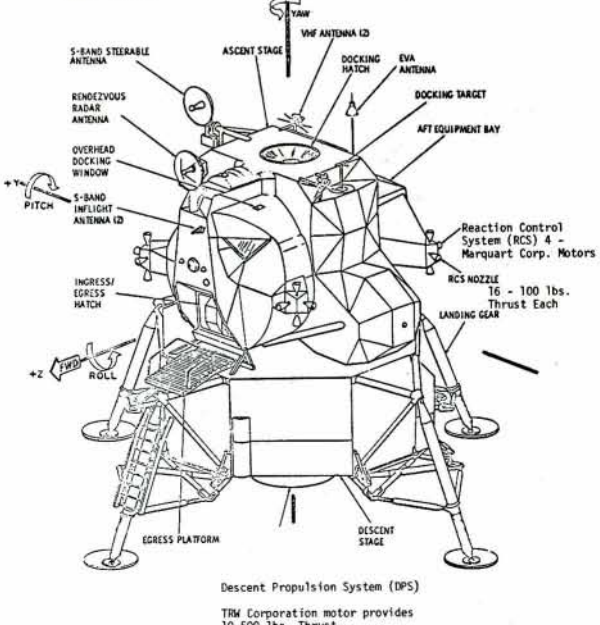
PRE-LAUNCH LAUNCH VEHICLE GROSS WEIGHT ≈ 6,368,000 POUNDS

• MINIMUM VACUUM THRUST AT 120°F
† AT 170,000 FT. AND 70°F
‡ NOMINAL VACUUM THRUST AT 60°F

NOTE: THRUST VALUES, WEIGHTS, AND BURN TIMES ARE ALL APPROXIMATIONS.



COVER UP - An inertial guidance system of the type assigned to keeping the Saturn V rocket on course during Apollo 11 moon shot. The unit is built by Navigation and Control Division, Teterboro, N. J.



Descent Propulsion System (DPS)

TRW Corporation motor provides 10,500 lbs. Thrust

Total Weight - 30,531 lbs.

OUTLINE OF FLIGHT PROFILE

Launch and Earth Parking Orbit Insertion - The Saturn V Vehicle will insert the S-IVB/IU/LM/CSM into a 100 NM circular orbit at 11 minutes, 24 seconds after liftoff. The S-IVB/IU and Spacecraft checkout will be accomplished during the orbital coast phase.

Translunar Injection and Coast - The Launch Vehicle S-IVB stage will be reignited during the second parking orbit, to inject the S-IVB, LM and CSM into a translunar trajectory. This nominal injection will provide a "free return" to Earth if the insertion into lunar parking orbit cannot be accomplished.

The CSM will separate from the S-IVB, transpose, dock, and initiate ejection of the LM. Midcourse corrections will be made, as required, utilizing the Manned Space Flight Network (MSFN) for navigation.

Lunar Orbit Insertion - Service Propulsion System (SPS) will insert the Spacecraft into an initial orbit of 60 X 170 NM. Following insertion and systems checks and two revolutions in this orbit, the orbit will be circularized at 60 NM.

Lunar Module Descent and Landing - The Commander (CDR) and LM Pilot (LMP) will enter the LM and separate from the CSM using the SM - Reaction Control System (RCS). The LM Descent Propulsion System (DPS) will be used for powered descent to the lunar surface. The vertical descent portion of the landing phase will start at an altitude of 150 feet. Rest periods will follow.

