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PRESENTATION BY WITNESS

Statement of

George E. Mueller

Associate Administrator for Manned Space Flight

before the

Committee on Aeronautical and Space Sciences

United States Senate

Volume II--Illustrations

(Text for these illustrations is contained in Volume I)

ILLUSTRATIONS

MP69-5122	Lunar Module-3 in Earth Orbit
MP69-5121	Command and Service Module 104 in Earth Orbit
MP69-5124	Astronaut Schweickart EVA
MP69-5287	Astronaut Scott in Open Command and Service Module Hatch
SM69-353	Geologists Simulating Apollo Mission
SM69-318	Logistics of Returned Lunar Sample
MA68-7512	Solar Powered Seismometer
SM69-347	Laser Ranging Retro-Reflector
MA66-9694	Saturn V Launch Vehicle Production Summary
MA66-9695-B	Spacecraft Production Summary - Command and Service Module
MA66-9695-A	Spacecraft Production Summary - Lunar Module
MC69-4095	Mission Operations
MC69-4096	Mission Operations
MA69-4228	Sea of Tranquillity-Eastern Mare
MC69-4773	Apollo Landing Site-Western Mare
SM69-354	Crater Censorinus
SL68-738	Crater Tycho
SL68-723	Marius Hills Area
MA68-7407	Schroter's Valley
SL68-716	Hyginus Rille
SL68-736	Crater Copernicus
SM69-431	Apollo Command and Service Module Typical Lunar Orbital Science Instruments

SM69-427	ALSEP Array A
SM69-448	Lunar Roving Vehicle
MC68-5185	Major MSF Milestones

Apollo Applications

ML68-6015	Apollo Applications Basic Objectives
ML67-7074	Apollo Applications Mission Concepts
MC68-5607	Saturn I Workshop
ML69-4296	Airlock Flight Article No. 1
ML68-5909	Multiple Docking Adapter
ML68-5911	Command and Service Module
ML68-6244	LM-ATM
ML69-4270	Saturn I Workshop Activation and Operation
MC68-5515	Saturn I Workshop Activation Phase
MC68-5513	Saturn I Workshop Activation Phase
MC68-5689	AAP-1 and AAP-2 Mission Orbital Configuration
ML69-4301	AAP-1 and AAP-2 Experiments
ML69-4269	Saturn I Workshop - Crew Quarters Layout
MC68-5062	AAP-1 and AAP-2 Primary Mission Objectives
ML69-4372	Workshop Revisit and Solar Astronomy Missions
MA68-7001	AAP Cluster
ML69-4293	ATM Scientific Experiments
ML69-4274	Saturn I Workshop Zero 'G' Hardware
ML69-4295	Airlock Structural Test Article

ML69-4335	Airlock Mockup
ML69-4230	Multiple Docking Adapter
ML69-4341	Apollo Telescope Mount
ML69-4344	AAP LM-A Mockup
ML69-4345	AAP LM-A Mockup

Space Station

MT69-4101	Manned Earth Orbital Space Station
MT69-4100	Space Station Core Modules
MT69-4556	Command Control Deck
MT69-4555	Crew Quarters
MT69-4557	Crew Cabin
MT69-4554	Engine Room
MT69-4303	One Large Space Station Evolution Plan
MT69-4534	Modularity
MT68-7234	Economic Significance of Logistics to Space Station Program
MT68-7243	Planning Perspective for Logistic System
MC68-6674	Operational Characteristics of the Space Shuttle
MT69-4376	Integral Launch and Reentry Vehicle
MT69-4375	Space Shuttle Reusable Vehicle
MC 68-6609	Space Shuttle Operational Concept
MC 68-6600	Space Shuttle
MT69-4549	Triamese Reusable Launch Vehicle
MT69-4551	Triamese Operational Approach

MT69-4520	Biology Laboratory
MT69-4519	Space Manufacturing Module
MT69-4517A	Astronomy Module

Advanced Manned Missions

MT68-7395	Space Station Concept Development
MT68-7398	Major NASA In-House Station Studies
MT69-4637D	Spectrum of Integral Launch and Reentry Vehicle Studies
MT69-4637	Spectrum of Integral Launch and Reentry Vehicle Studies - McDonnell-Douglas
MT69-4637A	Spectrum of Integral Launch and Reentry Vehicle Studies - North American-Rockwell
MT69-4637C	Spectrum of Integral Launch and Reentry Vehicle Studies - Lockheed
MT69-4637B	Spectrum of Integral Launch and Reentry Vehicle Studies - General Dynamics
MT69-5382	TEKTITE Habitat

Management

MC69-4395	MSF Field Center Manpower Reductions - FY 1969

Funding

MP69-4380	Manned Space Flight FY 1970 Authorization Request
MC69-4410	Manned Space Flight Manpower
MP69-4047	Manned Space Flight Apollo FY 1970 Budget Estimate
MP69-4379	Manned Space Flight Operations FY 1970 Budget Estimate

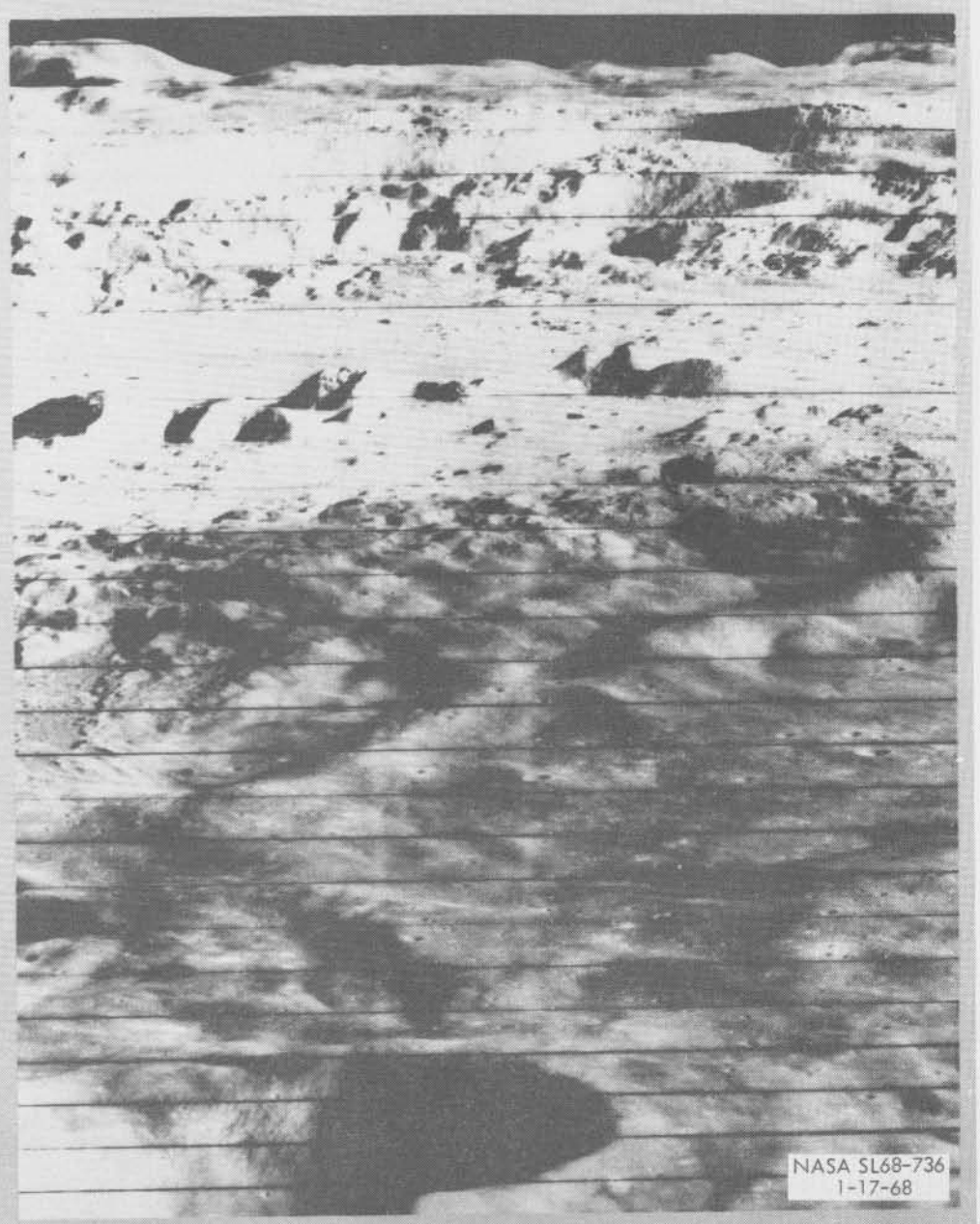
MP69-4046	Manned Space Flight Operations FY 1970 Budget Estimate
MP69-4048	Manned Space Flight Operations FY 1970 Budget Estimate
MP69-4381	Manned Space Flight Construction of Facilities FY 1970 Budget Estimate
MP69-4045	Manned Space Flight Research and Program Management Distribution of Funds by Center FY 1970 Budget Estimate
MP69-4050	Manned Space Flight Research and Program Management Number of Permanent Positions FY 1970 Budget Estimate
MP69-4049	Manned Space Flight Research and Program Management Distribution of Funds by Function FY 1970 Budget Estimate

MANNED SPACE FLIGHT
GENERAL OBJECTIVES

- ESTABLISHMENT OF MAN'S CAPABILITIES
- NATIONAL COMPETENCE FOR MANNED SPACE FLIGHT
  - INDUSTRIAL BASE
  - TRAINED PERSONNEL
  - GROUND FACILITIES
  - LAUNCH VEHICLES
  - SPACECRAFT
  - OPERATIONAL EXPERIENCE
- EXPLORATION OF SPACE
- UNITED STATES LEADERSHIP

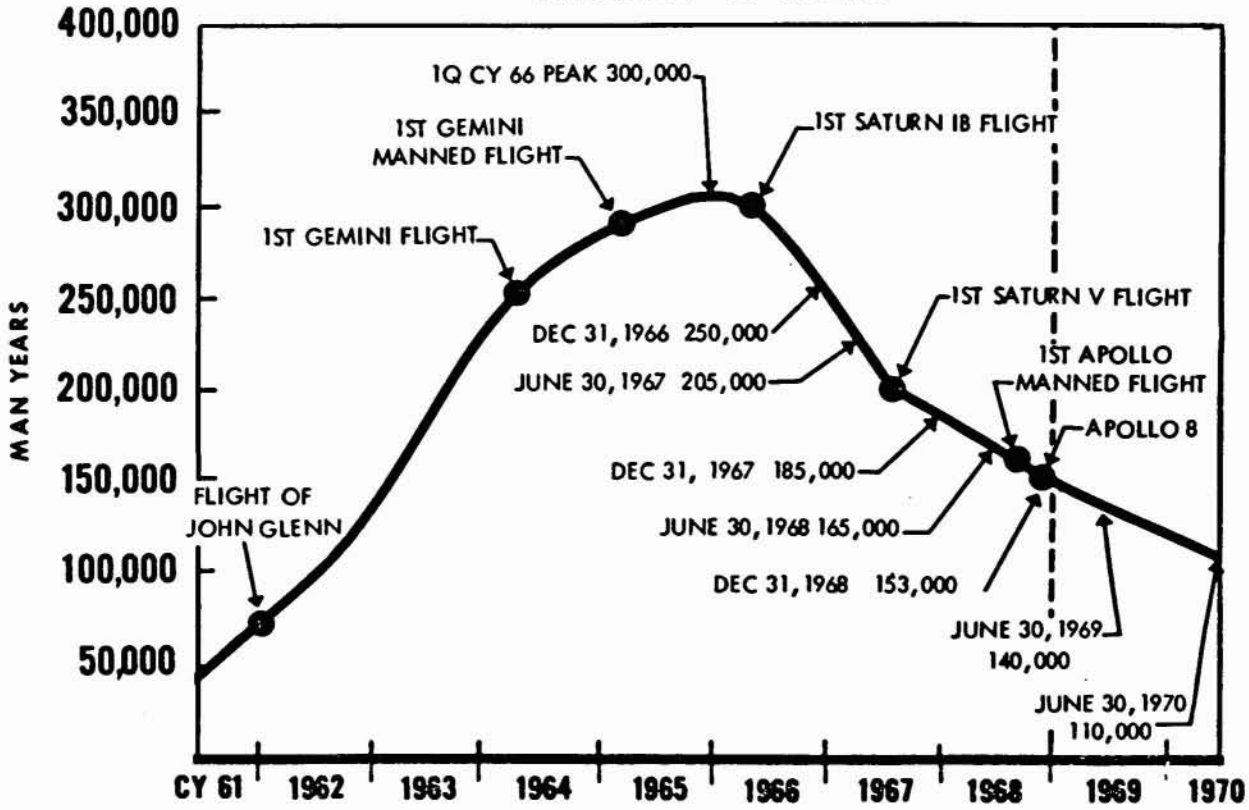
NASA M64-68

CRATER COPERNICUS - ORBITER II OBLIQUE PHOTO



MANNED SPACE FLIGHT

MANPOWER



	JUNE 1966	JUNE 1967	JUNE 1968	DEC 1968	JUNE 1969	JUNE 1970
R&D	222,000	172,000	140,000	130,000	118,500	89,000
C of F	30,000	11,000	5,000	3,000	2,000	2,000
AO & CIVIL SERVICE	22,000	22,000	20,000	21,000	19,500	19,000
TOTAL	274,000	205,000	165,000	153,000	140,000	110,000

NASA HQ MC69-4410
2-19-69

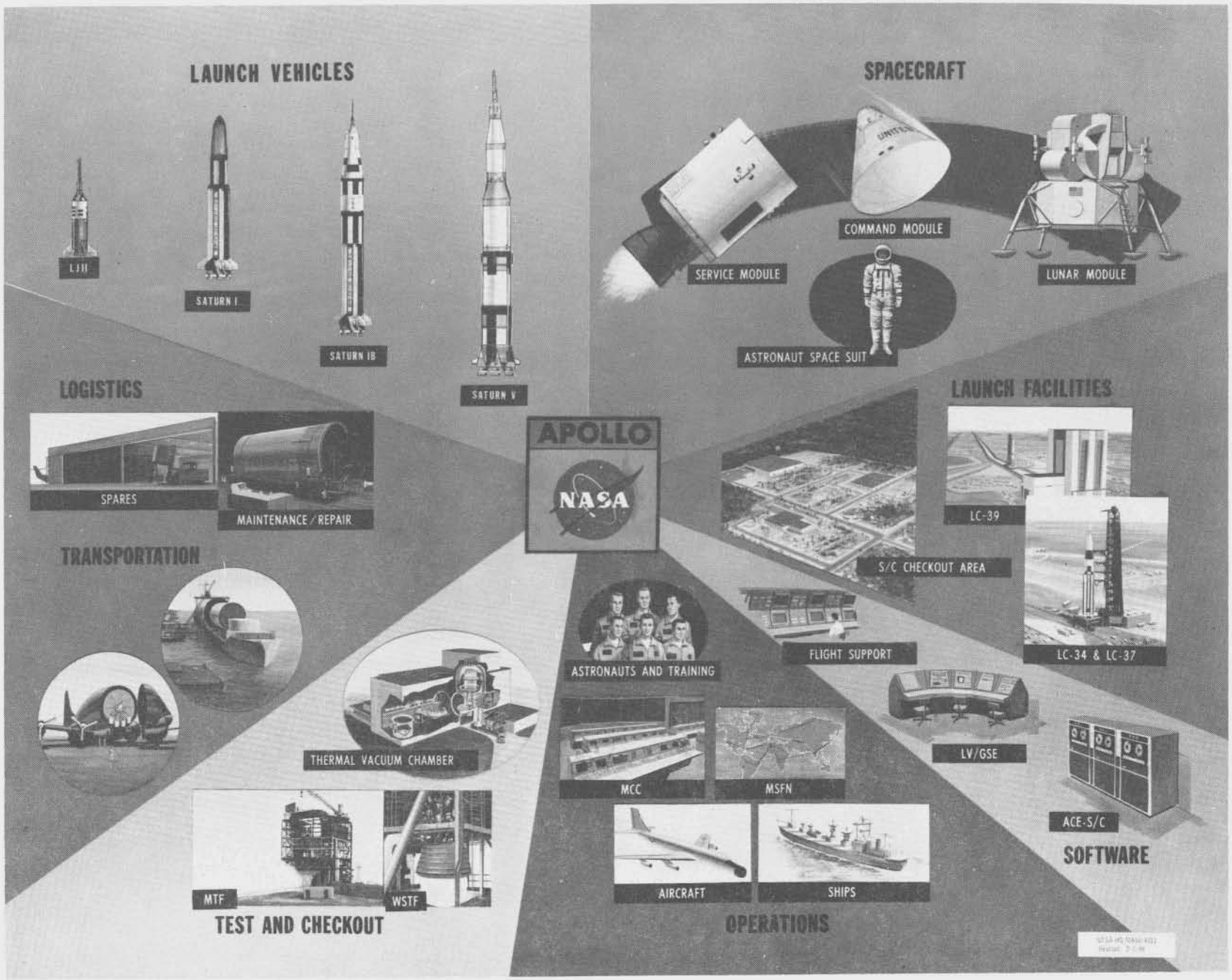
MANNED SPACE FLIGHT

FY 1970 AUTHORIZATION REQUEST

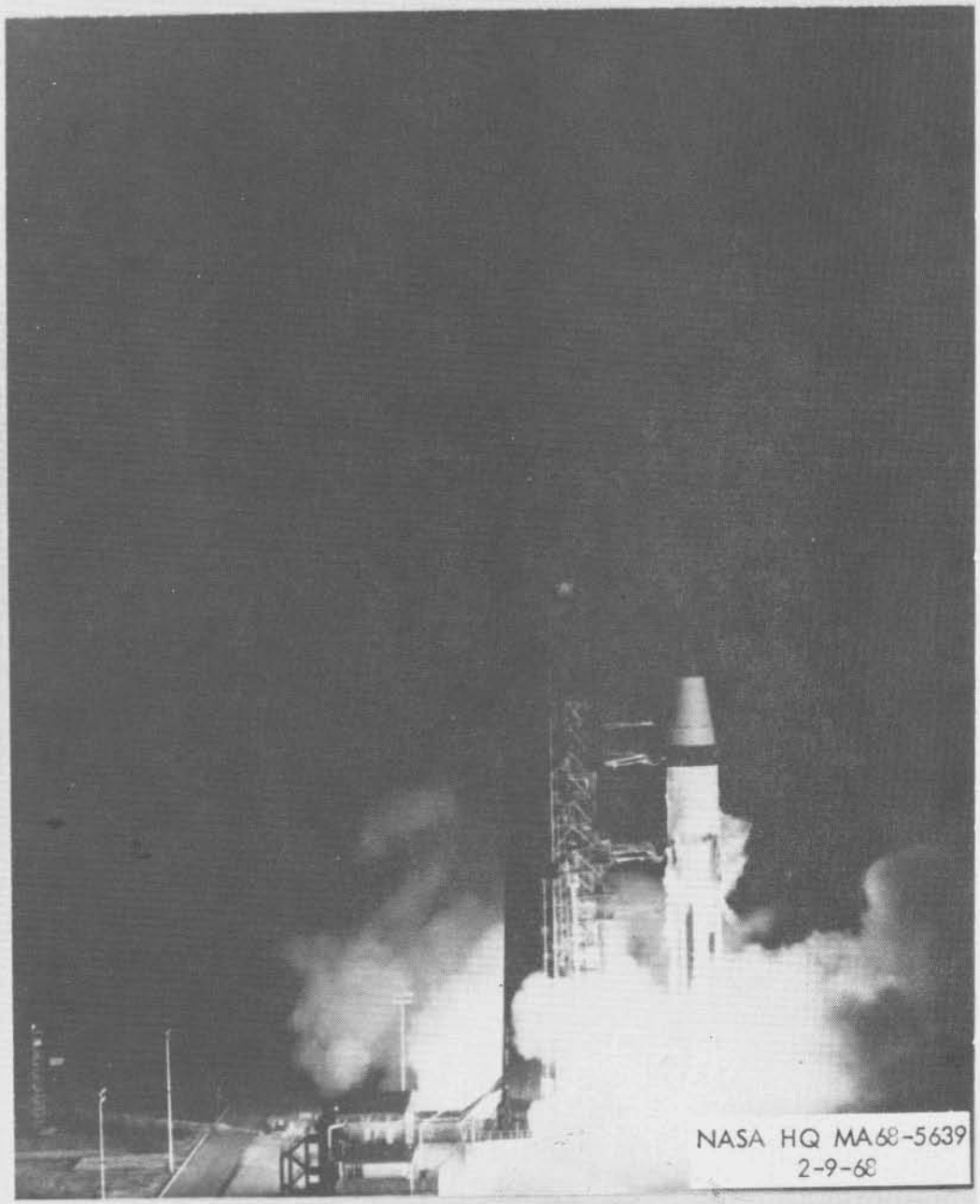
(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	REQUEST FY 1970 AMENDED
RESEARCH & DEVELOPMENT	$2809.2	$2177.5	$1919.2
APOLLO	2556.0	2025.0	1691.1
SPACE FLIGHT OPERATIONS	253.2	150.0	225.6
ADVANCED MISSIONS	-0-	2.5	2.5
CONSTRUCTION OF FACILITIES	$21.3	$10.4	$14.2
RESEARCH & PROGRAM MANAGEMENT	$315.1	$312.0	$307.5
TOTAL	$3145.7	$2499.9	2240.9

NASA HQ MP69-4380
4-16-69

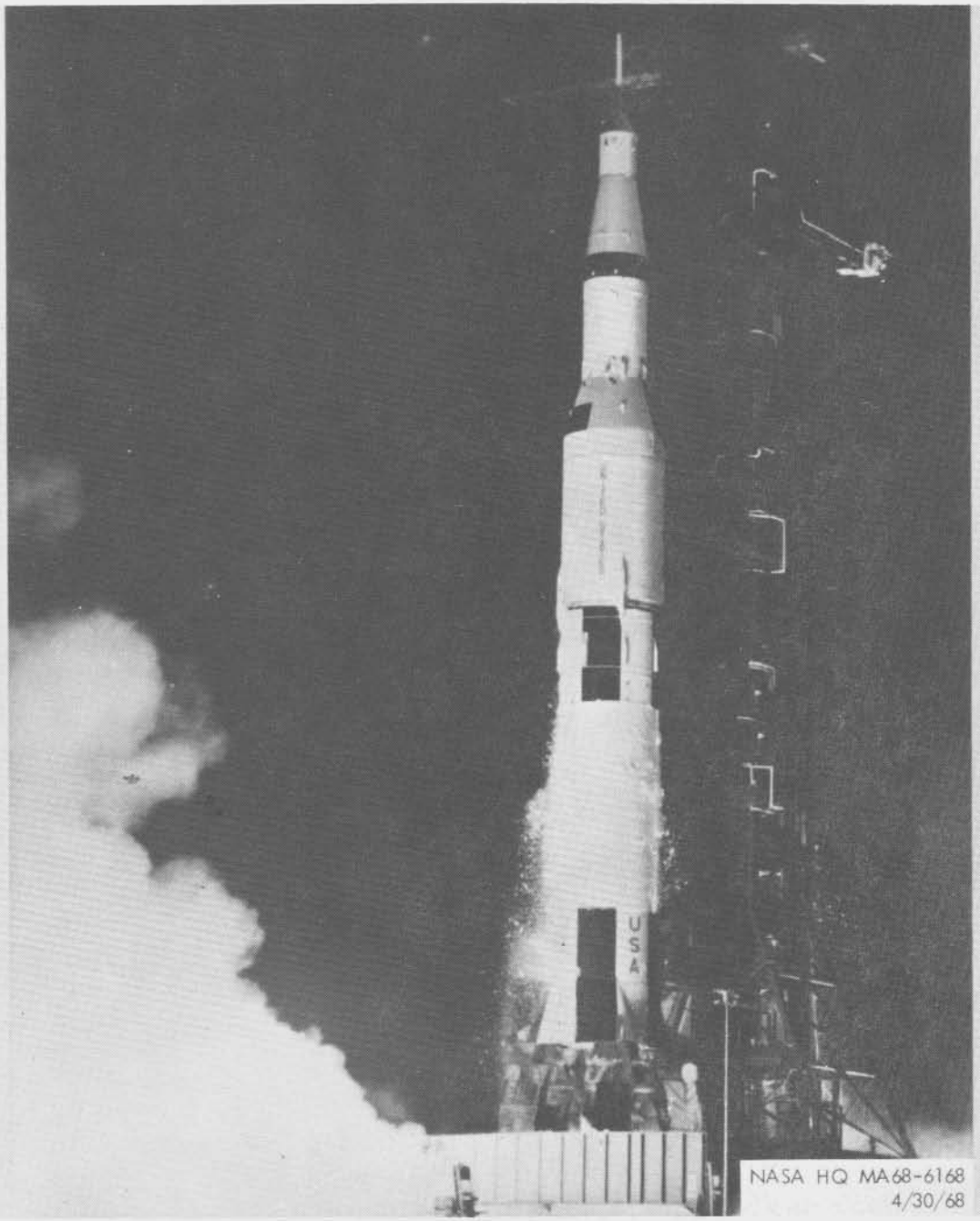

LAUNCH VEHICLES
LJII
SATURN I
SATURN IB
SATURN V
SPACECRAFT
SERVICE MODULE
COMMAND MODULE
LUNAR MODULE
ASTRONAUT SPACE SUIT
LOGISTICS
SPARES
MAINTENANCE / REPAIR
APOLLO
NASA
LAUNCH FACILITIES
LC-39
S/C CHECKOUT AREA
LC-34 & LC-37
TRANSPORTATION
THERMAL VACUUM CHAMBER
ASTRONAUTS AND TRAINING
FLIGHT SUPPORT
LV/GSE
MCC
MSFN
ACE-S/C
SOFTWARE
AIRCRAFT
SHIPS
MTF
WSTF
TEST AND CHECKOUT
OPERATIONS

APOLLO 5 LAUNCH
JAN. 22, 1968



APOLLO 6
LIFT-OFF

APRIL 4, 1968



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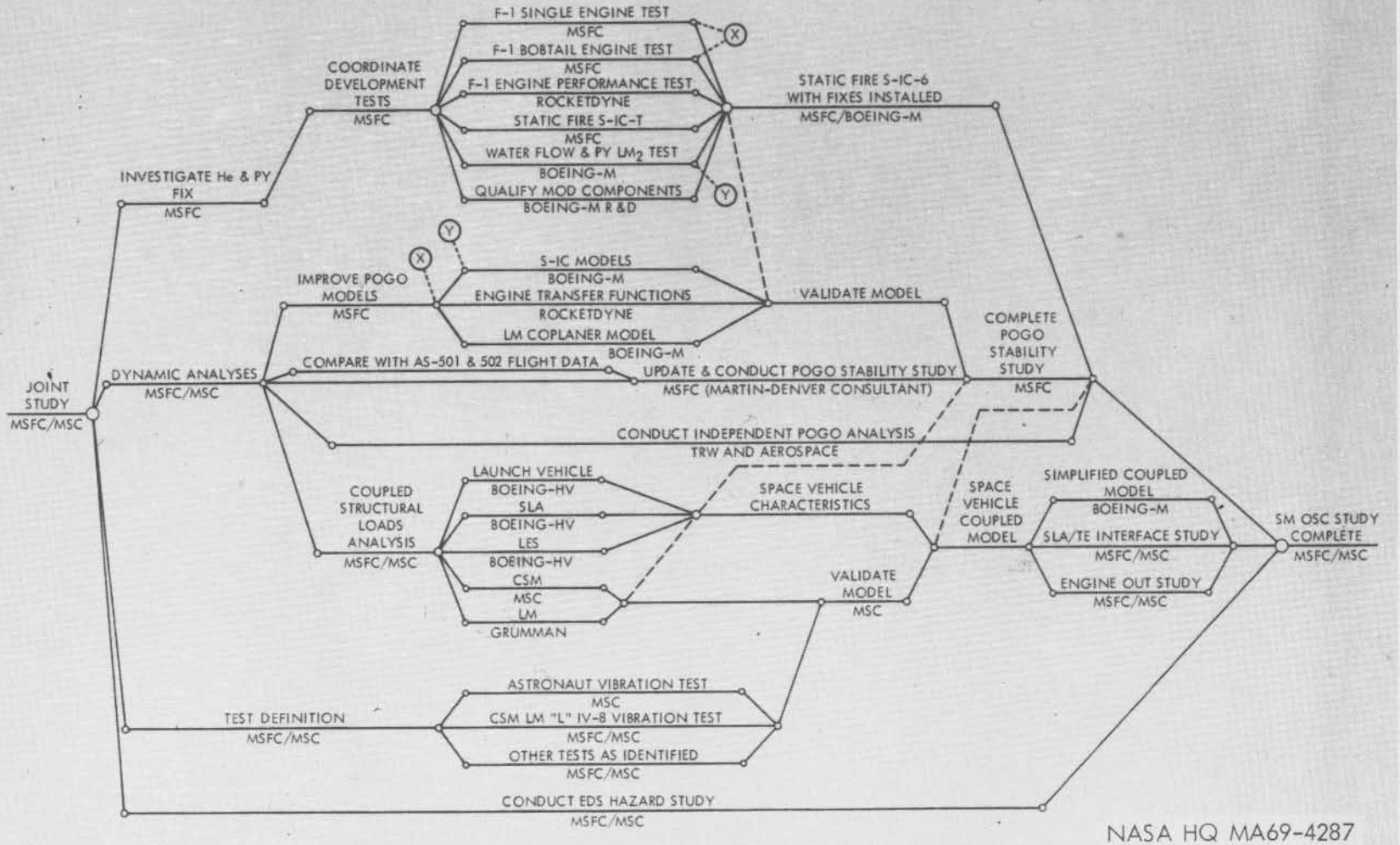
4/30/68

SPACE VEHICLE OSCILLATION PROGRAM PLAN

POGO



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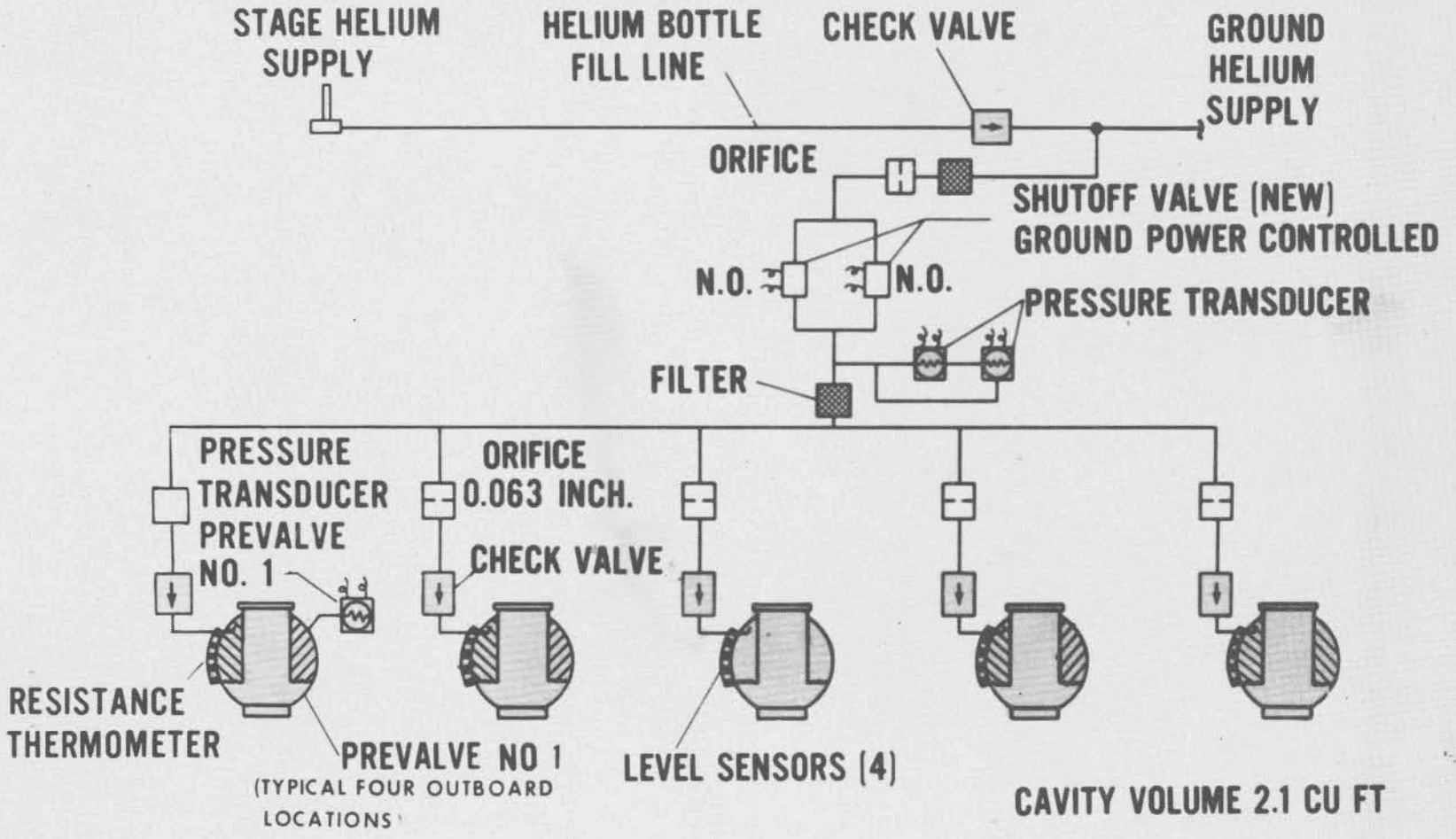
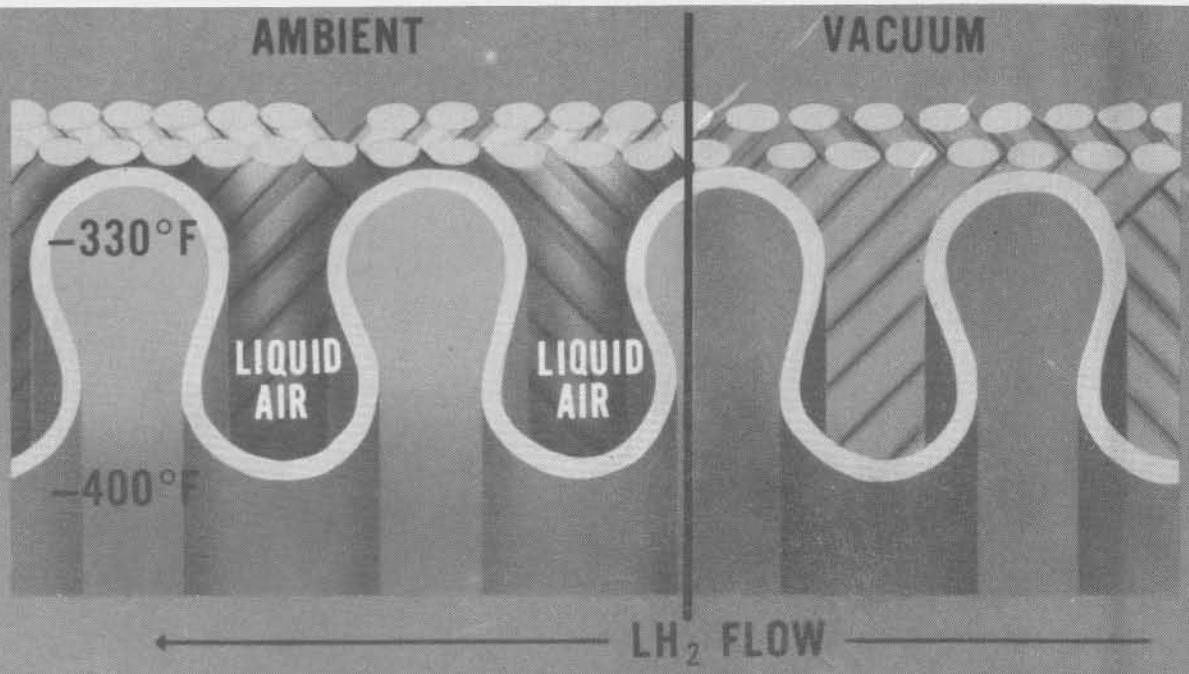
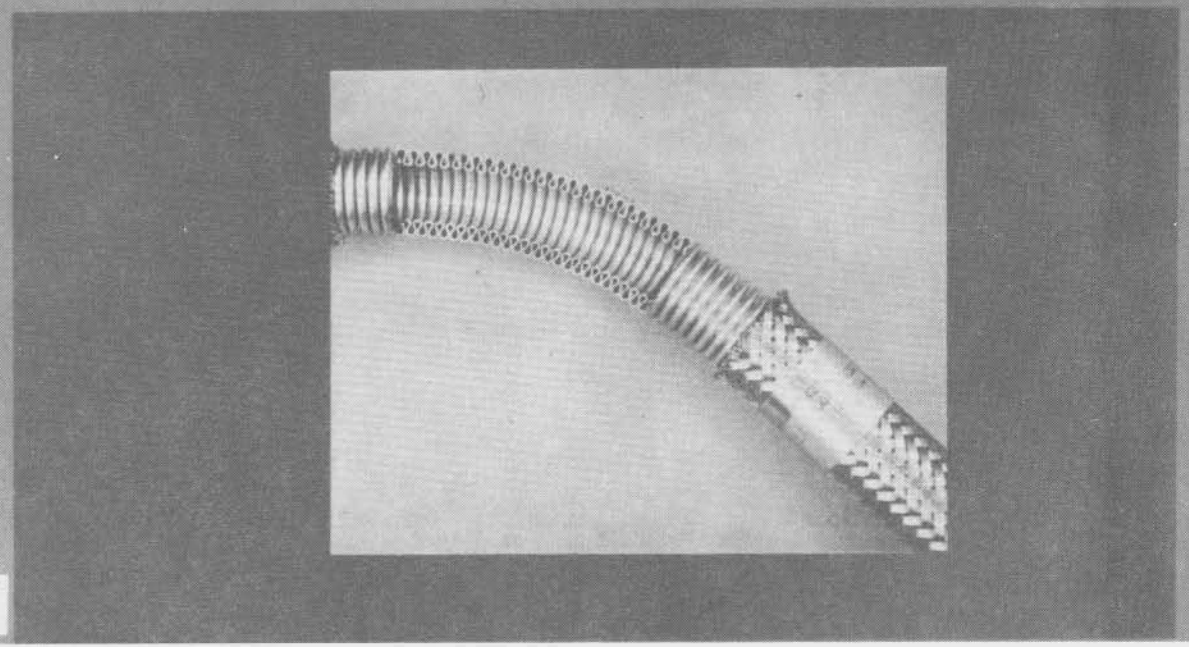
2-5-69

POGO SOLUTION
S-IC STAGE PREVALVE ACCUMULATOR SYSTEM



LIQUID AIR DAMPING OF BELLOWS VIBRATIONS





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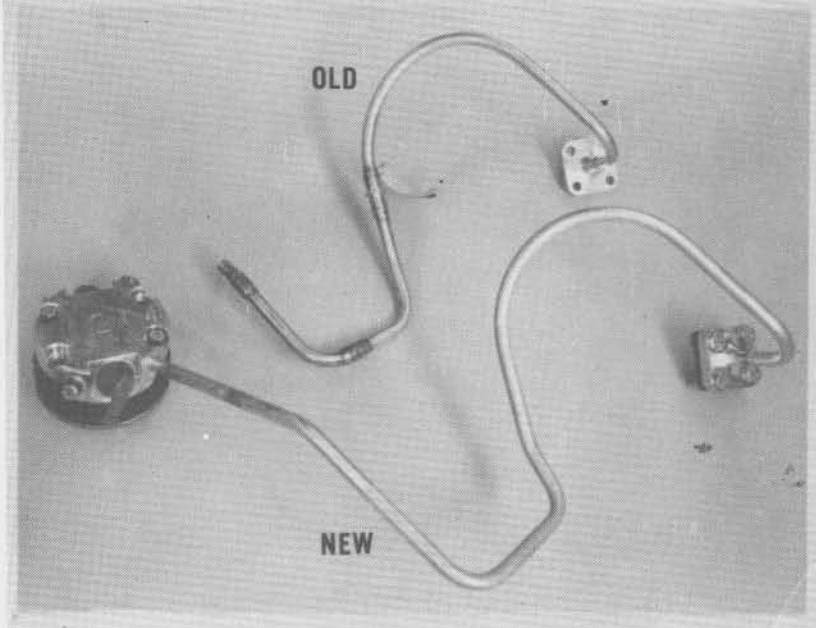
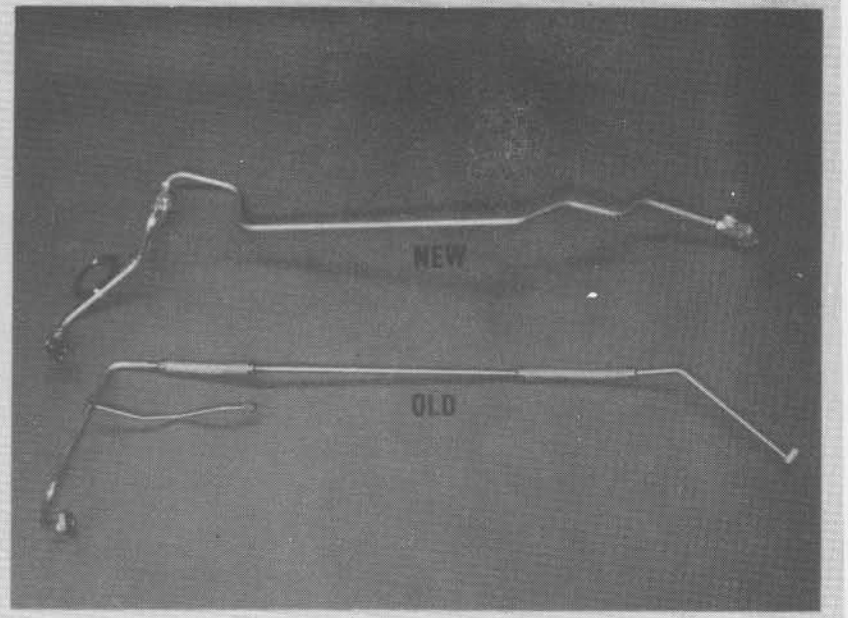
(REV. 1) 2-3-69

ASI LINES



LIQUID OXYGEN OXIDIZER

(3/8" DIA.)



