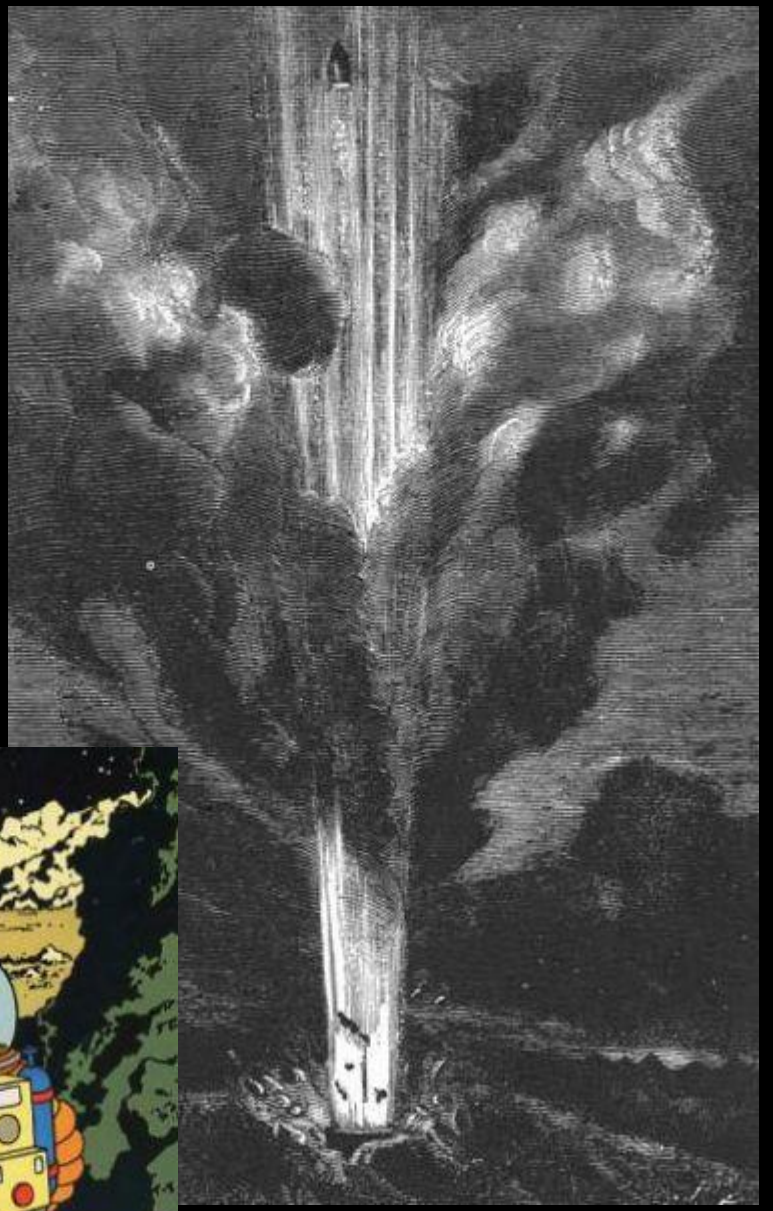
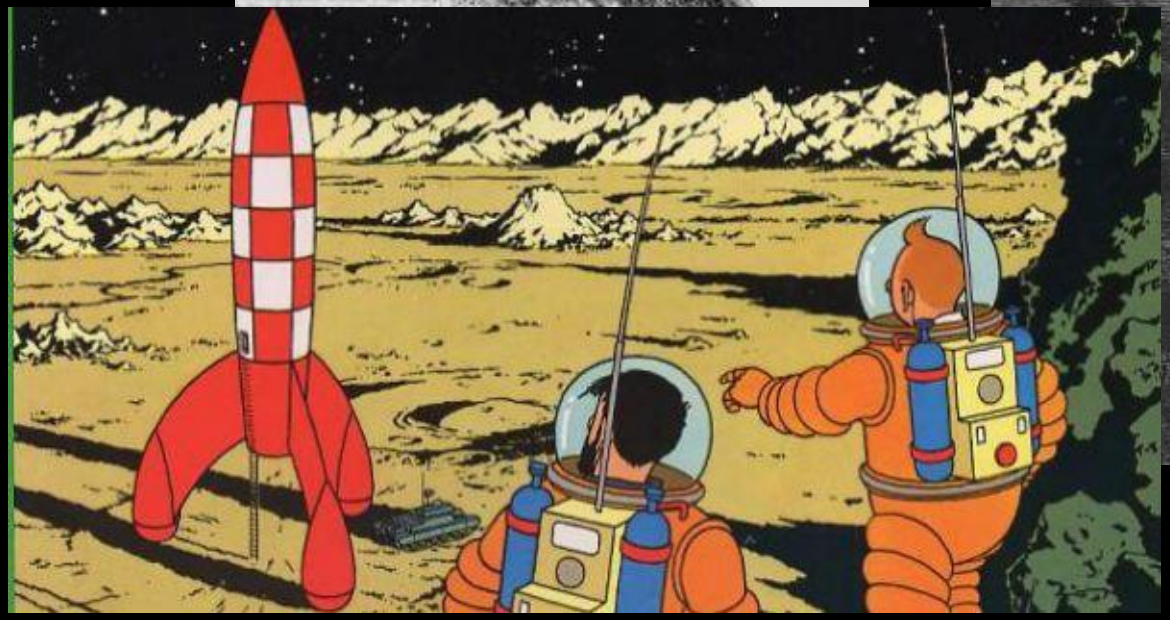
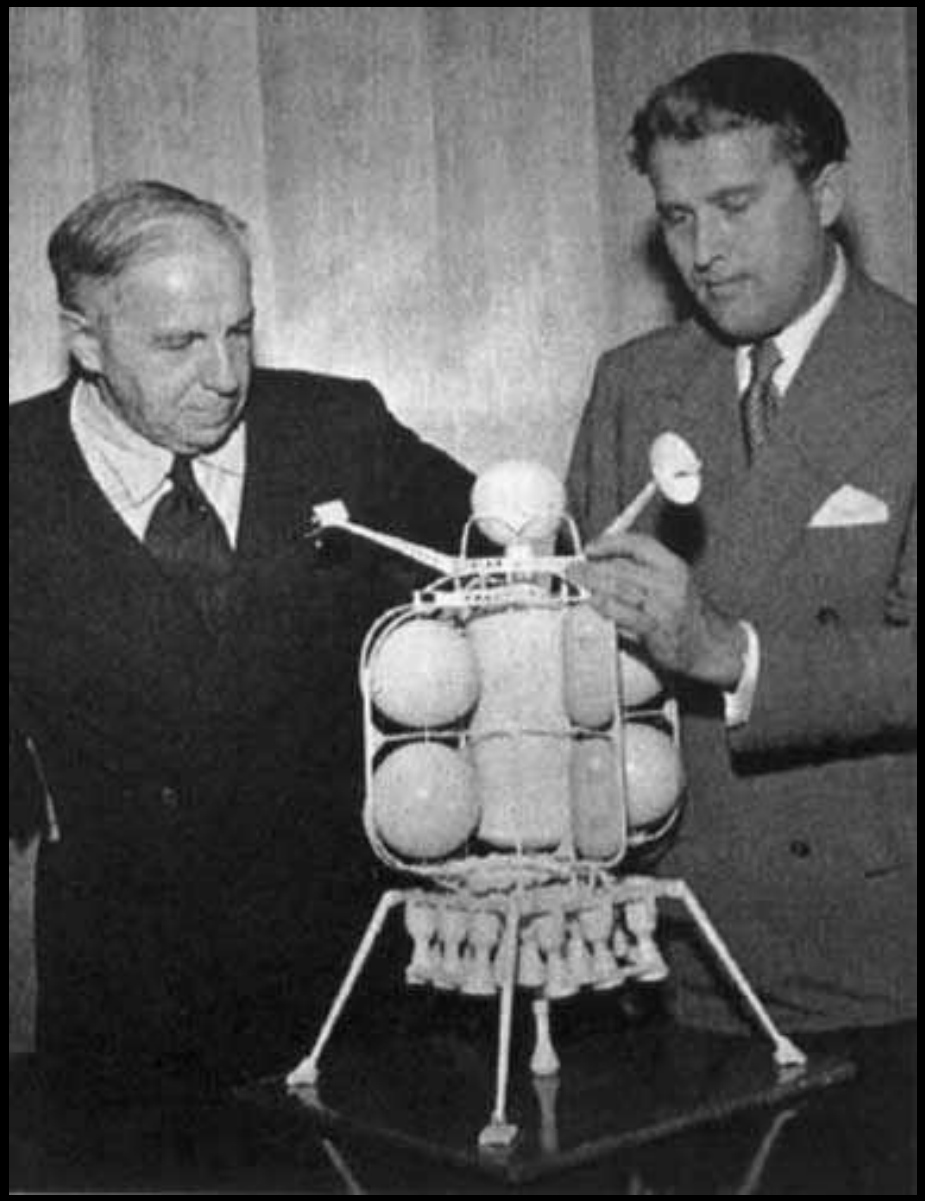
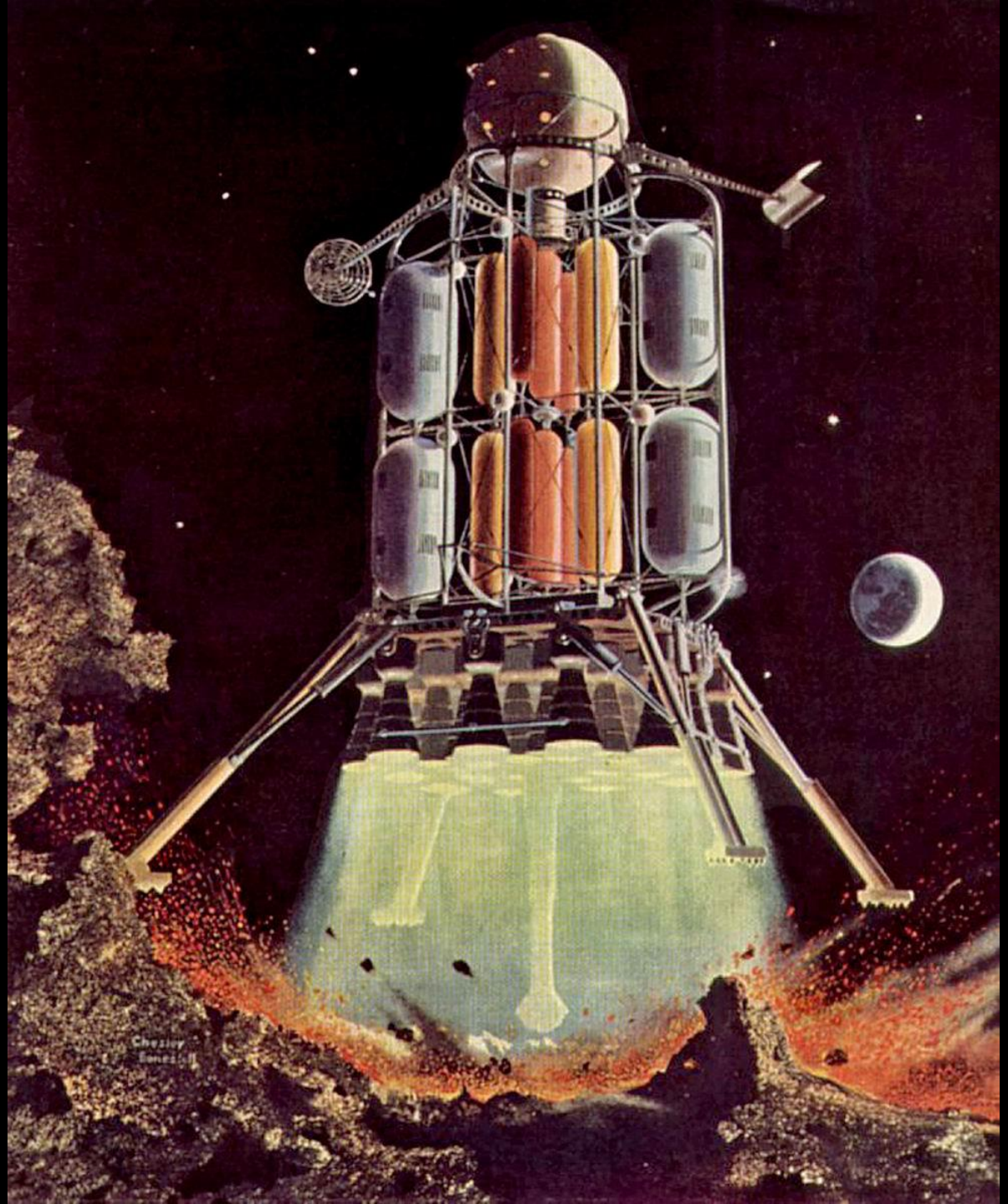
Příběh lunárního modulu