Flight Profile

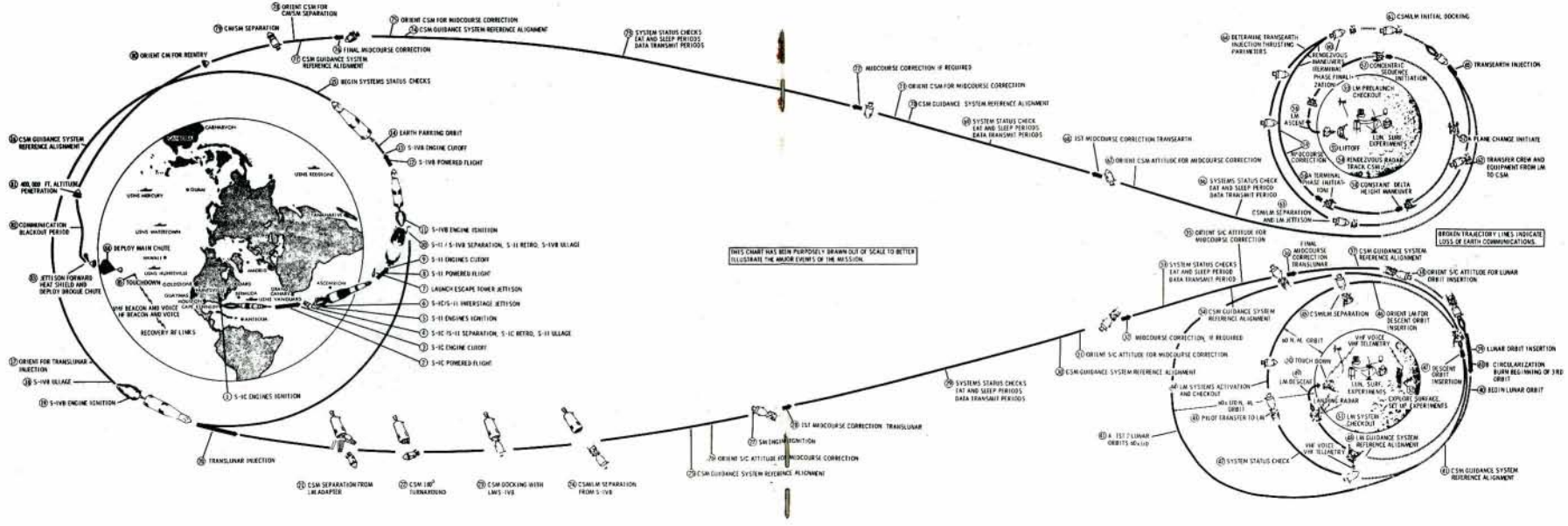
Lunar Surface Operations - The staytime on the lunar surface is planned at 21 hours, 33 minutes, and 21 seconds. Stay will include rest periods and EVA of 2 hours and 40 minutes at not over 70 feet radius from the LM. Planned activities include photography, TV, sample collection, LM inspection, assessment of astronaut capabilities, and limitations and experiment deployment.

Lunar Module Ascent - At the completion of the lunar surface activities the LM-Ascent Propulsion System (APS) and the LM-RCS will be used to launch, rendezvous and dock to the CSM. The LM will coast from insertion to an elliptical orbit (9 X 45 NM) for one hour after which several maneuvers will be made to bring the LM and CSM range to within one nautical mile. Braking from this point will be performed manually. Once docked to the CSM the two LM Crewmen will transfer to the CSM with samples of lunar surface material. The CSM will be separated from the LM using the SM-RCS.

Transearth Injection and Coast - The SPS will be used to inject the CSM into the transearth trajectory. Transearth return time will be 63 hours, 51 minutes, 50 seconds. During the transearth coast intermediate midcourse corrections will be made, if required, utilizing the MSFN for navigation.