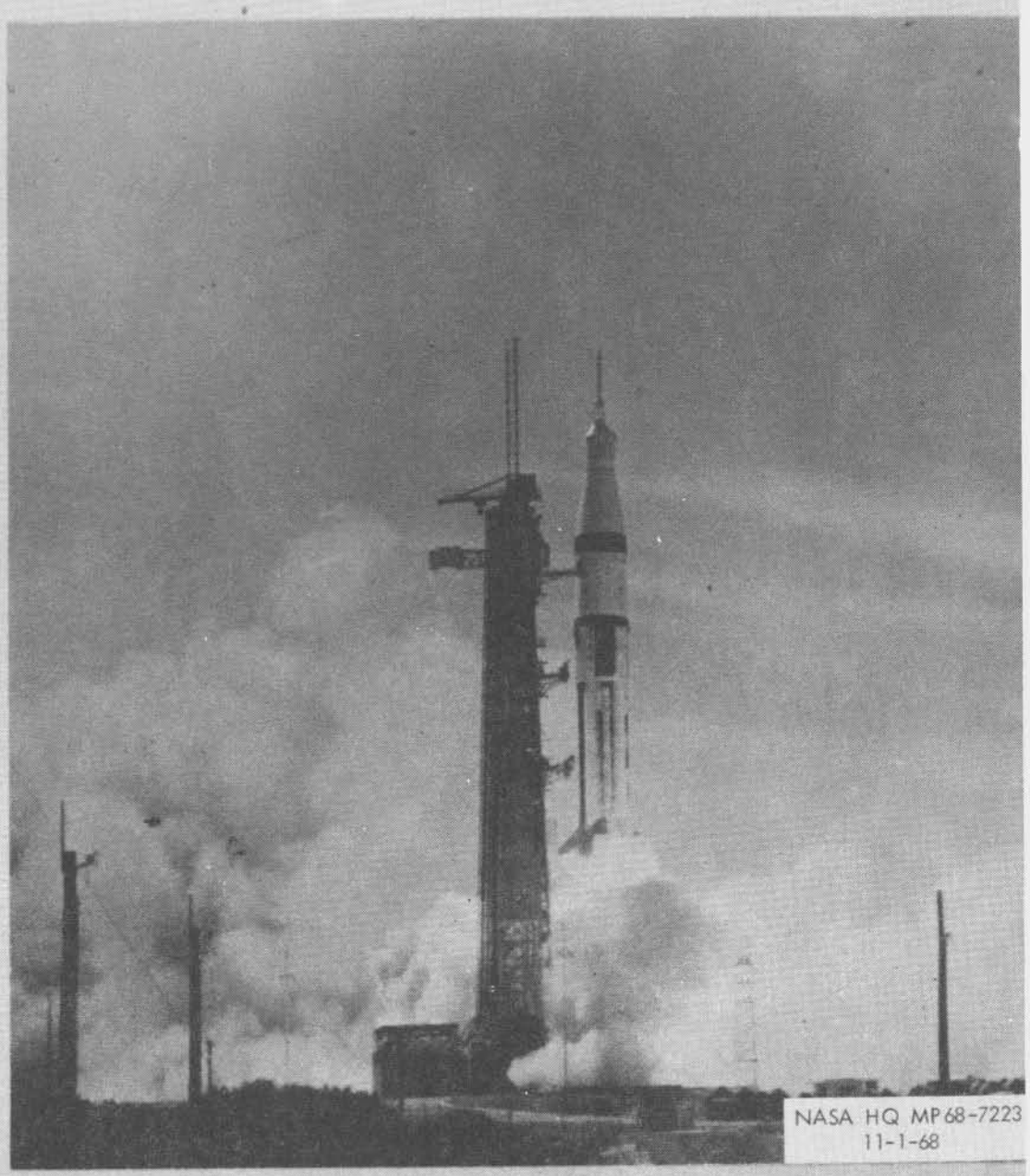
LIQUID HYDROGEN FUEL

(UPPER LINE 1/2" DIA; LOWER LINE 5/8" DIA.)

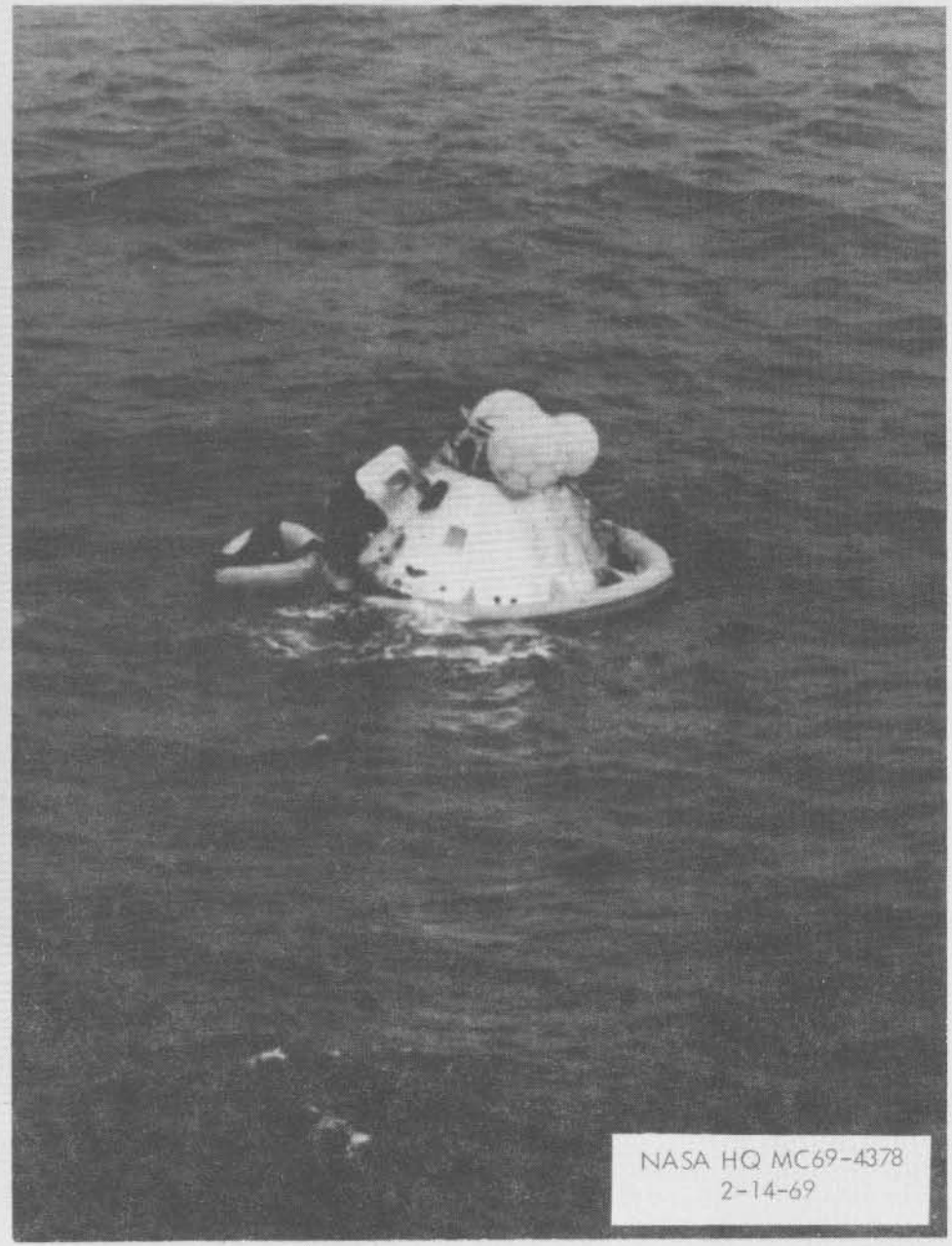
NASA HQ MA68-6069
9-20-68

APOLLO 7

OCTOBER 11, 1968



APOLLO 7 RECOVERY



NASA HQ MC69-4378
2-14-69

HOW SEVERE WERE THE RISKS?

- SPACECRAFT DESIGNED FOR THIS MISSION
  - REDUNDANT SYSTEMS
  - GOOD EXPERIENCE IN GROUND AND FLIGHT TESTS

- LARGE MARGIN FOR UNKNOWNS OR ERRORS
  - CONSUMABLES
  - SYSTEMS DESIGN

- FLIGHT INVOLVED ONLY ONE COMPLEX SPACECRAFT
  - NO LUNAR MODULE

- ADDED RISKS, OVER AND ABOVE THOSE FOR ANY MANNED FLIGHT, ARE EQUAL TO THOSE GENERALLY INHERENT IN A PROGRESSIVE FLIGHT TEST PROGRAM

- PROBABILITY OF SUCCESS ON LUNAR LANDING MISSION ENHANCED

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2-5-69

MISSION DESIGN CONCEPTS

1. DAYLIGHT LAUNCH
2. BASIC FREE-RETURN TRAJECTORY
3. TRANSLUNAR MIDCOURSE RETAINS REACTION CONTROL SYSTEM CAPABILITY FOR ACCEPTABLE EARTH LANDING
4. TWO BURN LUNAR ORBIT INSERTION
5. MINIMIZE LUNAR ORBIT TIME
6. MINIMIZE RETURN TIME
7. TRANSEARTH MIDCOURSE FOR ENTRY CORRIDOR
8. SHORT RANGE NON-SKIP ENTRY TRAJECTORY

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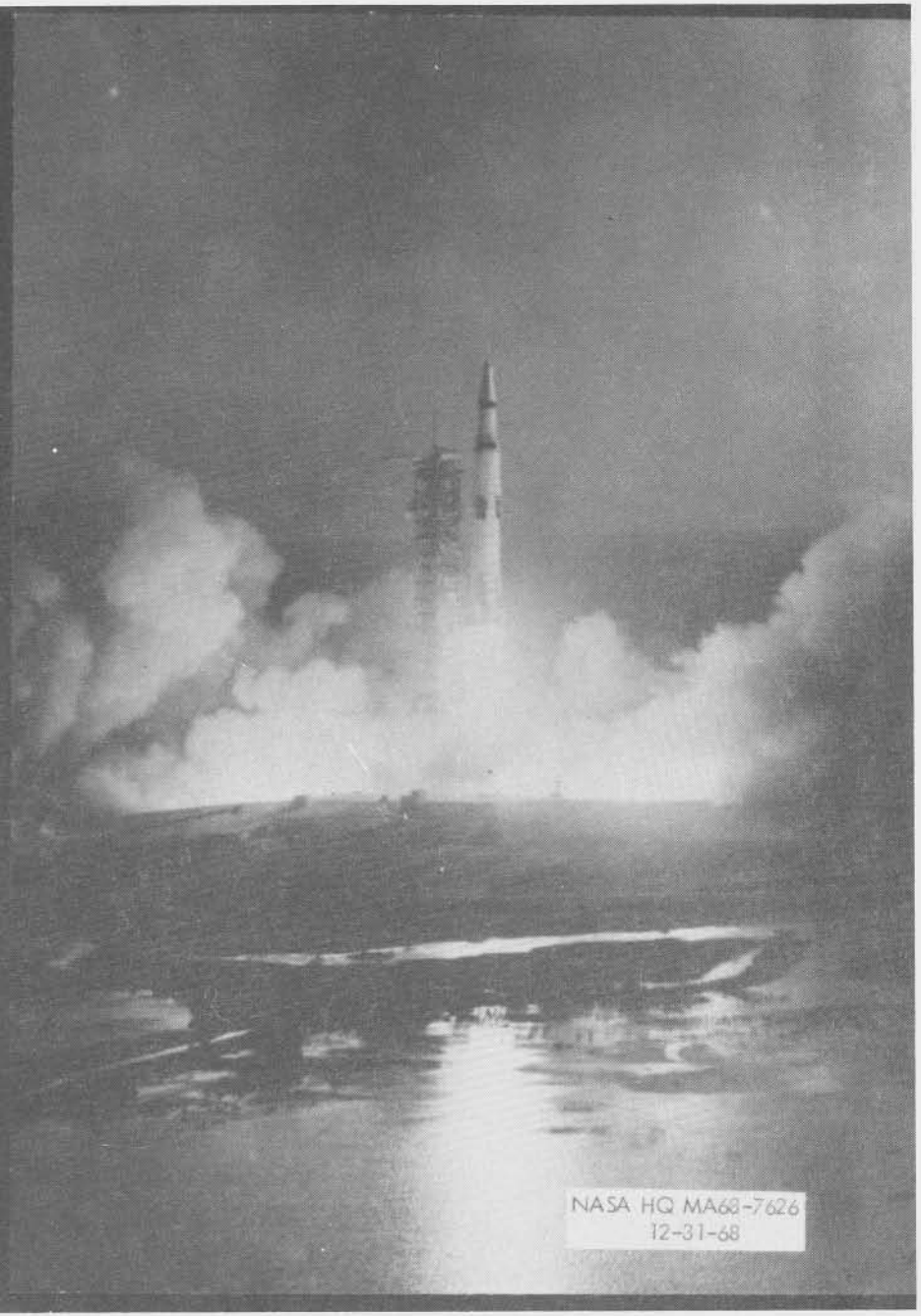
2-5-69

APOLLO 8

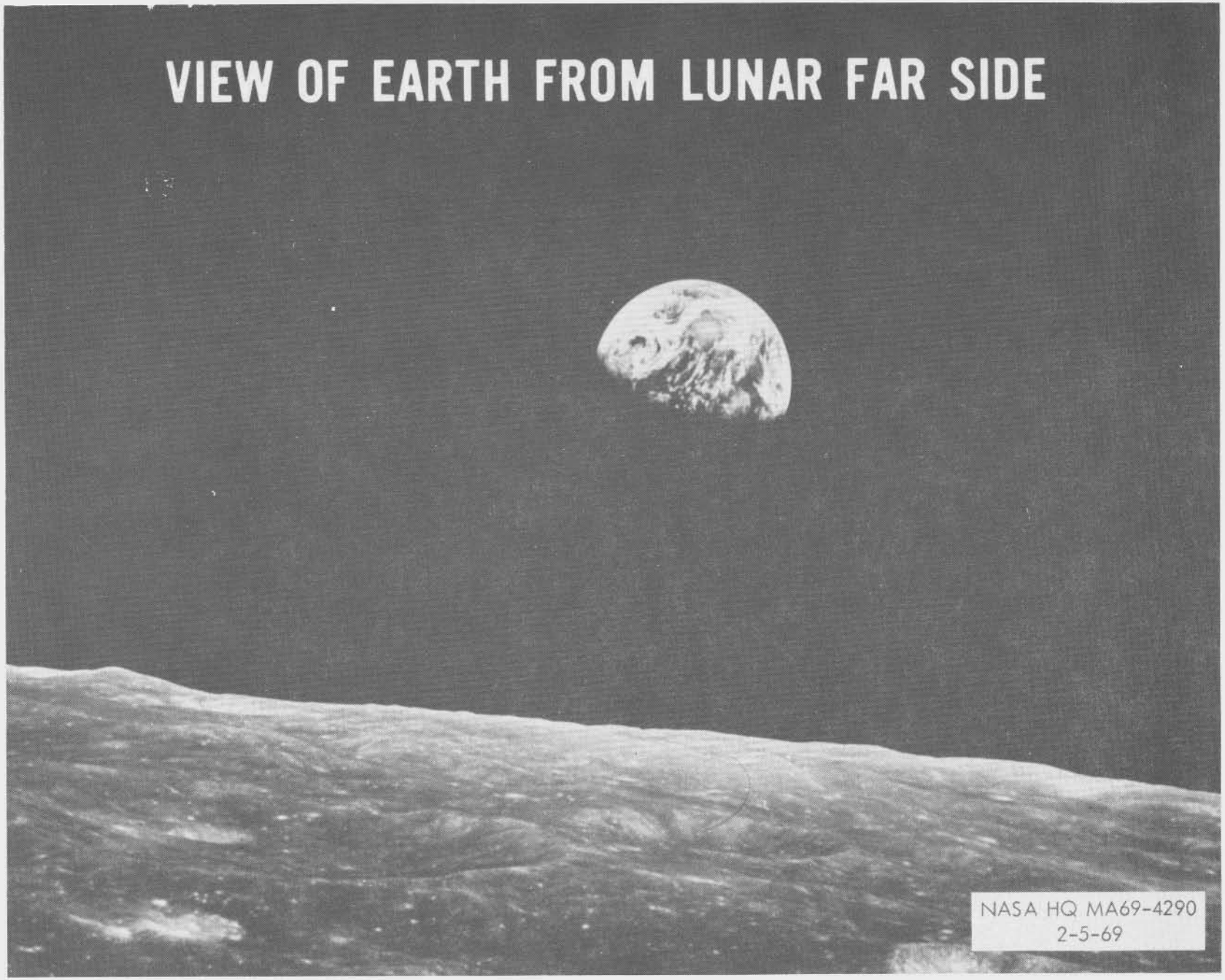
LIFT - OFF

DECEMBER 1968



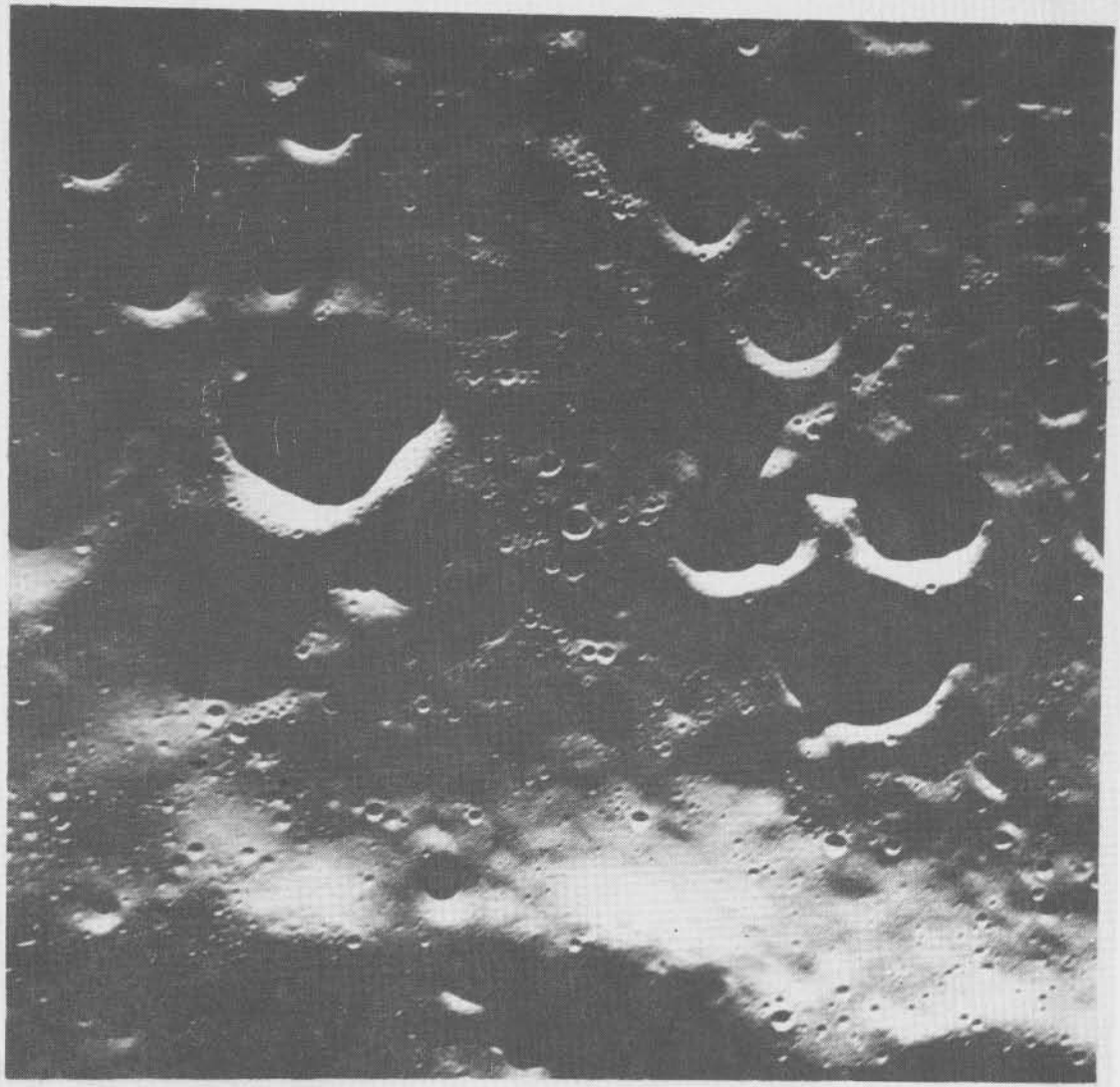
NASA HQ MA68-7626
12-31-68

VIEW OF EARTH FROM LUNAR FAR SIDE



NASA HQ MA69-4290
2-5-69

LUNAR FARSIDE SURFACE



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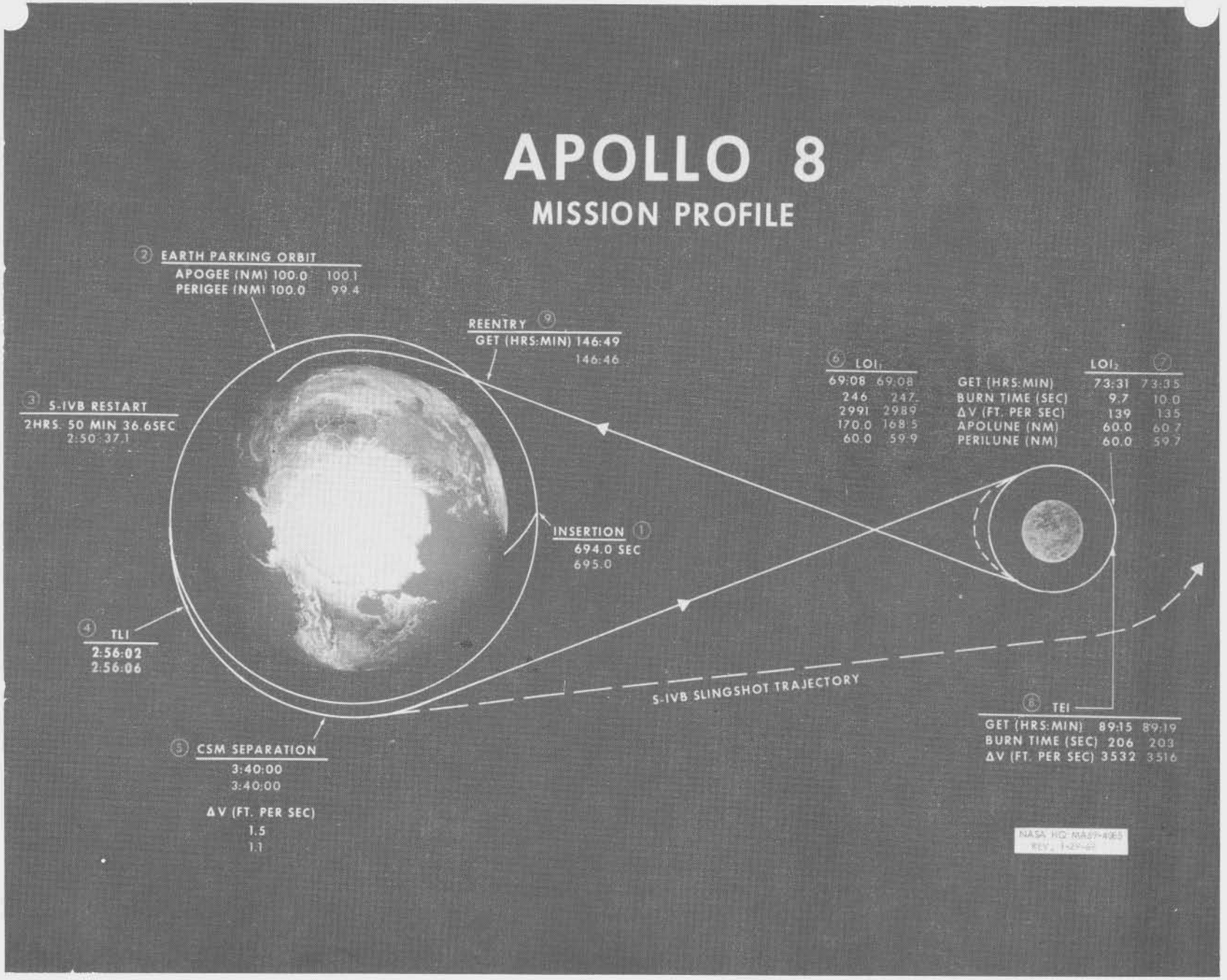
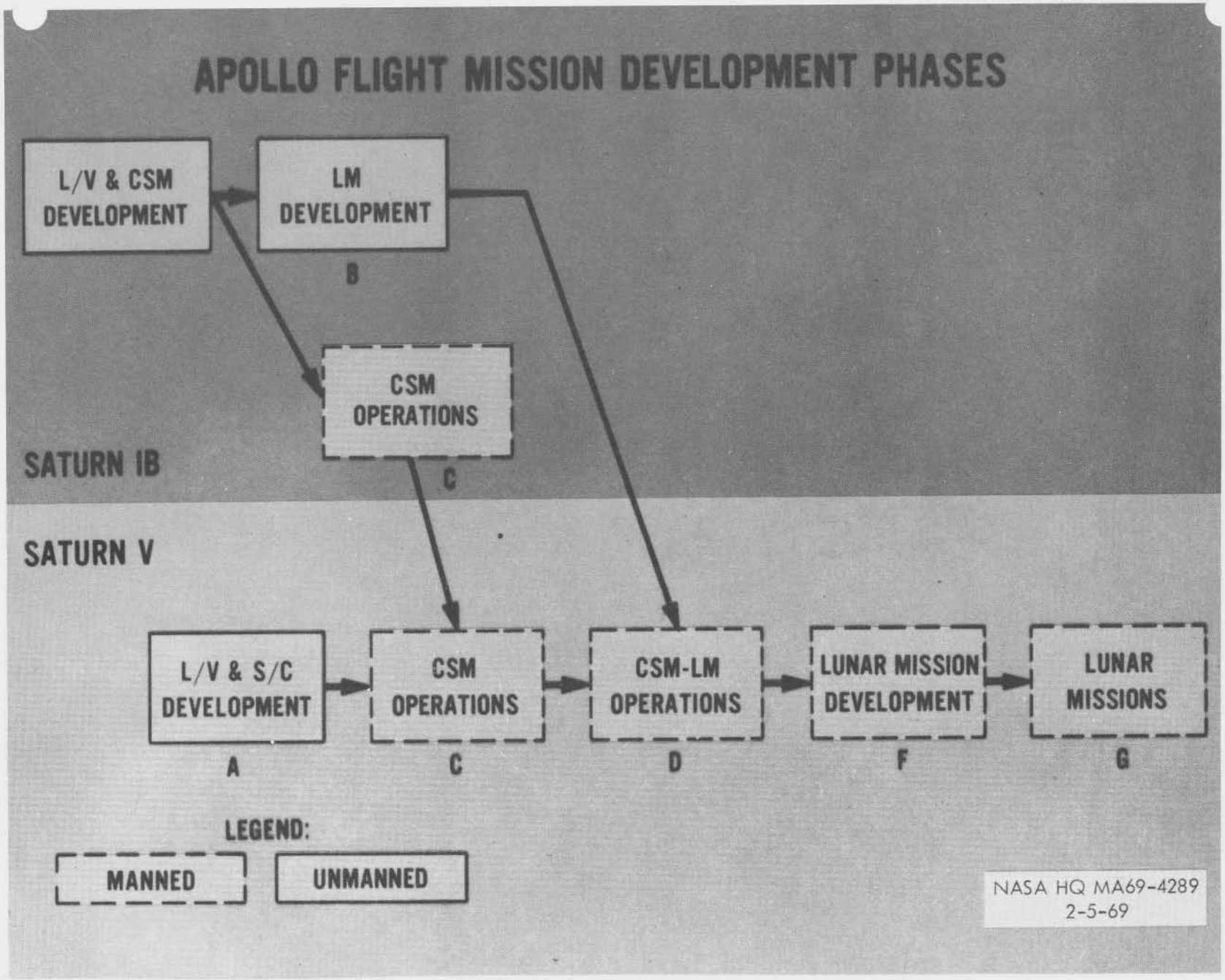
2-14-69

APOLLO 8

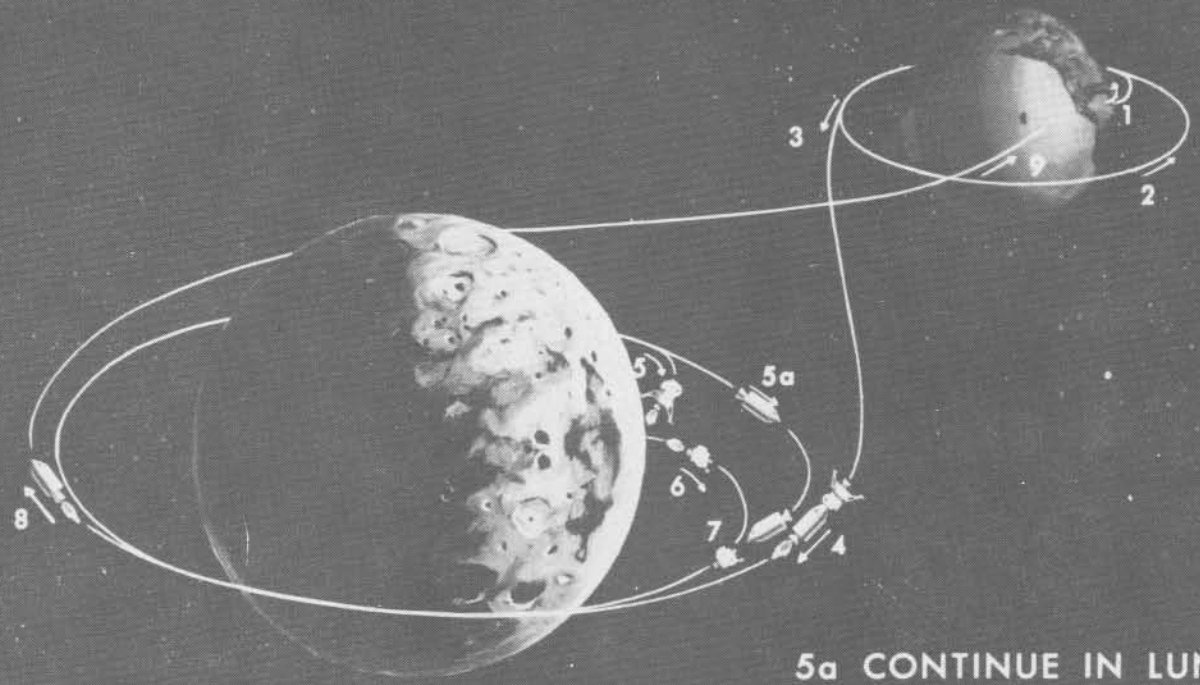
MISSION PROFILE




APOLLO FLIGHT MISSION DEVELOPMENT PHASES
L/V & CSM DEVELOPMENT
LM DEVELOPMENT
B
CSM OPERATIONS
C
SATURN IB
SATURN V
L/V & S/C DEVELOPMENT
A
CSM OPERATIONS
C
CSM-LM OPERATIONS
D
LUNAR MISSION DEVELOPMENT
F
LUNAR MISSIONS
G
LEGEND:
MANNED
UNMANNED
NASA HQ MA69-4289
2-5-69

MISSION G - PROFILE

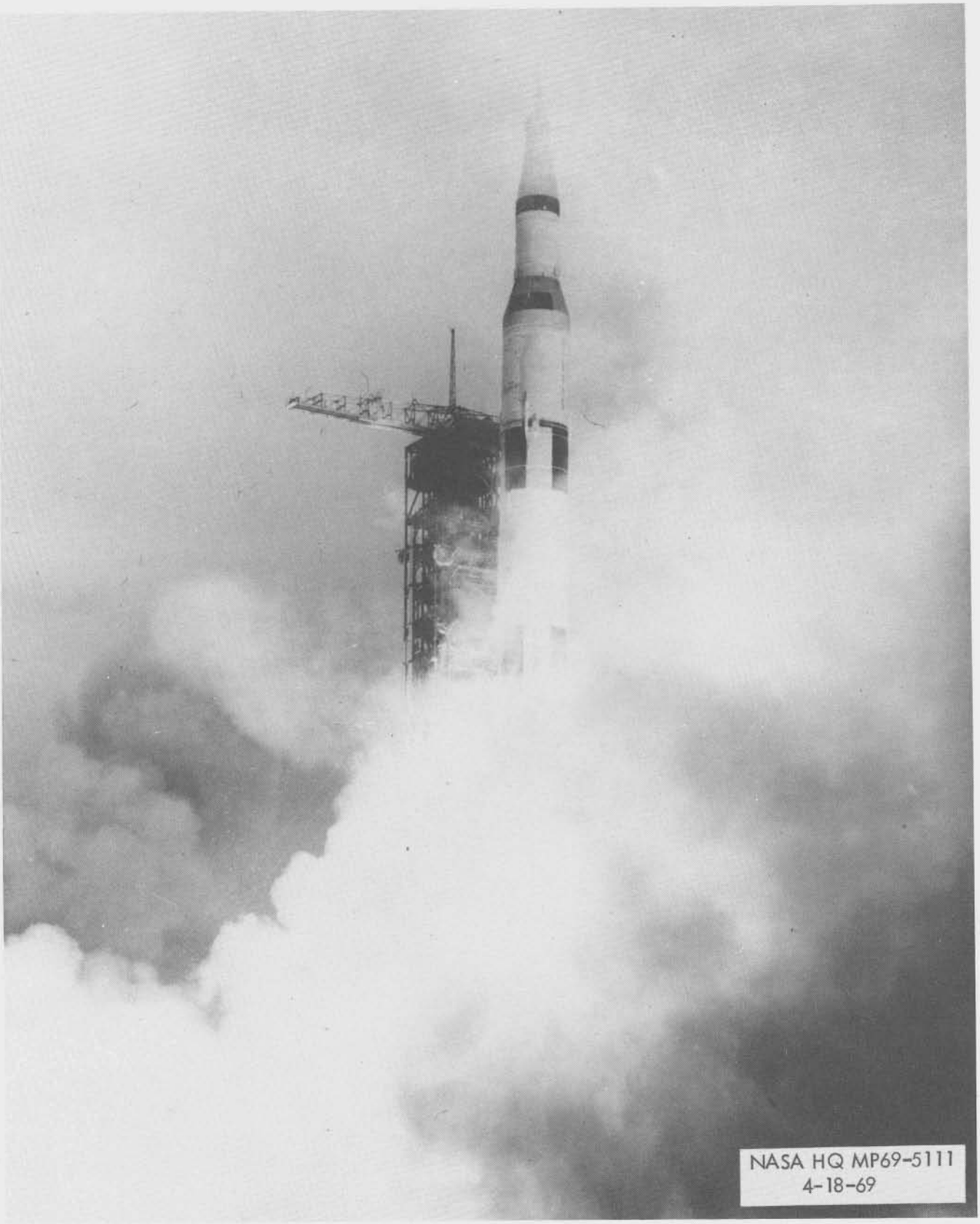
APOLLO LUNAR LANDING MISSION



1 LAUNCH INTO EARTH ORBIT
2 EARTH ORBITAL CHECKOUT
3 INJECT INTO TRAJECTORY TOWARD MOON
4 DE-BOOST INTO LUNAR ORBIT
5 DESCENT TO SURFACE (LM ONLY)