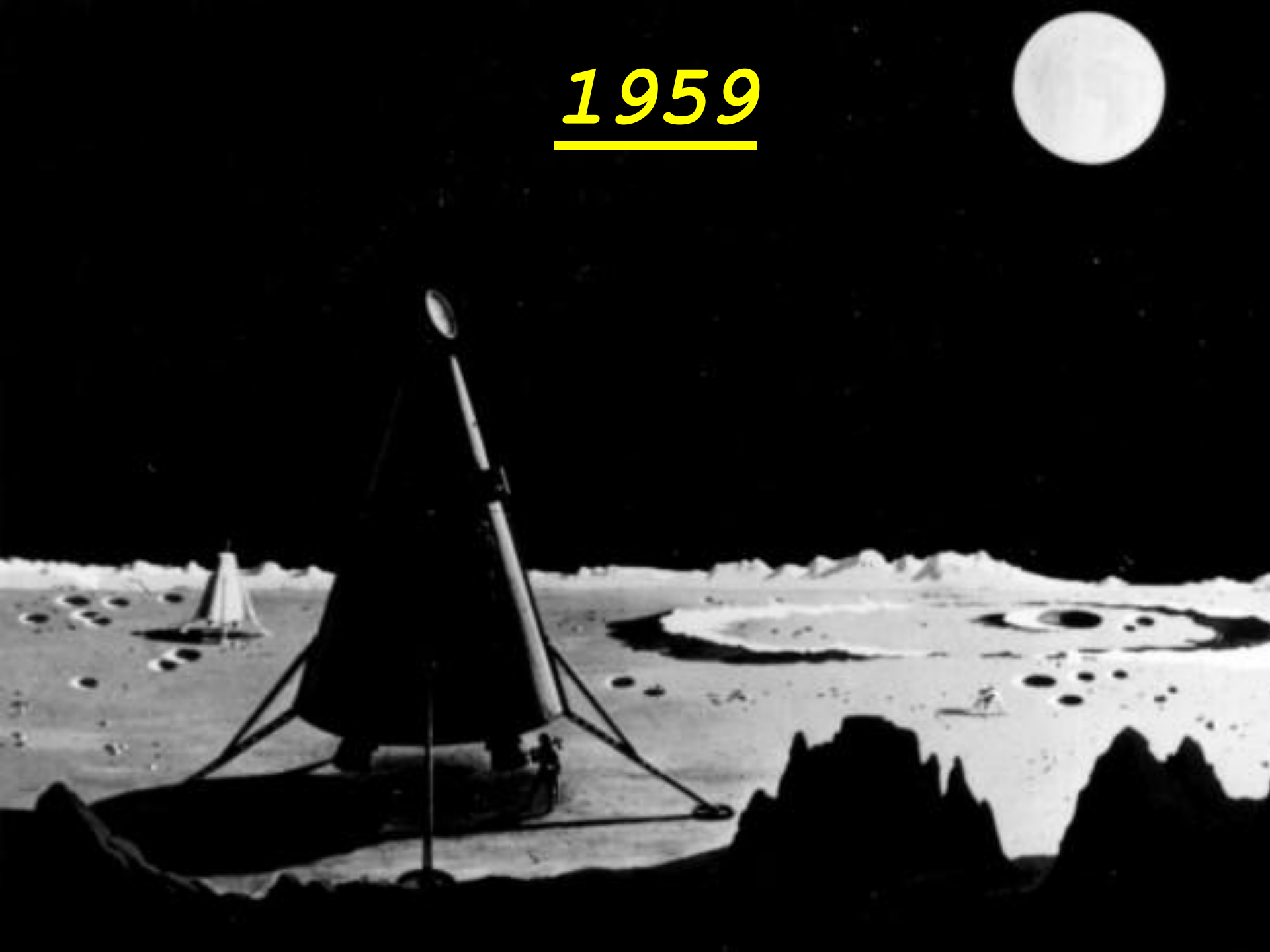
1952





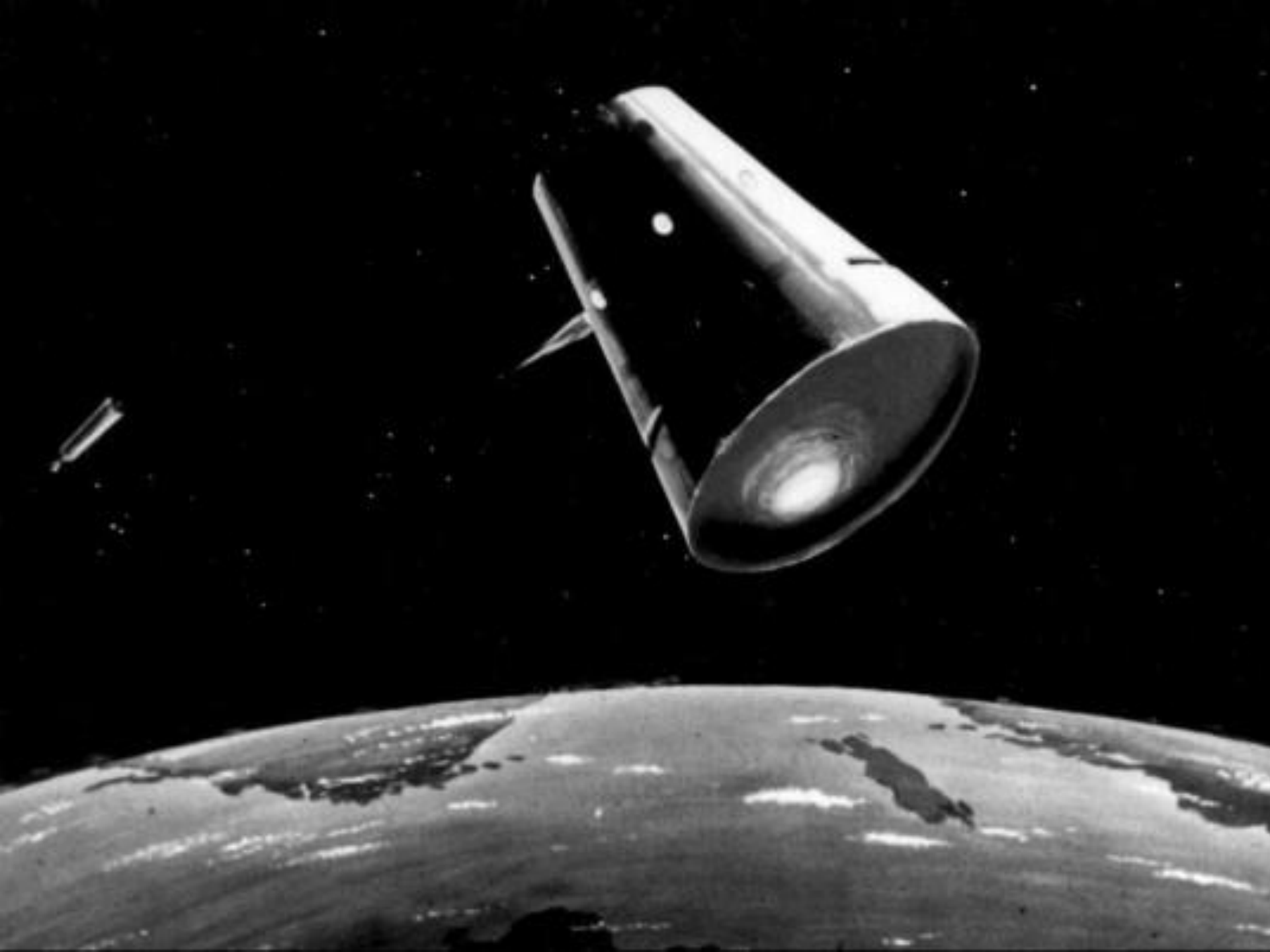

1952 | THE DREAM
UNDER THE LM's thin aluminum skin is a configuration of fuel and oxygen tanks similar to that of its '52 cousin. The earlier "spider" was 160 feet high and 110 wide, designed to carry 20 men on a round trip from Earth orbit to the moon. The 23-foot-high LM is built to carry two men 140 miles and is destined to be jettisoned after doing its job
1969 | THE REALITY