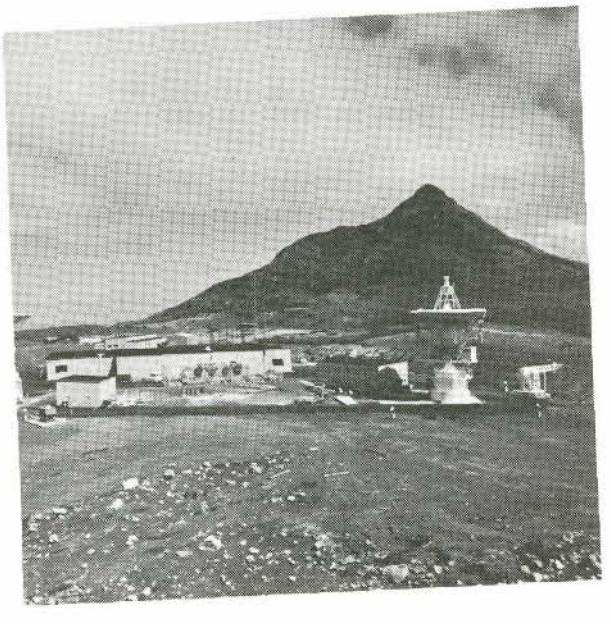
Entry and Recovery - Prior to atmosphere entry the Command Module will be separated from the Service Module using the SM-RCS. The drogue parachute deployment sequence will start at an altitude of 23,300 feet, the three main parachutes at 10,500 feet altitude. The nominal range from the entry interface at 400,000 feet altitude to touchdown will be 1285 nautical miles. Earth touchdown will be in the Mid-Pacific.

LUNAR LANDING MISSION PROFILE



MAJOR SCHEDULE AND COUNTDOWN EVENTS

Approximate Time	
T - 4 months, 2 weeks	Erected Launch Vehicle S-IC, S-II, S1VB, and IU
T - 3 months, 1 week	Erected Spacecraft CSM-107 and and LM-5
T - 2 months	Installed S/C and LV Ordnance and LES and Transferred SV to Pad A
T - 1 month, 2 weeks	Conducted SV - Flight Readiness Test - FRT
T - 1 month	Hypergolic Loading and RP-1 Fuel Loading of SV
T - 3 weeks	Begin Countdown Demonstration Test - Wet and Dry
Countdown	
T - 114 hours	Begin Countdown
T - 106 hours, 30 min.	Monitor GH_2 Facility and Provide GN_2 and GHe for Duration of Test
T - 93 hours	Begin Space Vehicle Ordnance Operations
T - 89 hours	Begin Launch Vehicle Ordnance Operations
T - 85 hours	Provide SCAPE Support



APOLLO TRACKING - Bendix men operate the Devil's Ashpit station on tiny volcanic-extinct Ascension Island, 5,000 miles downrange from Cape Kennedy. This is one of the 12 stations maintained and operated for NASA's Goddard Space Flight Center by the Bendix Field Engineering Corporation.

Countdown	
T - 25 hours	Validate Astronaut Vans
T - 24 hours	Inspect MSS for Travel Configuration
T - 22 hours	Activate First Industrial Water Engine and Bring Up to Speed
T - 20 hours	Install and Soap Plywood Surface at Pad
T - 15 hours, 45 min.	Start and Stabilize Crawler Transporter Secure Hammerhead Crane for Launch
T - 15 hours, 30 min.	Pressurize and Leak Check GH_2 Cross Country Lines
T - 13 hours, 45 min.	Propel C/T to Top of Ramp
T - 13 hours, 15 min.	Propel C/T to Mate MSS
T - 12 hours, 45 min.	Jack C/T to Mate MSS
T - 11 hours	Install and Soap Plywood Surface at MSS Parksite Release Weather Balloon
T - 10 hours, 45 min.	Jack MSS up to Clearance Height
T - 10 hours, 15 min.	Propel MSS to Parksite
T - 9 hours, 45 min.	Provide Generator Support at CCF Until End of Mission
T - 9 hours, 30 min.	Verify 11 Scott Air Packs in the ECS Room and 23 in the Blast Room

Countdown	
T - 9 hours	Begin Built-in Hold of 6 hours Slide Wire Preps Complete and Ready to Support
T - 8 hours, 15 min.	Begin LV Propellant Loading
T - 8 hours	Begin LV Cryogenic Loading
T - 7 hours	Clear Route for Astro Van Activate 2nd and 3rd Industrial Water Engines
T - 6 hours, 45 min.	MSS Mated at Parksite
T - 6 hours, 15 min.	MSS is Hard Down on Mounts
T - 6 hours	Release Weather Balloon
T - 3 hours, 45 min.	MSS Parksite Clear of Personnel
T - 3 hours, 15 min.	Prime Crew Enter Astro Van at MSO Bldg.
T - 2 hours, 45 min.	Crew Ingress at C-39 Pad A
T - 1 hour	Support RP-1 Fuel Level Adjustment on LV
T - 7 min.	Verify GO for Launch
*T - 3 min.	Terminate LV Liquid Oxygen and Hydrogen Replenishment
*T - 2 min., 47 sec.	Pressurize S-IVB LOX Tank
*T - 1 min., 37 sec.	Pressurize S-IC, S-II and S-IVB Fuel Tanks