5a CONTINUE IN LUNAR ORBIT (CSM ONLY)
6 LM ASCENT
7 RENDEZVOUS AND DOCK
8 INJECT CSM INTO TRAJECTORY TOWARD EARTH
9 SEPARATE CM, ENTER ATMOSPHERE AND LAND

NASA H.Q. MA68-6082
2-14-69


NASA HQ MP69-5111
4-18-69

NASA HQ MP69-5122
4-18-69

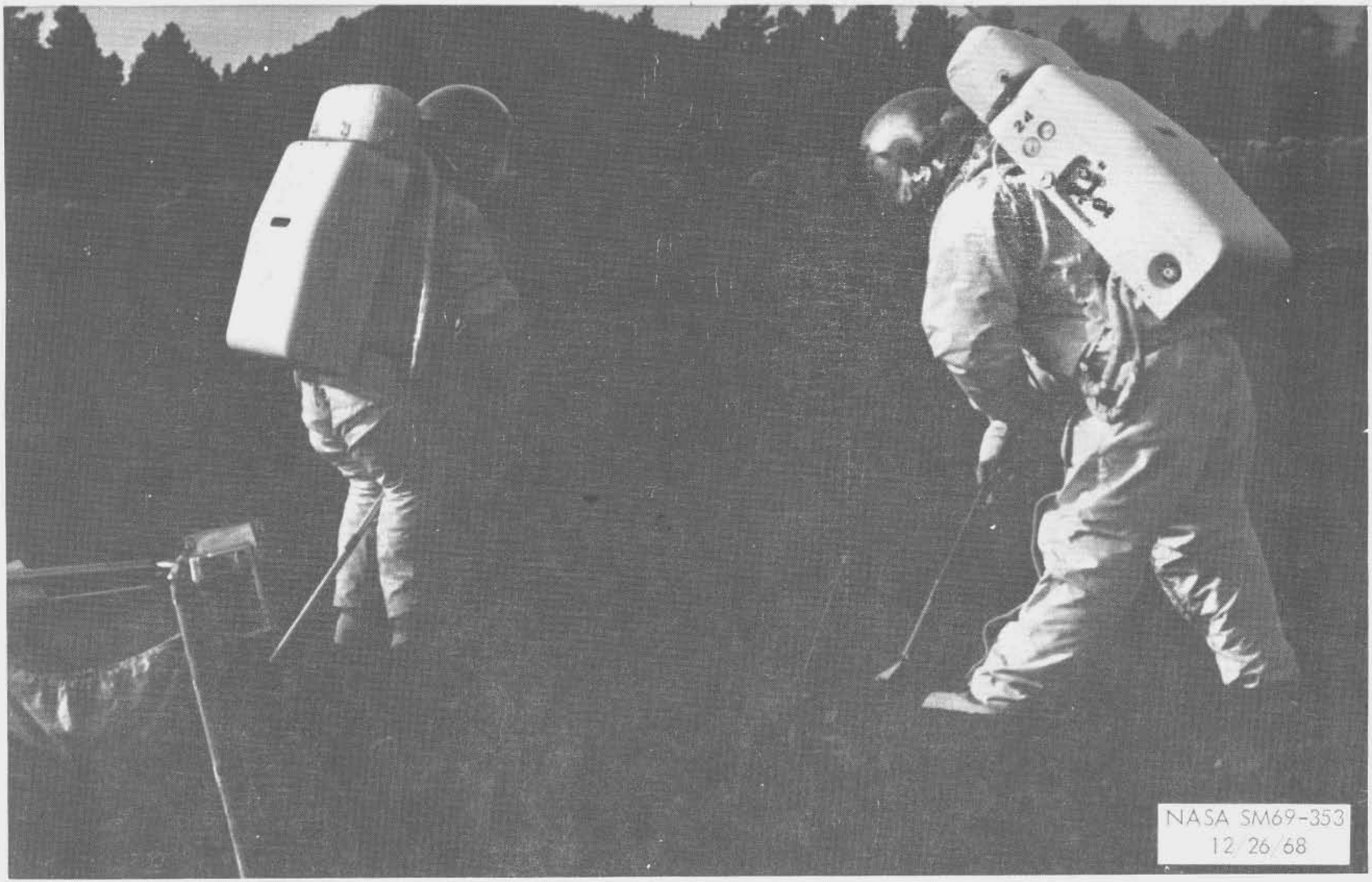

NASA HQ MP69-5121
4-18-69


NASA HQ MP69-5124
4-18-69


NASA HQ MP69-5287
4-18-69

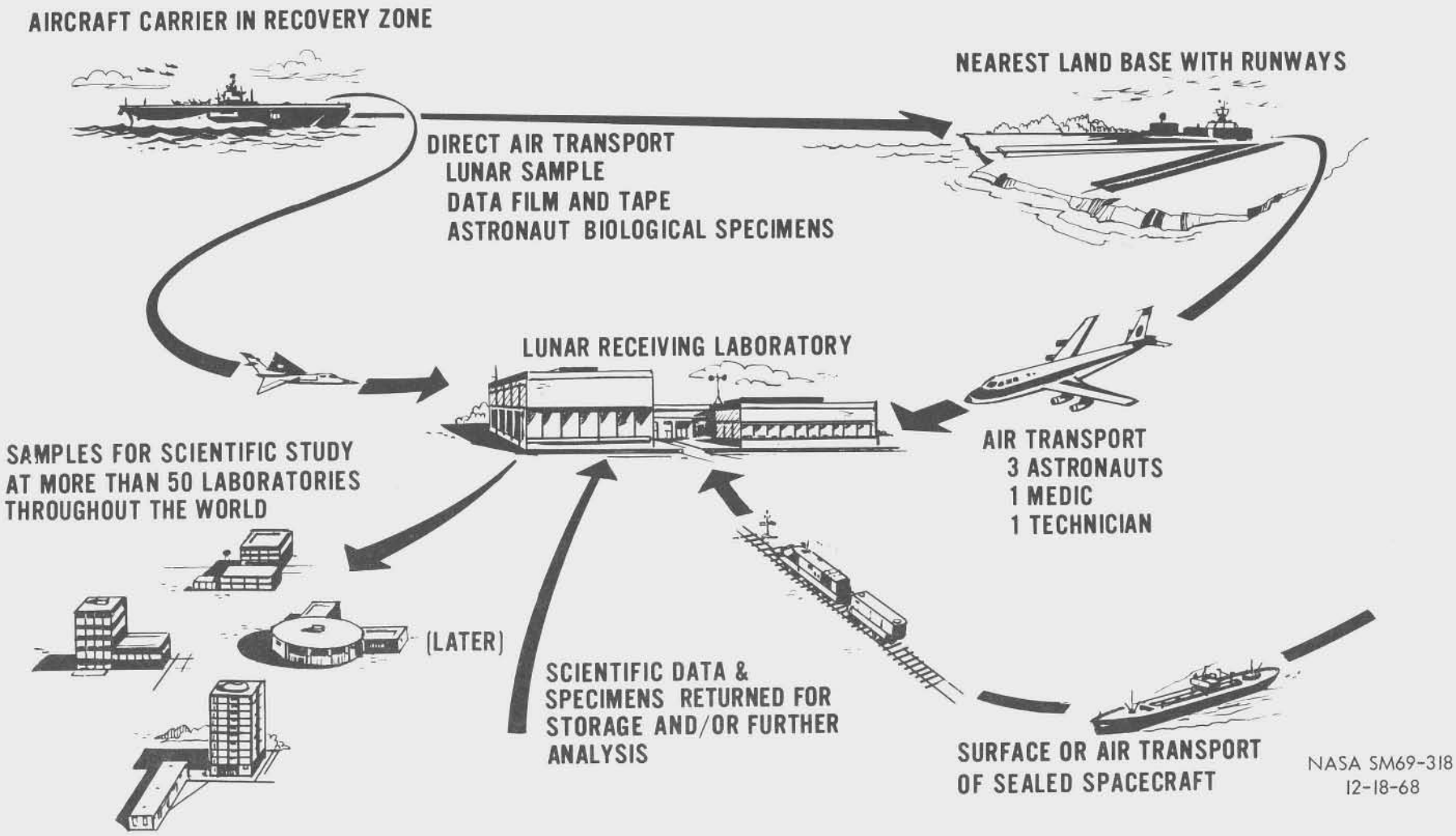
GEOLOGISTS SIMULATING APOLLO MISSION AT LUNAR SURFACE TEST SITE

(FLAGSTAFF, ARIZONA)



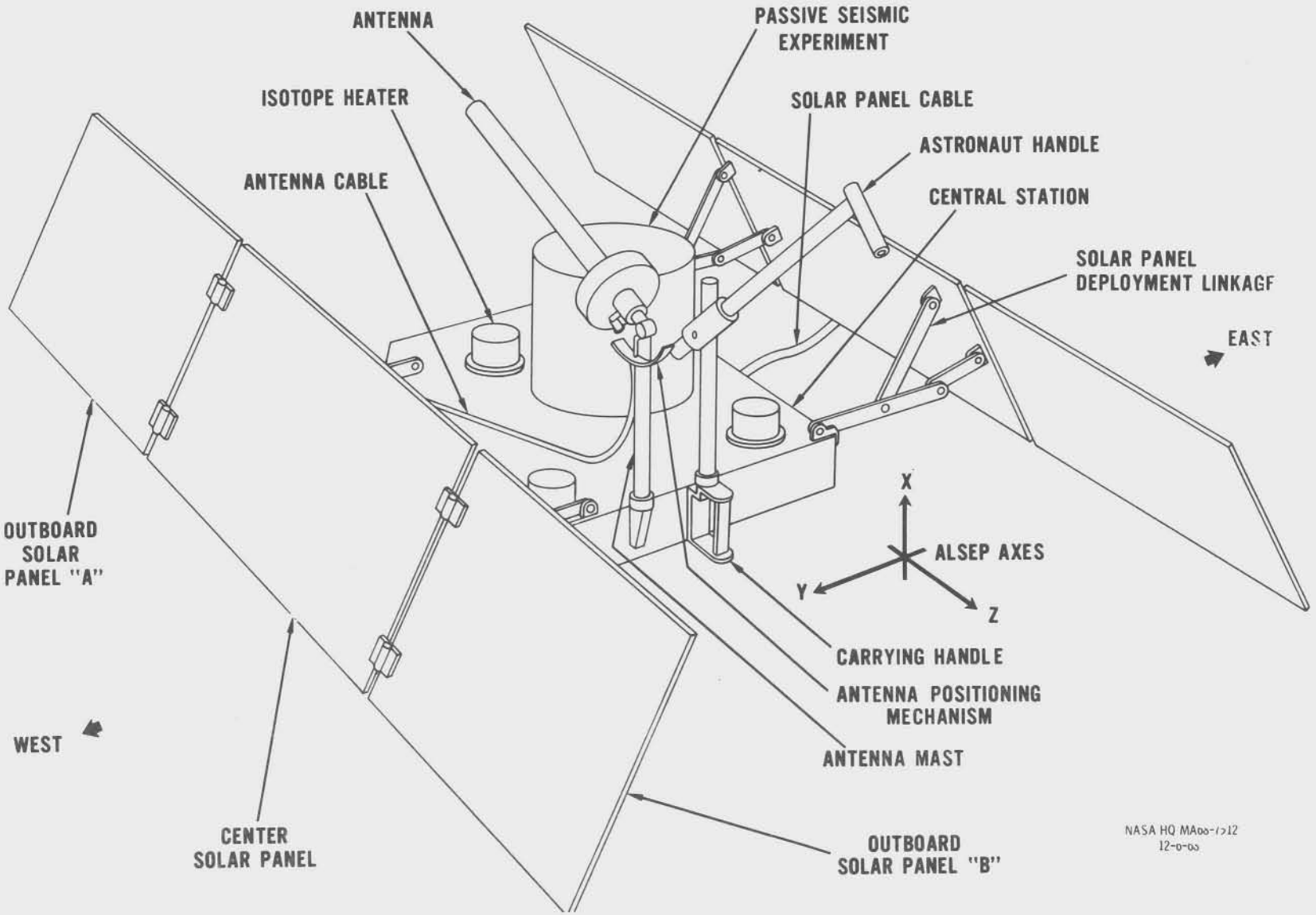
NASA SM69-353
12 26 68

LOGISTICS OF RETURNED LUNAR SAMPLE



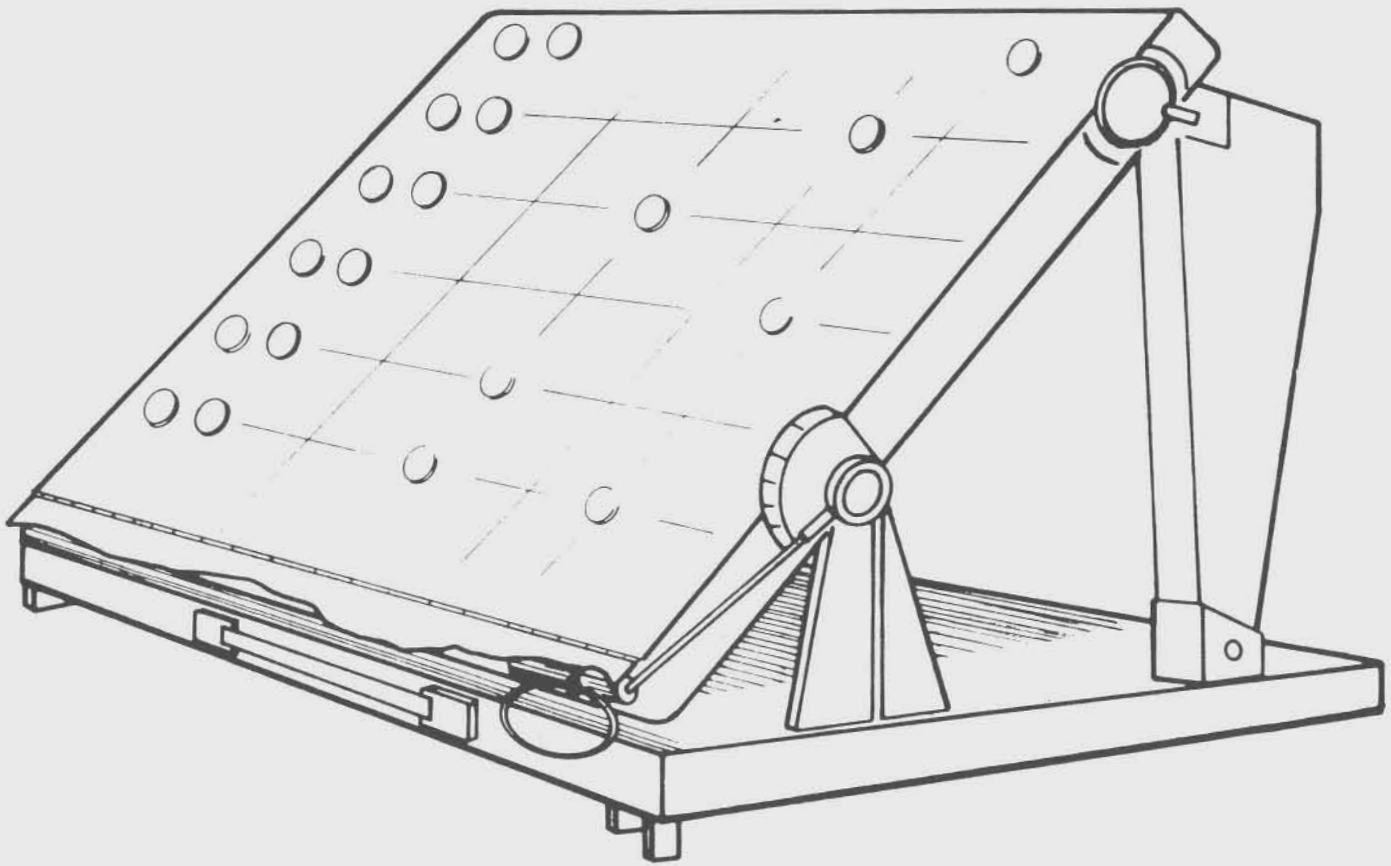
NASA SM69-318
12-18-68

PASSIVE SEISMIC EXPERIMENT FOR EARLY ALSEP SCIENCE EXPERIMENTS PACKAGE EASEP



NASA HQ MA00-1>12
12-0-00

LASER RANGING RETRO-REFLECTOR

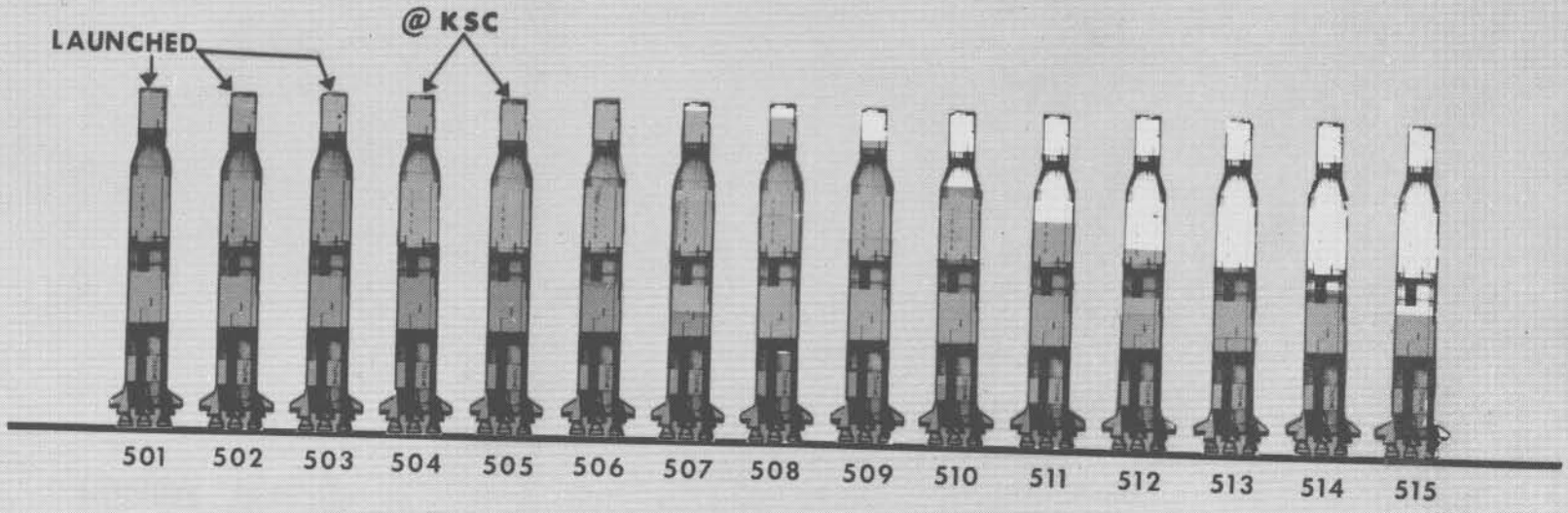


NASA SM69-347
12-26-68

APOLLO PROGRAM

LAUNCH VEHICLE PRODUCTION SUMMARY

SATURN V



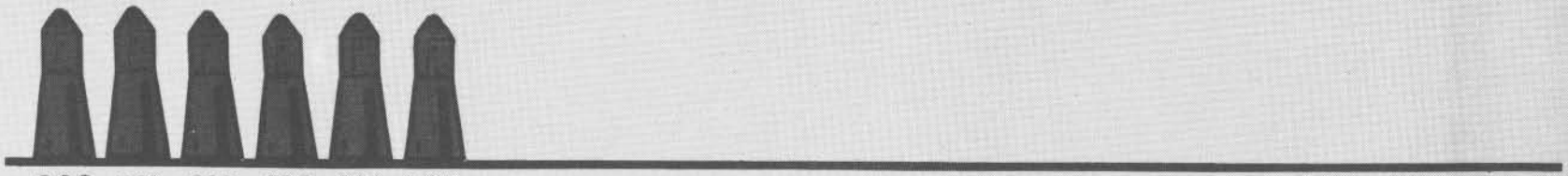
NASA HQ MA66-7674
REV. 2-14-69

APOLLO PROGRAM

SPACECRAFT PRODUCTION SUMMARY

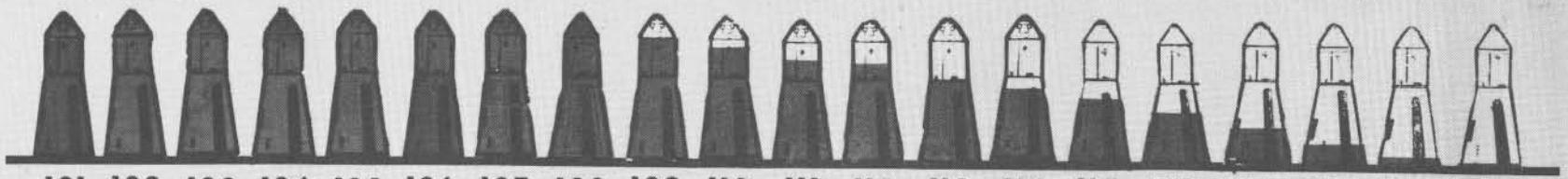
COMMAND AND SERVICE MODULE

BLOCK I



009 011 012 014 017 020

BLOCK II



101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 115A 116 117 118 119

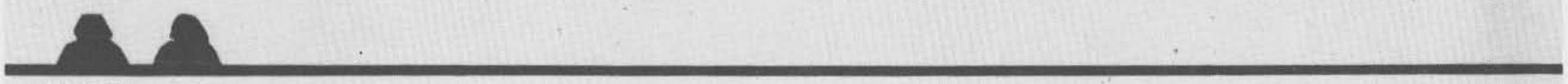
NASA HQ MA66-9695-B
REV. 2-14-69

APOLLO PROGRAM

SPACECRAFT PRODUCTION SUMMARY

LUNAR MODULE

LUNAR MODULE TEST ARTICLE (FLIGHT)



10R 2R

LUNAR MODULE

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

NASA HQ MA66-9695-A
REV. 2-14-69

MISSION OPERATIONS

- DEFINITION
- OPERATIONS BASELINE
- MISSIONS
  - LAST YEAR
    - LUNAR MODULE FLIGHT TEST
    - OFF - NOMINAL SATURN V FLIGHT
    - FIRST MANNED APOLLO MISSION
    - FIRST MANNED LUNAR MISSION
  - THIS YEAR
    - MAN RATE LUNAR MODULE
    - CONDUCT LUNAR DEVELOPMENT MISSION
    - LUNAR LANDING
    - ALSEP FLIGHT
- FLIGHT CREW OPERATIONS

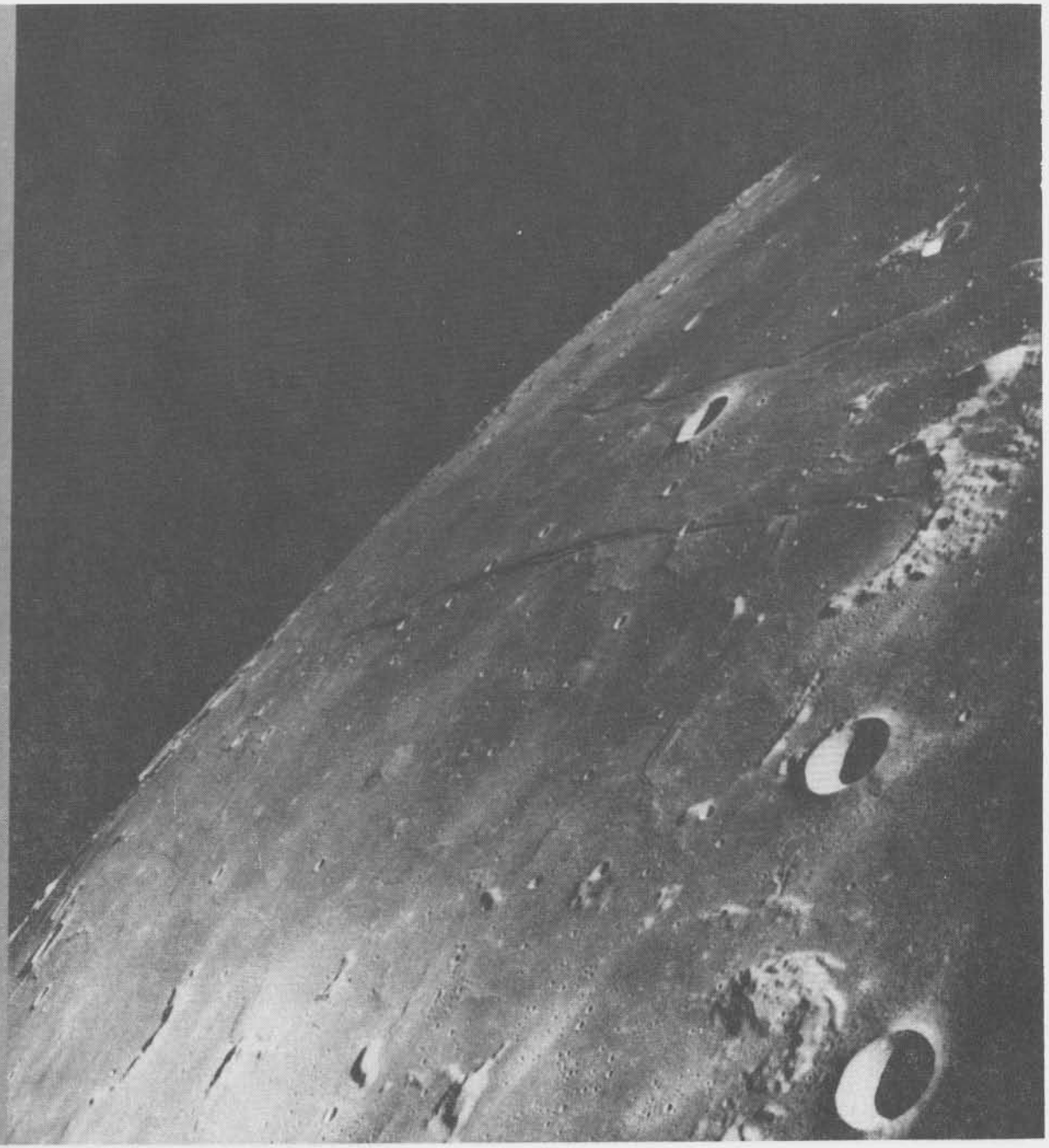
NASA HQ MC69-4095
1-21-69

MISSION OPERATIONS

- GROUND OPERATIONS SUPPORT SYSTEMS (GOSS)
  - MISSION CONTROL SYSTEMS
  - LAUNCH INSTRUMENTATIONS
  - LAUNCH OPERATIONAL COMMUNICATIONS
  - LAUNCH INFORMATION EXCHANGE FACILITY
- RECOVERY
- MANNED SPACE FLIGHT NETWORK (MSFN)
- LAUNCH SUPPORT
- OPERATIONS MANAGEMENT
  - CONFIGURATION MANAGEMENT
  - NASA/DOD RESPONSIBILITY - ETR

NASA HQ MC69-4096
1-21-69

SEA OF TRANQUILLITY



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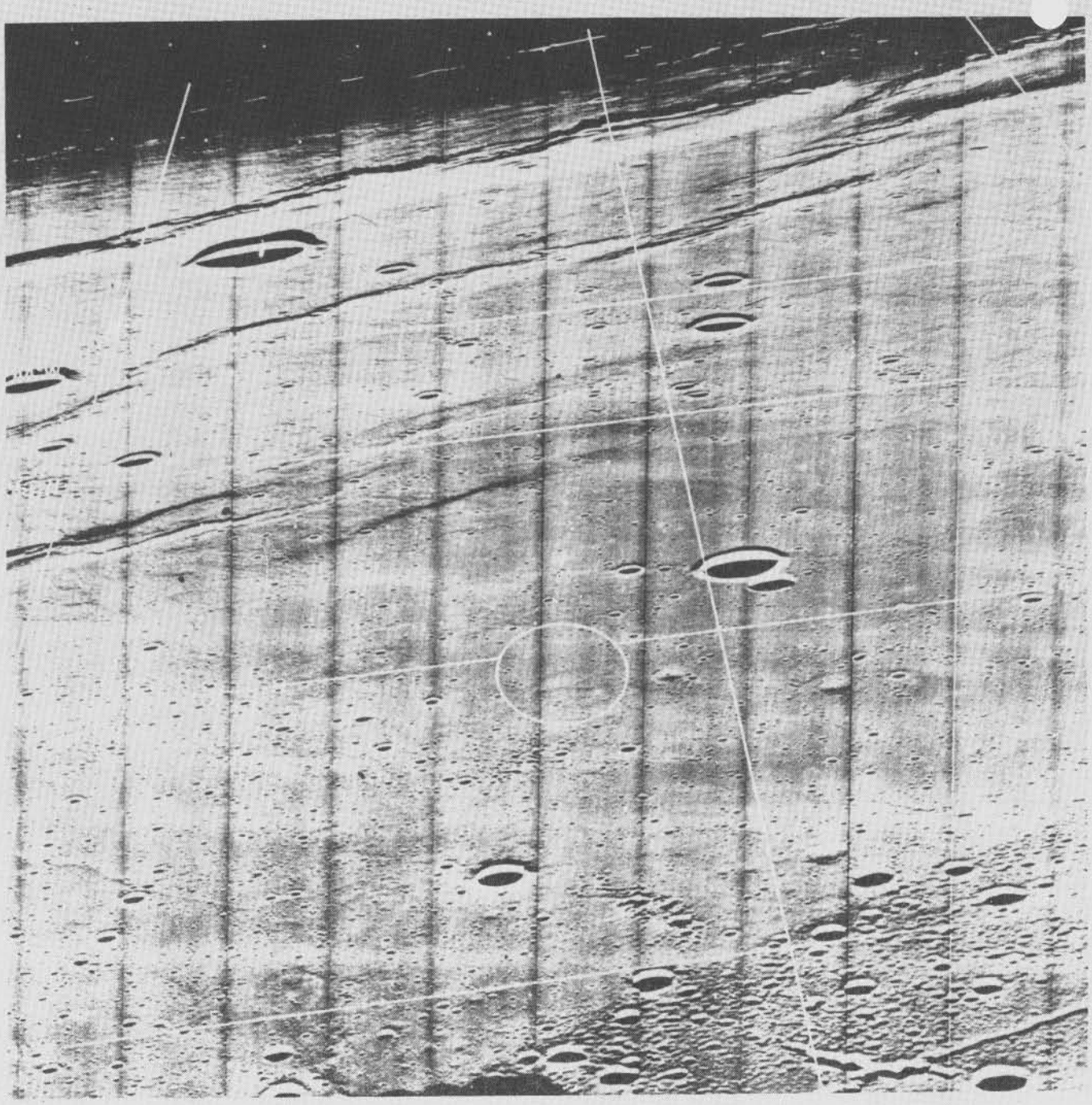
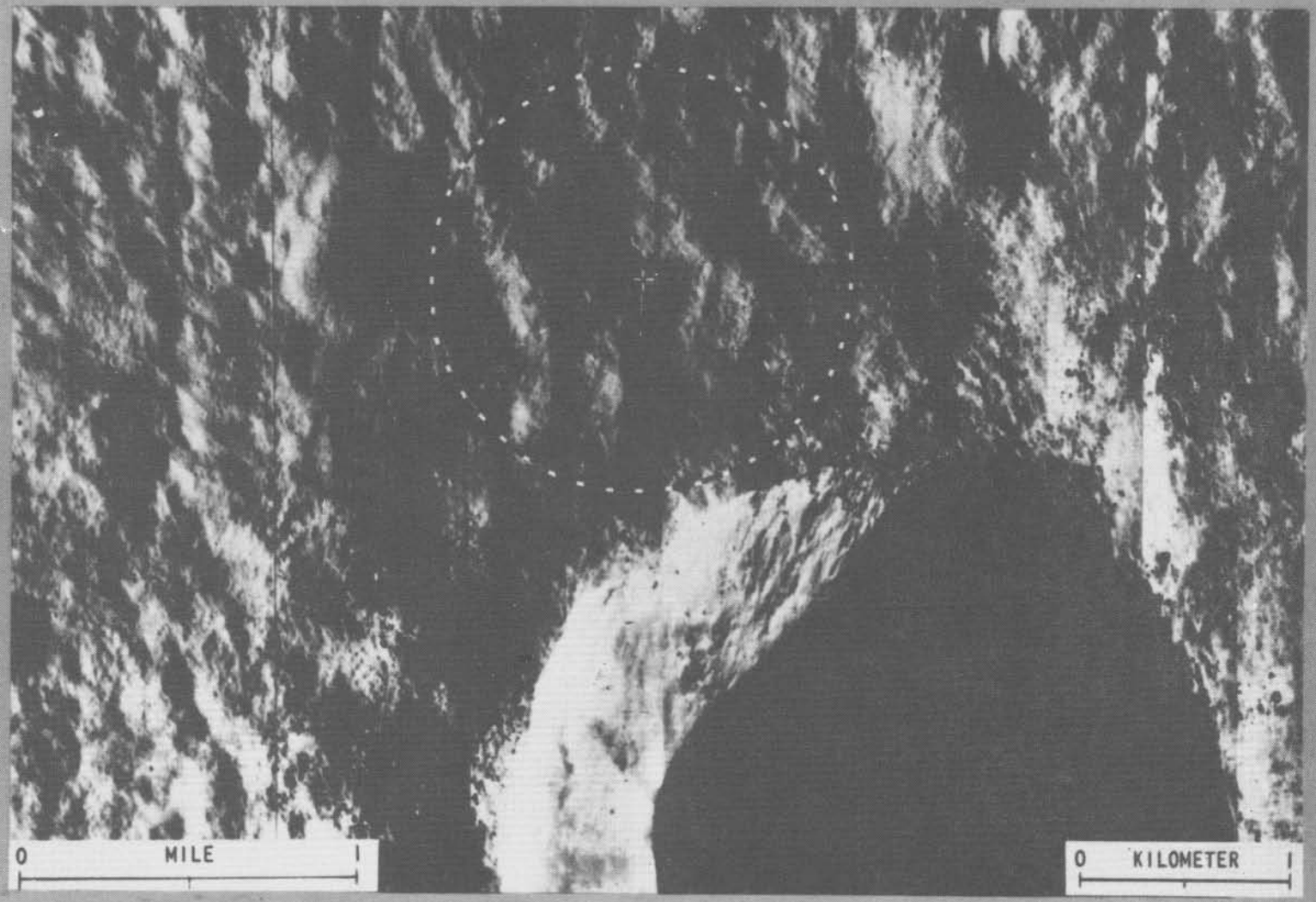
ORBITER OBLIQUE SHOWING APOLLO LANDING SITE