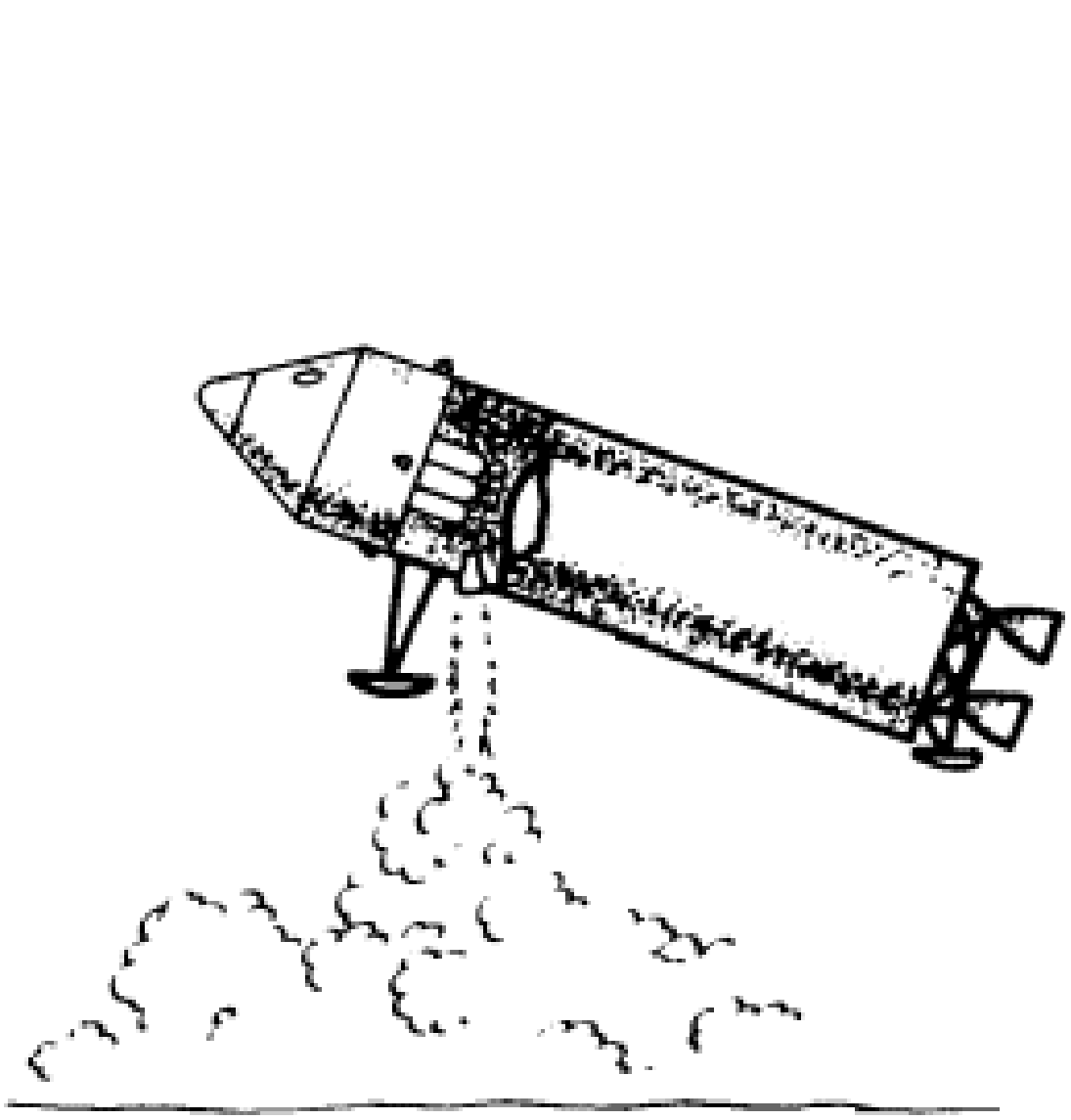
1959

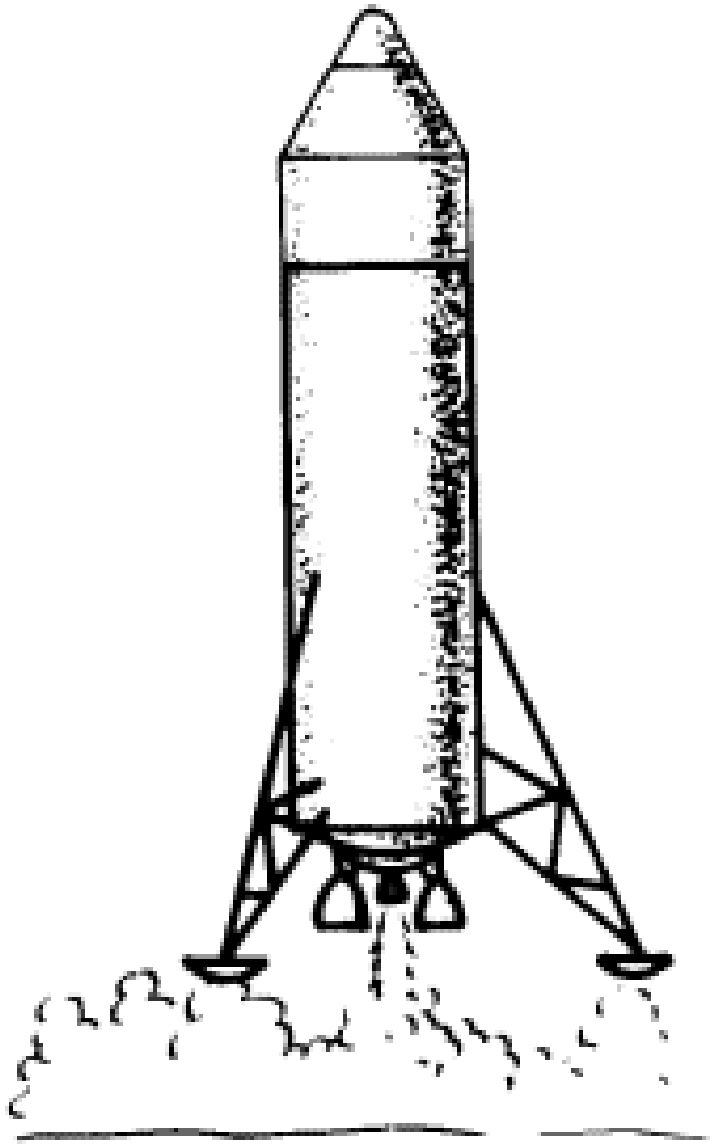


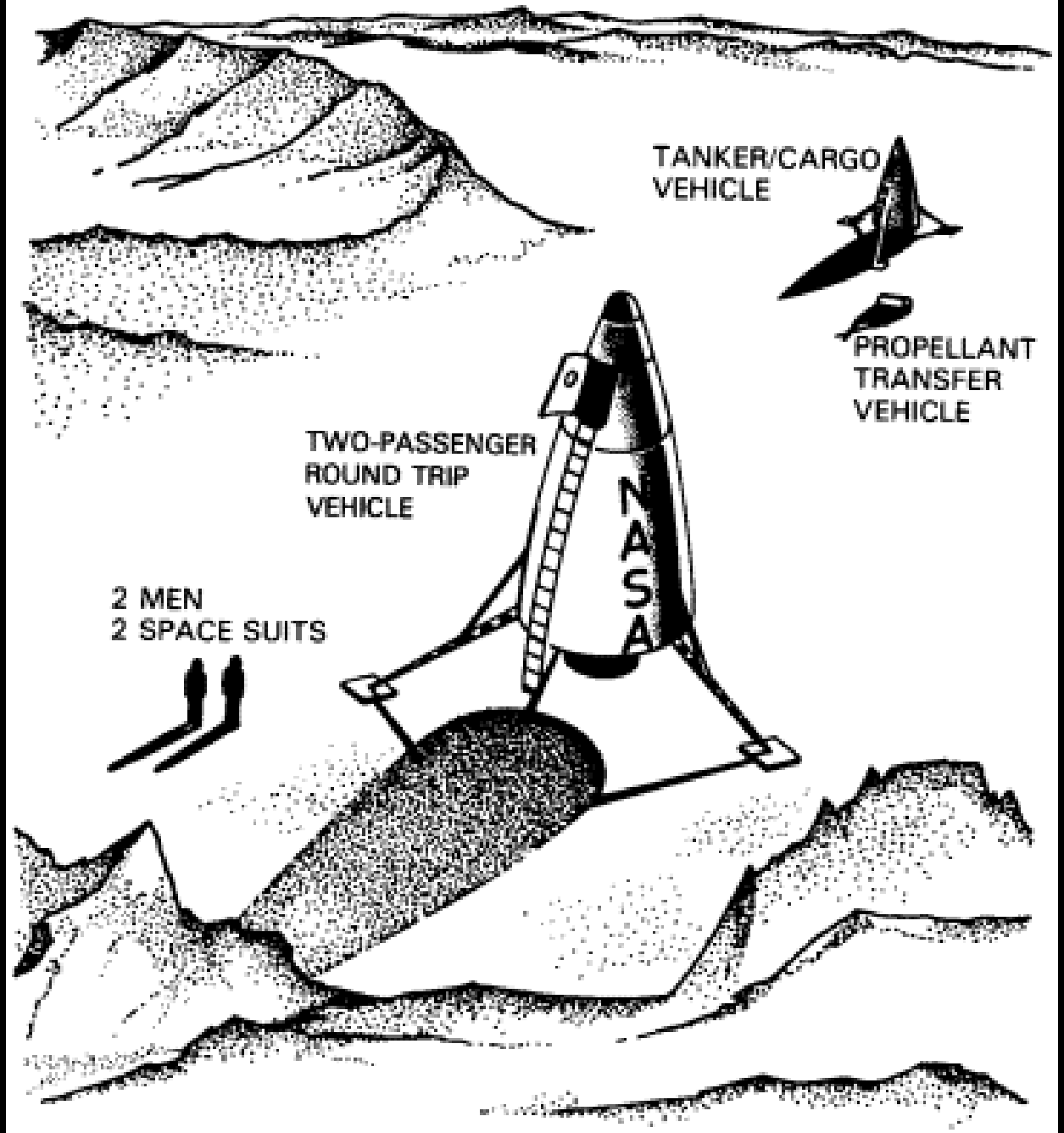
LUNAR
RETURN MISSION

TAKE-OFF FROM MOON
WITH FIFTH STAGE



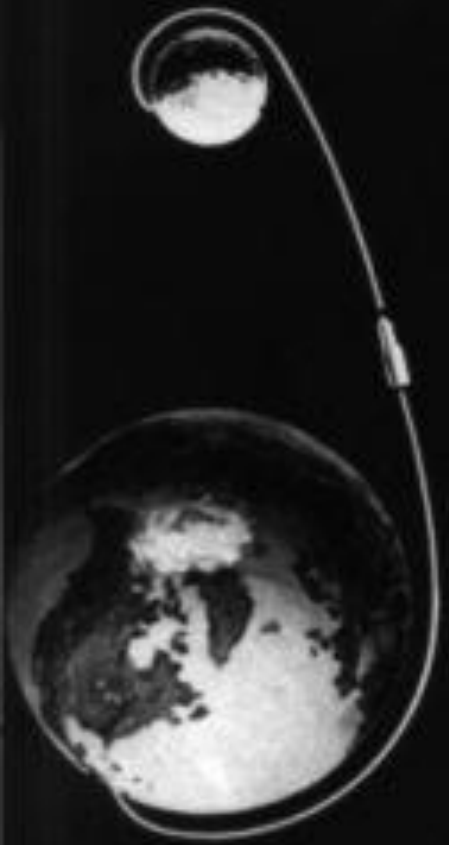





TANKER/CARGO
VEHICLE
PROPELLANT
TRANSFER
VEHICLE
TWO-PASSENGER
ROUND TRIP
VEHICLE
NASA
2 MEN
2 SPACE SUITS

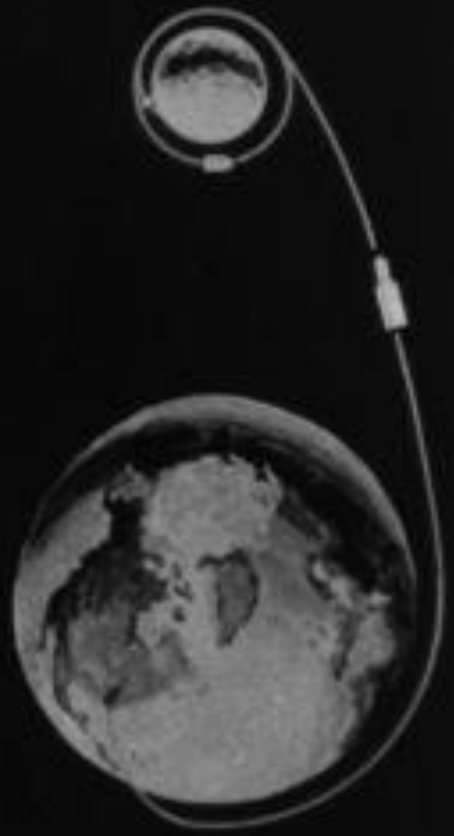