Countdown	
*T - 1 min., 22 sec.	Pressurize S-II Liquid Hydrogen Tank
*T - 1 min., 12 sec.	Pressurize S-IC LOX Tank
T - 1 min.	Pad Industrial Water On
*T - 40 sec.	Flame Deflection Cooling Water On
T - 9 sec.	Ignition Sequence Start
T - 2 sec.	All 5 Engines Running

*May not be exact time - actual countdown not available at this time.

FIRST DAY
Wednesday

T - 9 sec.	Ignition Command
T - 0	Liftoff
T + 2 min., 14 sec.	S-IC Inboard Engine Cutoff (1)
T + 2 min., 40 sec.	S-IC Outboard Engine Cutoff (4)
T + 2 min., 41 sec.	S-IC/S-II Separation
T + 2 min., 42 sec.	S-II (2nd Stage) Ignition Jettison Launch Escape Tower (LET)
T + 8 min., 50 sec.	S-II Engine Cutoff (5) S-II/S-IVB Separation
T + 8 min., 51 sec.	S-IVB (3rd Stage) 1st Ignition
T + 11 min., 21 sec.	S-IVB Velocity Cutoff - Orbit Insertion - 100 NM
T + 2 hrs., 44 min., 18 sec.	S-IVB 2nd Ignition on 2nd Revolution
T + 2 hrs., 49 min., 39 sec.	S-IVB Cutoff - Translunar Injection (TLI)
T + 3 hrs., 12 min.	CSM Separation from S-IVB/IU/LM-5 and Transposition
T + 3 hrs., 22 min.	Dock CSM with LM
T + 4 hrs., 10 min.	Eject LM from S-IVB
T + 4 hrs., 39 min., 37 sec.	Evasive Maneuver - SPS Ignition of CSM/LM

FIRST DAY

T + 4 hrs., 49 min.	S-IVB 3rd Ignition - Slingshot Maneuver - Orbit S-IVB/IU Around Sun
T + 7 hrs.	30,000 NM from Earth
T + 11 hrs , 16 min.	Midcourse Correction Maneuver No. 1 (MCC #1) of CSM/LM-5
T + 19 hrs.	90,000 NM from Earth

SECOND DAY
Thursday

T + 26 hrs., 20 min.	MCC #2 (if required)
T + 43 hrs.	150,000 NM from Earth

THIRD DAY
Friday

T + 53 hrs., 55 min.	MCC #3 (if required)
T + 56 hrs., 17 min.	Lunar Module Pilot (LMP) - Intra-Vehicular Transfer (IVT) to LM Commander (CDR) - Transfer Equipment to LMP in LM
T + 57 hrs., 5 min.	CDR - IVT to LM
T + 58 hrs.	LMP and CDR return to CSM 180,000 NM from Earth
T + 70 hrs., 55 min.	MCC #4 (if required)

FOURTH DAY
Saturday

T + 73 hrs.	GO-NO-GO for Lunar Orbit Insertion #1 (LOI_1)
T + 75 hrs., 55 min., 03 sec.	LOI_1 60NM X 170NM Orbit Burn Time - 6 min., 5 sec.
T + 80 hrs., 10 min	Lunar Revolution # 3
T + 80 hrs., 12 min., 01 sec.	LOI_2 60NM X 60NM Orbit Burn Time - 14 sec
T + 81 hrs., 48 min.	LMP - IVT to LM
T + 83 hrs., 48 min.	LMP - Returns to CSM
T + 84 hrs., 07 min.	Lunar Revolution #5
T + 94 hrs., 26 min.	LMP - IVT to LM
T + 94 hrs., 50 min.	CDR - ICT to LM