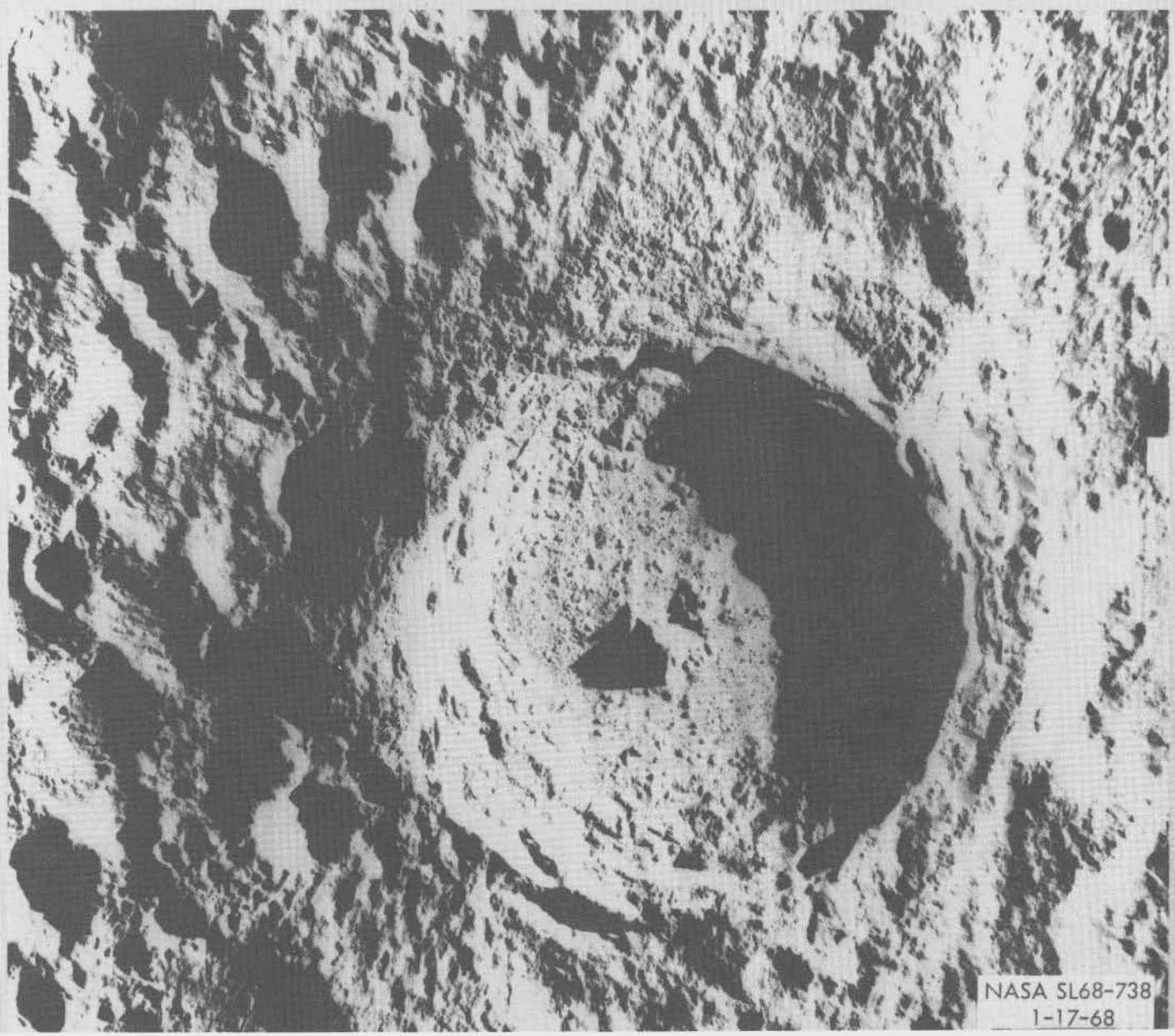
NASA HQ MC69-4773
3-12-69

PROPOSED LANDING SITE NEAR CRATER CENSORINUS

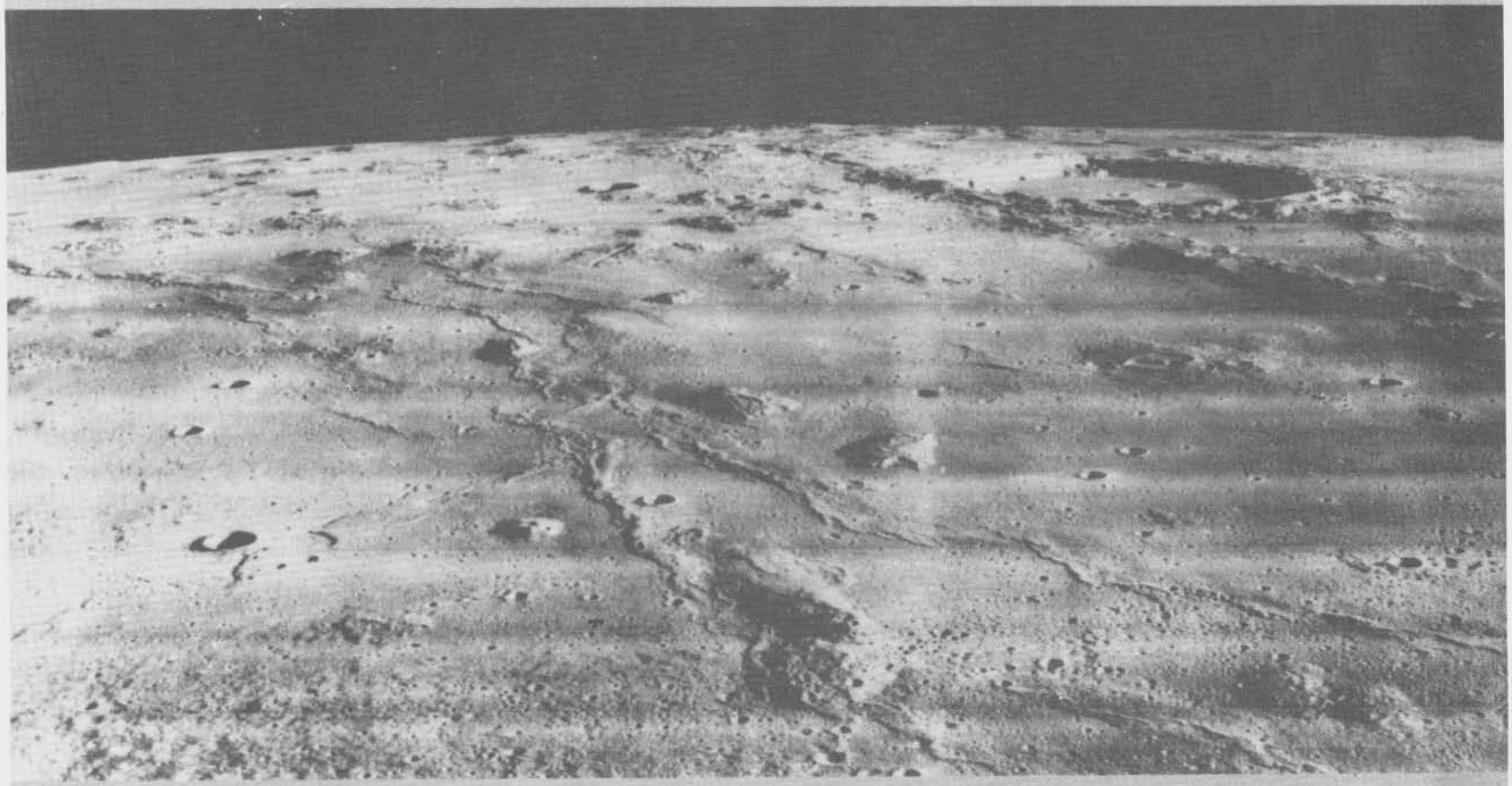


NASA SM69-354
12/26/68

CRATER TYCHO - ORBITER V PHOTO



MARIUS HILLS AREA - ORBITER II OBLIQUE PHOTO



NASA SL68-723
1-17-68

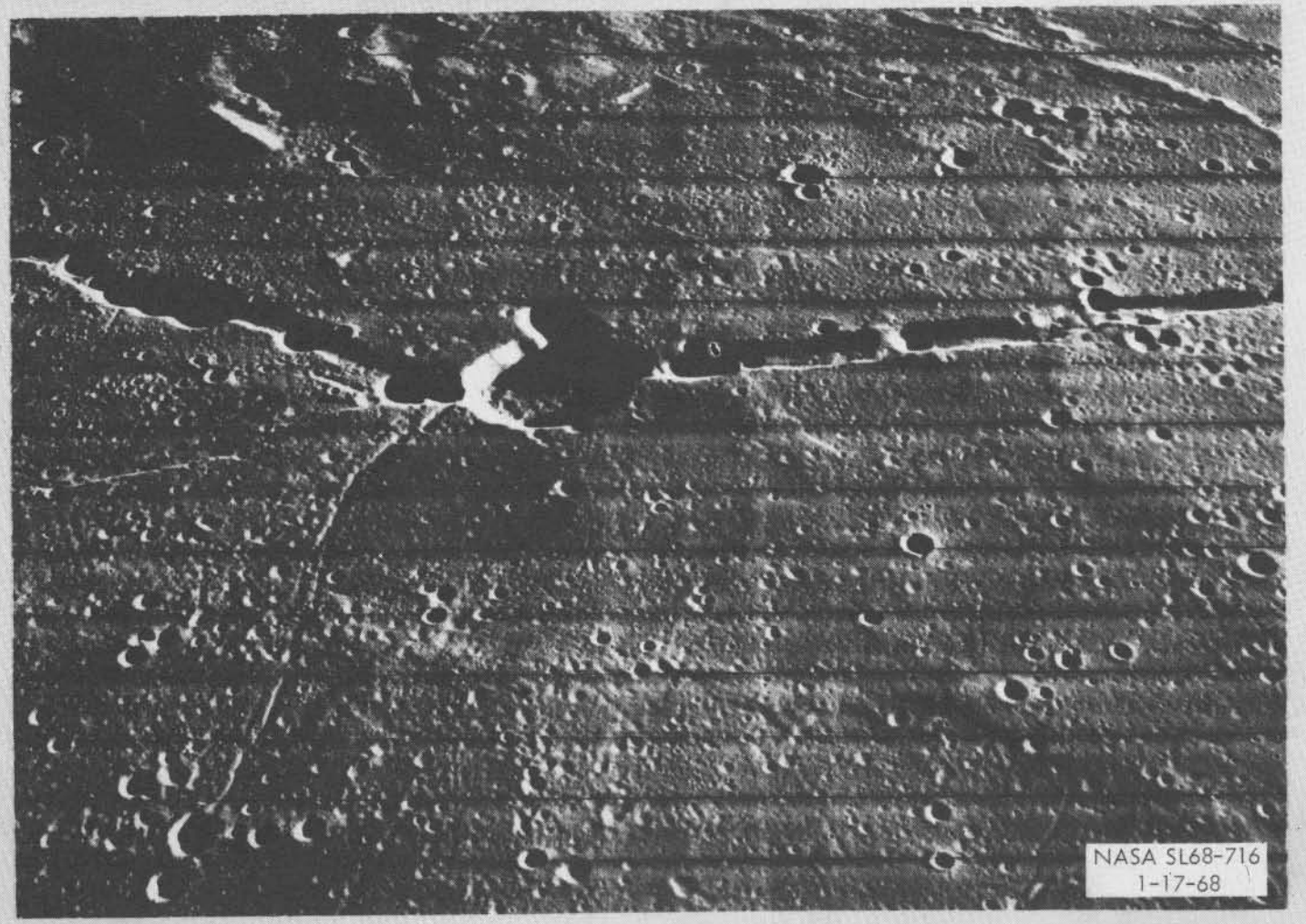
LUNAR ORBITER V

SCHRÖTER'S VALLEY

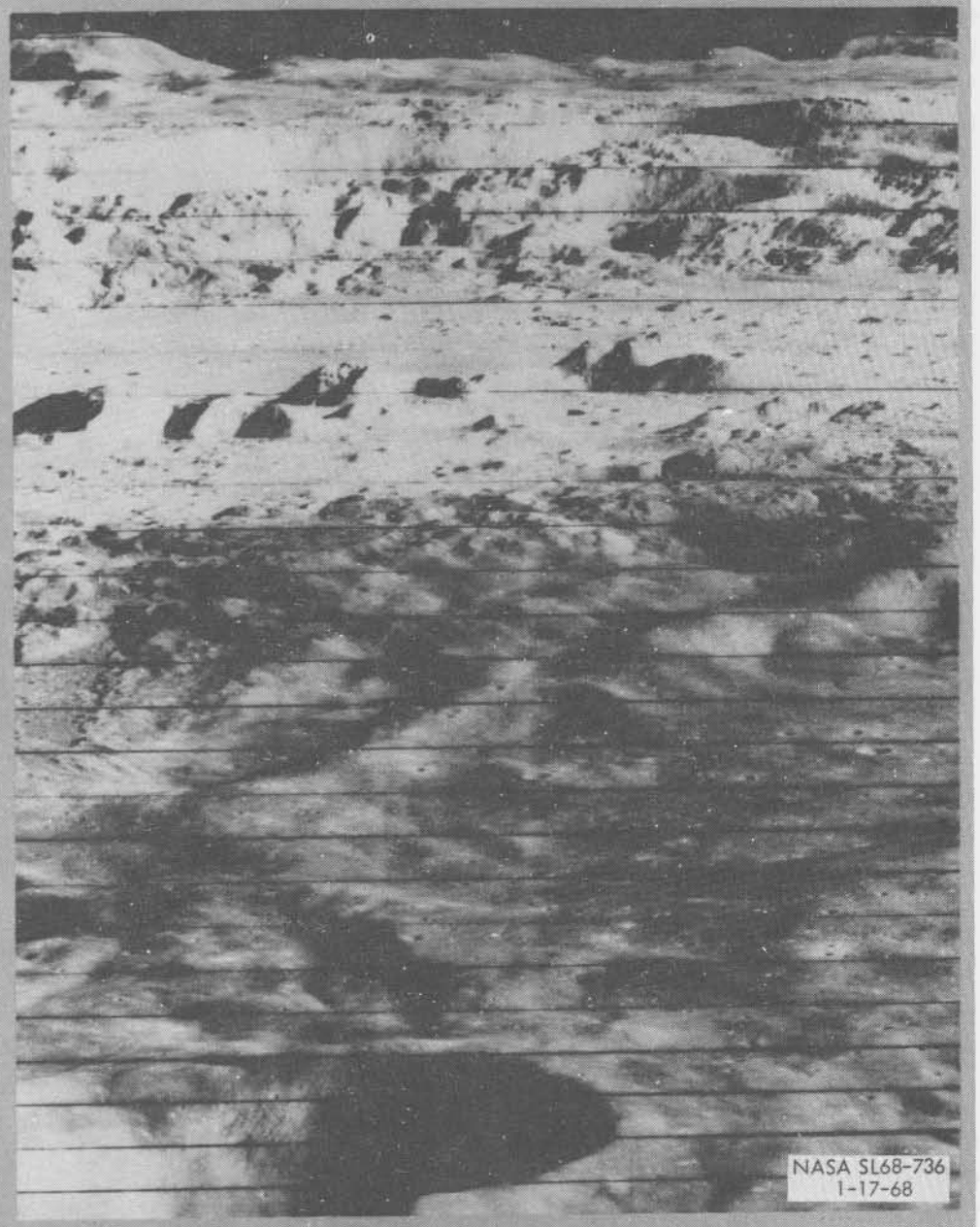
NASA HQ MA68-7407
11-20-68

OBLIQUE VIEW OF HYGINUS RILLE

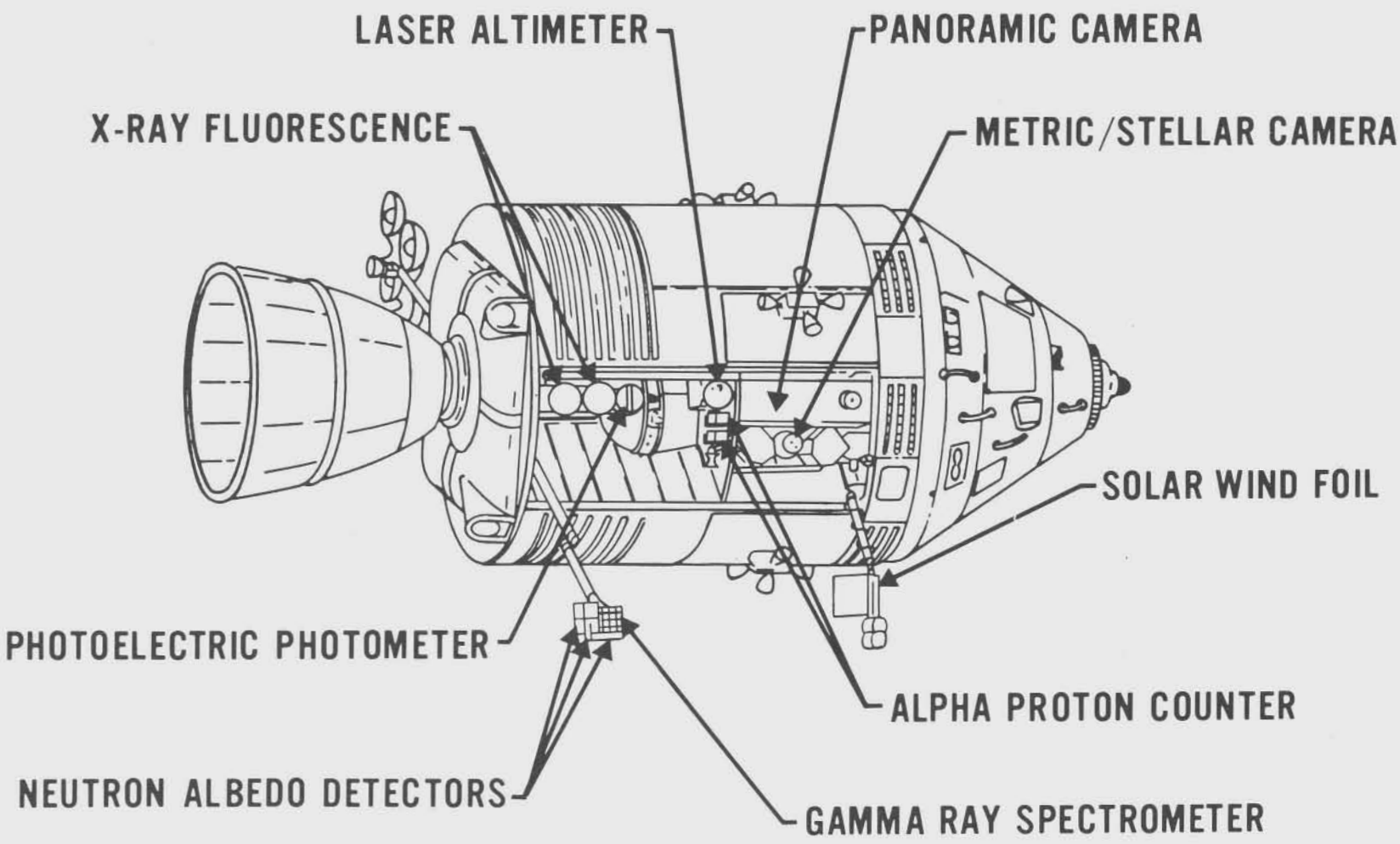
ORBITER II PHOTO



CRATER COPERNICUS - ORBITER II OBLIQUE PHOTO

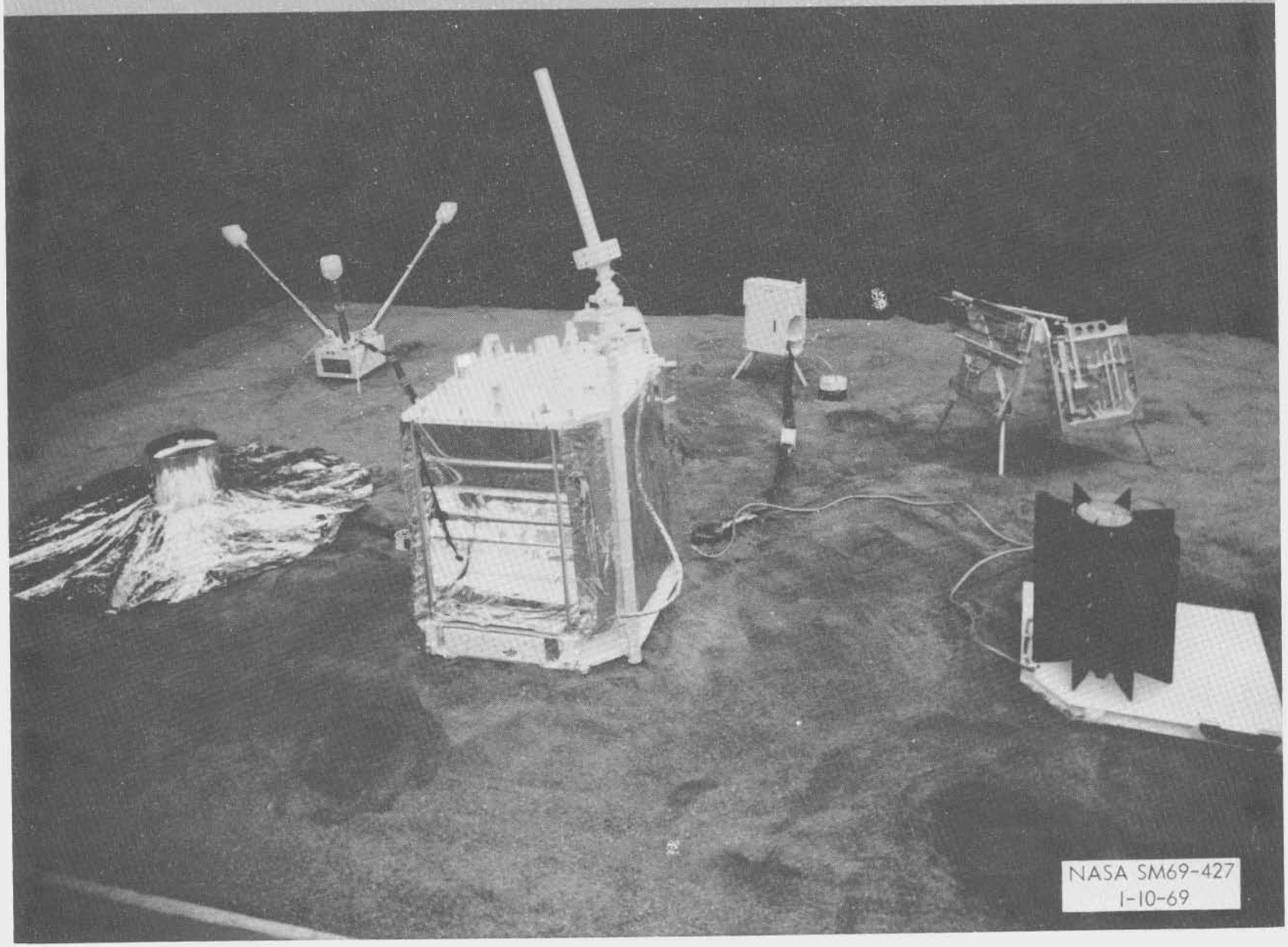


APOLLO COMMAND AND SERVICE MODULE
TYPICAL LUNAR ORBITAL SCIENCE INSTRUMENTS



NASA SM69-431
1-10-69

ALSEP ARRAY A



MAJOR MSF MILESTONES

GEMINI	ACCOMPLISHED
1964 - 1st GEMINI FLIGHT	1964
1965 - 1st GEMINI MANNED FLIGHT	1965
1966 - 1st GEMINI RENDEZVOUS FLIGHT	1965
1967 - GEMINI OPERATIONS	1966

APOLLO	
1966 - 1st APOLLO SATURN IB UNMANNED FLIGHT	1966
1967 - 1st APOLLO SATURN IB MANNED FLIGHT	1968
1967 - 1st APOLLO SATURN V UNMANNED FLIGHT	1967
1968 - 1st APOLLO SATURN V MANNED FLIGHT	1968
1969 - APOLLO OPERATIONS	

NASA HQ MC68-5185
REV 1-8-68

APOLLO APPLICATIONS
BASIC OBJECTIVES

- LONG DURATION SPACE FLIGHTS OF MEN AND SYSTEMS
  - UNIQUE CAPABILITIES OF MAN
  - HABITABILITY
  - BIOMEDICAL/BEHAVIORAL
  - SYSTEMS DEVELOPMENT
- SCIENTIFIC INVESTIGATIONS IN EARTH ORBIT
  - SOLAR ASTRONOMY
  - EARTH OBSERVATIONS
  - STELLAR ASTRONOMY
- APPLICATIONS IN EARTH ORBIT
  - METEOROLOGY
  - EARTH RESOURCES
  - COMMUNICATIONS
- EFFECTIVE AND ECONOMICAL APPROACH TO THE DEVELOPMENT OF A BASIS FOR POTENTIAL FUTURE SPACE PROGRAMS

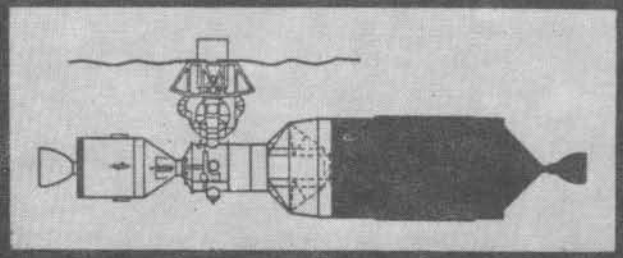
NASA HQ ML68-6015
2-20-69

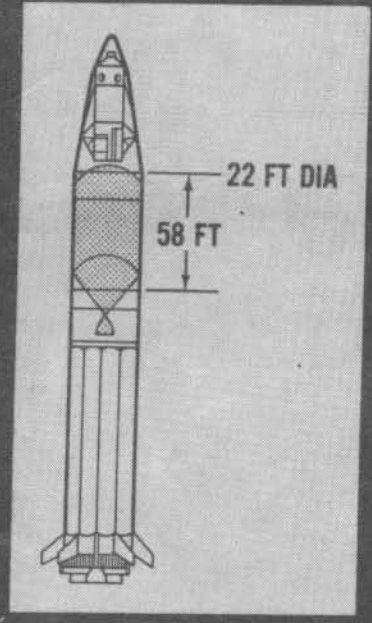
APOLLO APPLICATIONS-
MISSION CONCEPTS

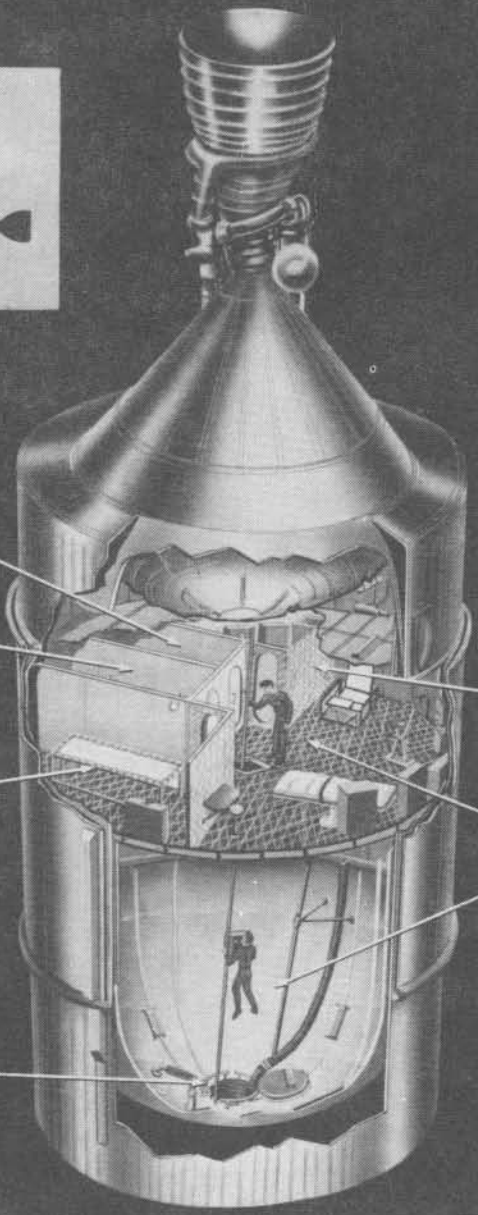
- USE OF LAUNCH VEHICLES AND SPACECRAFT DEVELOPED FOR APOLLO
- RE-VISIT, RE-SUPPLY, RE-USE, REPAIR
- OPEN-ENDED MISSION PHILOSOPHY
- MAXIMUM UTILIZATION OF EXISTING HARDWARE
- DEVELOP OPERATING TECHNIQUES AND EXPAND BASIS OF KNOWLEDGE

NASA HQ ML67-7074
2-20-69

SATURN I WORKSHOP







FOOD PREPARATION/
EATING

WASTE STORAGE

CREW QUARTERS

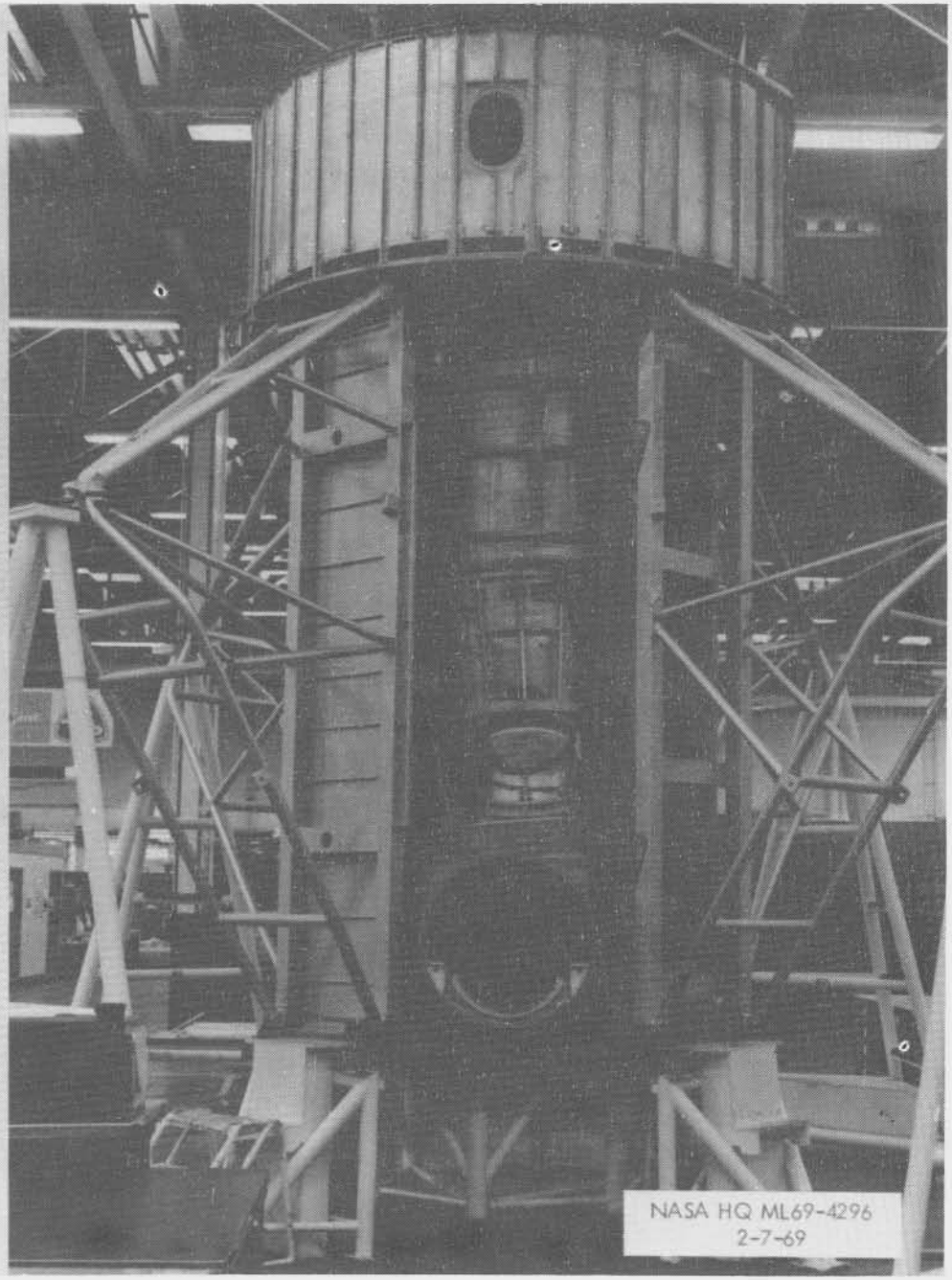
HATCH TO
AIRLOCK MODULE

CREW QUARTERS

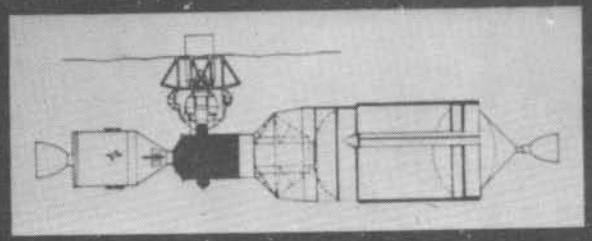
EXPERIMENT
WORK AREAS

NASA HQ MC68-5607
4-4-68

AIRLOCK FLIGHT ARTICLE NO.1

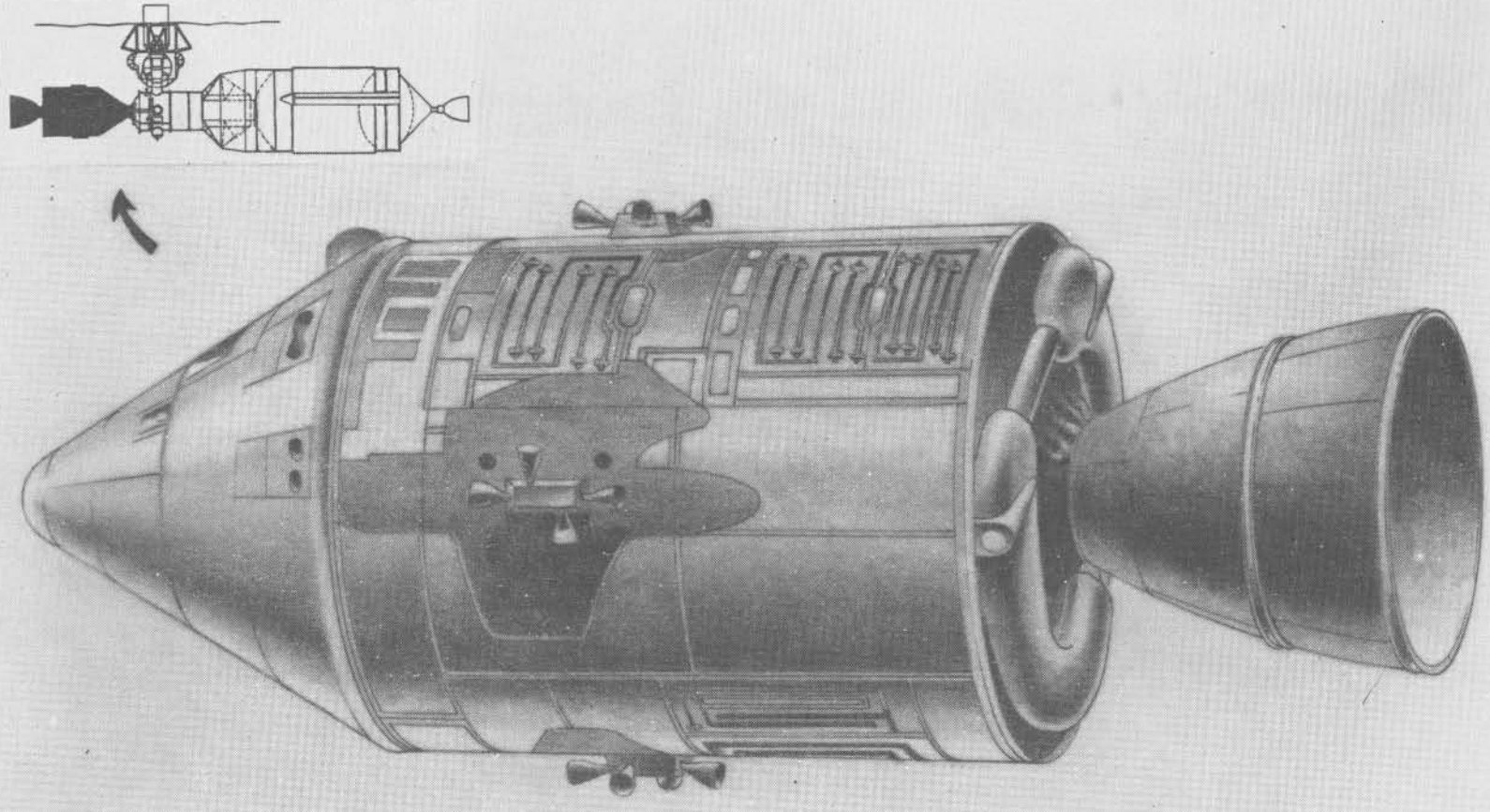


MULTIPLE DOCKING ADAPTER (MDA)