PROJECT APOLLO

LUNAR LANDING FLIGHT TECHNIQUES

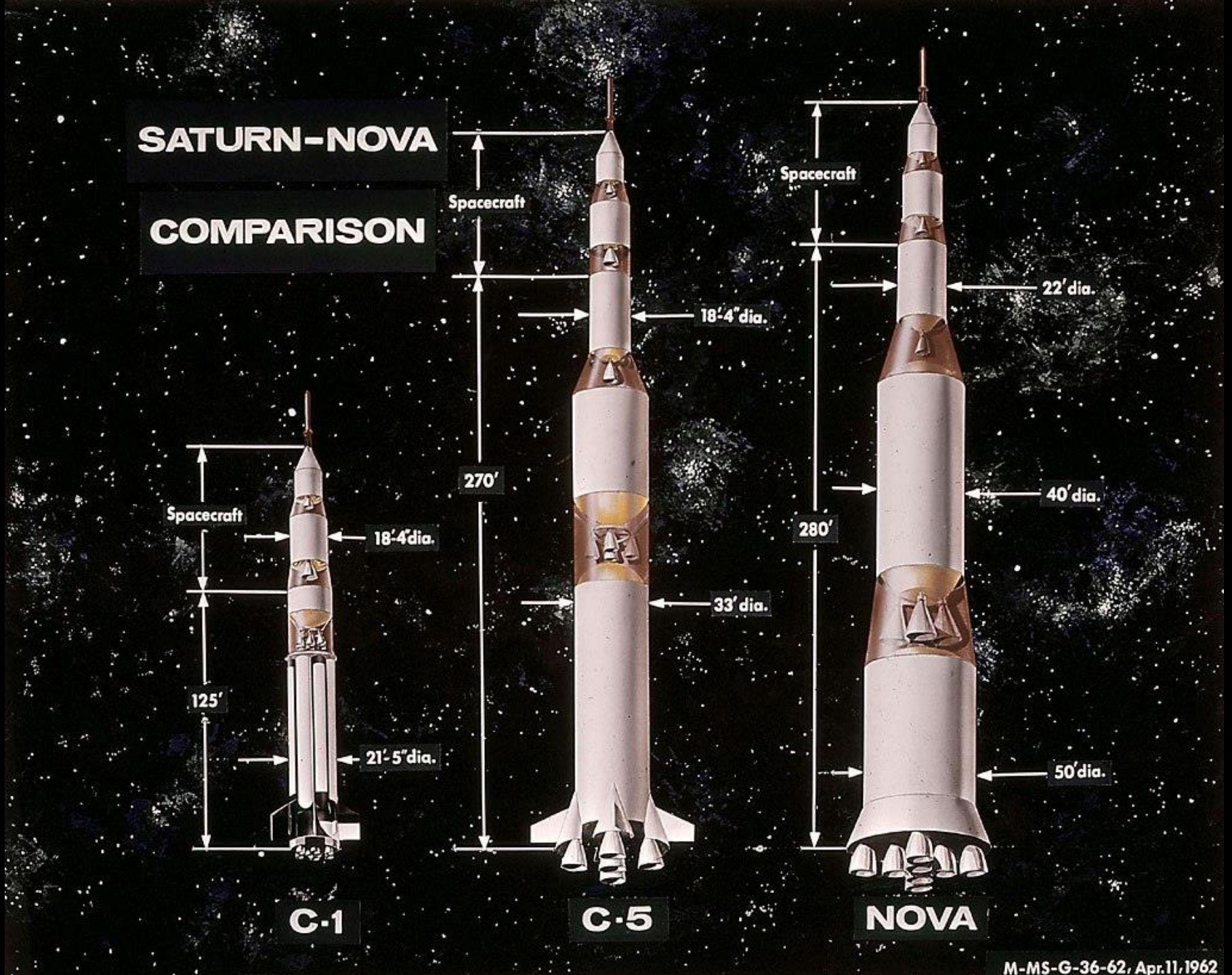


DIRECT

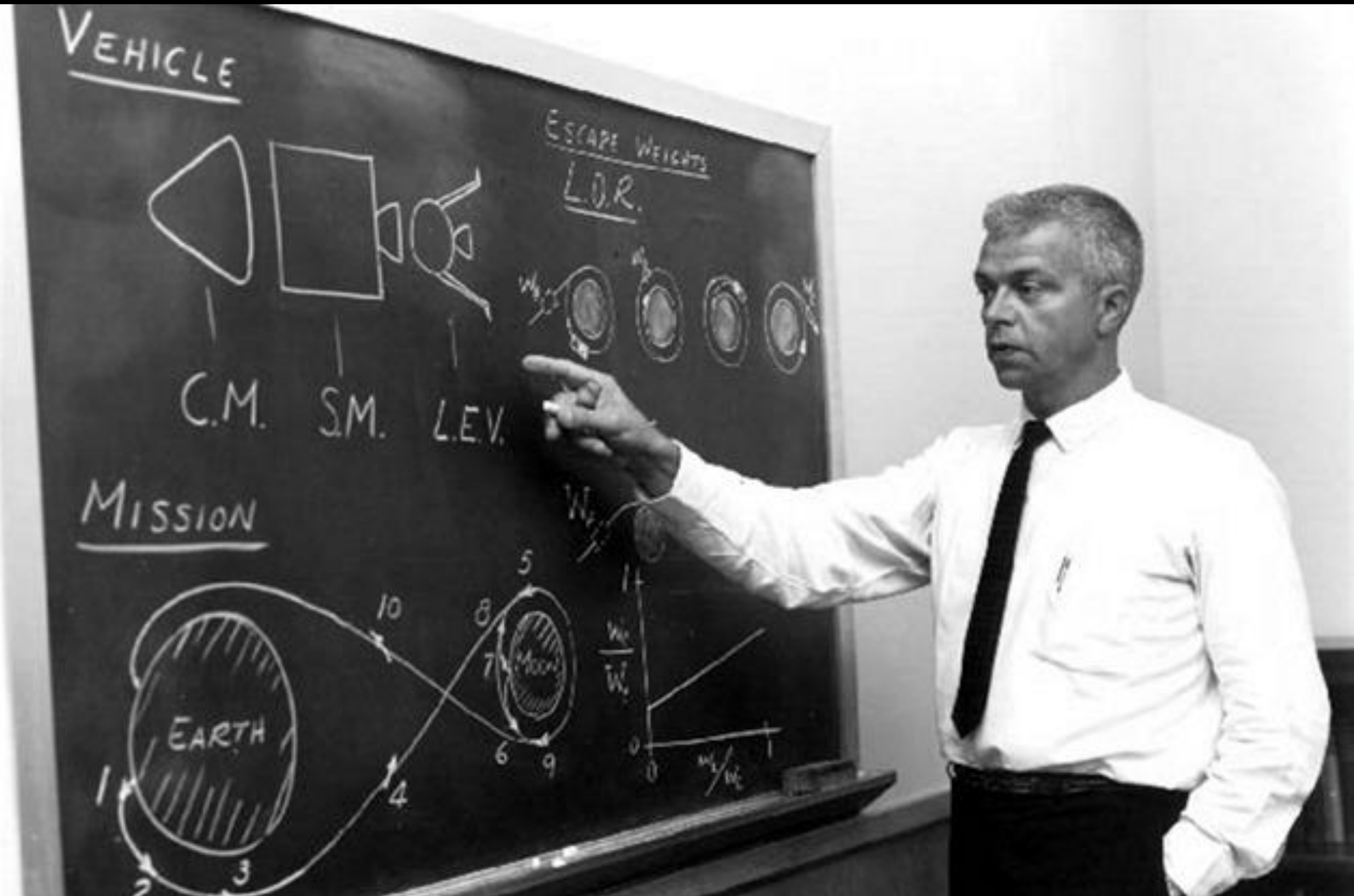
EARTH ORBIT RENDEZVOUS



LUNAR ORBIT RENDEZVOUS


SATURN-NOVA
COMPARISON
Spacecraft
18'-4"dia.
125'
21'-5"dia.
C-1
Spacecraft
270'
18'-4"dia.
33'dia.
C-5
Spacecraft
280'
22'dia.
40'dia.
50'dia.
NOVA
M-MS-G-36-62, Apr.11,1962