FIFTH DAY
Sunday

T + 97 hrs., 30 min.	GO-NO-GO for Undocking
T + 97 hrs., 58 min.	Lunar Revolution #12
T + 98 hrs., 18 min.	Undock LM from CSM
T + 98 hrs., 43 min.	LM Separation from CSM
T + 99 hrs., 42 min., 27 sec.	Descent Orbit Insertion (DOI) Burn Time - 35 sec.
T + 100 hrs., 38 min., 57 sec.	PDI
T + 100 hrs., 50 min., 50 sec.	Touchdown on Moon

FIFTH DAY

T + 100 hrs., 54 min.	GO-NO-GO for 7 min. Stay
T + 101 hrs., 01 min.	GO-NO-GO for 1 Lunar Revolution of CSM
T + 101 hrs., 52 min.	Lunar Revolution #14 for CSM
T + 102 hrs., 10 min.	GO-NO-GO for Lunar Stay - LM
T + 108 hrs., 32 min.	Begin preparations for Egress
T + 109 hrs., 50 min.	Lunar Revolution #18 for CSM
T + 110 hrs., 30 min.	CDR - Start Extravehicular Activity (EVA)
T + 110 hrs., 40 min.	CDR - Initial EVA with LMP Assistance and Monitoring Sequence C Camera - TV
T + 110 hrs., 55 min.	Contingency Sample Collection
T + 111 hrs., 08 min.	CDR - Rest and Photograph LMP - EVA
T + 111 hrs., 30 min.	TV Deployment Solar Wind Component (SWC) Deployment Bulk Sample Collection EVA and Environment Evaluation
T + 111 hrs., 42 min.	Perform LM Inspection
T + 111 hrs., 45 min.	Lunar Revolution #19
T + 112 hrs.	Early Apollo Scientific Equipment Package (EASEP) Deployment
T + 112 hrs., 08 min.	Documented Sample Collection

FIFTH DAY

T + 112 hrs., 40 min.	LMP - EVA Termination
T + 112 hrs., 45 min.	CDR - Rock and Transfer Sample Return Container (SRC)
T + 113 hrs.	CDR - EVA Termination (Total EVA - 2 hrs., 40 min.)
T + 113 hrs., 43 min.	Lunar Revolution #20 - CSM
T + 114 hrs., 21 min.	Jettison Surplus Equipment Eat and Rest

SIXTH DAY
Monday

T + 122 hrs., 28 min., 11 sec.	LM-AS-Liftoff-Ascent Propulsion (APS) System - Burn Time - 400 sec.
T + 122 hrs., 35 min., 25 sec.	Orbit Insertion of LM-AS
T + 123 hrs., 26 min., 27 sec.	LM-RCS-Coelliptic Sequence Initiation Maneuver - (CSI) Burn Time - 46 sec.
T + 123 hrs., 29 min., 27 sec.	CSM Backup CSI Burn
T + 124 hrs., 24 min., 25 sec.	LM-RCS Constant Delta Altitude Maneuver (CDH) Burn Time - 2.8 sec.
T + 124 hrs., 27 min., 25 sec.	CSM Backup - CDH Burn
T + 124 hrs., 02 min., 46 sec.	LM-RCS Terminal Phase Initiation Maneuver (TPI) Burn Time - 23.3 sec.
T + 125 hrs., 17 min., 46 sec.	LM-RCS-MCC #1