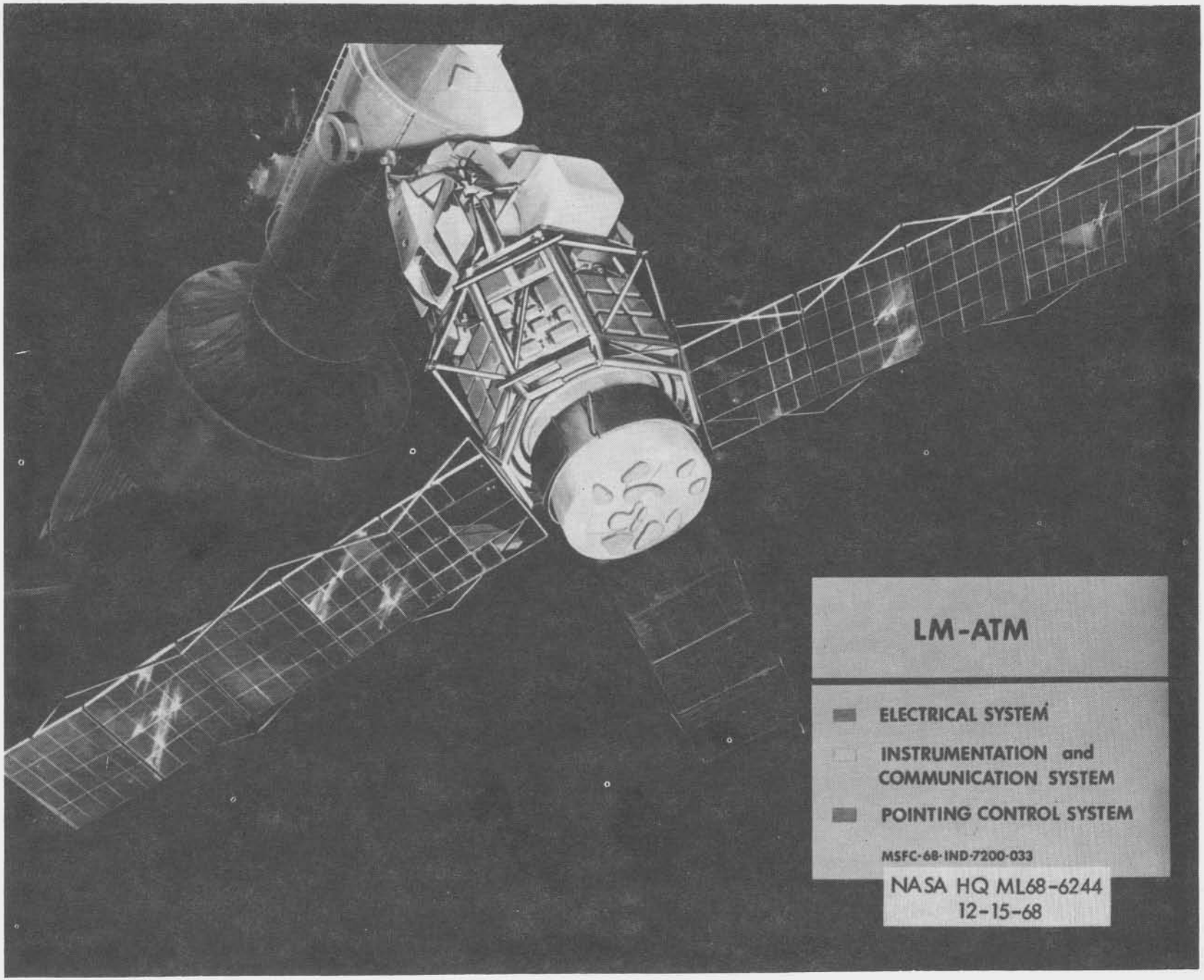


NASA HQ ML68-5909
4-8-68

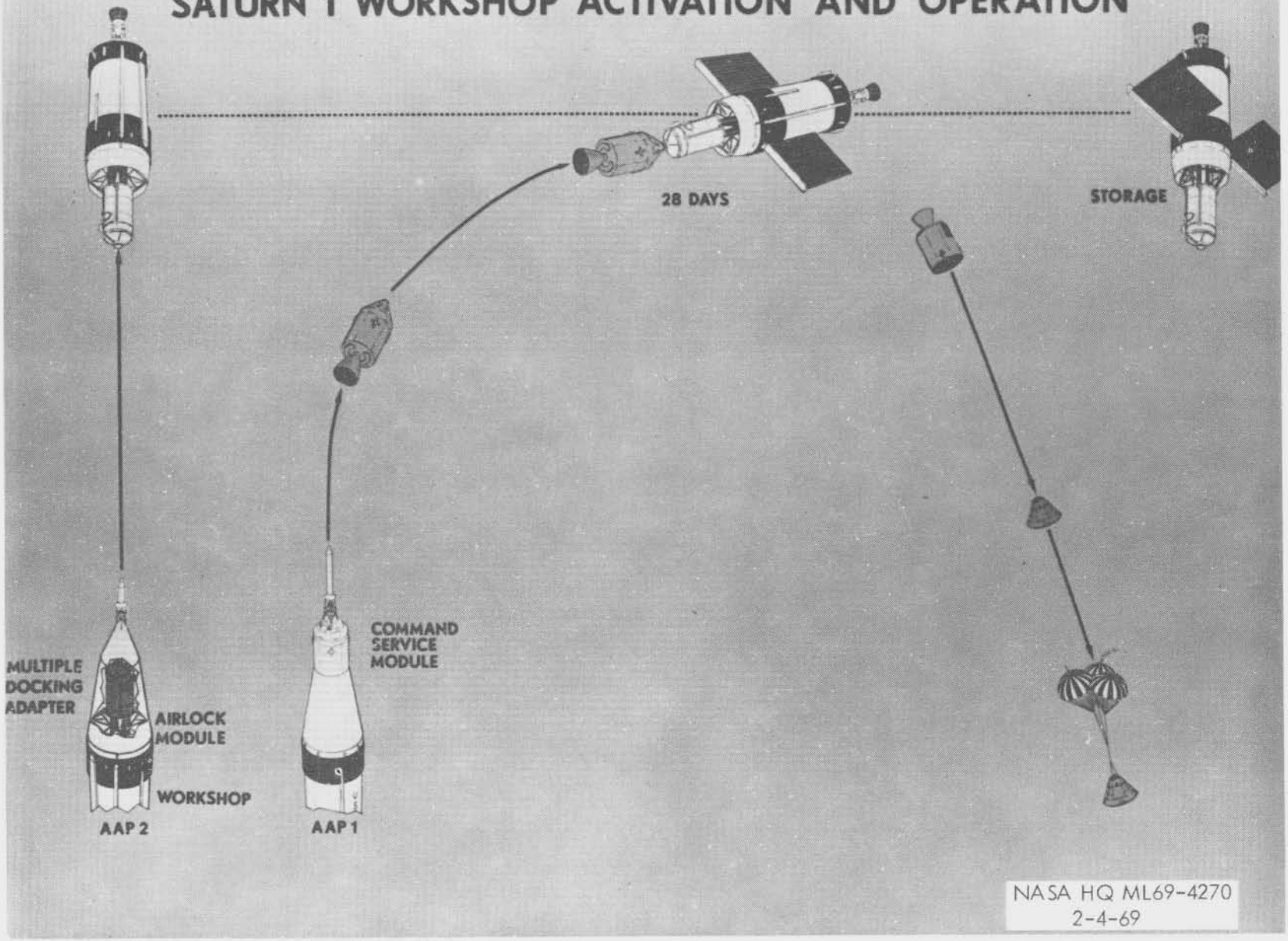
COMMAND AND SERVICE MODULE (CSM)



NASA HQ ML68-5911
3-15-68


LM-ATM
ELECTRICAL SYSTEM
INSTRUMENTATION and COMMUNICATION SYSTEM
POINTING CONTROL SYSTEM
MSFC-68-IND-7200-033
NASA HQ ML68-6244
12-15-68

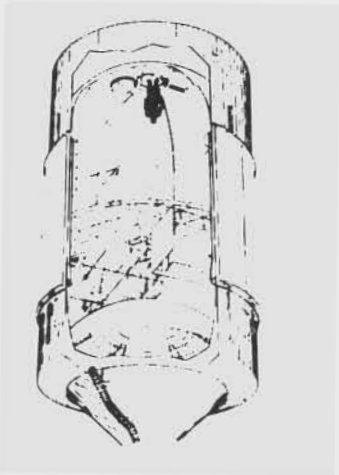
SATURN 1 WORKSHOP ACTIVATION AND OPERATION

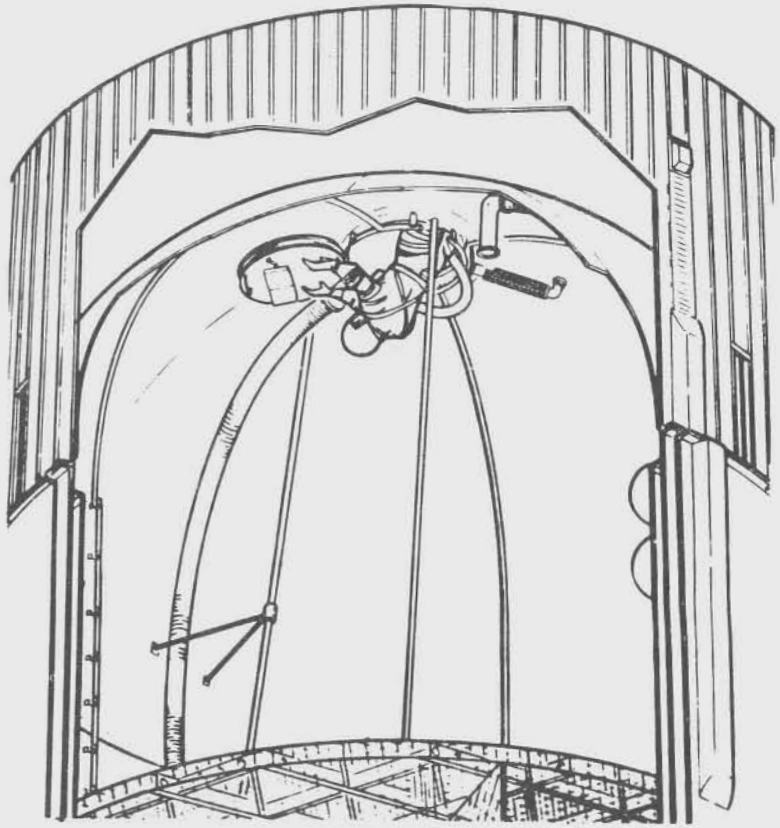


NASA HQ ML69-4270
2-4-69

SATURN I
S-IVB ORBITAL WORKSHOP PROJECT
ACTIVATION PHASE

OPENING HATCH - INITIAL TANK INSPECTION



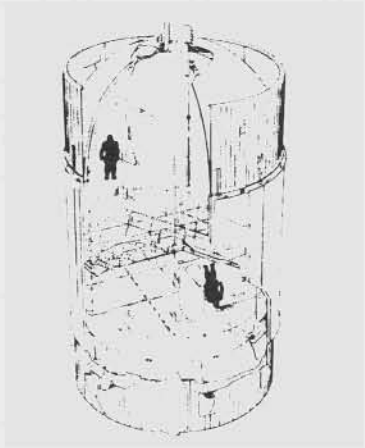


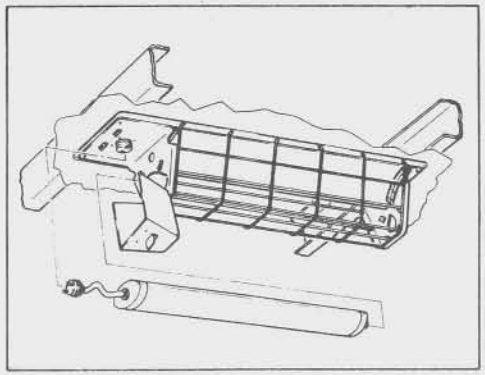
1. ASTRONAUT OPENS HATCH
2. INITIAL ENTRY LIGHT ON
3. VISUAL INSPECTION PERFORMED
4. INITIAL ENTRY LIGHT OFF
5. ASTRONAUT RETURNS TO CSM
6. START OWS PRESSURIZATION

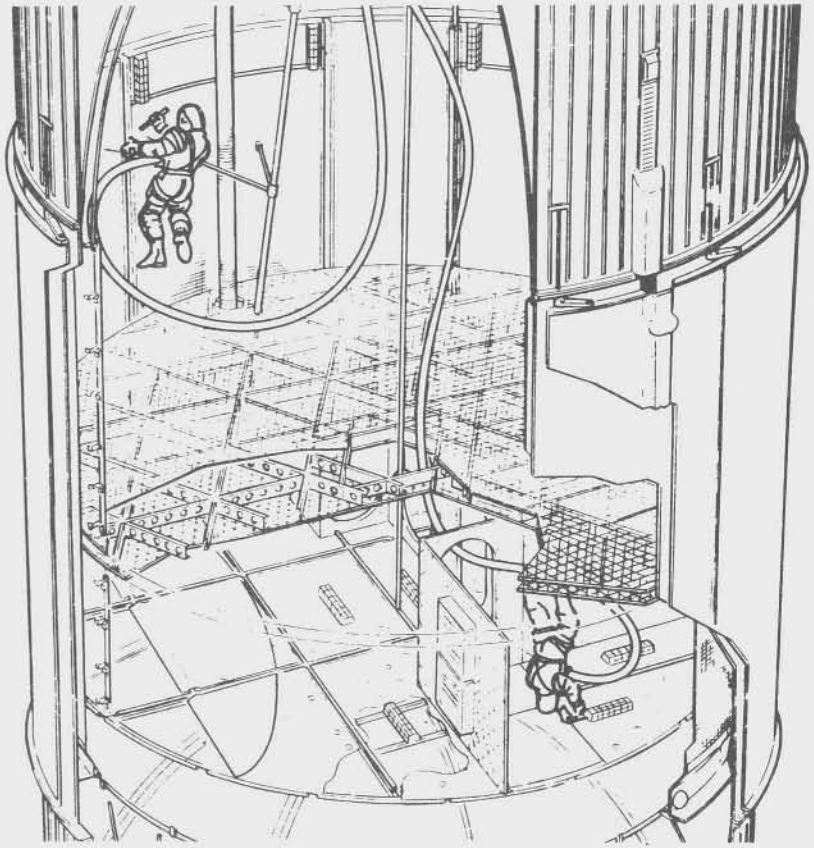
NASA HQ MC68-5515
2-20-69

SATURN I
S-IVB ORBITAL WORKSHOP PROJECT
ACTIVATION PHASE

INSTALLING & ACTIVATING AFT TANK, CREW & FWD TANK AREA LIGHTS

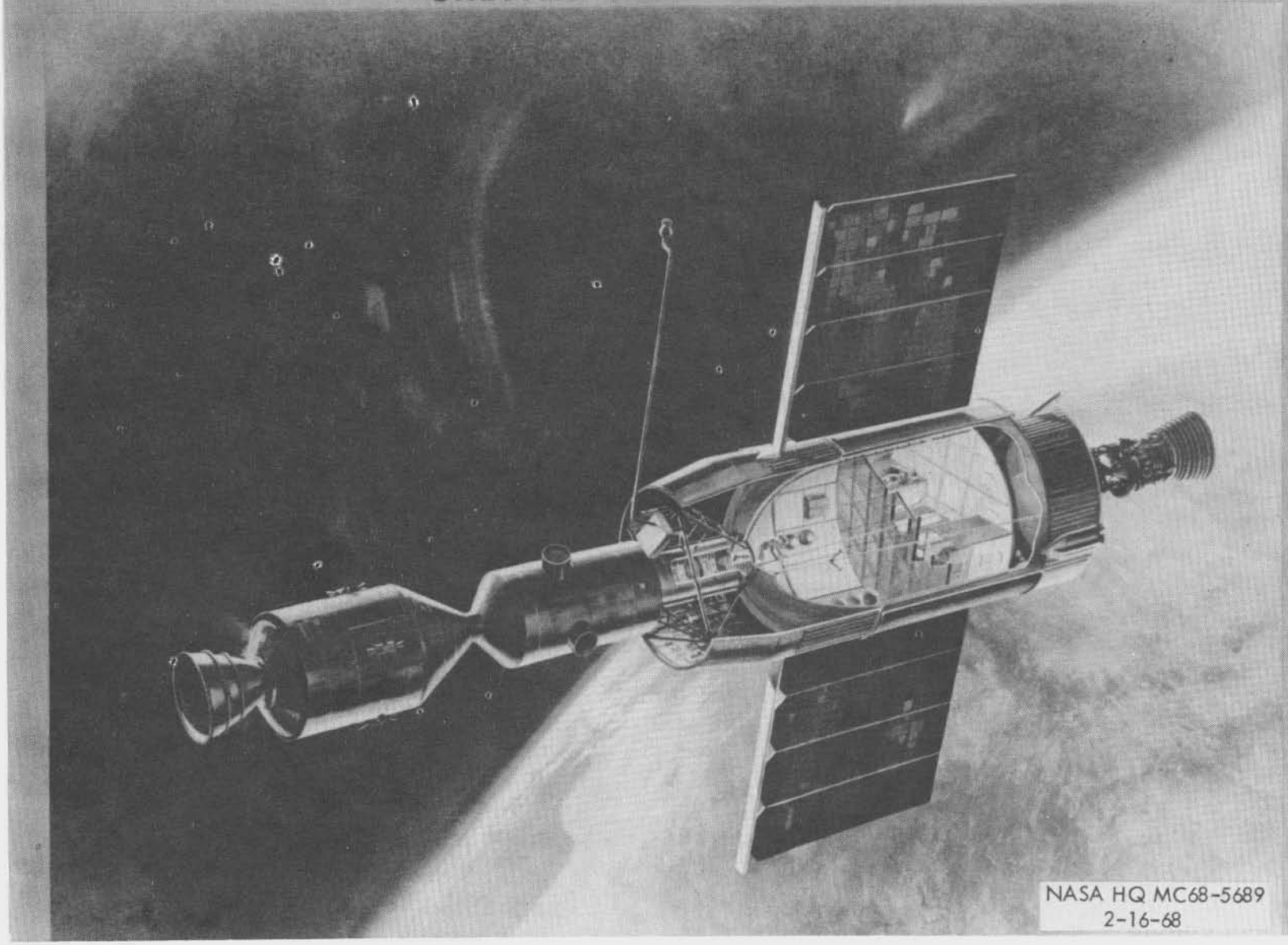






NASA HQ MC68-5513
2-20-69

AAP-1 & AAP-2 MISSION
ORBITAL CONFIGURATION



NASA HQ MC68-5689
2-16-68

AAP 1 & 2 EXPERIMENTS

ENGINEERING

M402	ORBITAL WORKSHOP
M487	HABITABILITY/CREW QUARTERS
M492	TUBE JOINING ASSEMBLIES
M493	ELECTRON BEAM WELDING
M507	GRAVITY SUBSTITUTE WORK BENCH
M508	EVA HARDWARE EVALUATION
M509	ASTRONAUT MANEUVERING EQUIPMENT

TECHNOLOGY

T003	IN-FLIGHT NEPHELOMETER
T013	CREW-VEHICLE DISTURBANCE
T018	PRECISION OPTICAL TRACKING
T020	FOOT CONTROLLED MANEUVER UNIT
T025	CORONAGRAPH CONTAMINATION MEASUREMENT
T027	ATM CONTAMINATION MEASUREMENT

MEDICAL

M071	MINERAL BALANCE
M072	BONE DENSITOMETRY
M073	BIOASSAY OF BODY FLUIDS
M074	SPECIMEN MASS MEASUREMENT
M091	LBNP (PRE-AND POST-FLIGHT)
M092	INFLIGHT LBNP
M093	VECTORCARDIOGRAM
M111	CYTOGENETIC STUDIES OF BLOOD
M113	BLOOD VOLUME AND RED CELL LIFE SPAN
M131	HUMAN VESTIBULAR FUNCTION
M151	TIME AND MOTION STUDY
M171	METABOLIC ACTIVITY
M172	BODY MASS MEASUREMENT

SCIENCE

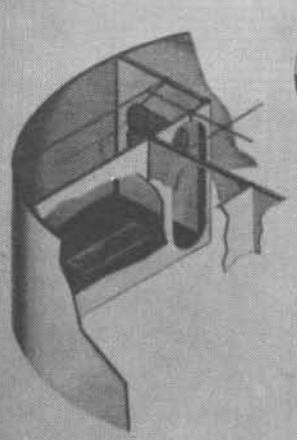
S009	NUCLEAR EMULSION
S015	ZERO "G" SINGLE HUMAN CELLS
S018	MICROMETEORITE COLLECTION
S019	UV STELLAR ASTRONOMY
S020	UV/X-RAY SOLAR PHOYOGRAPHY
S063	UV AIRGLOW HORIZON PHOTOGRAPHY
S073	GEGENSCHIEN/ZODIACAL LIGHT

DOD

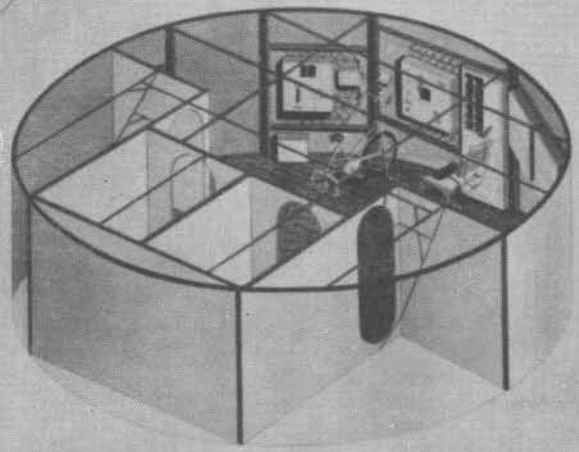
D008	RADIATION IN SPACECRAFT
D019	SUIT DONNING AND SLEEP STATION EVALUATION
D020	ALTERNATE RESTRAINTS EVALUATION
D021	EXPANDABLE AIRLOCK TECHNOLOGY
D022	EXPANDABLE STRUCTURE FOR RECOVERY

NASA HQ ML69-4301
2-7-69

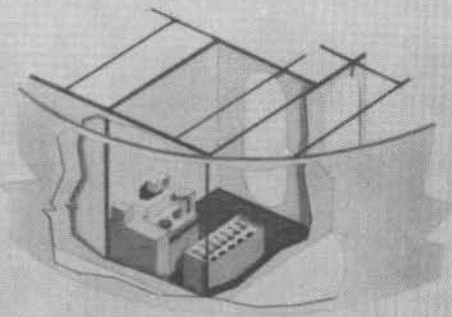
SATURN 1 WORKSHOP
CREW QUARTERS LAYOUT
FIRST FLOOR



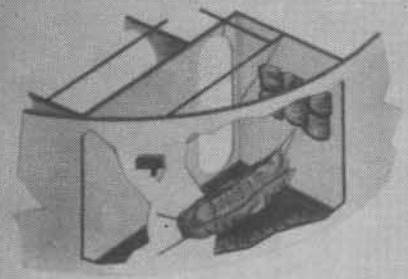
CREW COMPARTMENT NO.1



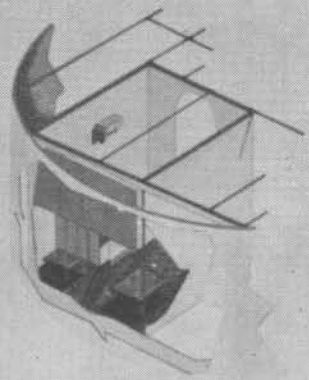
CREW QUARTERS AND WORK AREA



WASTE MANAGEMENT AREA



CREW COMPARTMENT NO. 2



FOOD MANAGEMENT AREA

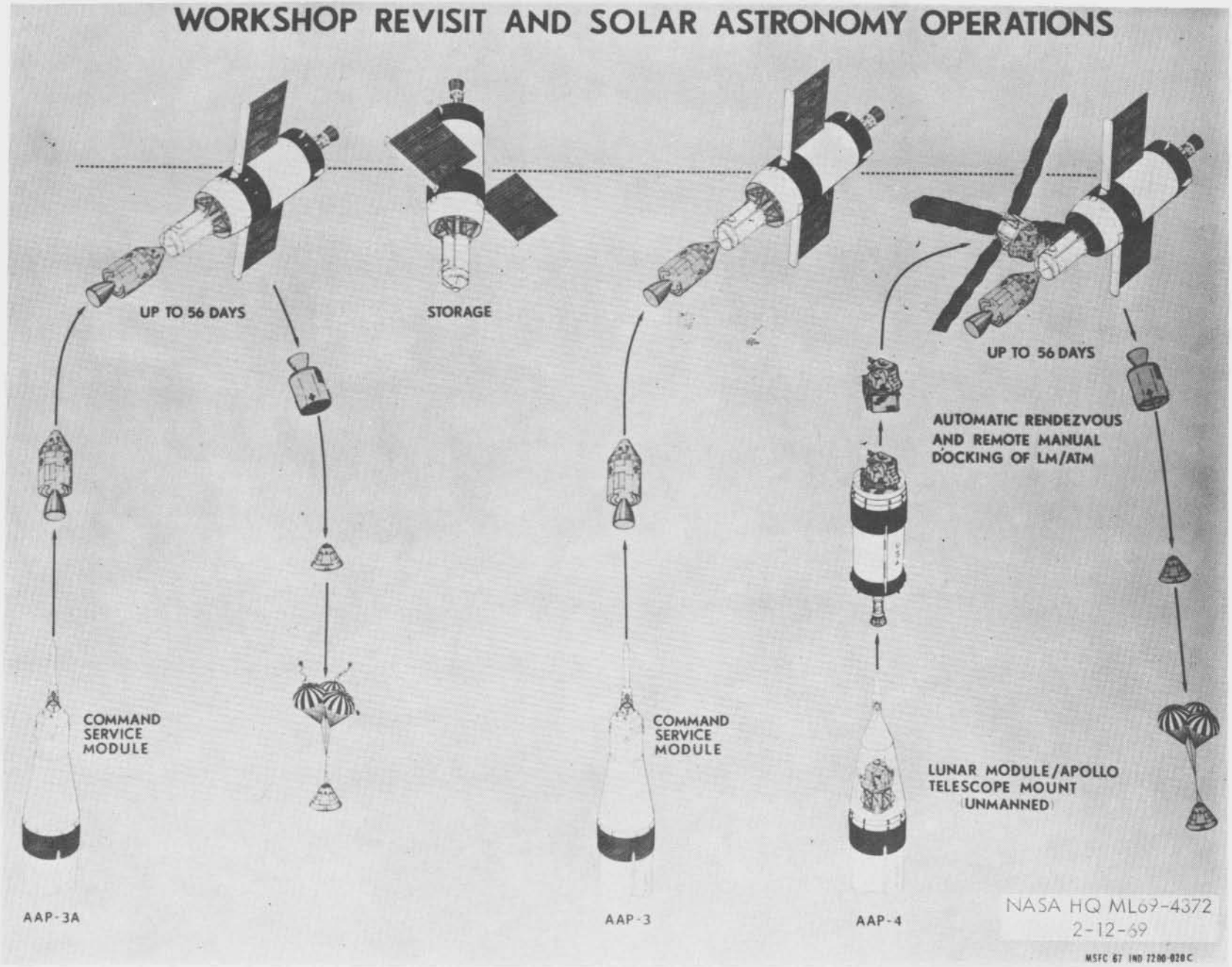
NASA HQ ML69-4269
2-4-69

AAP 1 & 2 PRIMARY MISSION OBJECTIVES

- DETERMINE THE FEASIBILITY OF ACTIVATING AND OPERATING THE ORBITAL WORKSHOP AS A HABITABLE SPACE STRUCTURE FOR A PERIOD OF UP TO 28 DAYS
- EVALUATE EFFECTS OF LONG DURATION SPACE FLIGHT ON THE CREW
- OBTAIN SCIENTIFIC , ENGINEERING, AND TECHNOLOGICAL DATA NEEDED FOR DEVELOPMENT OF ADVANCED SPACE VEHICLES AND EQUIPMENT
- DEMONSTRATE DEACTIVATION OF THE WORKSHOP FOR ORBITAL STORAGE AND REUSE

NASA HQ MC68-5062
1-15-68

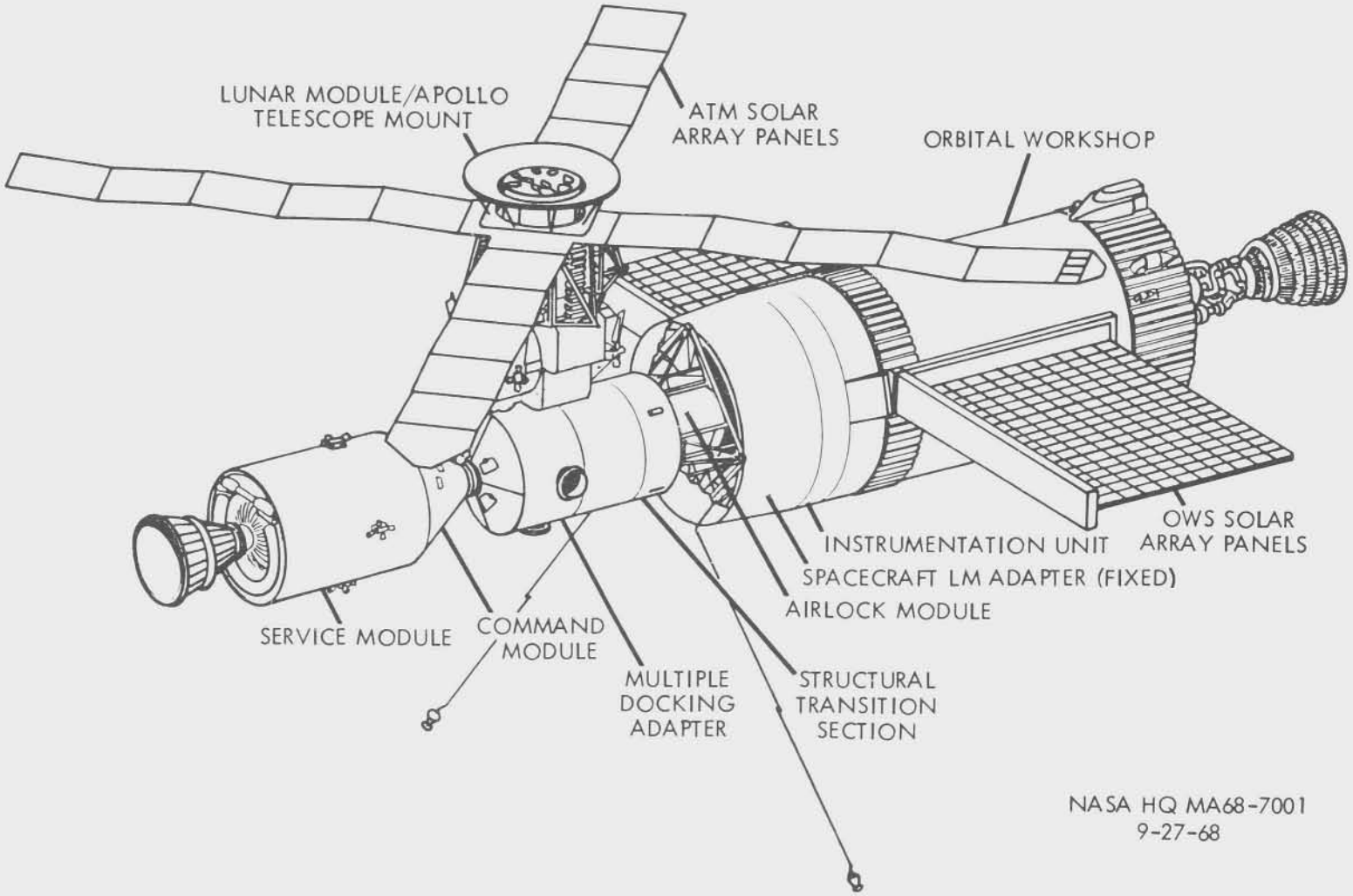
WORKSHOP REVISIT AND SOLAR ASTRONOMY OPERATIONS



NASA HQ ML69-4372
2-12-69

MSFC 67 IND 7280-020C

AAP CLUSTER



NASA HQ MA68-7001
9-27-68

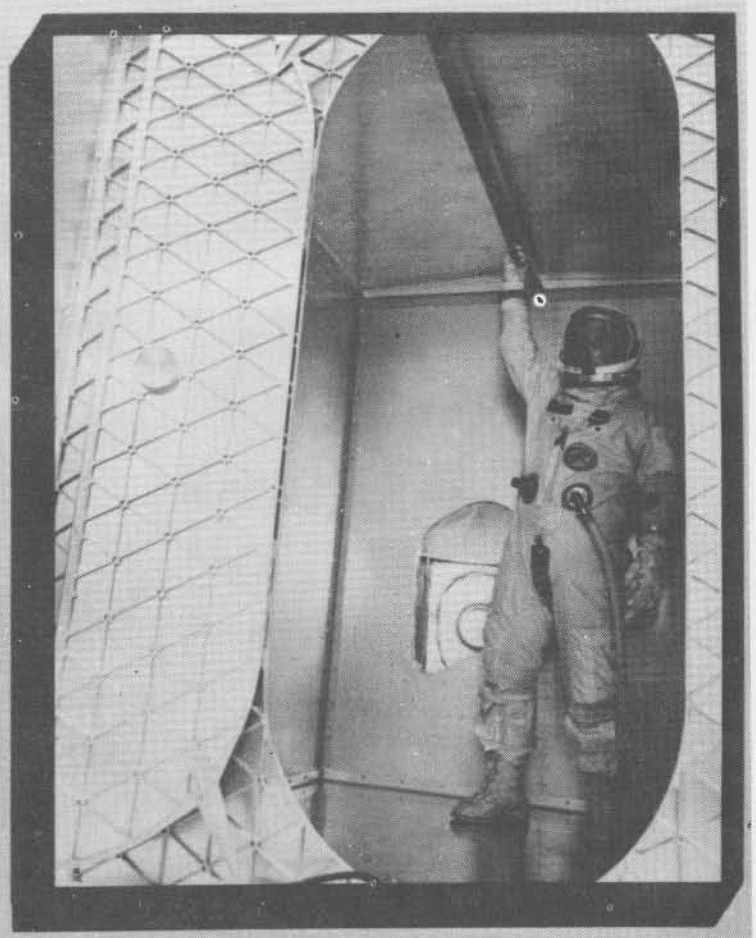
APOLLO TELESCOPE MOUNT SCIENTIFIC EXPERIMENTS

EXPERIMENT NUMBERS	ORGANIZATION	PRINCIPAL INVESTIGATOR	INSTRUMENT	PURPOSE
S052	HIGH ALTITUDE OBSERVATORY	DR. G. NEWKIRK, JR.	WHITE LIGHT CORONAGRAPH	MONITOR THE BRIGHTNESS, FORM AND POLARIZATION OF THE SOLAR CORONA IN WHITE LIGHT.
S082	NRL	MR. J. D. PURCELL	CORONAL SPECTROHELIOGRAPH	MAKE HIGH-SPATIAL RESOLUTION MONOCHROMETRIC SOLAR IMAGES IN THE 160-650 ANGSTROM RANGE
			CHROMOSPHERIC SPECTROGRAPH	RECORD SOLAR SPECTRA IN THE 800-3000 ANGSTROM RANGE WITH HIGH SPECTRAL RESOLUTION
S054	AS & E	DR. R. GIACCONI	X-RAY SPECTROGRAPHIC TELESCOPE	STUDY SOLAR FLARE EMISSIONS IN THE SOFT X-RAY WAVELENGTHS (2-60 ANGSTROMS)
S055	HCO	DR. L. GOLDBERG	UV SCANNING POLYCHROMATOR SPECTROHELIOMETER	PHOTOELECTRICALLY RECORD HIGH RESOLUTION SOLAR IMAGES AND STUDY EMISSION SPECTRA OF SELECTED FEATURES OF SOLAR DISC.
S056	GSFC	MR. J. E. MILLIGAN	HI-RESOLUTION X-RAY TELESCOPES	OBTAIN TIME-HISTORIES OF THE DYNAMICS OF THE SOLAR ATMOSPHERE IN X-RAYS IN THE 3-100 ANGSTROM RANGE