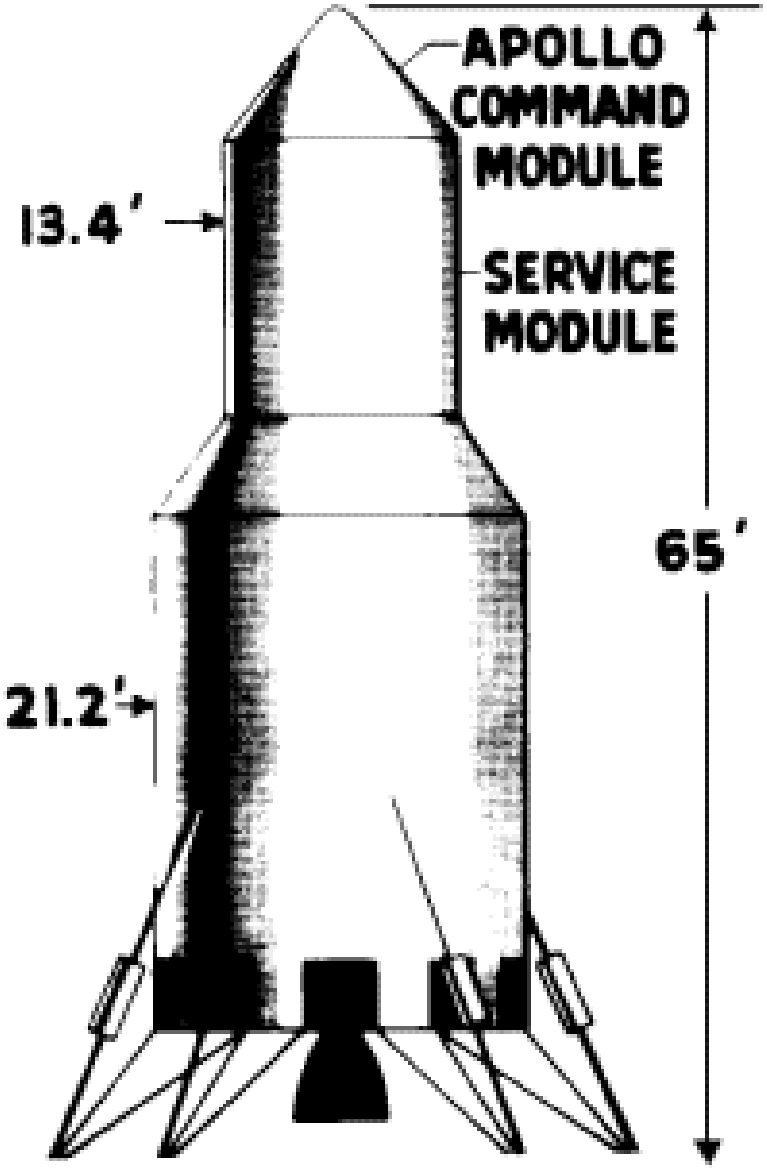
John Houbolt




UNITED
STATES

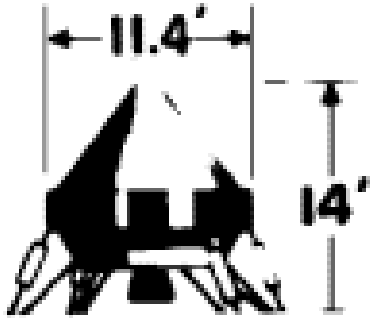
COMPARISON OF LANDER SIZES

DIRECT LANDING



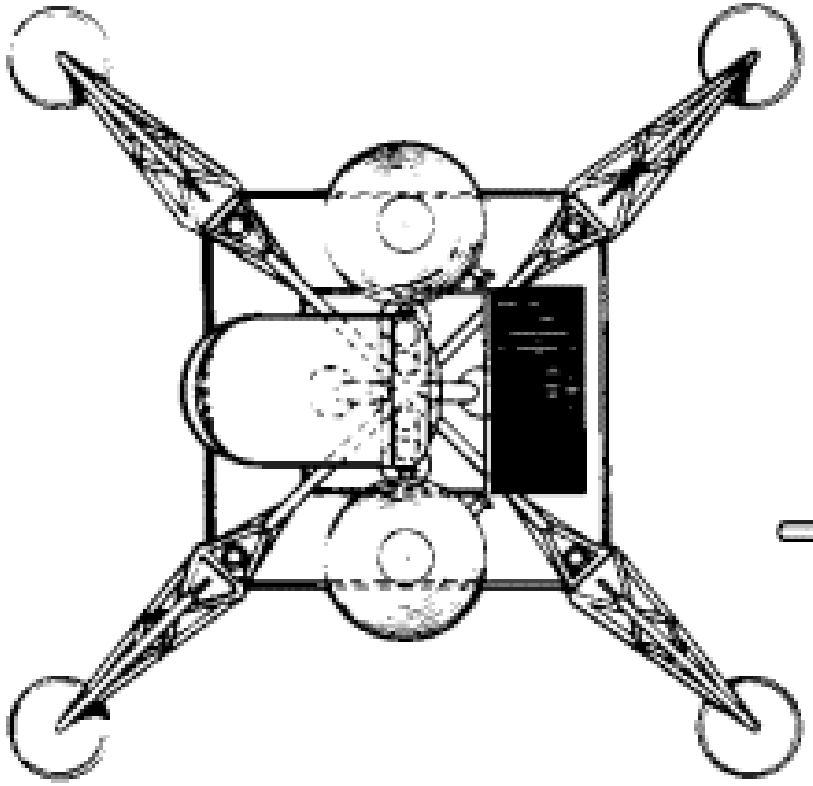
LUNAR FERRY OF LUNAR RENDEZVOUS

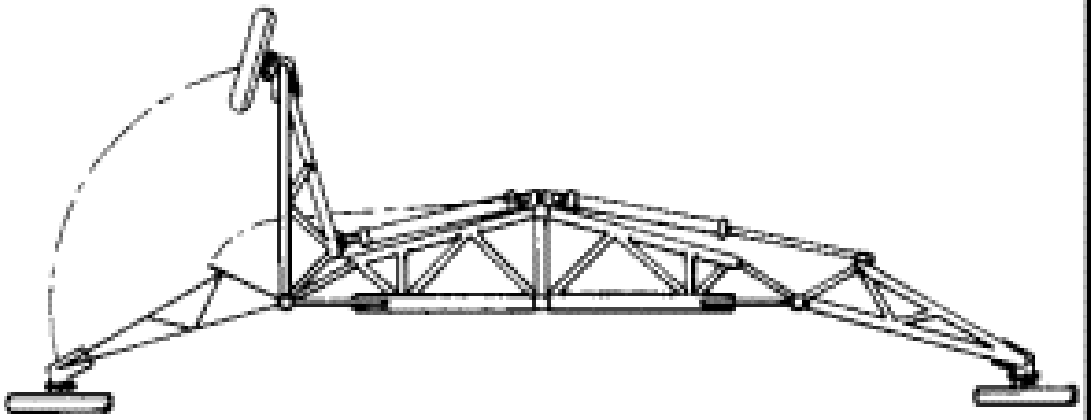