SIXTH DAY

T + 125 hrs., 32 min., 46 sec.	LM-RCS-MCC #2
T + 125 hrs., 42 min., 22 sec.	LM-RCS Braking Maneuvers Burn Time - 1.5 sec., Range - 1.0 NM
T + 125 hrs., 44 min., 05 sec.	LM-RCS Braking Maneuvers Burn Time - 9.6 sec., Range - .5 NM
T + 125 hrs., 45 min., 14 sec.	LM-RCS Braking Maneuvers Burn Time - 9.0 sec., Range - .2 NM
T + 125 hrs., 47 min., 02 sec.	LM-RCS Braking Maneuvers Burn Time - 4.3 sec., Range - .08 NM
T + 125 hrs., 48 min., 03 sec.	LM-RCS Braking Maneuvers Burn Time - 4.2 sec., Range - 0.3 NM
T + 126 hrs.	LM Active Docking with CSM
T + 126 hrs., 48 min.	CDR - IVT to CSM
T + 127 hrs.	LMP - IVT to CSM
T + 128 hrs.	Jettison LM-AS
T + 129 hrs., 32 min.	Lunar Revolution #28
T + 131 hrs., 28 min., 43 sec.	Transearth Insertion (TEI) Burn Time - SPS - 2 min., 29 sec., Lunar Revolution #29

SEVENTH DAY
Tuesday

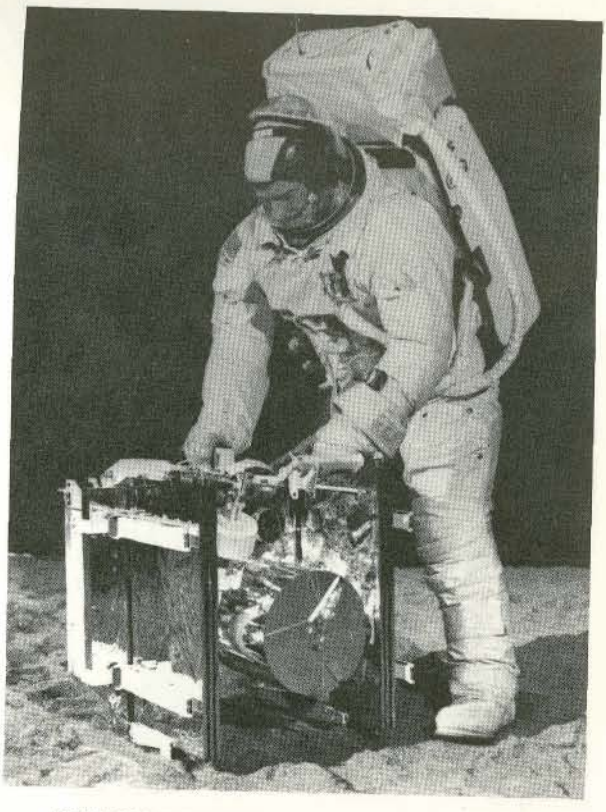
T + 148 hrs., 32 min.	MCC #5 (if required)

EIGHTH DAY
Wednesday

T + 172 hrs., 58 min.	MCC #6 (if required) Earth insertion (EI) - 22 hrs.

NINTH DAY
Thursday

T + 192 hrs., 06 min.	MCC #7 (if required) EI - 3 hrs.
T + 194 hrs., 57 min.	CM/SM Separation
T + 195 hrs., 06 min., 27 sec.	Earth Insertion - Altitude - 400,000 ft.
T + 195 hrs., 06 min., 53 sec.	Enter, S-Band Blackout
T + 195 hrs., 07 min., 51 sec.	Astronauts Experience Peak G Force
T + 195 hrs., 07 min., 53 sec.	Exit, S-Band Blackout
T + 195 hrs., 15 min.	Drogue Chutes Deployment 23,300 feet altitude
T + 195 hrs., 15 min., 49 sec.	Drogue Chutes Disconnect and 3 Main Parachutes Deploy at 10,500 feet altitude
T + 195 hrs., 20 min., 42 sec.	Splashdown - Pacific Ocean



FOOT STEPS ON THE MOON - Apollo 11 astronauts will carry this self-contained seismic station as part of the Early Apollo Scientific Experimental Package (EASEP), to be placed on the moon. When operating, the seismometer may transmit to earth listeners the sound of the astronaut's footsteps. Ron Redick, of the Bendix Corporation's Aerospace Systems Division, Ann Arbor, Michigan, simulates the moon deployment.