NASA HQ ML69-4[illegible]3
REV. 3-7-69

SATURN I WORKSHOP ZERO 'G' HARDWARE

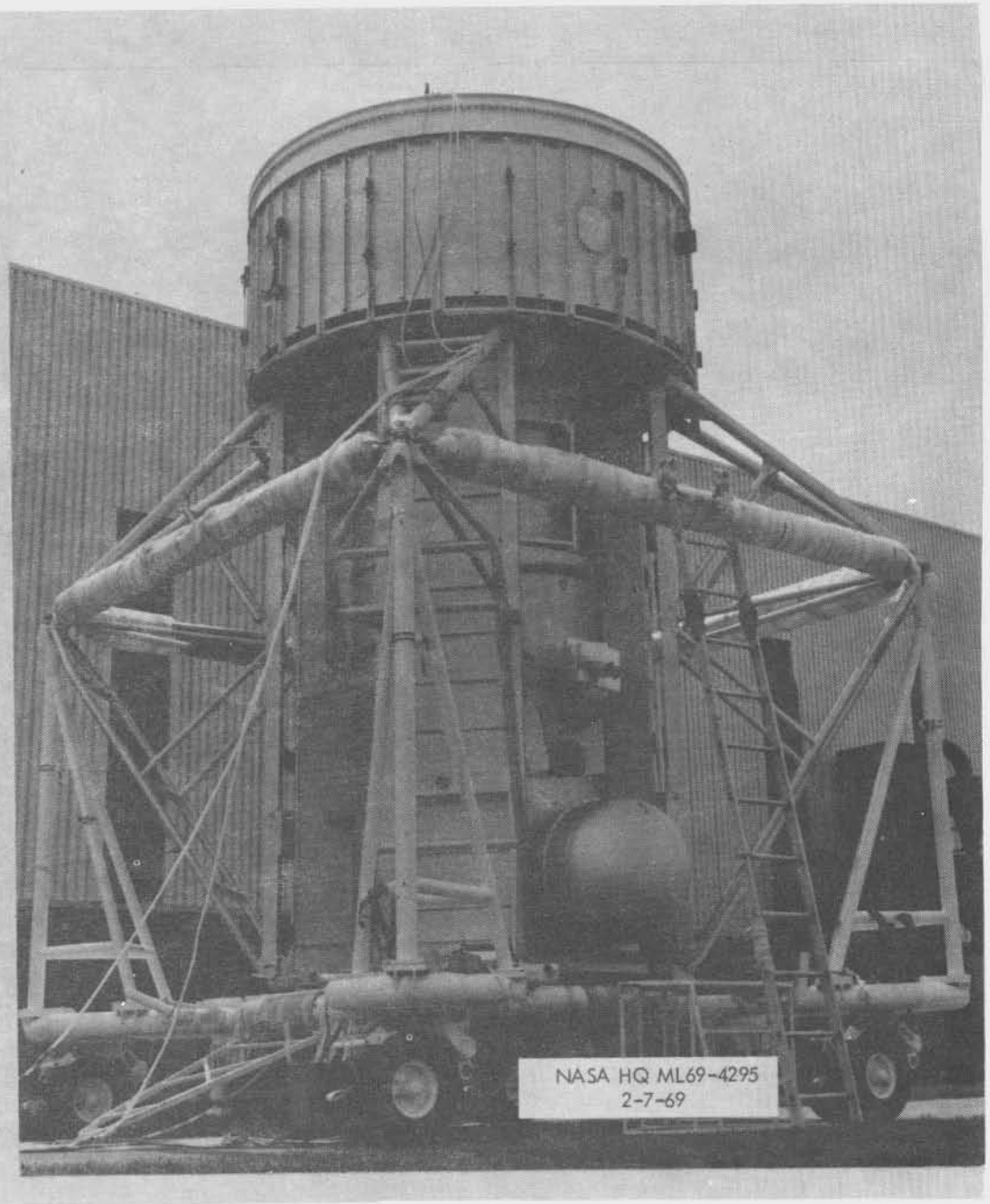
WASTE MANAGEMENT ENTRY WITH USE OF OVERHEAD HAND RAILS



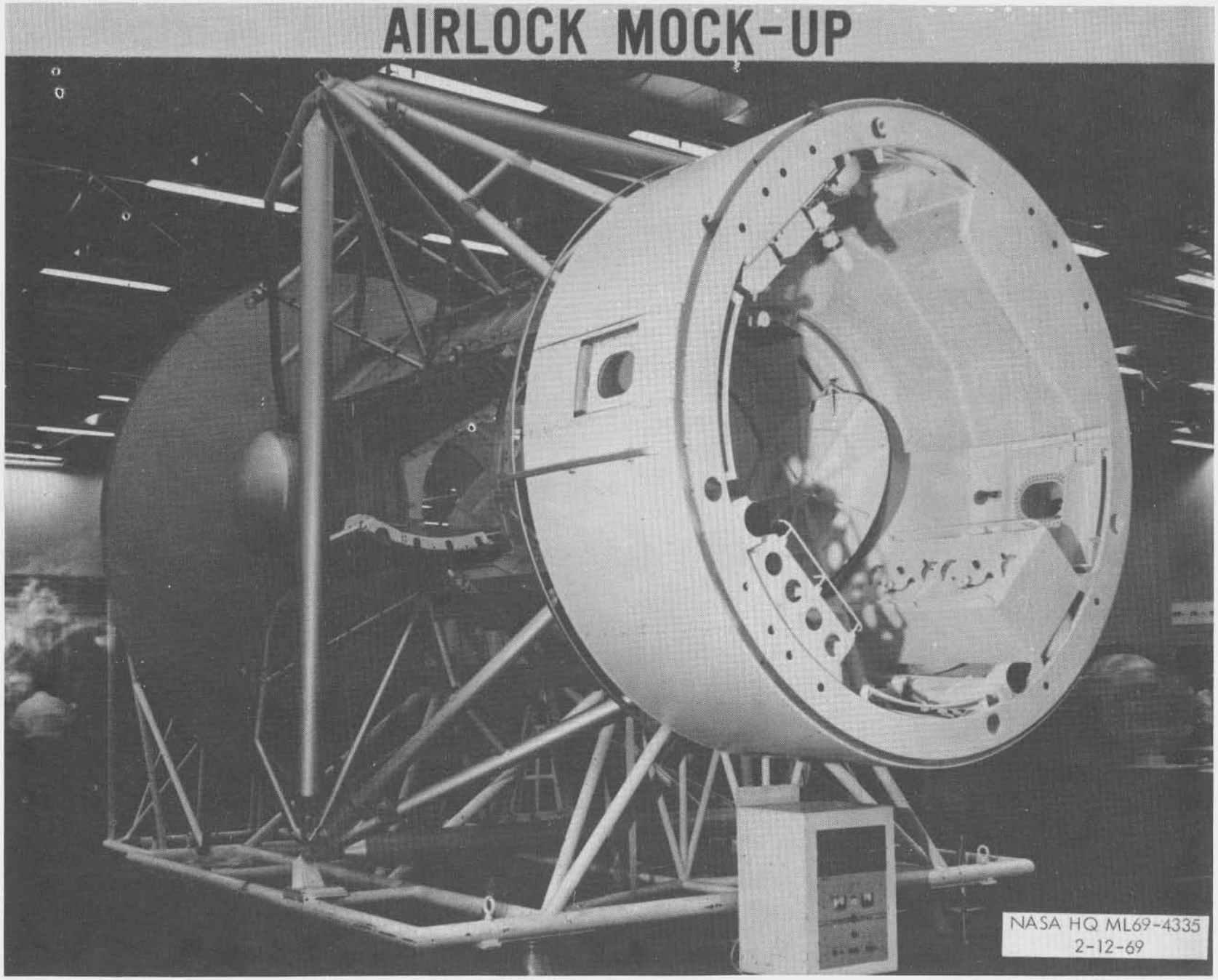
NASA HQ ML69-4274
2-4-69

AIRLOCK

STRUCTURAL TEST ARTICLE

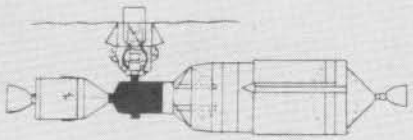


AIRLOCK MOCK-UP

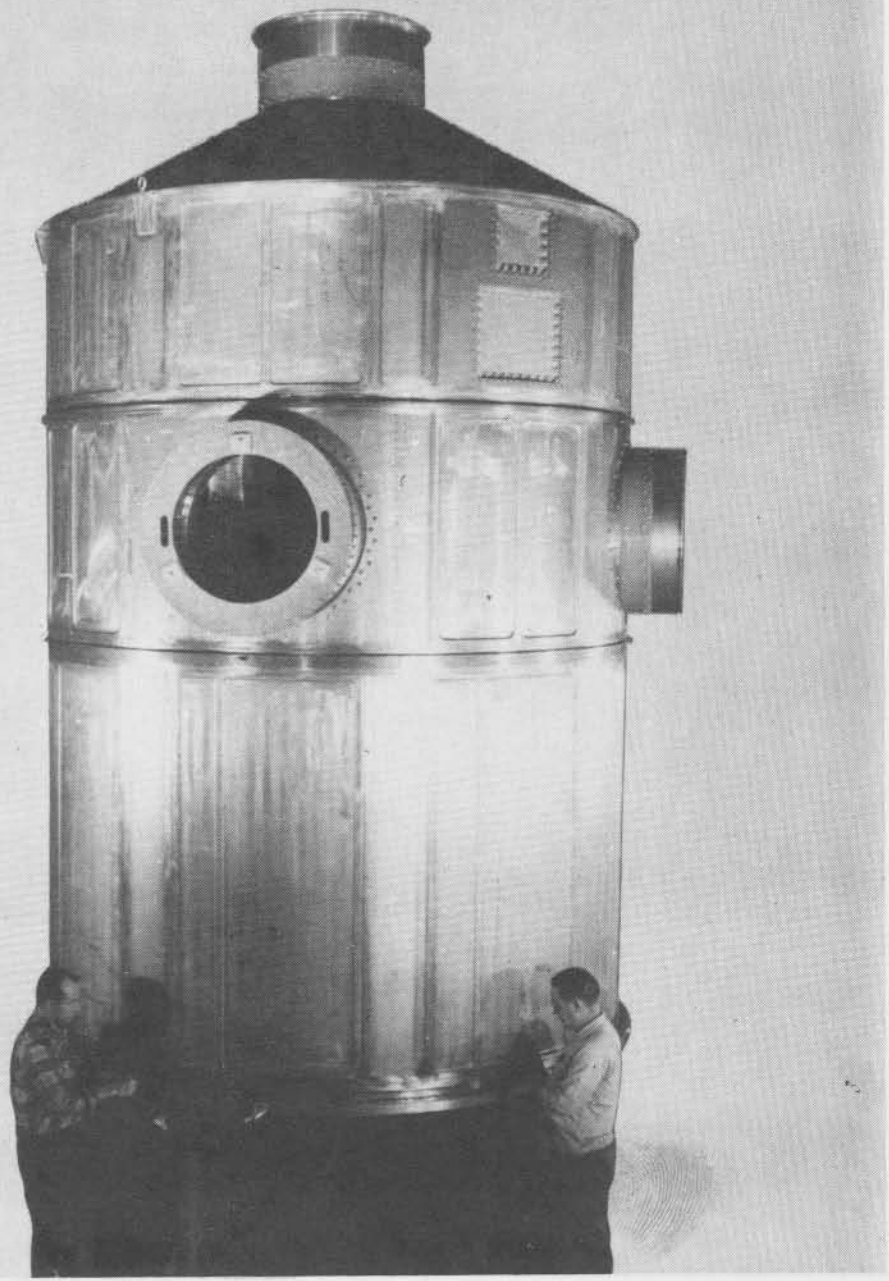


NASA HQ ML69-4335
2-12-69

MULTIPLE DOCKING ADAPTER

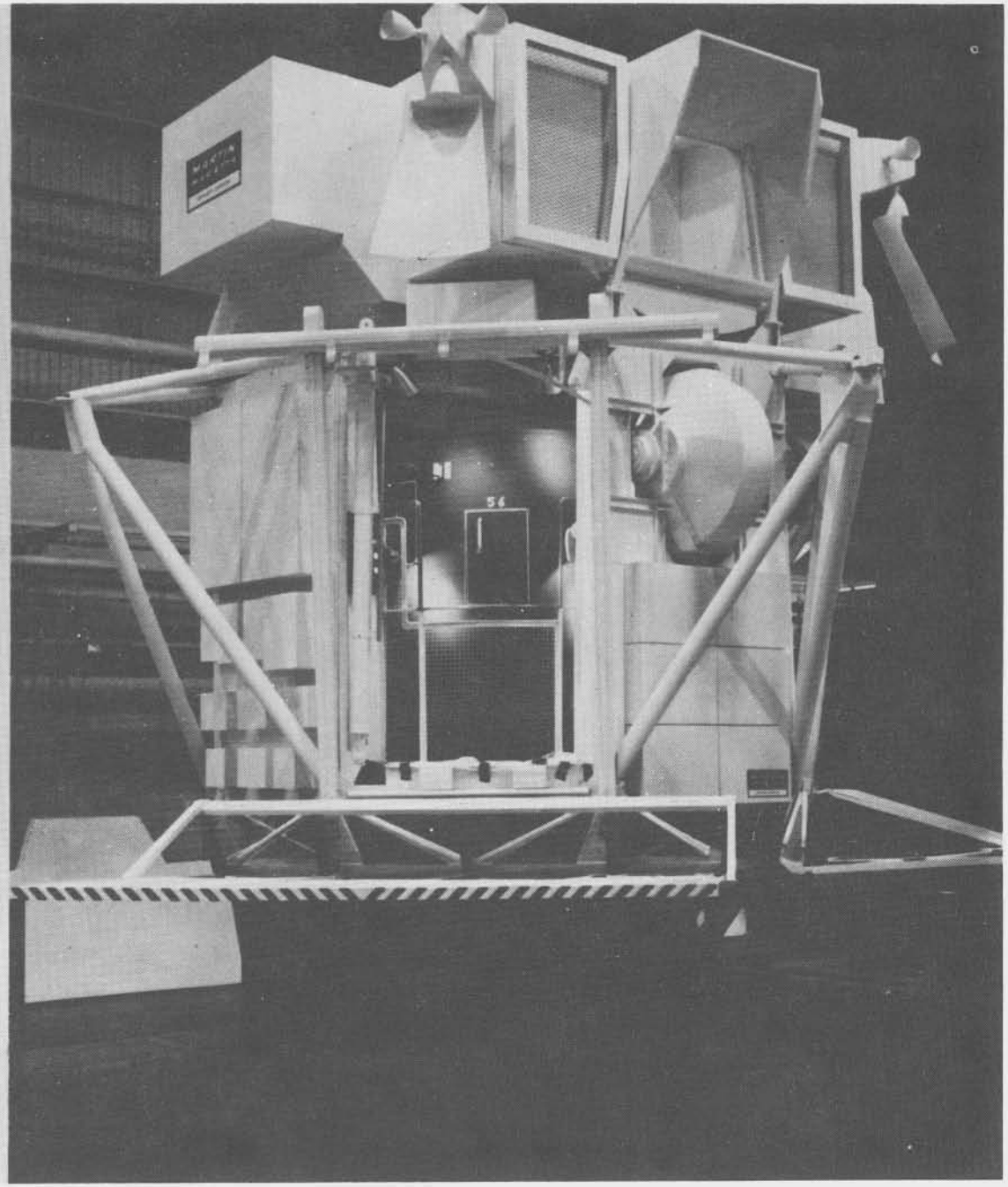


NASA HQ ML69-4230
2-12-69



APOLLO TELESCOPE MOUNT

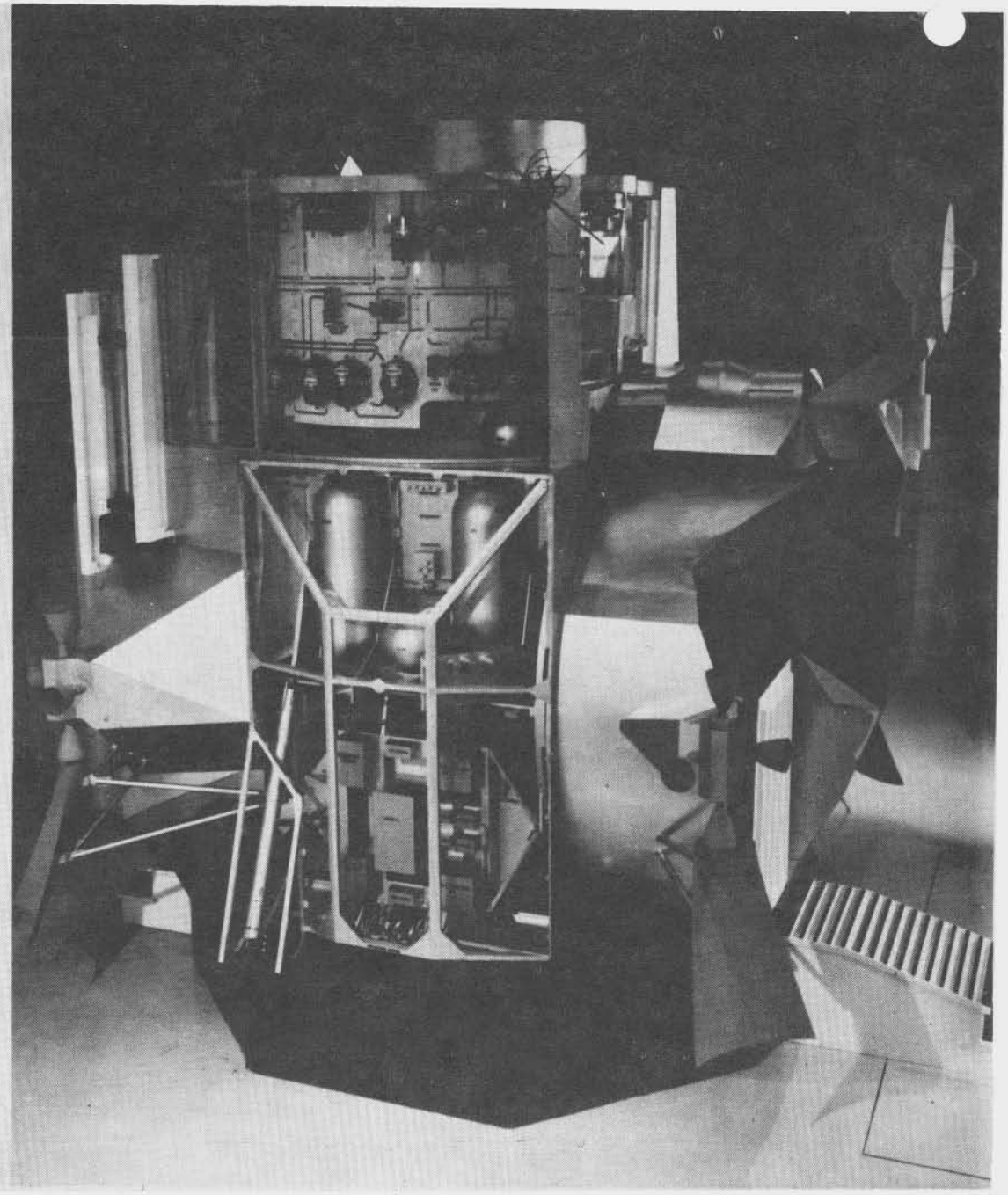
MARTIN MARIETTA MOCKUP



NASA HQ ML69-4341
2-12-69

AAP LM-A MOCKUP

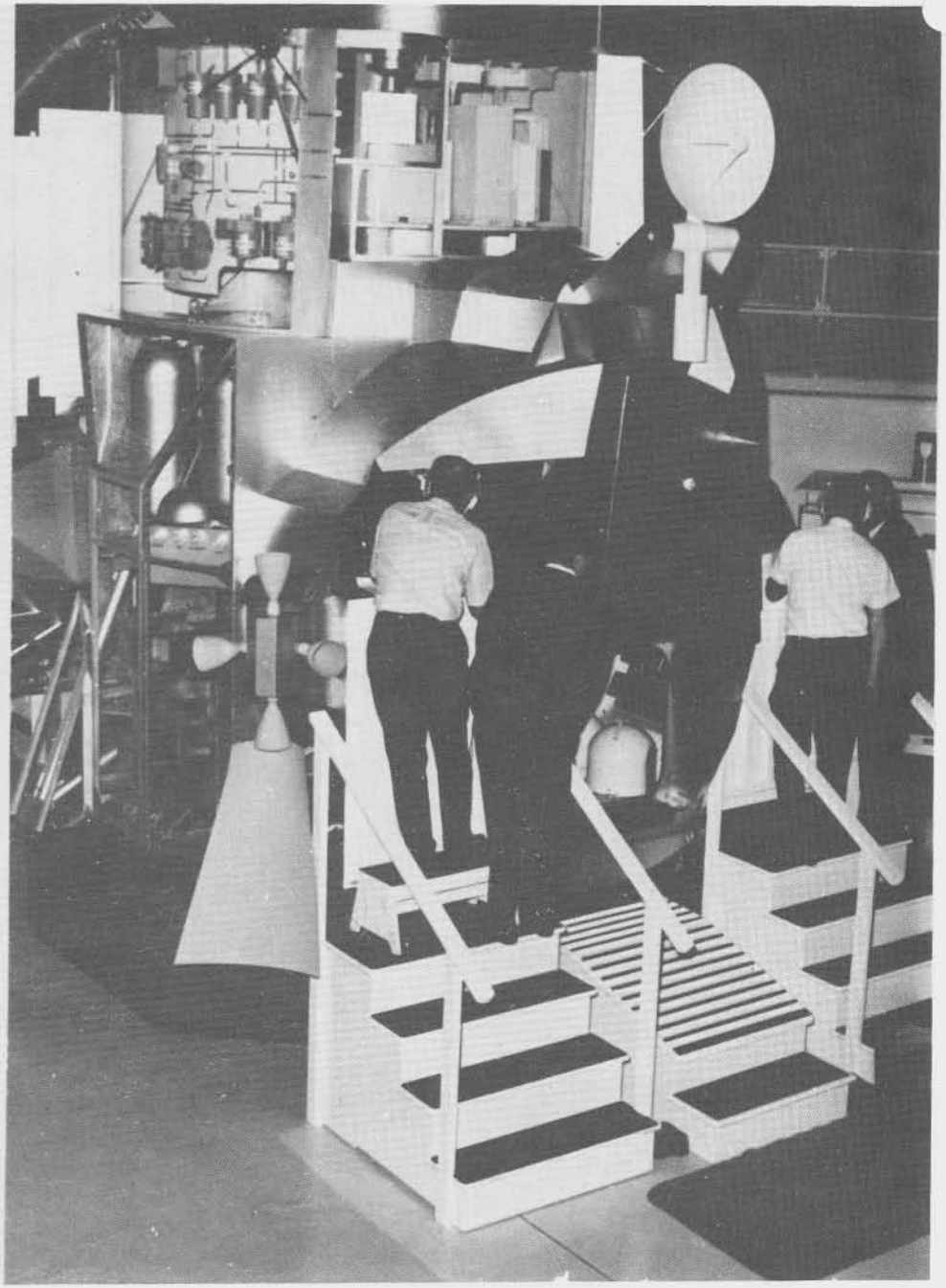
NASA HQ ML69-4344
2-12-69



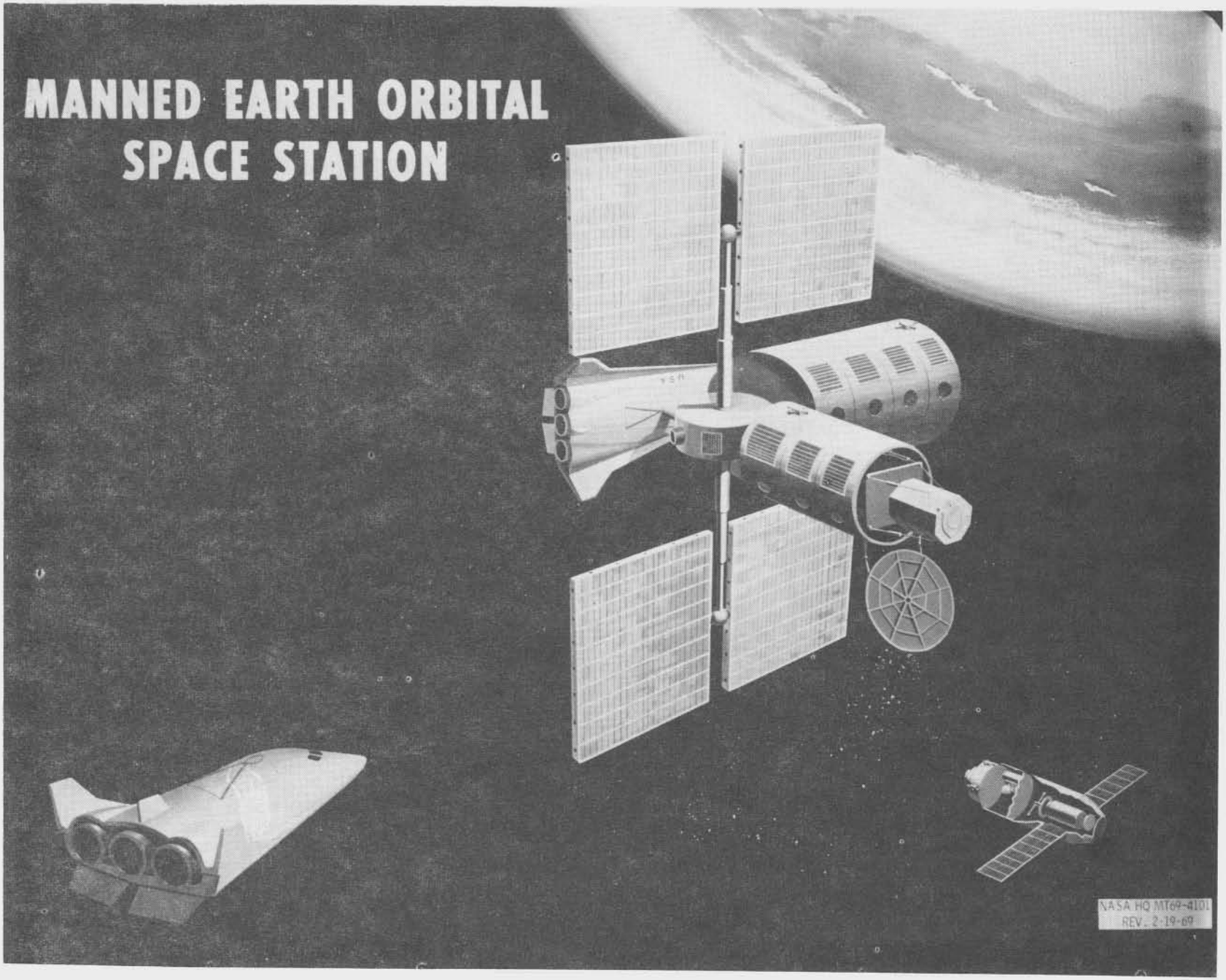
AAP LM-A MOCKUP

CREW WALK-THROUGH AT GAEC

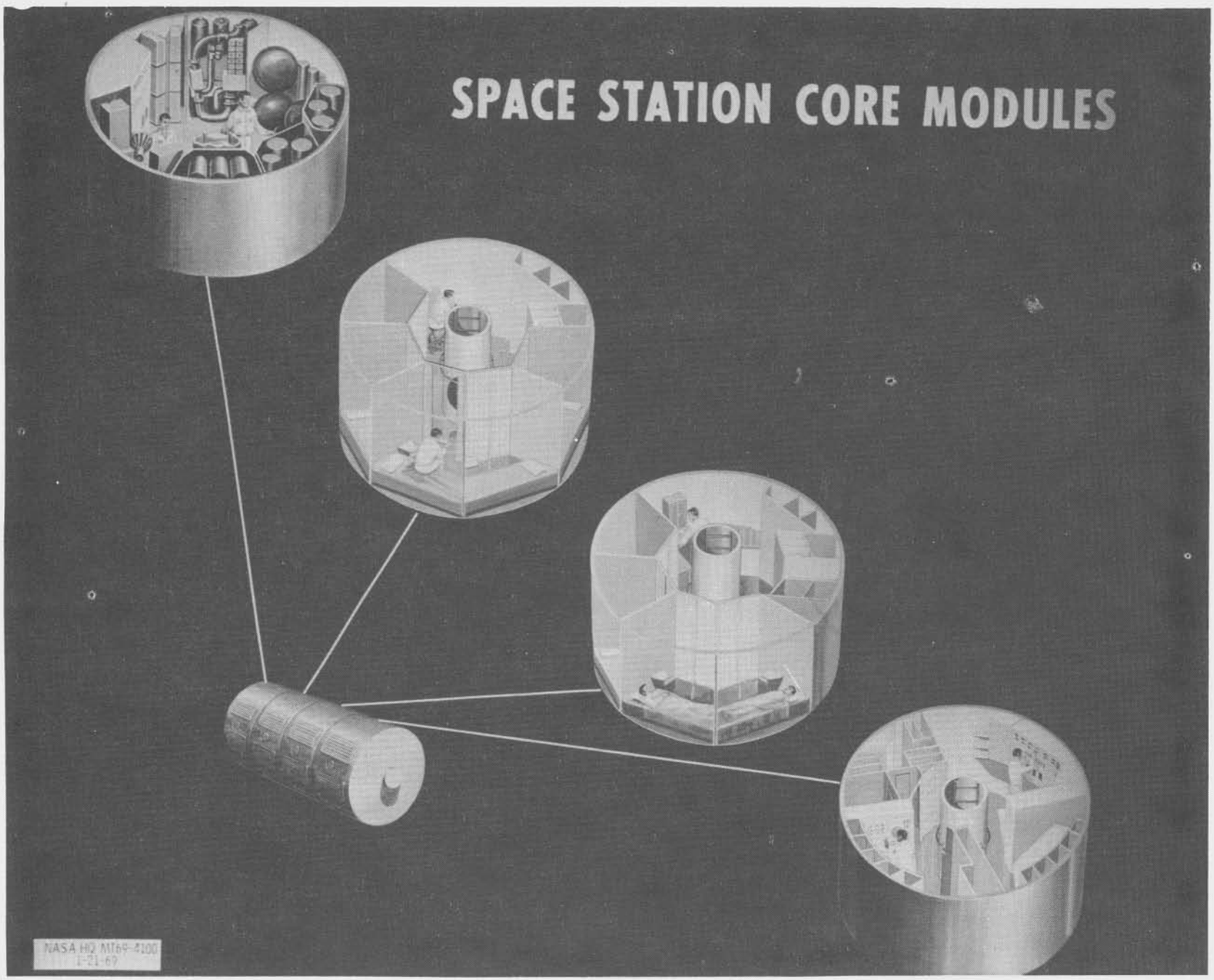
NASA HQ ML69-4345
2-12-69



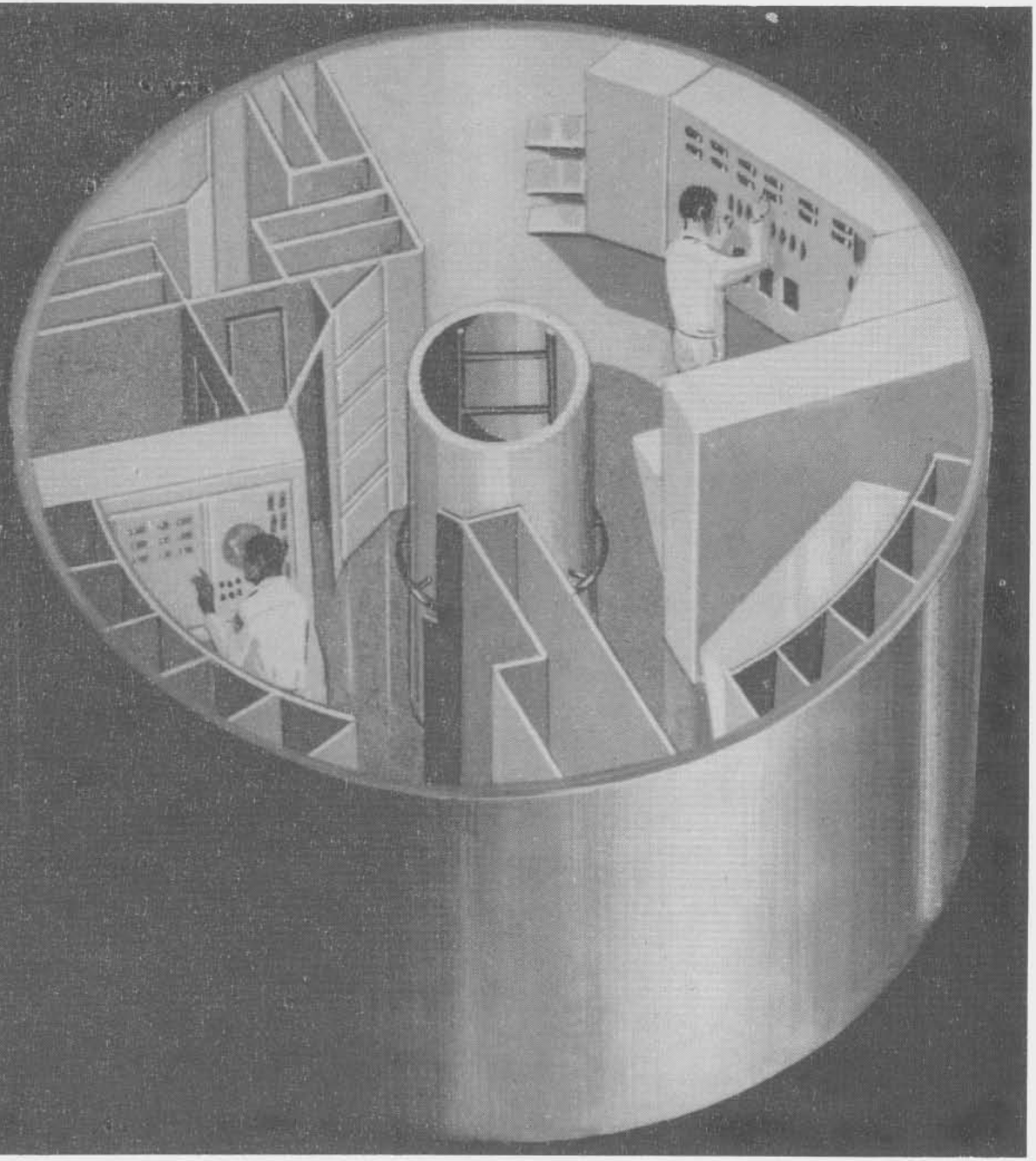
MANNED EARTH ORBITAL SPACE STATION



NASA HQ MT69-4101
REV. 2-19-69

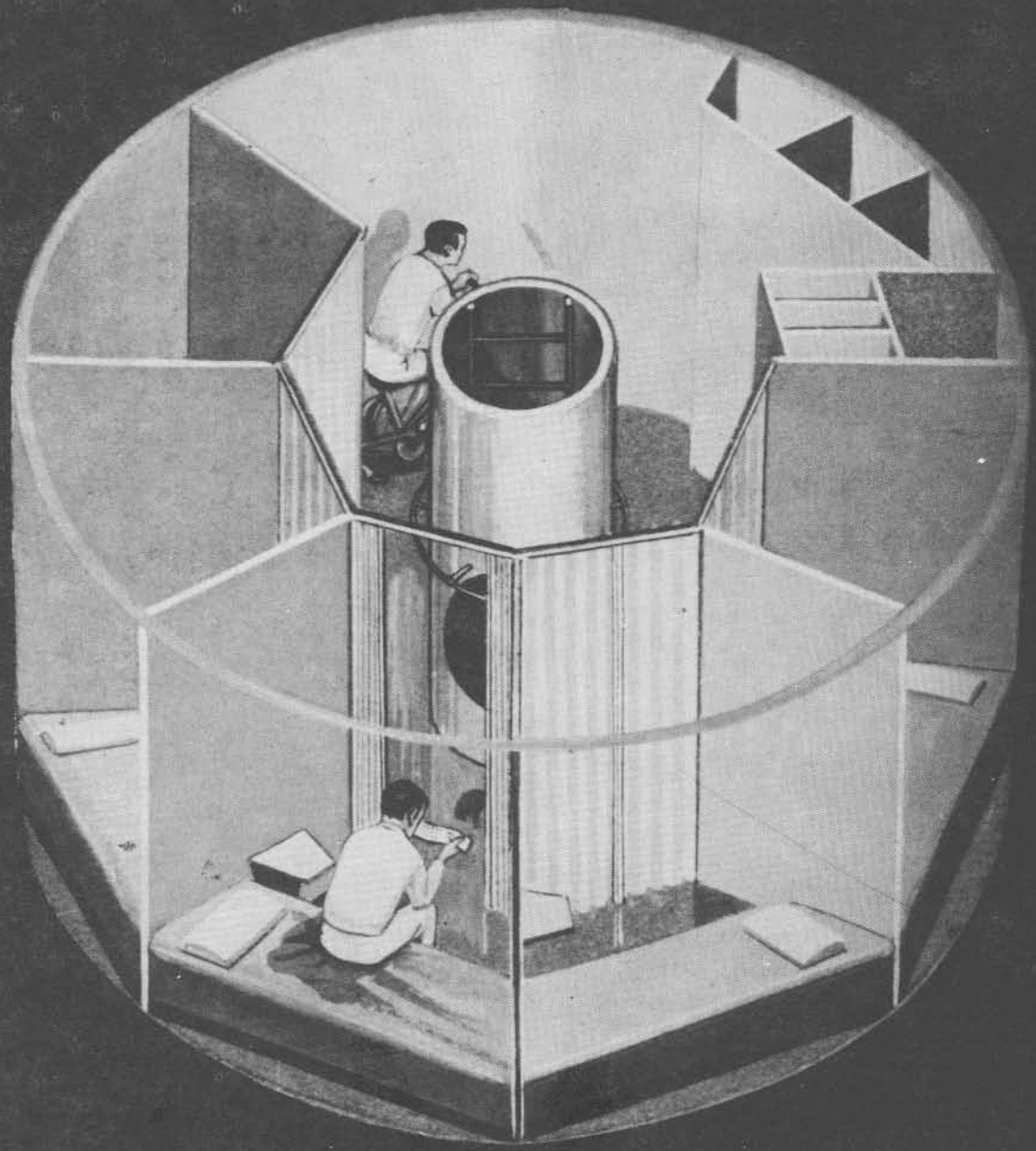

SPACE STATION CORE MODULES
NASA HQ M69-4100
1-21-69

COMMAND CONTROL DECK

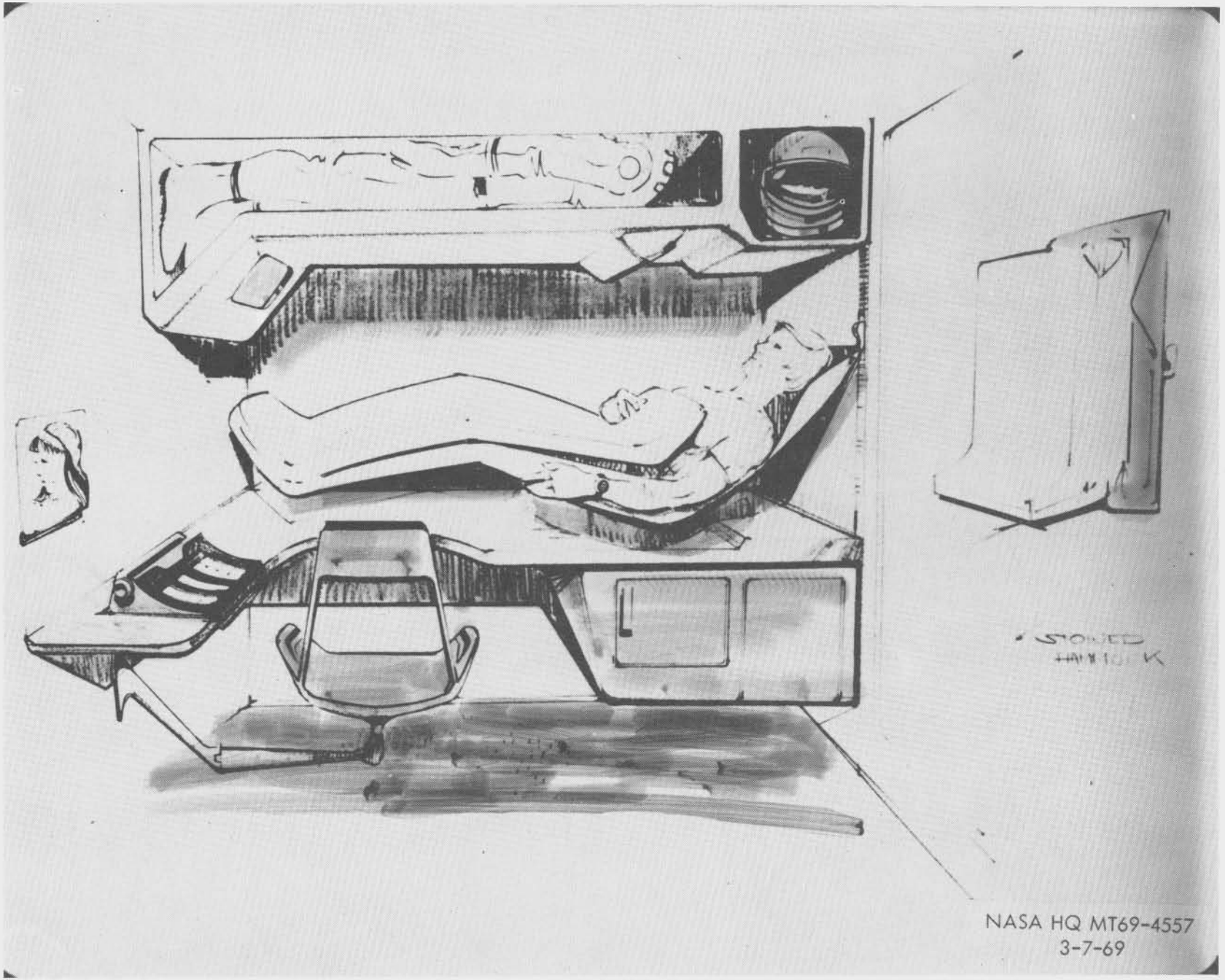


NASA HQ MT69-4556
3-6-69

CREW QUARTERS

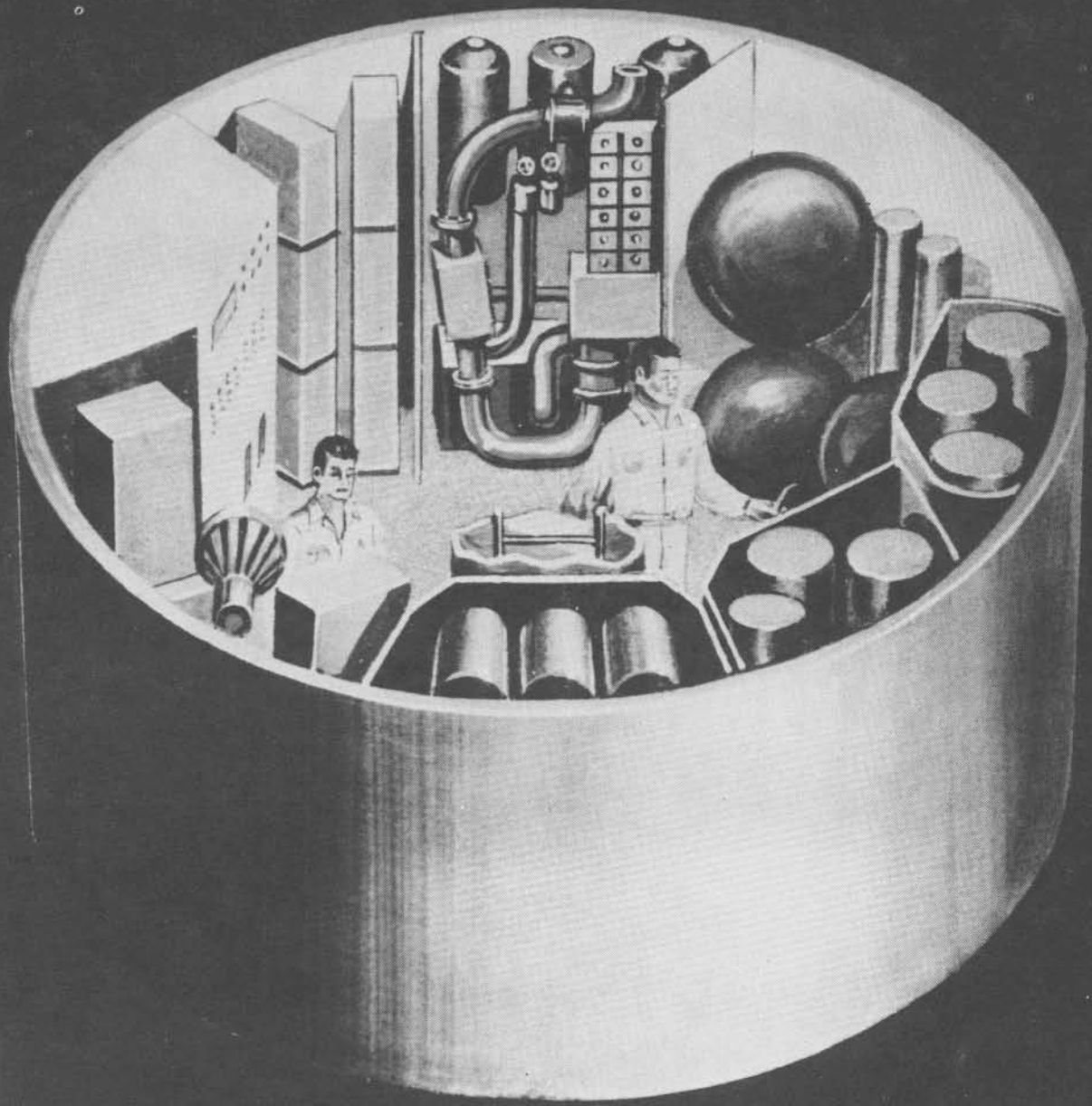


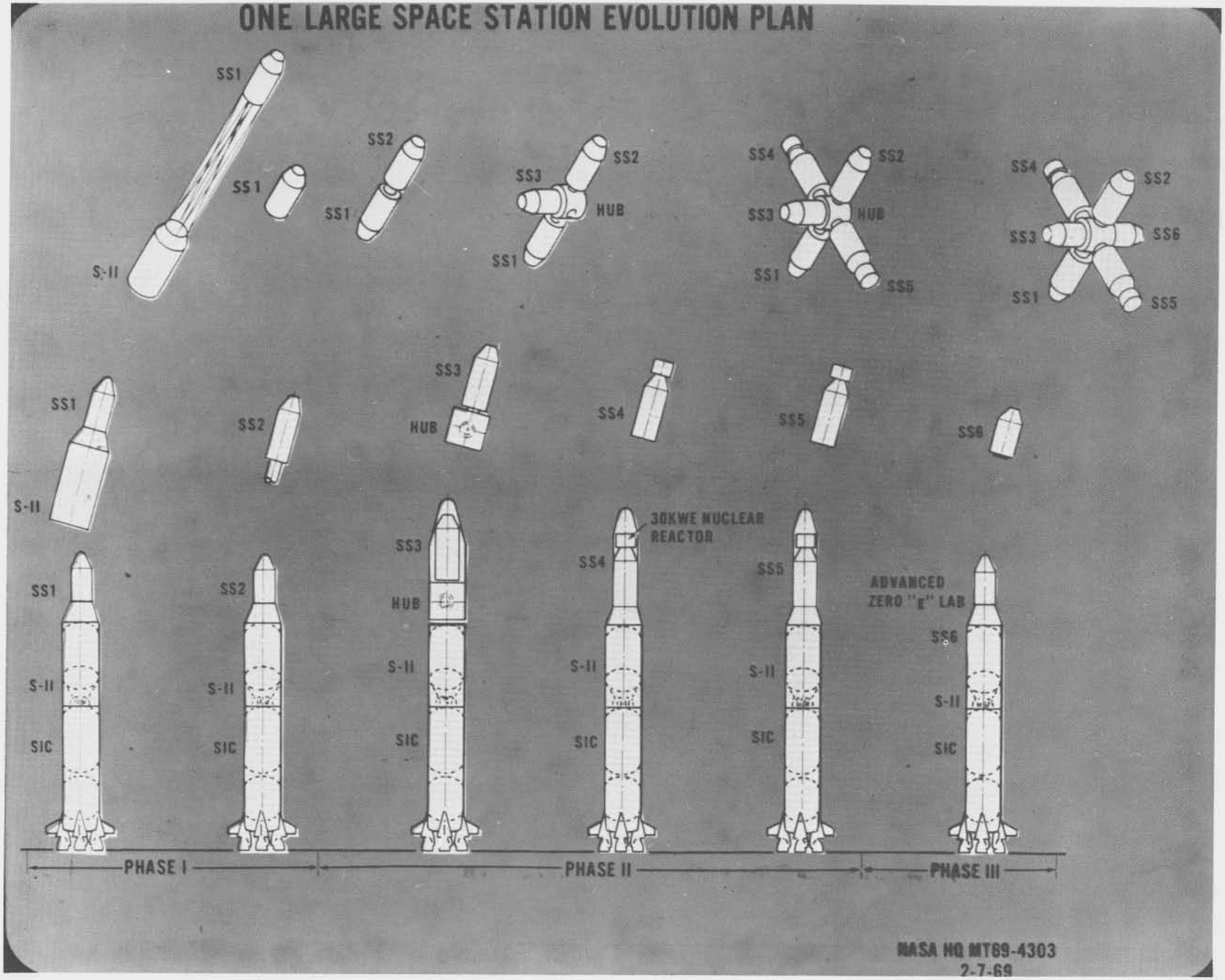
NASA HQ MT69-4555
3-6-69



NASA HQ MT69-4557
3-7-69

ENGINE ROOM

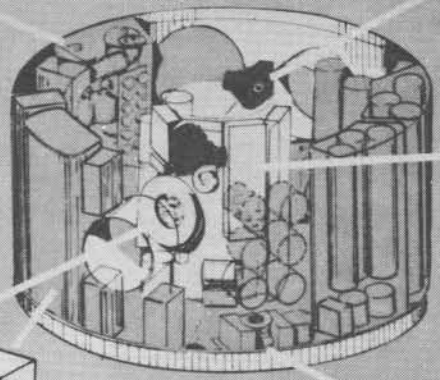



ONE LARGE SPACE STATION EVOLUTION PLAN
SS1
SS1
S-II
SS2
SS1
SS3
SS2
HUB
SS1
SS4
SS2
SS3
HUB
SS1
SS5
SS4
SS2
SS3
SS6
SS1
SS5
SS1
SS2
SS3
HUB
SS4
SS5
SS6
S-II
30KWE NUCLEAR REACTOR
ADVANCED ZERO "g" LAB
SS1
S-II
SIC
SS2
S-II
SIC
SS3
HUB
S-II
SIC
SS4
S-II
SIC
SS5
S-II
SIC
SS6
S-II
SIC
PHASE I
PHASE II
PHASE III
NASA HQ MT69-4303
2-7-69

MODULARITY

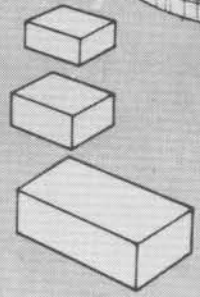
SUIT LOOP HUMIDITY CONTROL

CABIN HEAT EXCHANGE

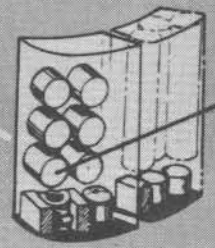


ELECTROLYSIS

CO_2 CONCENTRATOR
CO_2 REDUCTION



ELECTRICAL POWER

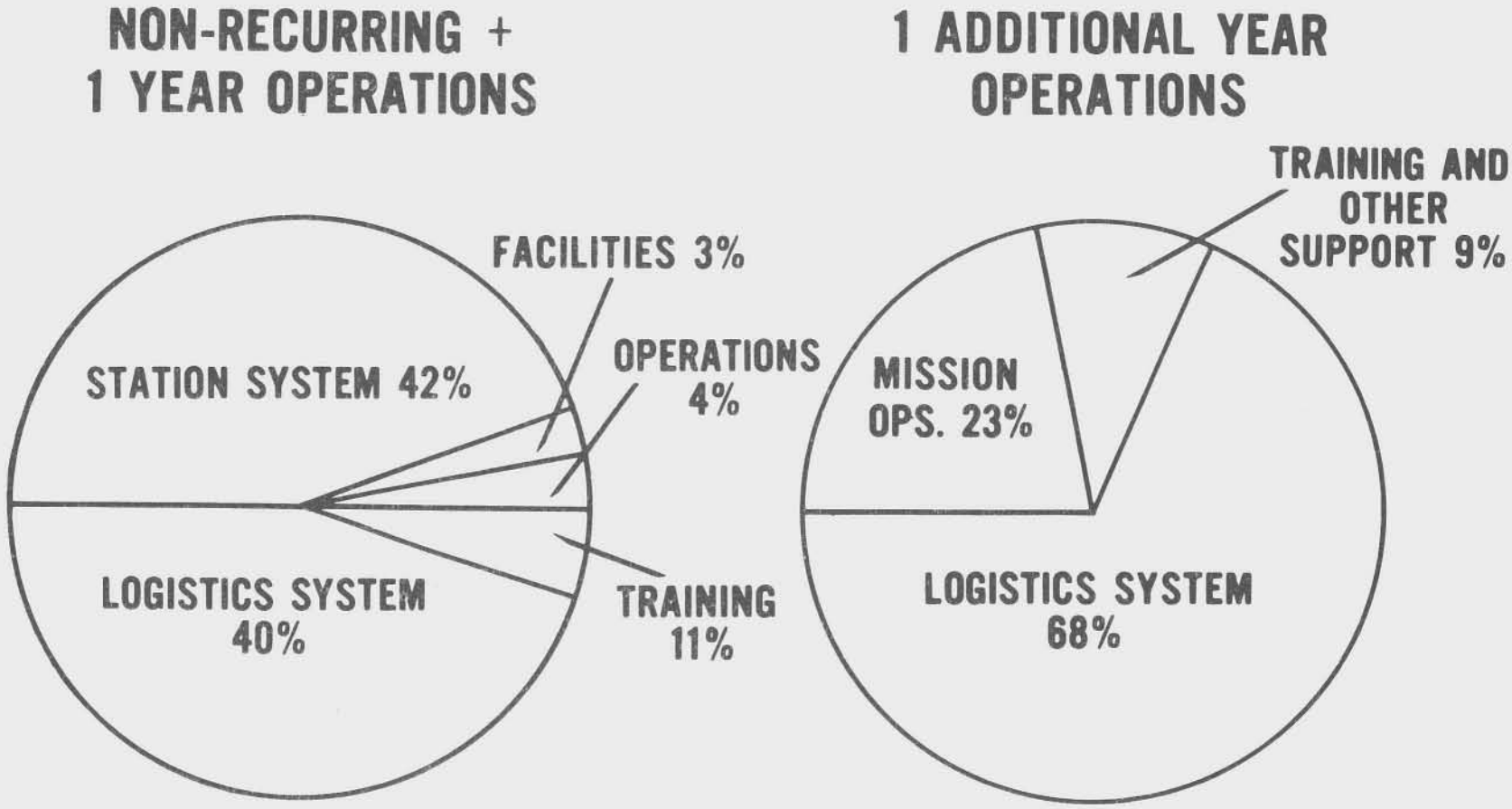


VAPOR COMPRESSOR

WATER & WASTE

NASA-MT69-4534

ECONOMIC SIGNIFICANCE OF LOGISTICS TO SPACE STATION PROGRAM



NASA HQ MT68-7234
11-21-68

PLANNING PERSPECTIVE FOR LOGISTIC SYSTEM

- MINIMUM NINE MAN CAPACITY FROM MISSION ANALYSIS AND REQUIREMENTS.
- CREW CONCEPT--ONE MAN CONTROL--PASSENGERS OF SPECIALIZED SKILLS IN SHIRT-SLEEVE ENVIRONMENT WITH LOW BOOST AND RE-ENTRY G LOAD.
- LAND LANDING--ALL WEATHER, HIGH RELIABILITY FOR SAFETY AND REUSABILITY.
- CREW AND CARGO TRANSFER WITHOUT EVA--LARGE PRESSURIZED CARGO VOLUME WITH MINIMUM DISCRETIONARY CARGO CAPABILITY OF 15,000 LBS. PER FLIGHT.