LUNAR EXCURSION VEHICLE

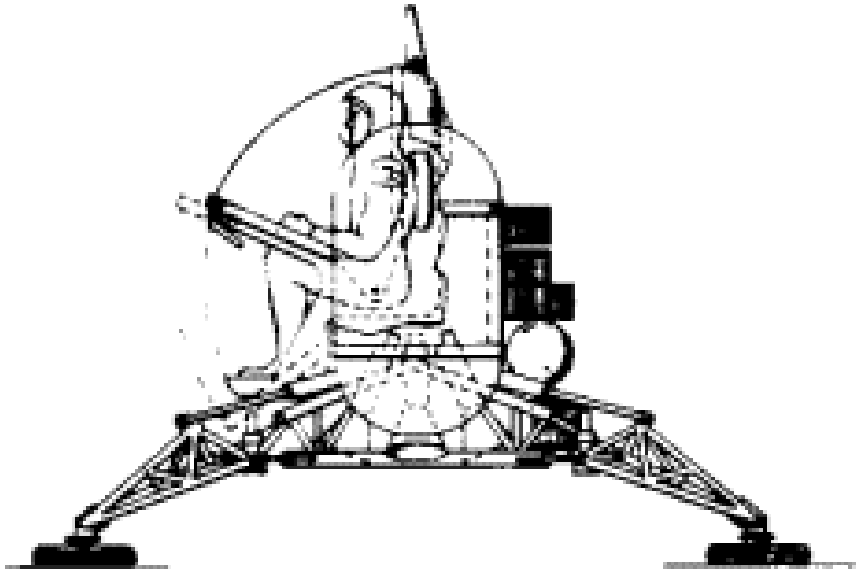


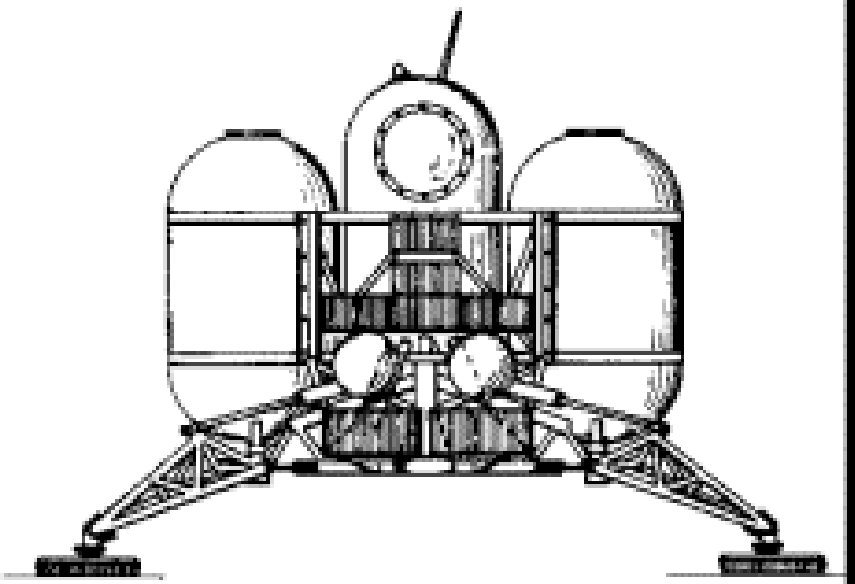
LUNAR LANDER–ONE MAN

	LB
1 MAN AND LIFE SUPPORT	220
CONTROLS	50
STRUCTURE	230
ENGINE AND TANKAGE	220
FUEL AND OXIDIZER	2500
TOTAL	3220

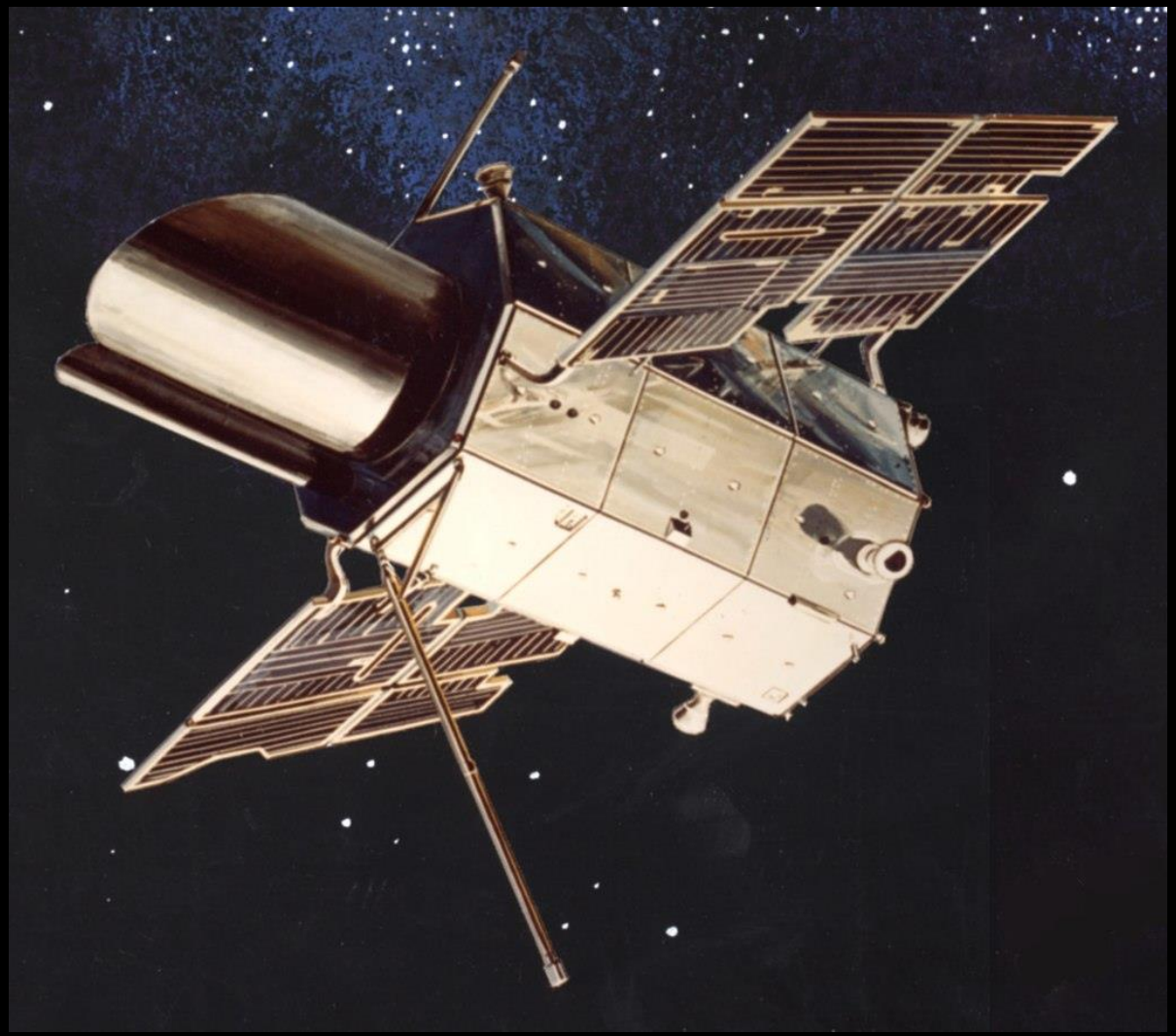


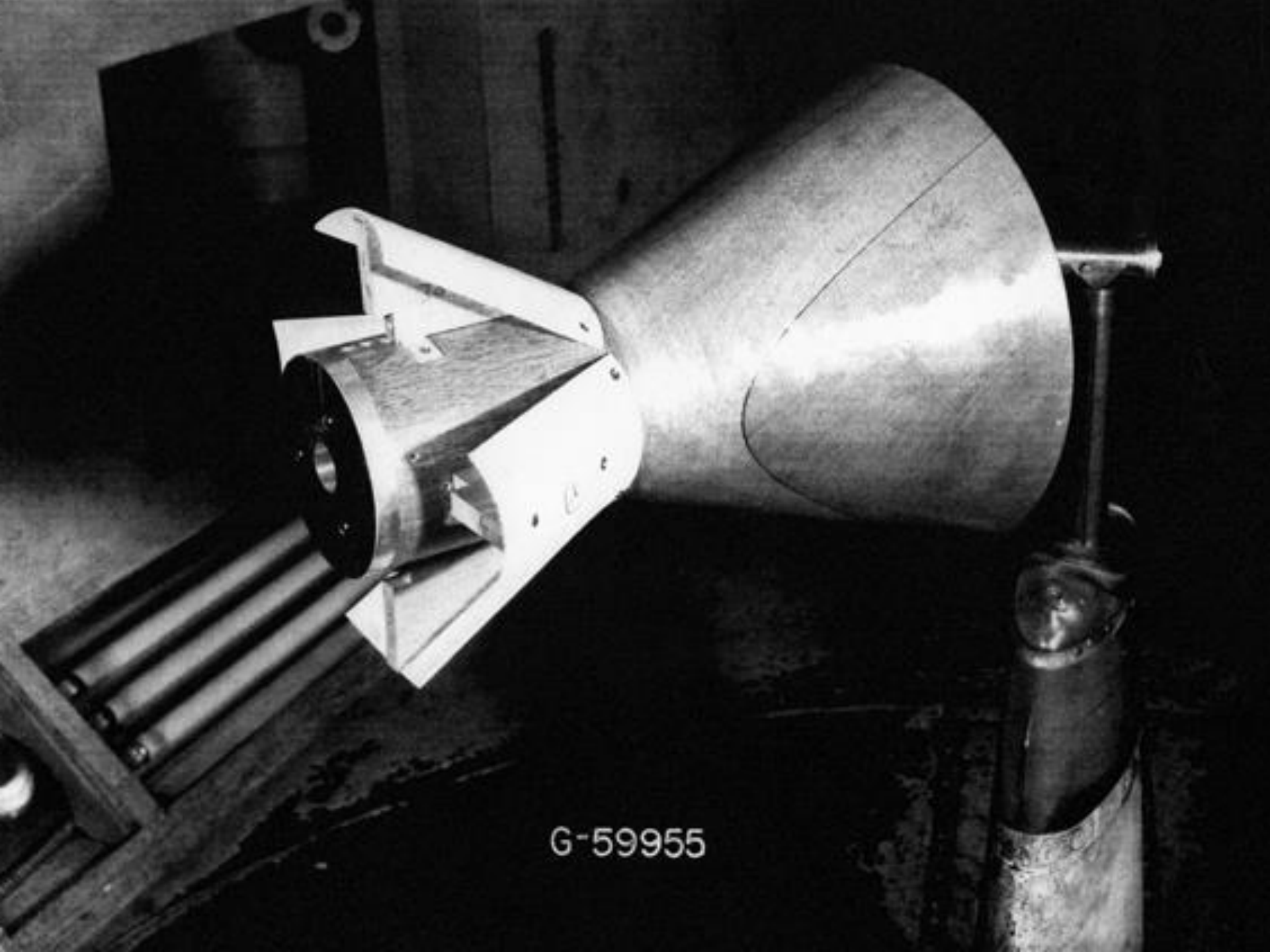






Grumman Aircraft Engineering Corporation




G-59955

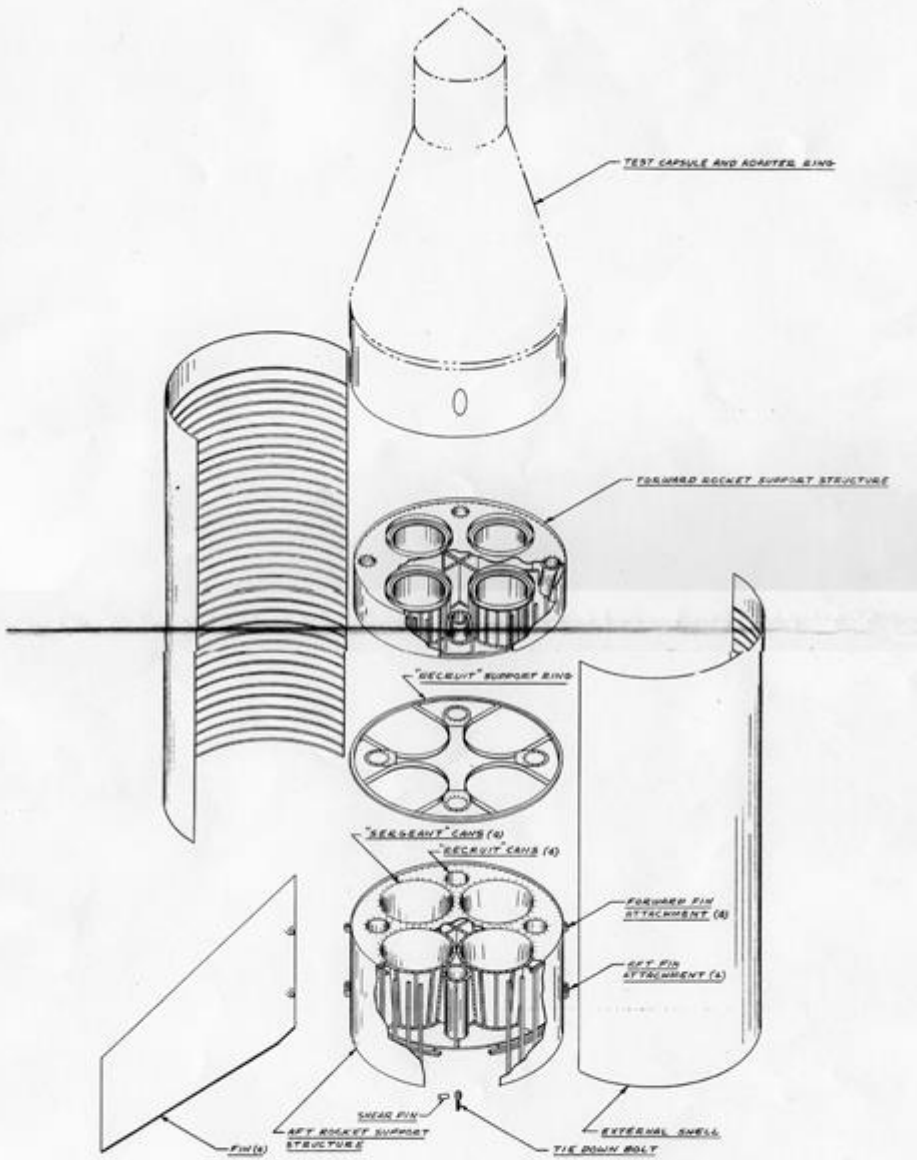
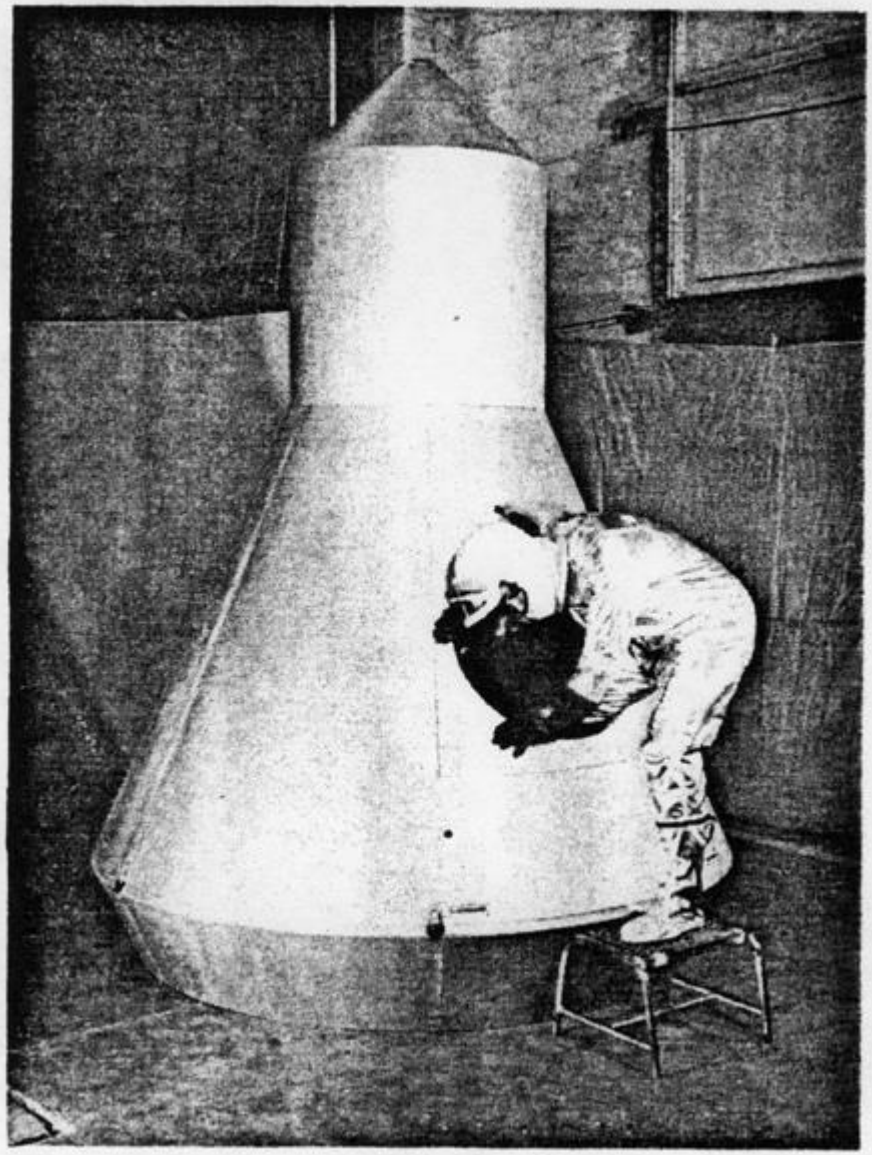
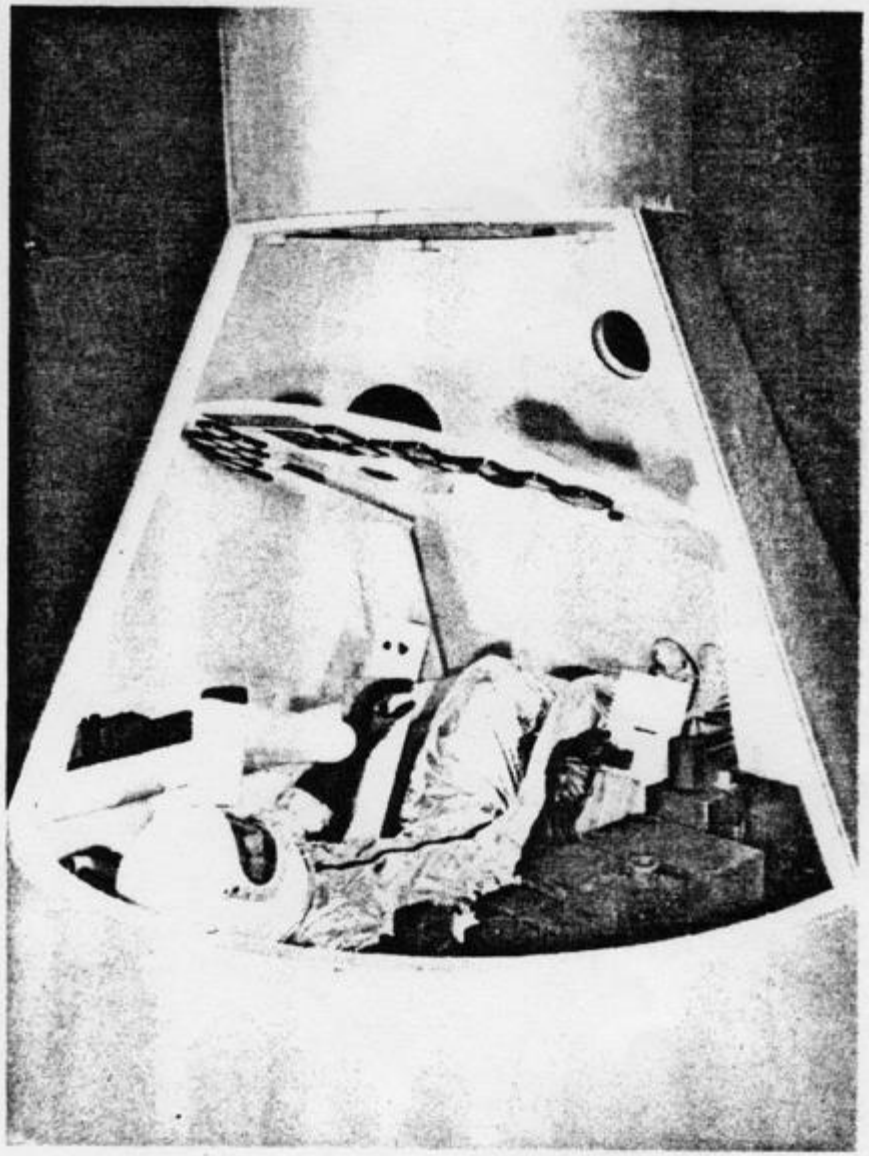
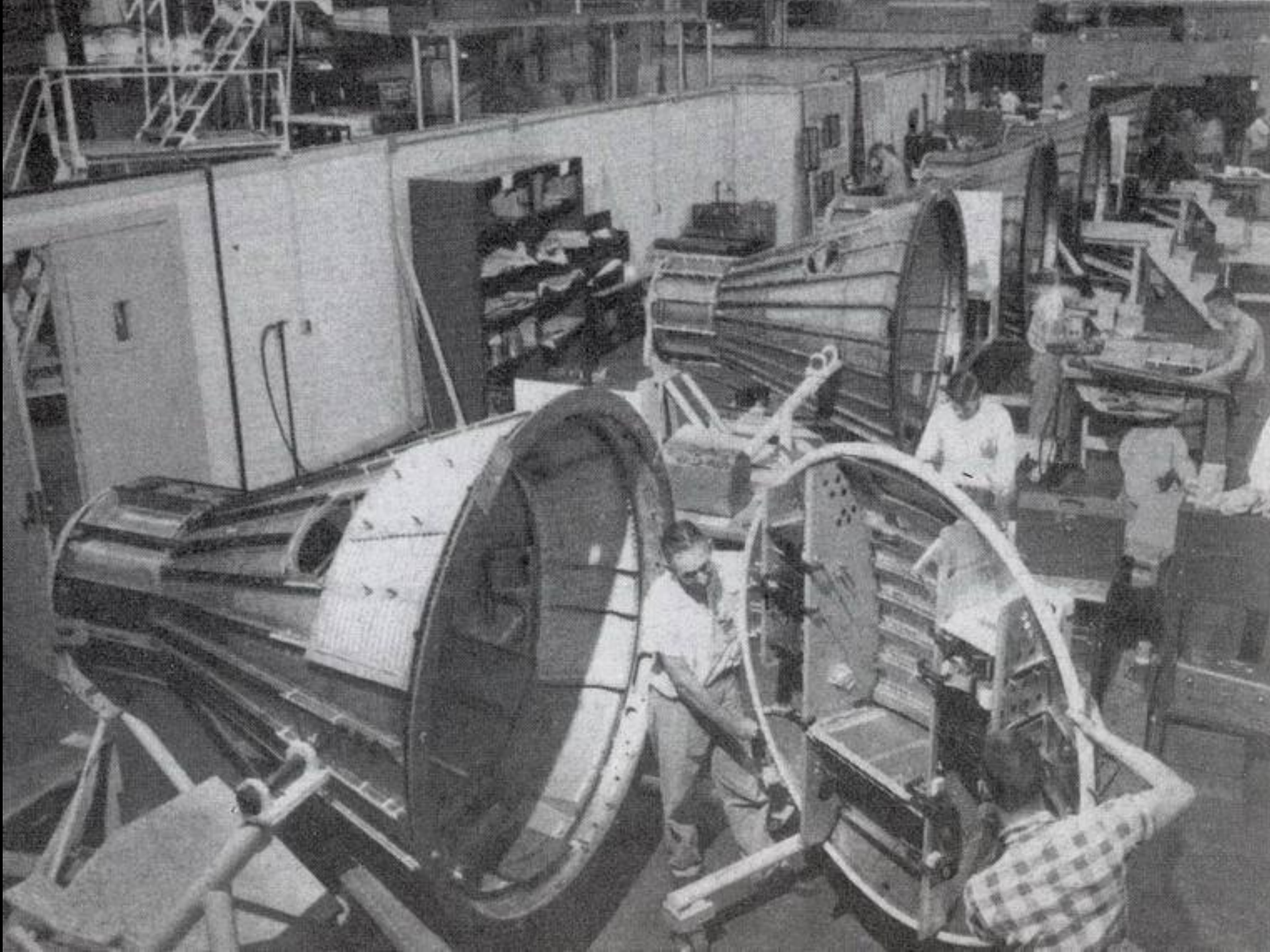