- MINIMUM RETURN CARGO CAPABILITY OF 2,000 LBS. PER FLIGHT BASED ON EXPERIMENT PROGRAM FILM AND TAPE OUTPUT.
- LOW TO MEDIUM HYPERSONIC L/D DEPENDENT ON RE-ENTRY AND TERMINAL LANDING OPERATIONS AND OVERALL SYSTEM CONFIGURATION TRADES.
- INTEGRAL LAUNCH AND ON-ORBIT G & N FUNCTIONS AND SYSTEMS TO MAXIMIZE SYSTEMS REUSE.
- ON-BOARD CHECKOUT SYSTEM/MINIMIZE GROUND SUPPORT OPERATIONS.
- AUTONOMOUS FLIGHT SYSTEM OPERATIONS--CREW-IN-COMMAND/CONTROL LOOP.
- INTEGRAL CARGO/PROPULSION MODULE WITH LARGE PERFORMANCE MARGIN FOR PROGRAM CONTINGENCY.
- EXPERIMENT MODULES COMPATIBLE WITH CARGO/PROPULSION MODULE FOR EITHER INTERNAL STOWAGE OR SPACE TUG OPERATIONS.

NASA HQ MT68-7243
11-22-68

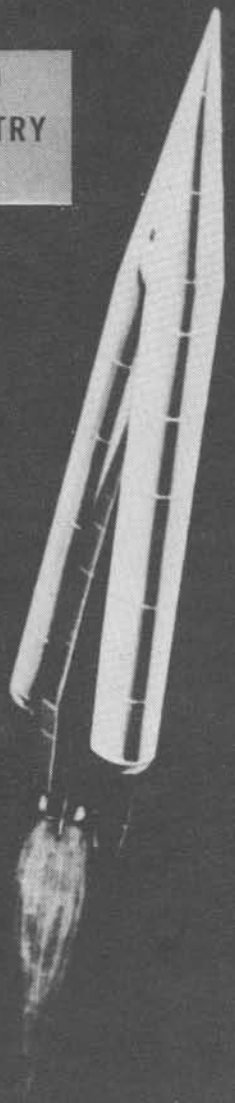
OPERATIONAL CHARACTERISTICS OF THE SPACE SHUTTLE

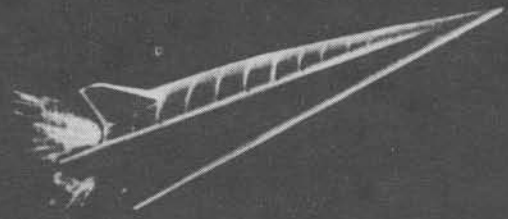
1. TAKE-OFF AND LAND FROM AIR BASES OR MAJOR AIRPORTS
2. REFUEL WITH ORDINARY CRYOGENIC FUELS
3. SELF CONTAINED ON BOARD CHECKOUT
4. CONTINENTAL AND/OR INTERCONTINENTAL TRAFFIC CONTROL
5. STANDARDIZED GROUND SUPPORT EQUIPMENT
6. ALL WEATHER OPERATION
7. PASSENGER SAFETY AND COMFORT COMPARABLE TO LARGE TRANSPORT AIRCRAFT
8. STANDARDIZED EQUIPMENT AND PROCESSES FOR REFURBISHMENT
9. PROGRESSIVE MAINTENANCE
10. WILL CARRY 25,000 TO 50,000 LBS PAYLOAD AT A COST APPROACHING $5 PER POUND

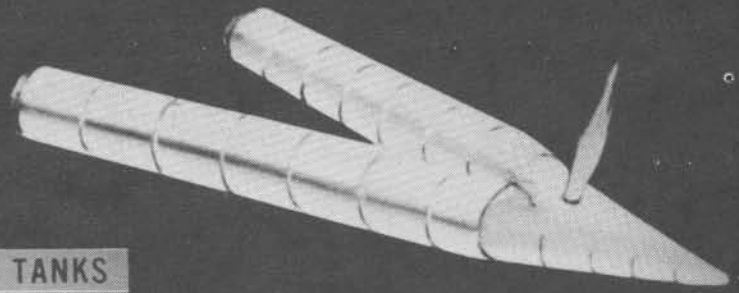
NASA HQ MC68-6674

INTEGRAL LAUNCH AND REENTRY VEHICLE

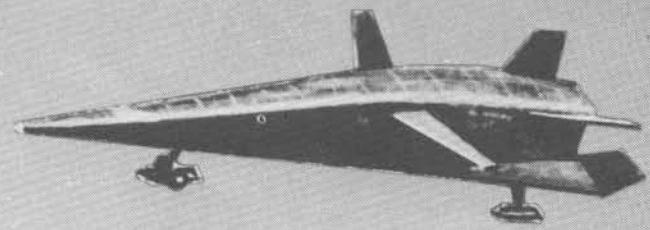
INTEGRATED LAUNCH/REENTRY VEHICLE







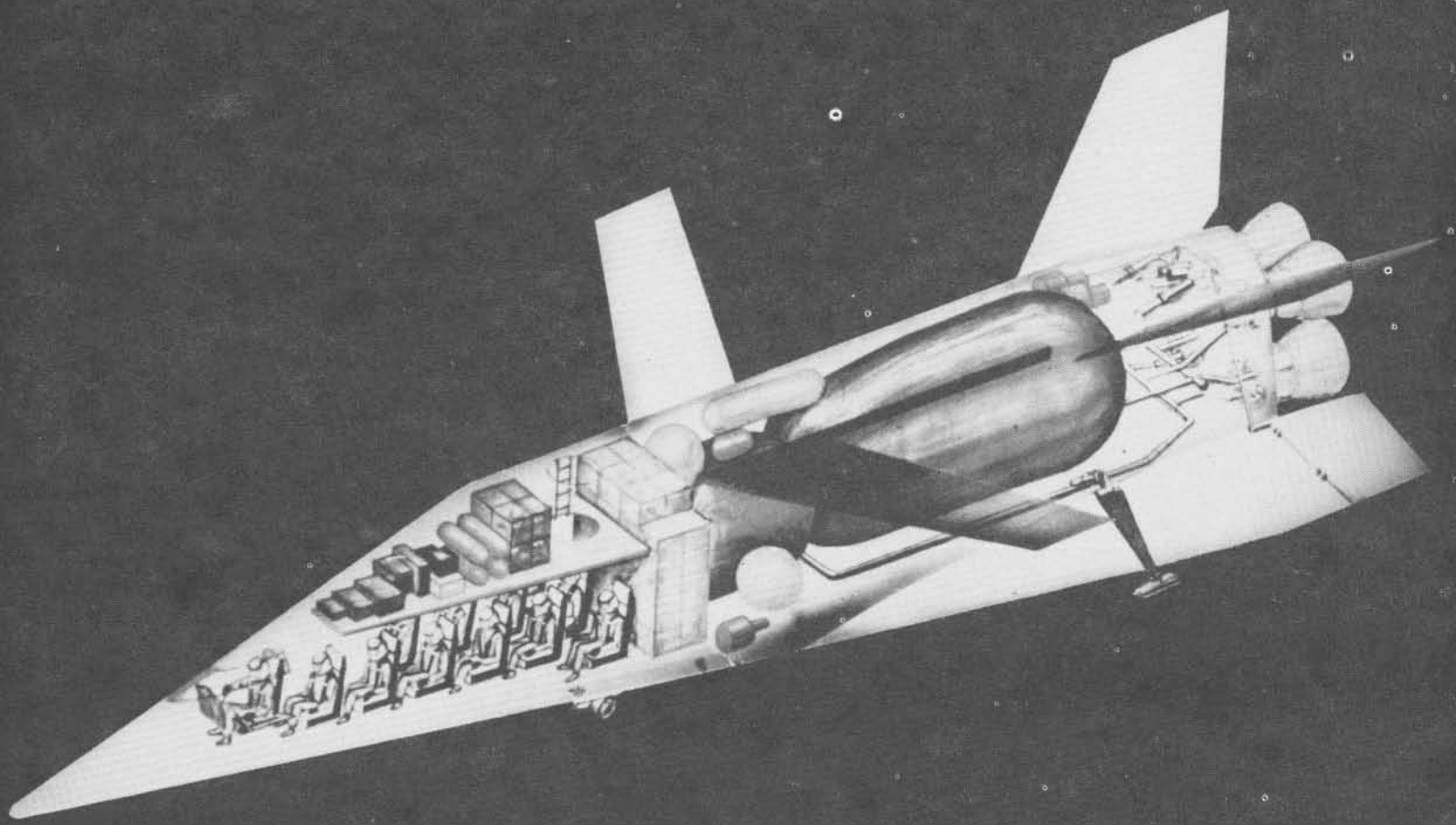
EXPENDABLE TANKS



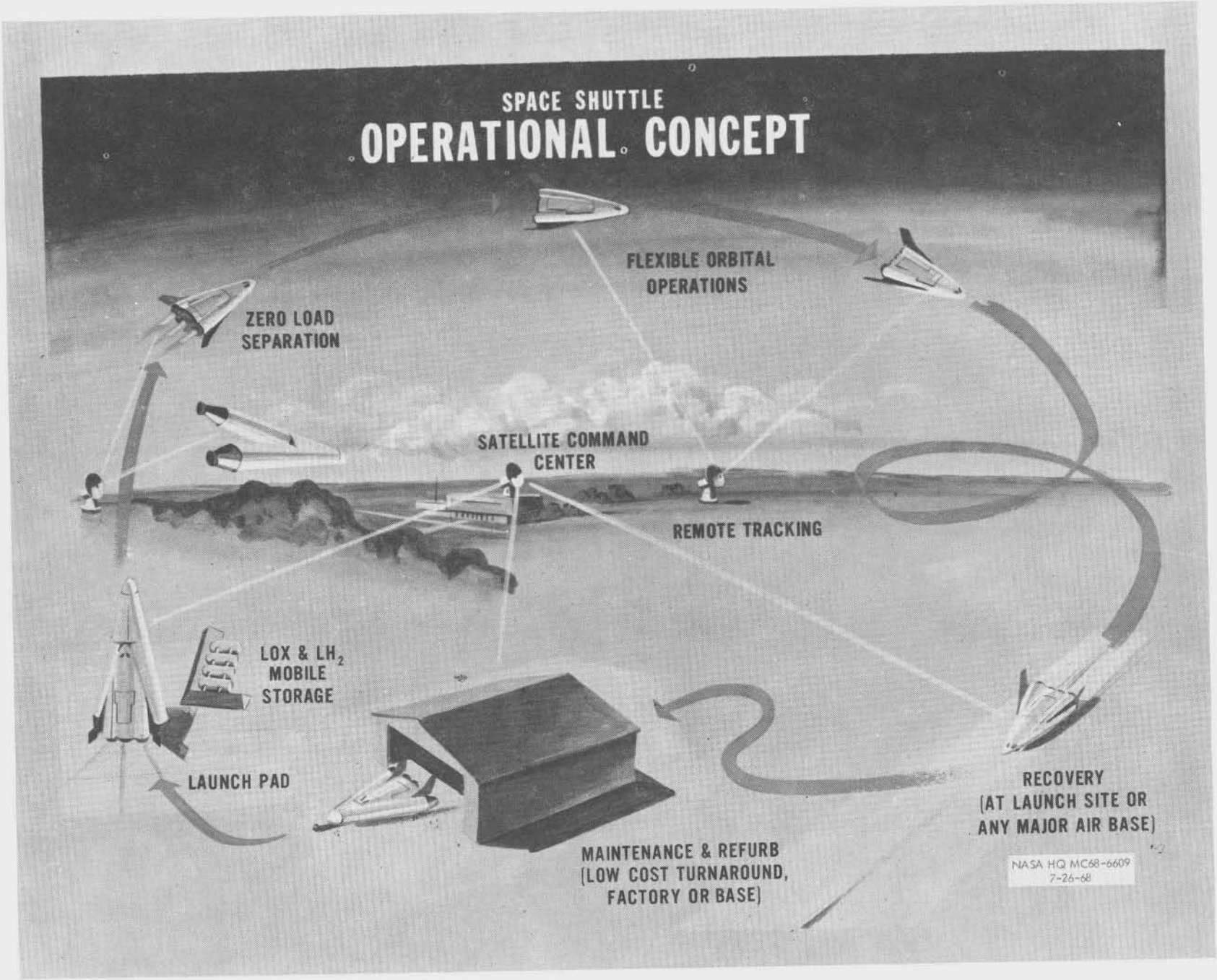
REUSABLE VEHICLE

NASA HQ MT69-4376
2-24-69

SPACE SHUTTLE REUSABLE VEHICLE

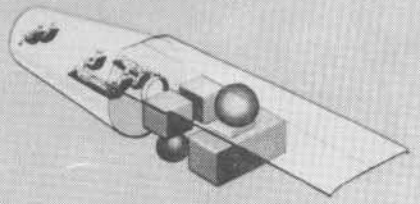


NASA HQ MT69-4375
2-24-69


SPACE SHUTTLE
OPERATIONAL CONCEPT
FLEXIBLE ORBITAL OPERATIONS
ZERO LOAD SEPARATION
SATELLITE COMMAND CENTER
REMOTE TRACKING
LOX & LH2 MOBILE STORAGE
LAUNCH PAD
MAINTENANCE & REFURB (LOW COST TURNAROUND, FACTORY OR BASE)
RECOVERY (AT LAUNCH SITE OR ANY MAJOR AIR BASE)
NASA HQ MC68-6609
7-26-68

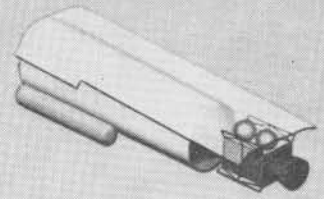
SPACE SHUTTLE

PAYLOAD A



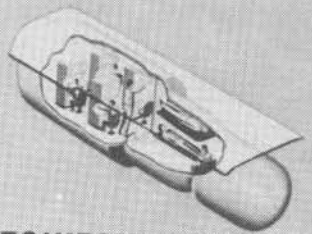
CARGO 7,260
PERSONNEL (7) 1,260

PAYLOAD B



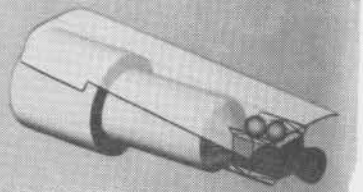
CARGO 19,900

PAYLOAD C



EQUIPMENT 11,760
PERSONNEL (7) 1,260

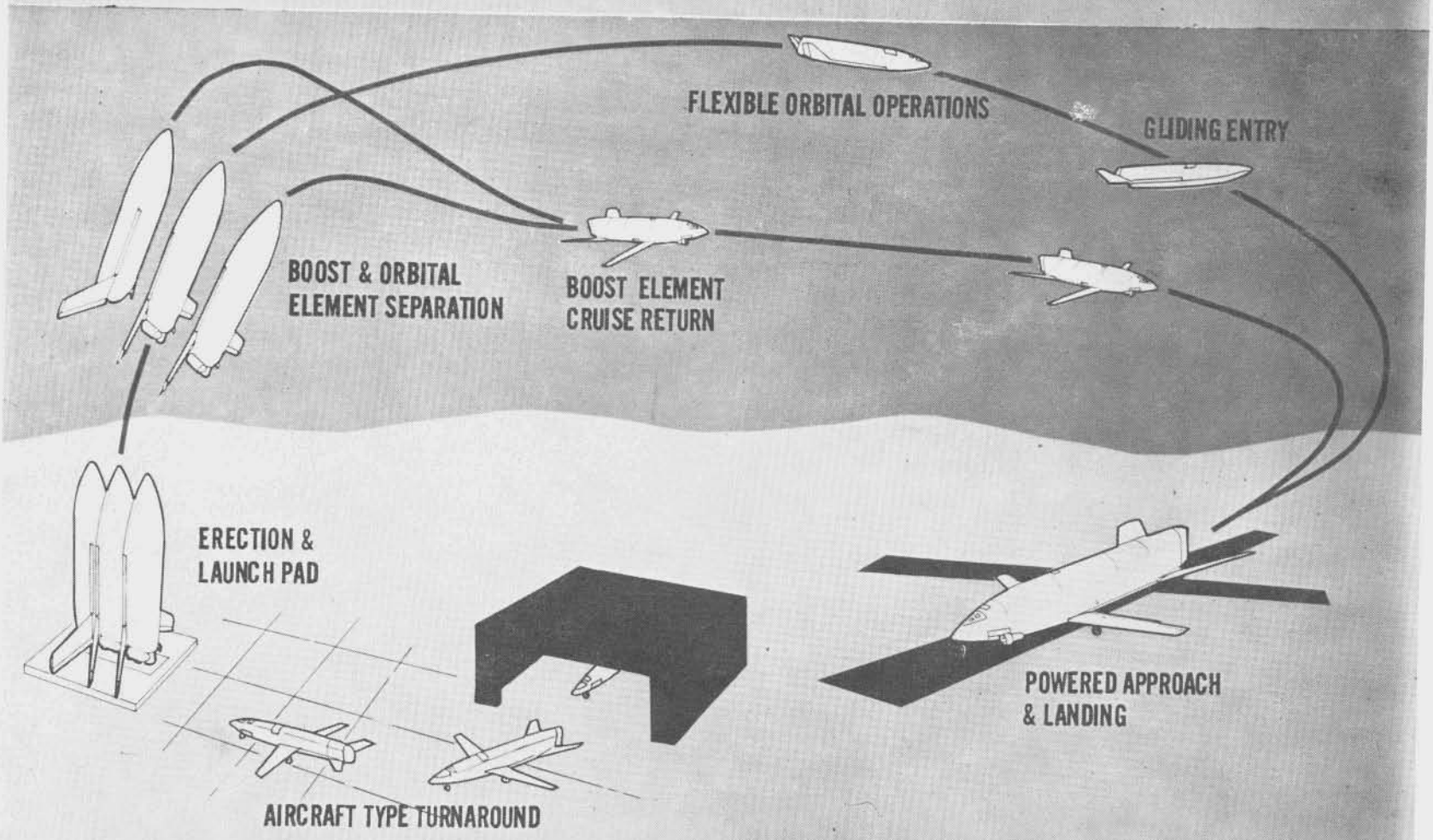
PAYLOAD D



CARGO 22,000

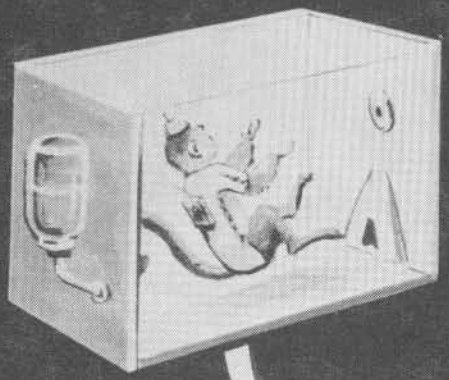
- TOTAL WEIGHT _____ 719,400
  PROPELLANT WT ____ 589,800
  DROP TANK WT _____ 28,600
- SPACECRAFT
  INERT WT _____ 40,000 (44,000)
  PROPELLANT WT ____ 50,000

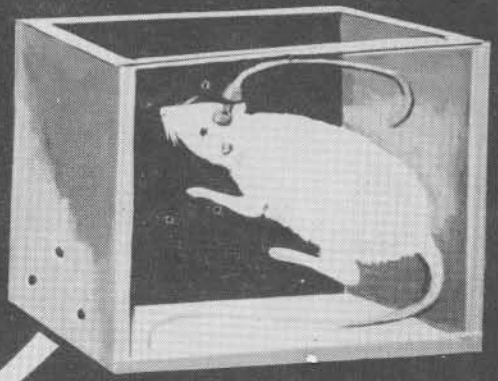
TRIAMESE OPERATIONAL APPROACH

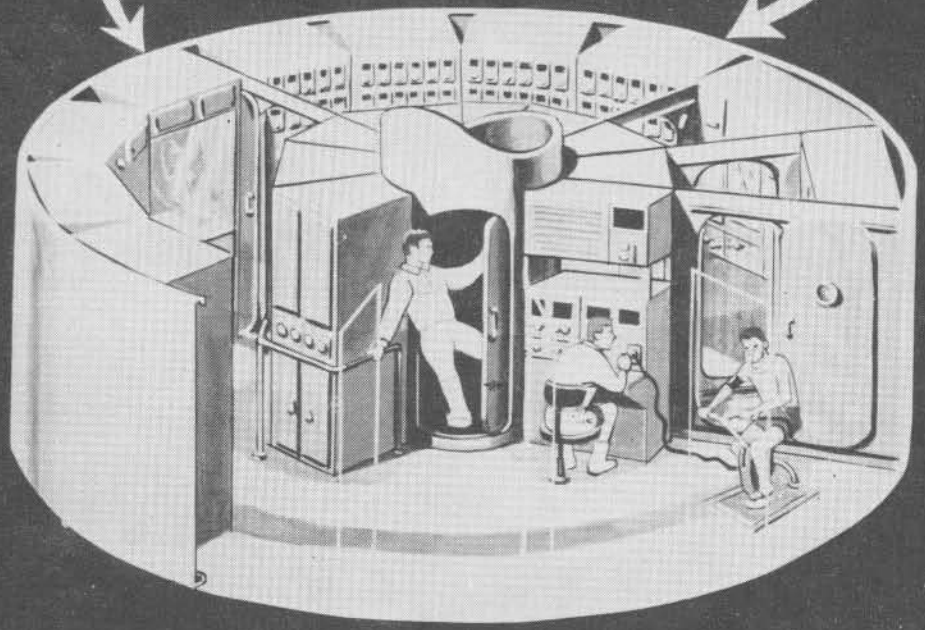


NASA HQ MT69—4551
3/7/69

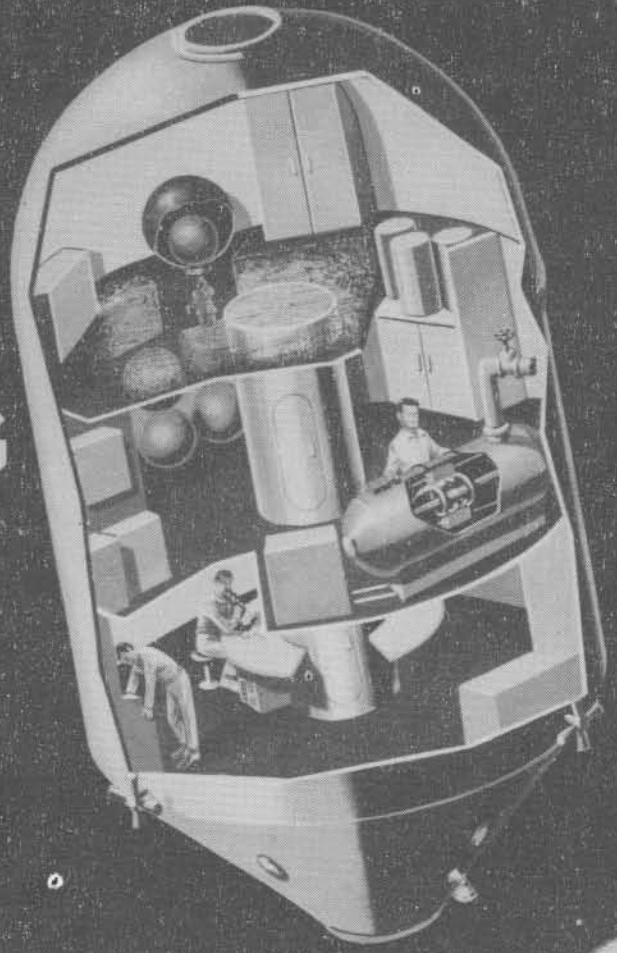
BIOLOGY LABORATORY



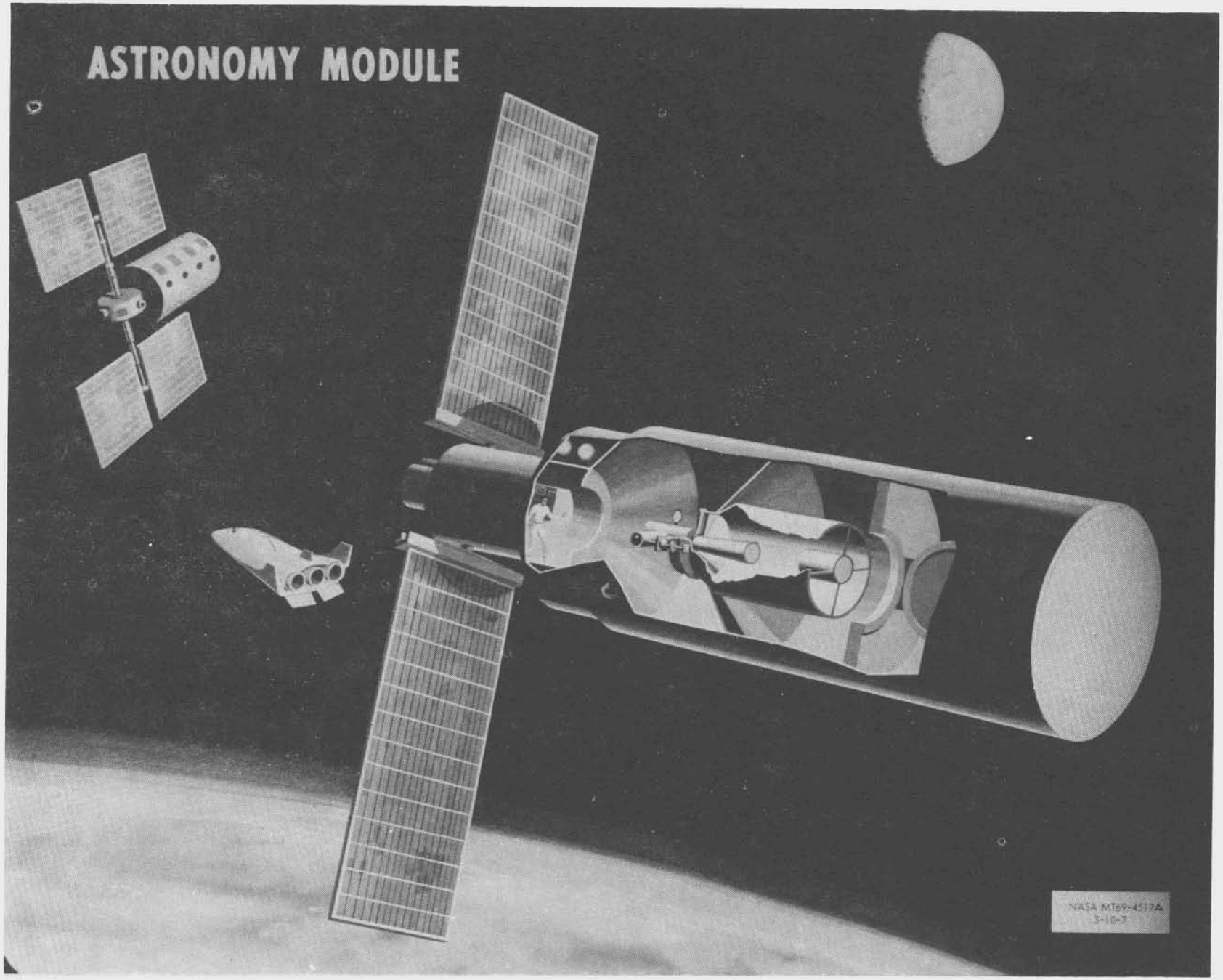




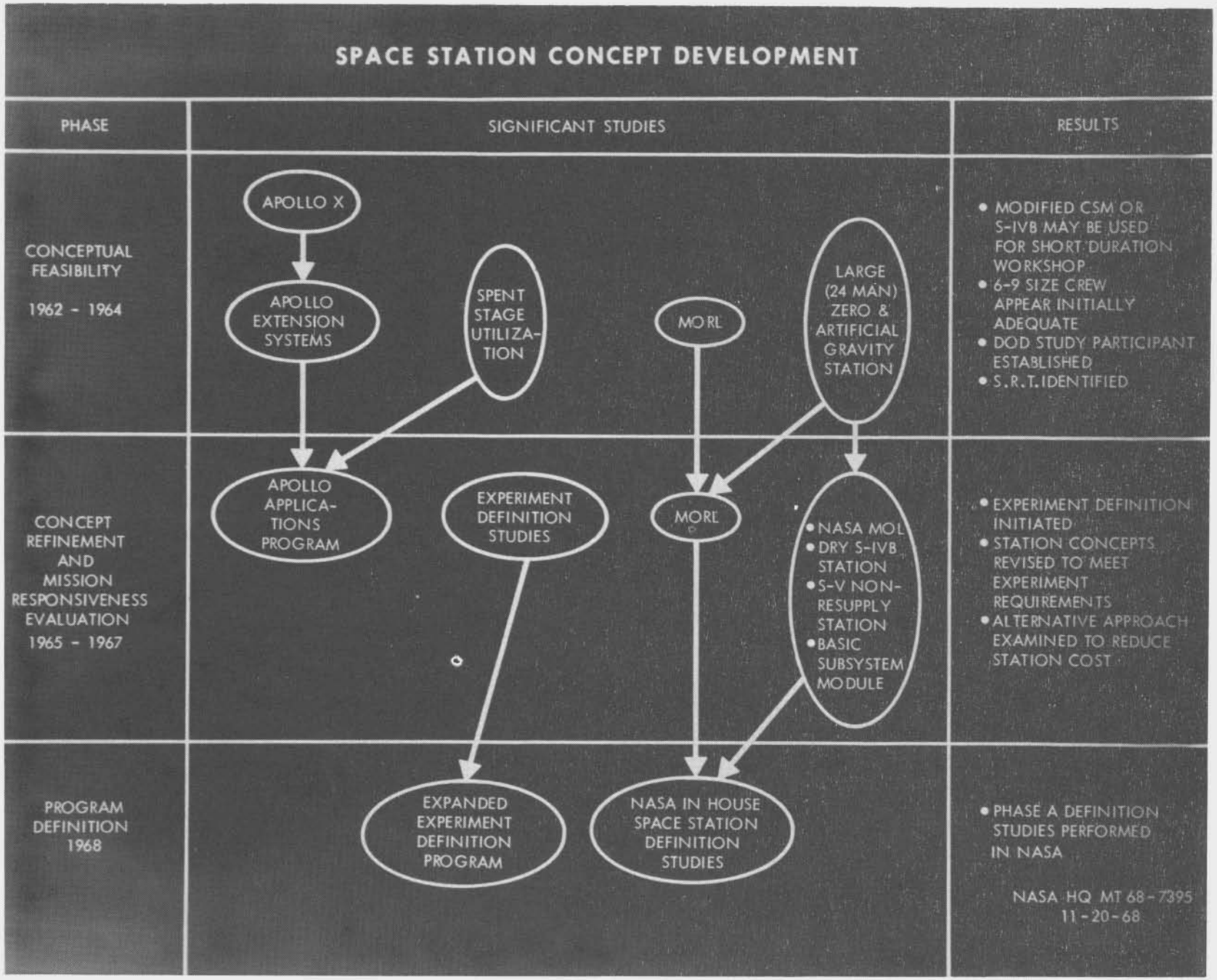
SPACE MANUFACTURING MODULE



NASA HQ MT 69-4519
3-11-69


ASTRONOMY MODULE
NASA M69-4517A
3-10-7

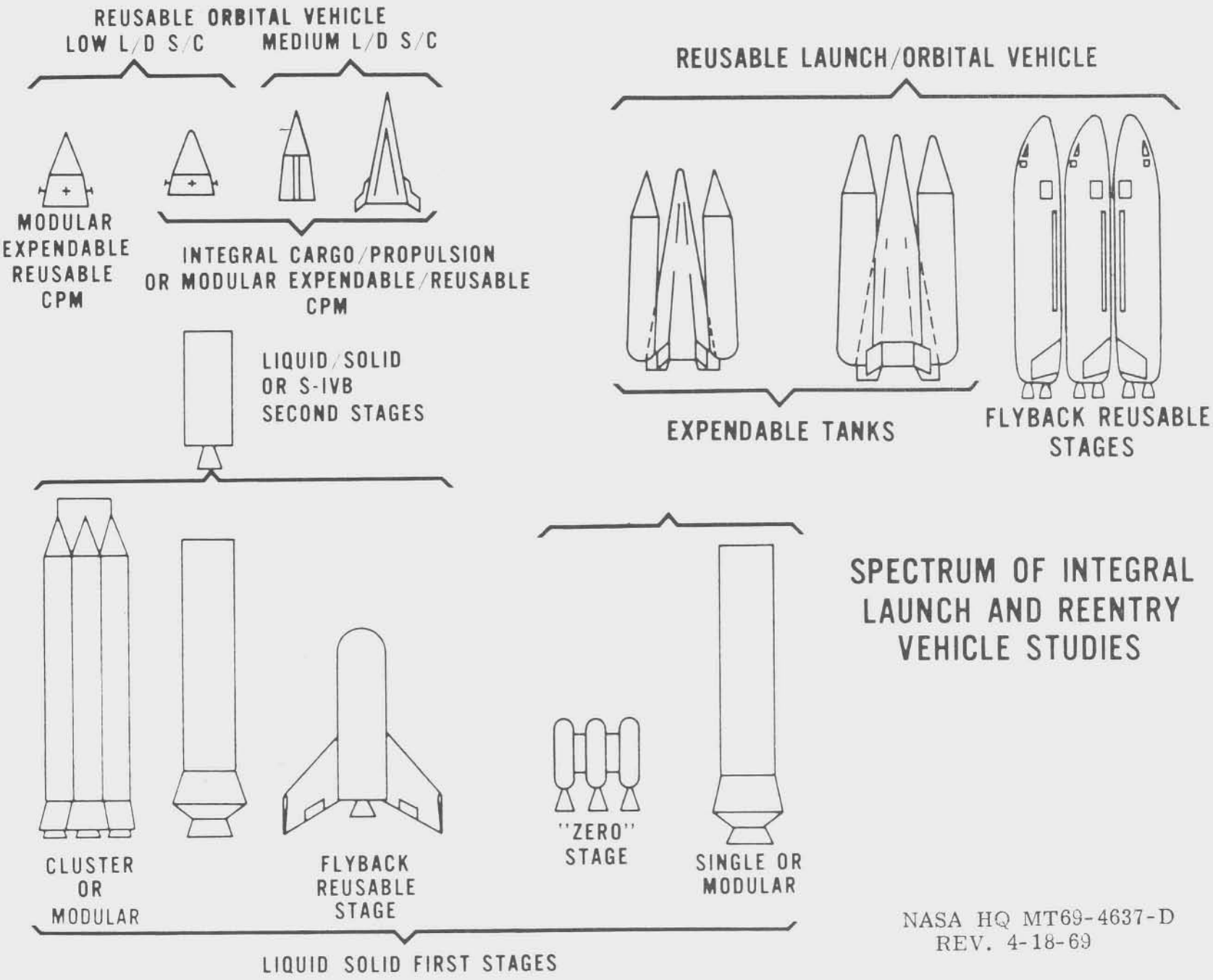
SPACE STATION CONCEPT DEVELOPMENT



MAJOR NASA IN HOUSE SPACE STATION STUDIES

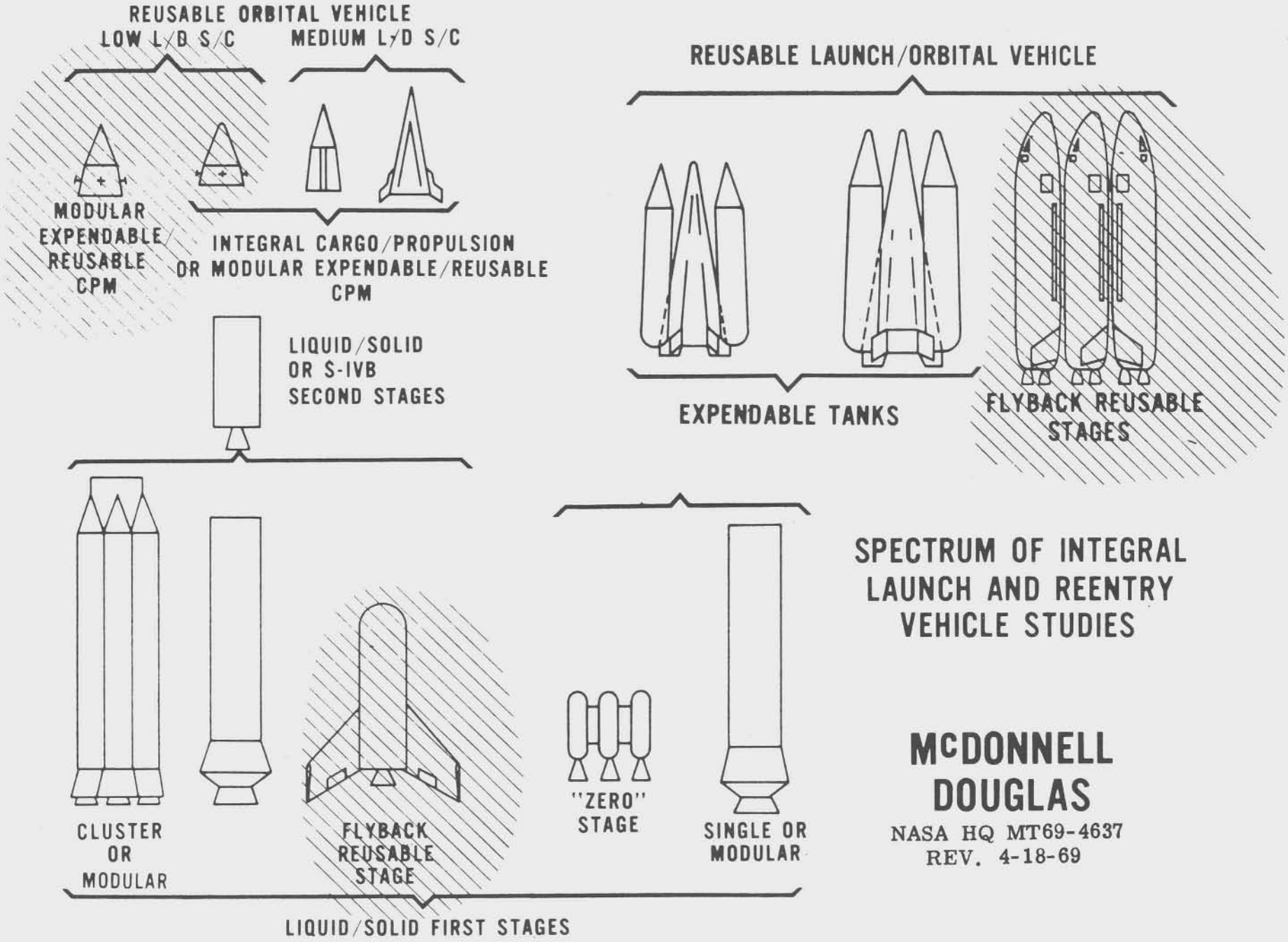
PERIOD	STUDY ACTIVITY	RESULTS
1962-1963	LaRC SPACE STATION SYMPOSIUM ↔ HDQ SPACE STATION STUDY	• FUNDED SPACE STATION STU. PROGRAM STARTED • TECHNOLOGY DEVELOPMENT PROGRAMS INITIATED
1964, 1965	AES (AAP)/ MOL (HDQ)	• COMPREHENSIVE EXPERIMENT CATALOG DEVELOPED • DOD PARTICIPATION
1966, 1967	EARTH ORBITING SPACE STATION REQUIREMENTS NASA-WIDE | CONFIGURATIONS MSC - MSFC	• NASA-WIDE REQUIREMENTS IDENTIFIED • 9 MAN ZERO AND ARTIFICIAL GRAVITY CONCEPTS DEVELOPED • CRITICAL TECHNOLOGY IDENTIFIED • LARGE, INTEGRATED STATIONS PROGRAMATICALLY CUMBERSOME- MORE FLEXIBLE CONCEPT REQUIRED
1968	SATURN V WORK SHOP STUDY MSC, MSFC, KSC INTERMEDIATE ORBITAL WORKSHOP STUDY • SPACE STATION PROGRAM MEMO. • PHASE A ANALYTIC REPORT • PROGRAM PLAN • PHASE B WORK STATEMENTS	• 9 MAN, MODULAR STATION CONCEPT DEVELOPED BY MSC & MSFC • 9 MAN INTEGRAL STATION CONCEPT DEVELOPED BY LaRC • MODULAR GROWTH SYSTEM MEETS AGENCIES NEEDS • DOD PARTICIPATION

NASA HQ MT68-7398
REV. 2-17-69



SPECTRUM OF INTEGRAL LAUNCH AND REENTRY VEHICLE STUDIES

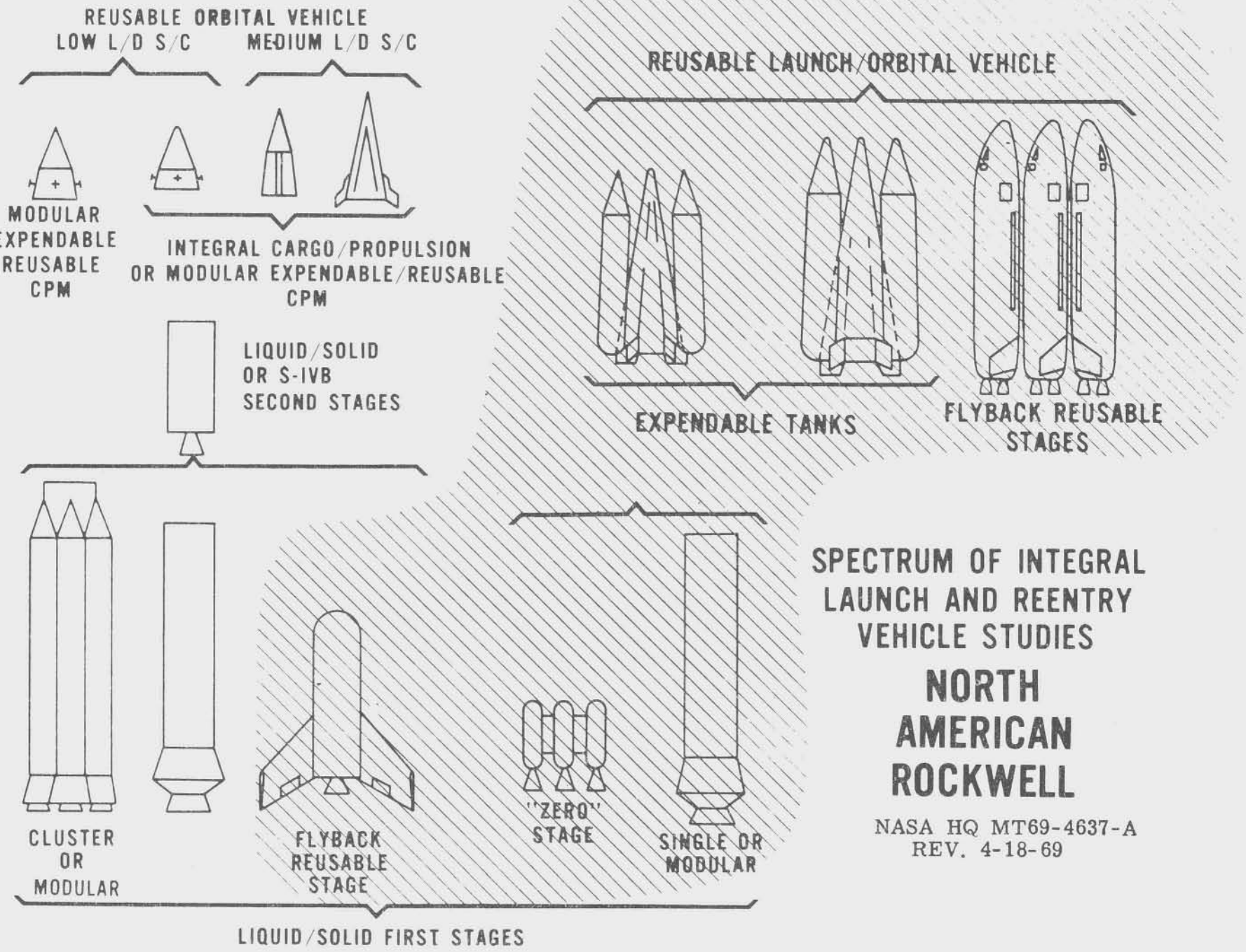
NASA HQ MT69-4637-D
REV. 4-18-69



SPECTRUM OF INTEGRAL LAUNCH AND REENTRY VEHICLE STUDIES

McDONNELL DOUGLAS

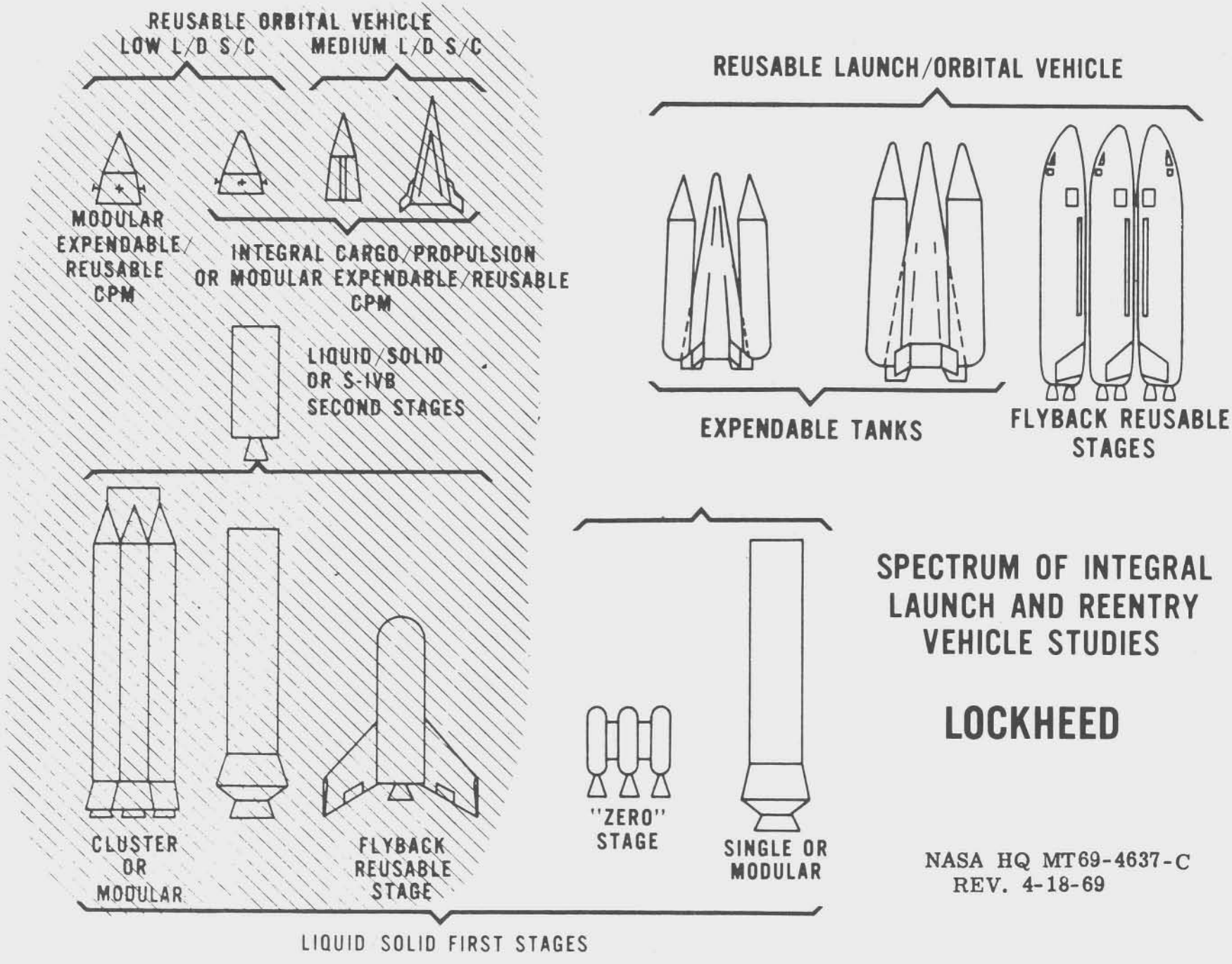
NASA HQ MT69-4637
REV. 4-18-69



SPECTRUM OF INTEGRAL LAUNCH AND REENTRY VEHICLE STUDIES

NORTH AMERICAN ROCKWELL

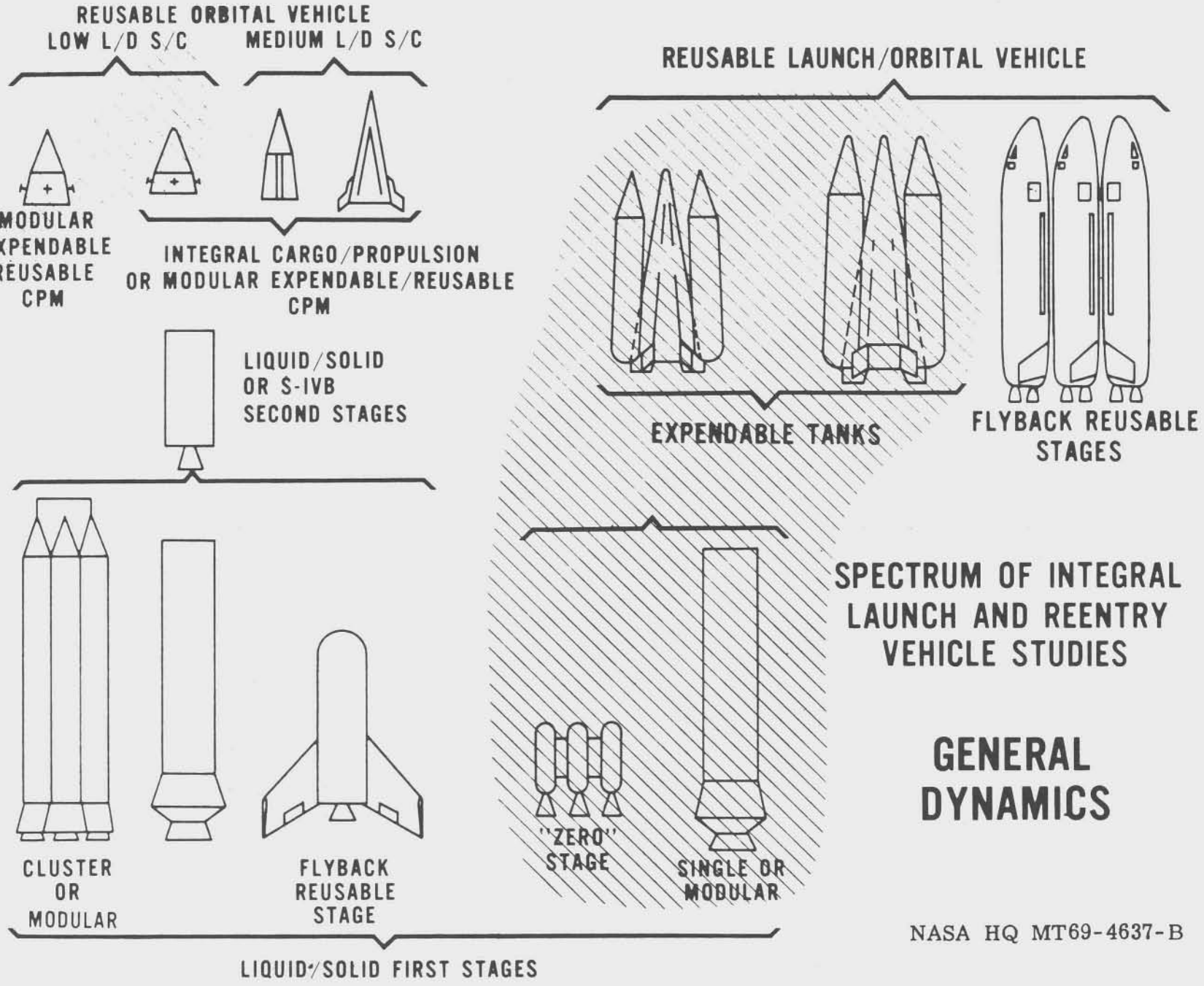
NASA HQ MT69-4637-A
REV. 4-18-69



SPECTRUM OF INTEGRAL LAUNCH AND REENTRY VEHICLE STUDIES

LOCKHEED

NASA HQ MT69-4637-C
REV. 4-18-69



SPECTRUM OF INTEGRAL LAUNCH AND REENTRY VEHICLE STUDIES

GENERAL DYNAMICS

NASA HQ MT69-4637-B

MANNED SPACE FLIGHT

FY 1970 AUTHORIZATION REQUEST

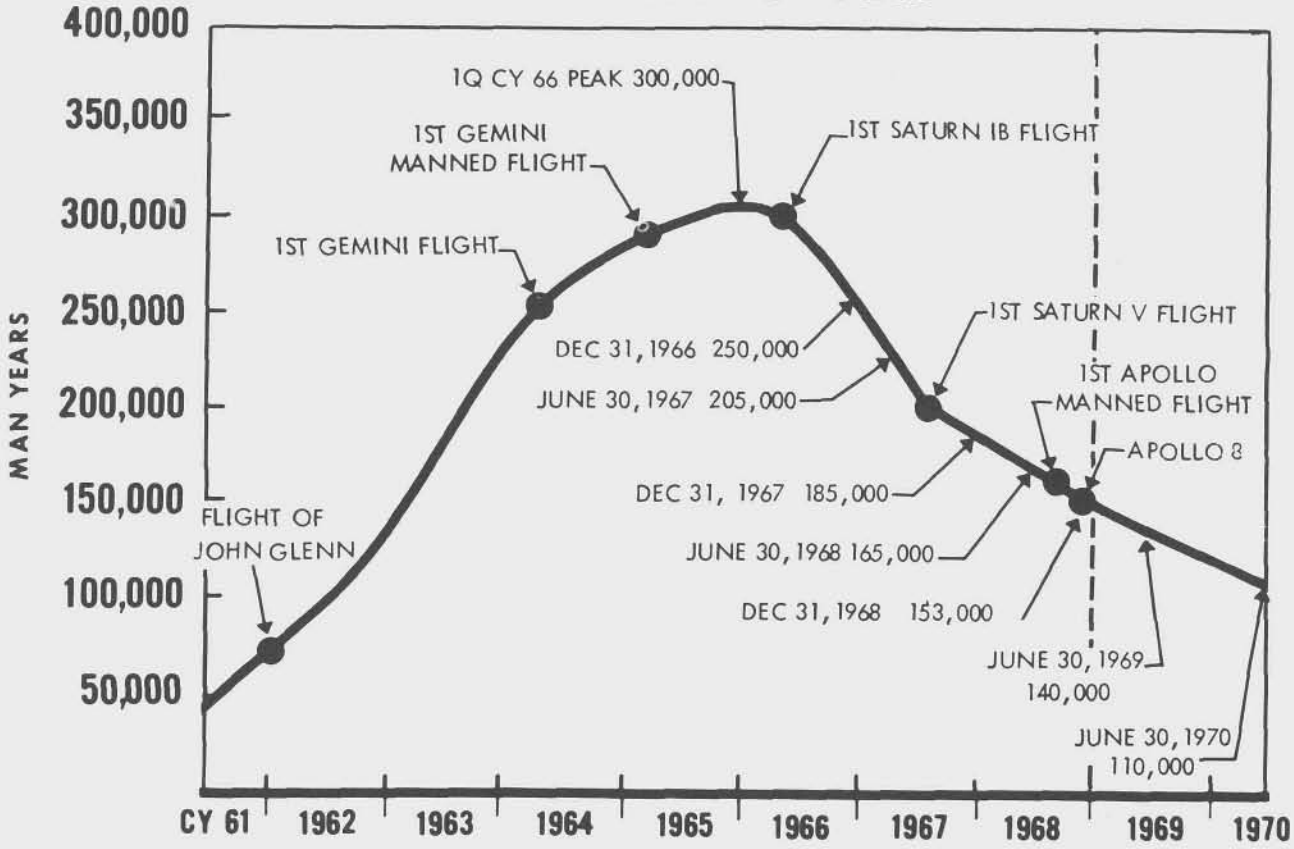
(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	REQUEST FY 1970 AMENDED
RESEARCH & DEVELOPMENT	$2809.2	$2177.5	$1919.2
APOLLO	2556.0	2025.0	1691.1
SPACE FLIGHT OPERATIONS	253.2	150.0	225.6
ADVANCED MISSIONS	-0-	2.5	2.5
CONSTRUCTION OF FACILITIES	$21.3	$10.4	$14.2
RESEARCH & PROGRAM MANAGEMENT	$315.1	$312.0	$307.5
TOTAL	$3145.7	$2499.9	2240.9

NASA HQ MP69-4380
4-16-69

MANNED SPACE FLIGHT

MANPOWER



	JUNE 1966	JUNE 1967	JUNE 1968	DEC 1968	JUNE 1969	JUNE 1970
R&D	222,000	172,000	140,000	130,000	118,500	89,000
C of F	30,000	11,000	5,000	3,000	2,000	2,000
AO & CIVIL SERVICE	22,000	22,000	20,000	20,000	19,500	19,000
TOTAL	274,000	205.000	165,000	153,000	140,000	110,000

NASA HQ MC69-4410
2-19-69

MANNED SPACE FLIGHT

APOLLO

FY 1970 BUDGET ESTIMATES

(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	AMENDED FY 1970 PLAN
APOLLO	$2556.0	$2025.0	$1691.1
SPACECRAFT	1034.7	902.8	653.8
SATURN V	854.0	534.5	496.7
LUNAR EXPLORATION	-0-	-0-	90.0
OPERATIONS	545.8	546.4	450.6
SATURN IB	101.1	41.3	-0-
ENGINE DEVELOPMENT	20.5	-0-	-0-

NASA HQ MP69-4047
4-16-69

MANNED SPACE FLIGHT

SPACE FLIGHT OPERATIONS

FY 1970 BUDGET ESTIMATES

(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	AMENDED FY 1970 REQUEST
APOLLO APPLICATIONS	$253.2	$150.0	$251.8
SPACE STATION	-0-	-0-	9.0
SATURN V FOLLOW-ON PRODUCTION	-0-	-0-	46.0
OPERATIONS	-0-	-0-	36.3
SPACE FLIGHT OPERATIONS TOTAL	$253.2	$150.0	$343.1
APPLICATION OF UNAPPORTIONED FY 1969 APPROPRIATIONS			-117.5
AUTHORIZATION REQUESTED			$225.6

NASA HQ MP69-4379
4-16-69

MANNED SPACE FLIGHT

SPACE FLIGHT OPERATIONS

FY 1970 BUDGET ESTIMATES

(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	AMENDED FY 1970 PLAN
APOLLO APPLICATIONS	$253.2	$150.0	$251.8
APPROPRIATIONS AVAILABLE CARRIED FORWARD	−127.0	+127.0	−
OPERATING PLAN	$126.2	$277.0	$251.8
SPACE VEHICLES	29.6	93.6	110.4
PAYLOADS AND EXPERIMENTS	96.6	183.4	141.4

NASA HQ MP69-4046
4-16-69

MANNED SPACE FLIGHT

SPACE FLIGHT OPERATIONS

FY 1970 BUDGET ESTIMATES

(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	FY 1970
SPACE STATION	-0-	-0-	$9.0
OPERATIONS	-0-	-0-	$36.3
LAUNCH, FLIGHT & RECOVERY	-0-	-0-	30.1
TECHNICAL	-0-	-0-	6.2

NASA HQ MP69-4048
REV. 2-14-69

MANNED SPACE FLIGHT

CONSTRUCTION OF FACILITIES

FY 1970 BUDGET ESTIMATES

(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	FY 1970
TOTAL C OF F	$23.6	$10.6	$14.2
KENNEDY SPACE CENTER	21.6	7.4	12.5
MANNED SPACECRAFT CENTER	.8	1.3	1.7
MARSHALL SPACECRAFT CENTER	.8	-0-	-0-
MICHOUD ASSEMBLY FACILITY	.4	.4	-0-
VARIOUS LOCATIONS	-0-	1.5	-0-

NASA HQ MP69-4381
2-14-69

MANNED SPACE FLIGHT

RESEARCH AND PROGRAM MANAGEMENT

DISTRIBUTION OF FUNDS BY CENTER

FY 1970 BUDGET ESTIMATE

(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	FY 1970
RESEARCH & PROGRAM MGMT	$315.1	$312.0	$307.5
KENNEDY SPACE CENTER	93.1	97.7	97.5
MANNED SPACECRAFT CENTER	95.8	98.0	97.8
MARSHALL SPACEFLIGHT CENTER	126.2	116.3	112.2

NASA HQ MP69-4045
1-9-69

MANNED SPACE FLIGHT

RESEARCH AND PROGRAM MANAGEMENT

NUMBER OF PERMANENT POSITIONS

FY 1970 BUDGET ESTIMATE

	FY 1968	FY 1969	FY 1970
TOTAL PERMANENT POSITIONS	13,961	13,285	13,035
KENNEDY SPACE CENTER	2,917	2,921	2,881
MANNED SPACECRAFT CENTER	4,604	4,383	4,303
MARSHALL SPACEFLIGHT CENTER	6,440	5,981	5,851

NASA HQ MP69-4050
1-9-69

MANNED SPACE FLIGHT

RESEARCH AND PROGRAM MANAGEMENT

DISTRIBUTION OF FUNDS BY FUNCTION

FY 1970 BUDGET ESTIMATE

(MILLIONS OF DOLLARS)

	FY 1968	FY 1969	FY 1970
RESEARCH & PROGRAM MGMT	$315.1	$312.0	$307.5
PERSONNEL	191.2	202.8	201.8
TRAVEL	7.3	6.9	6.5
ADP	17.5	14.1	13.7
FACILITIES	65.0	59.0	57.4
TECHNICAL SERVICES	5.2	3.1	2.8
ADMINISTRATIVE SUPPORT	28.9	26.1	25.3

NASA HQ MP69-4049
1-9-69