FIG. 1
ISOMETRIC CUT-A-WAY
OF
TRANSPORT VEHICLE
MAJOR STRUCTURAL COMPONENTS





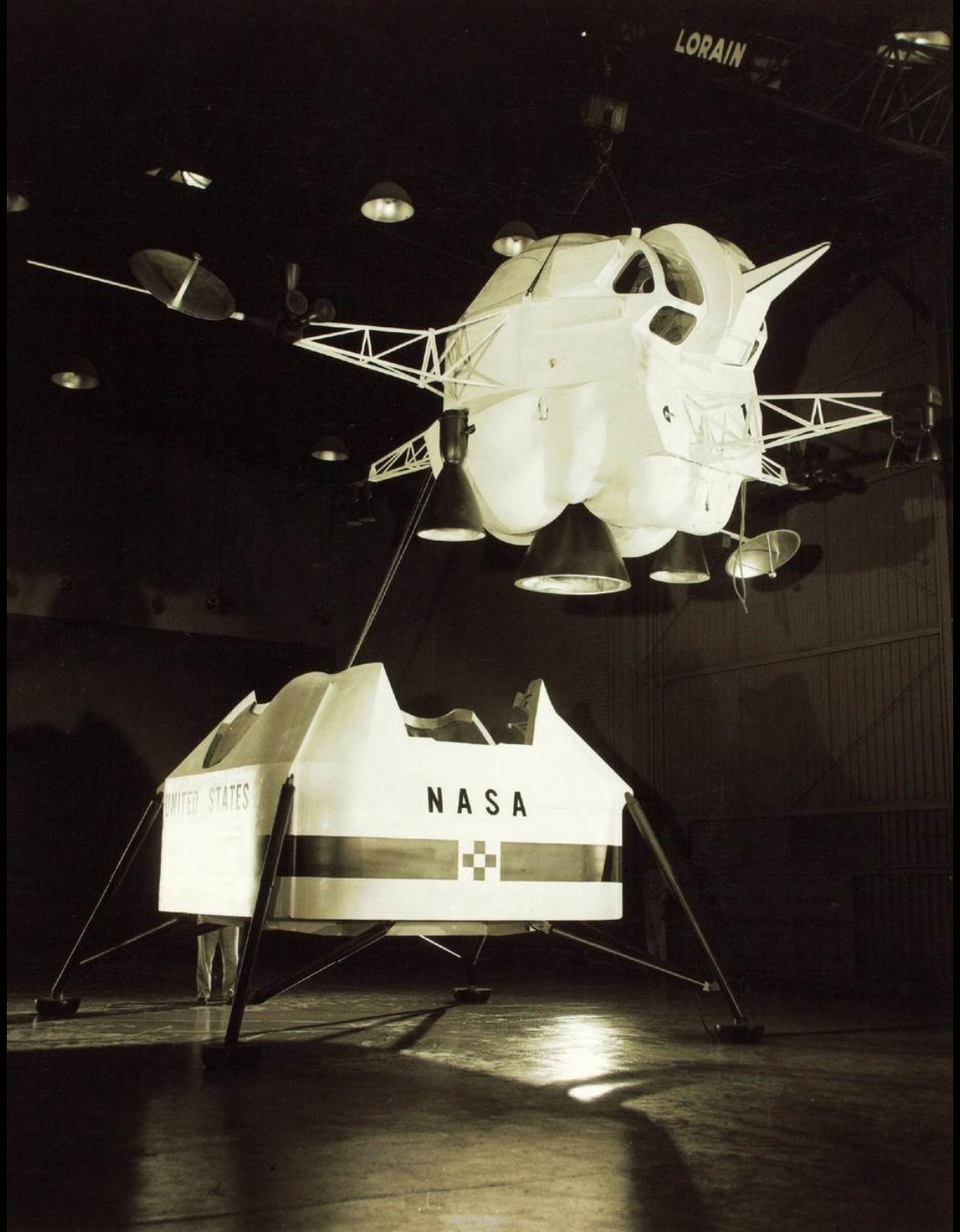

G-59962




UNITED
STATES

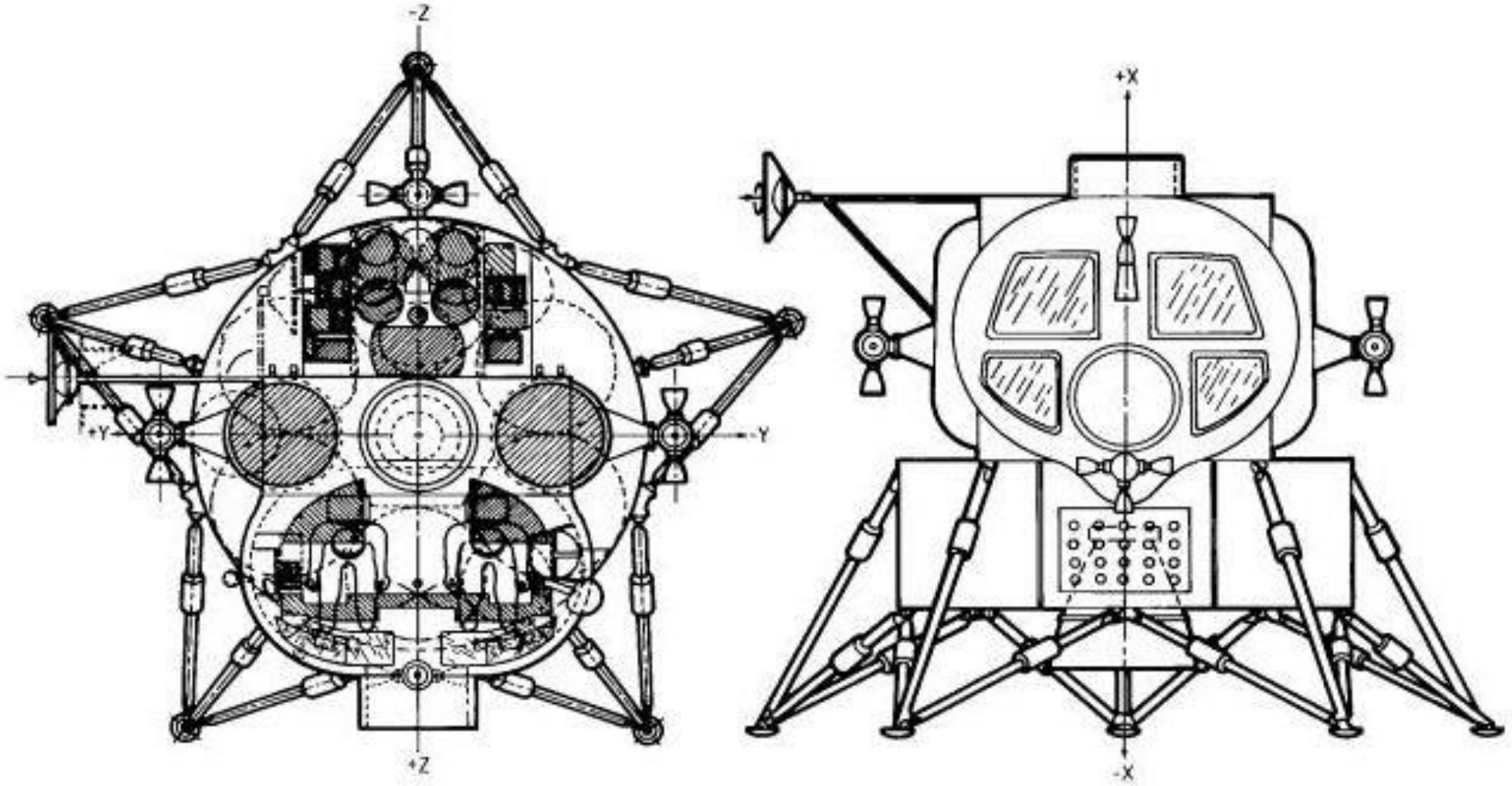

UNITED
STATES

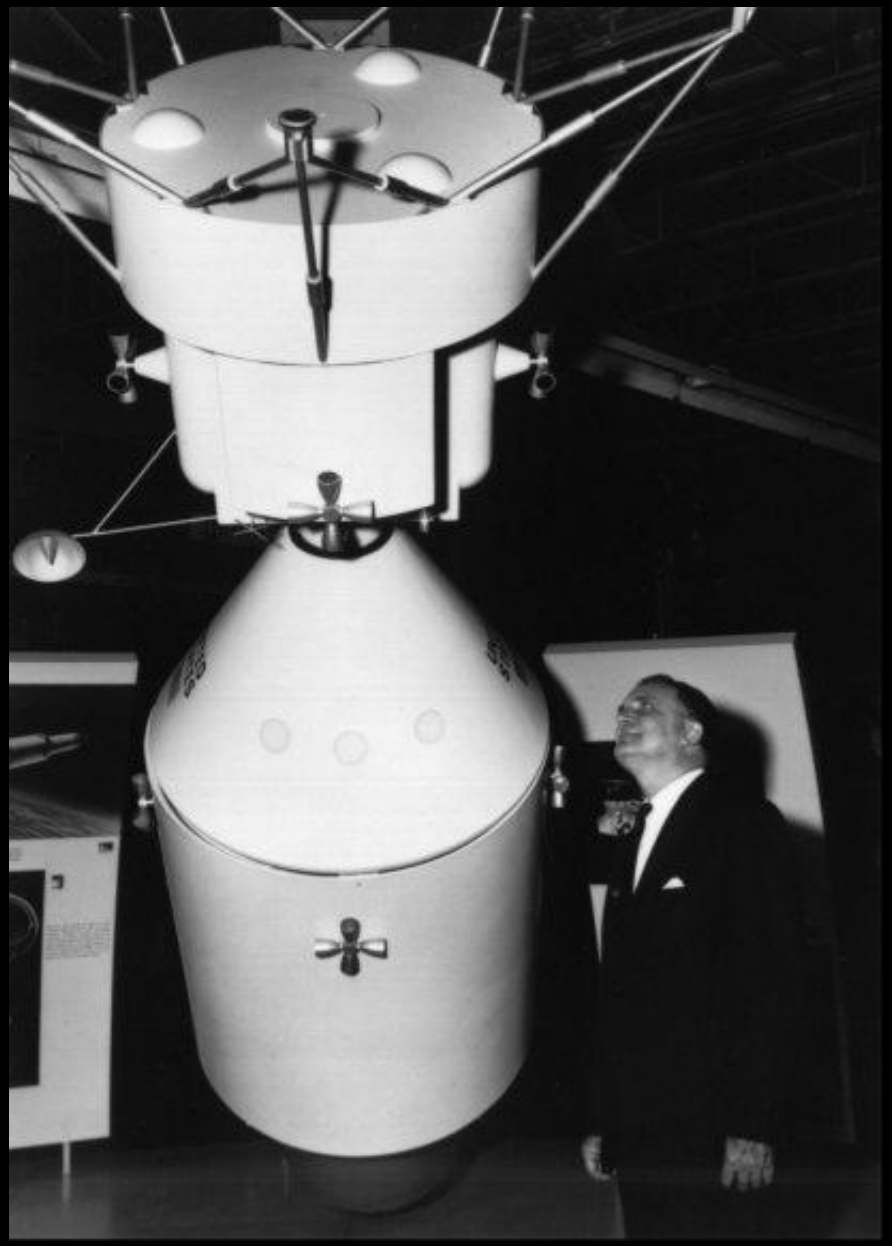
General Electric


LORAIN
NASA


UNITED STATES

„Made in Grumman“


-Z
+Y
-Y
+Z
+X
-X



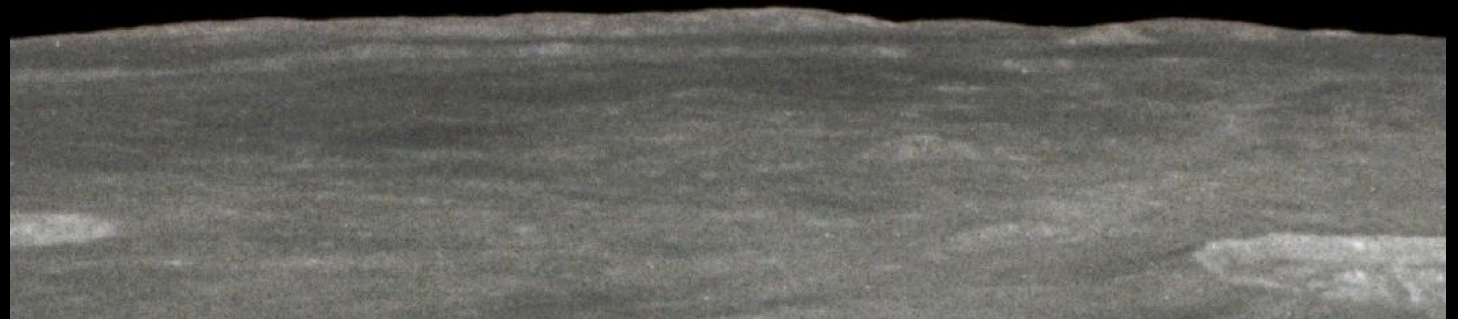
Listopad 1961 – Apollo

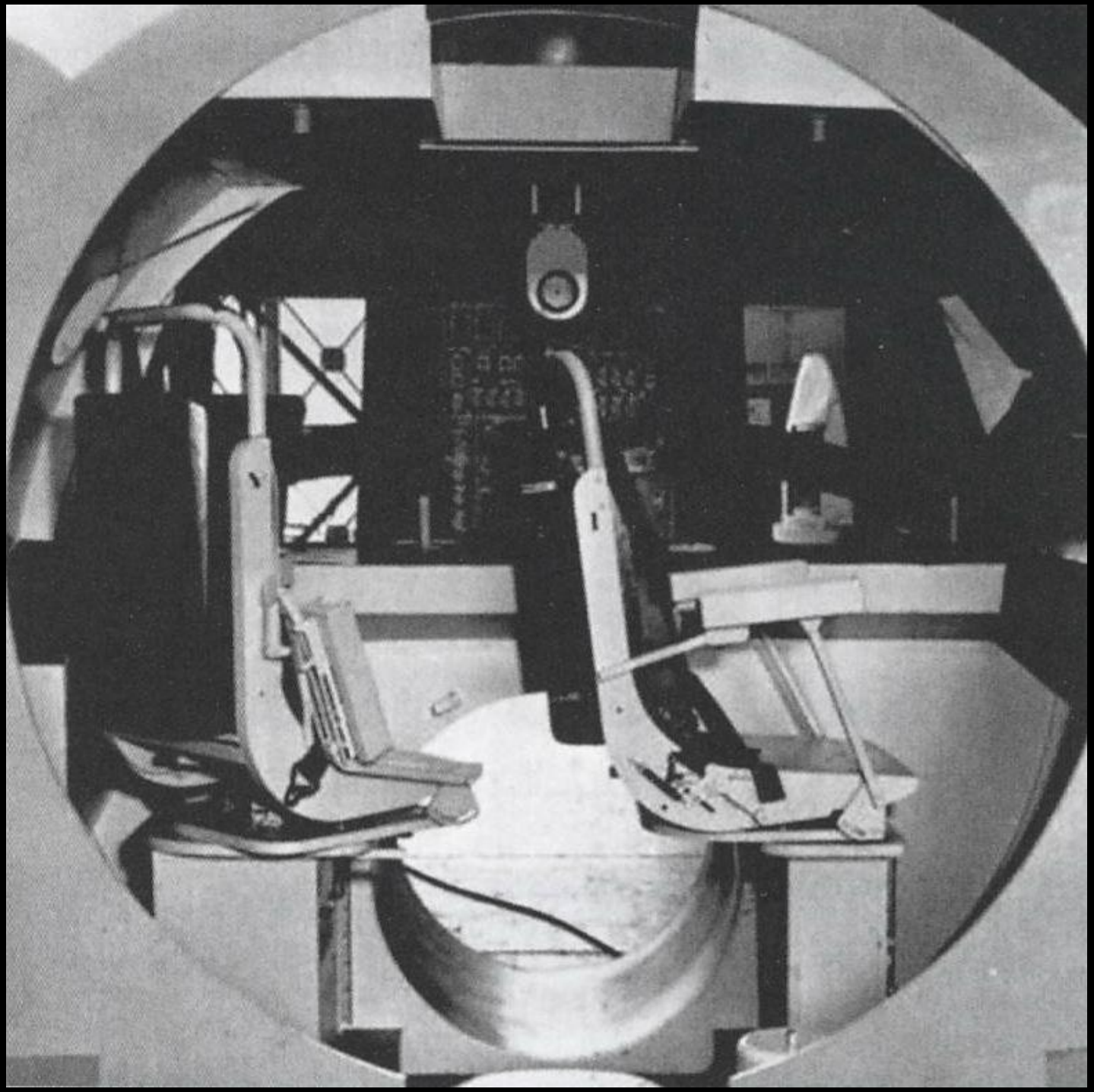
Září až prosinec – Saturn V

Listopad 1962 - LM

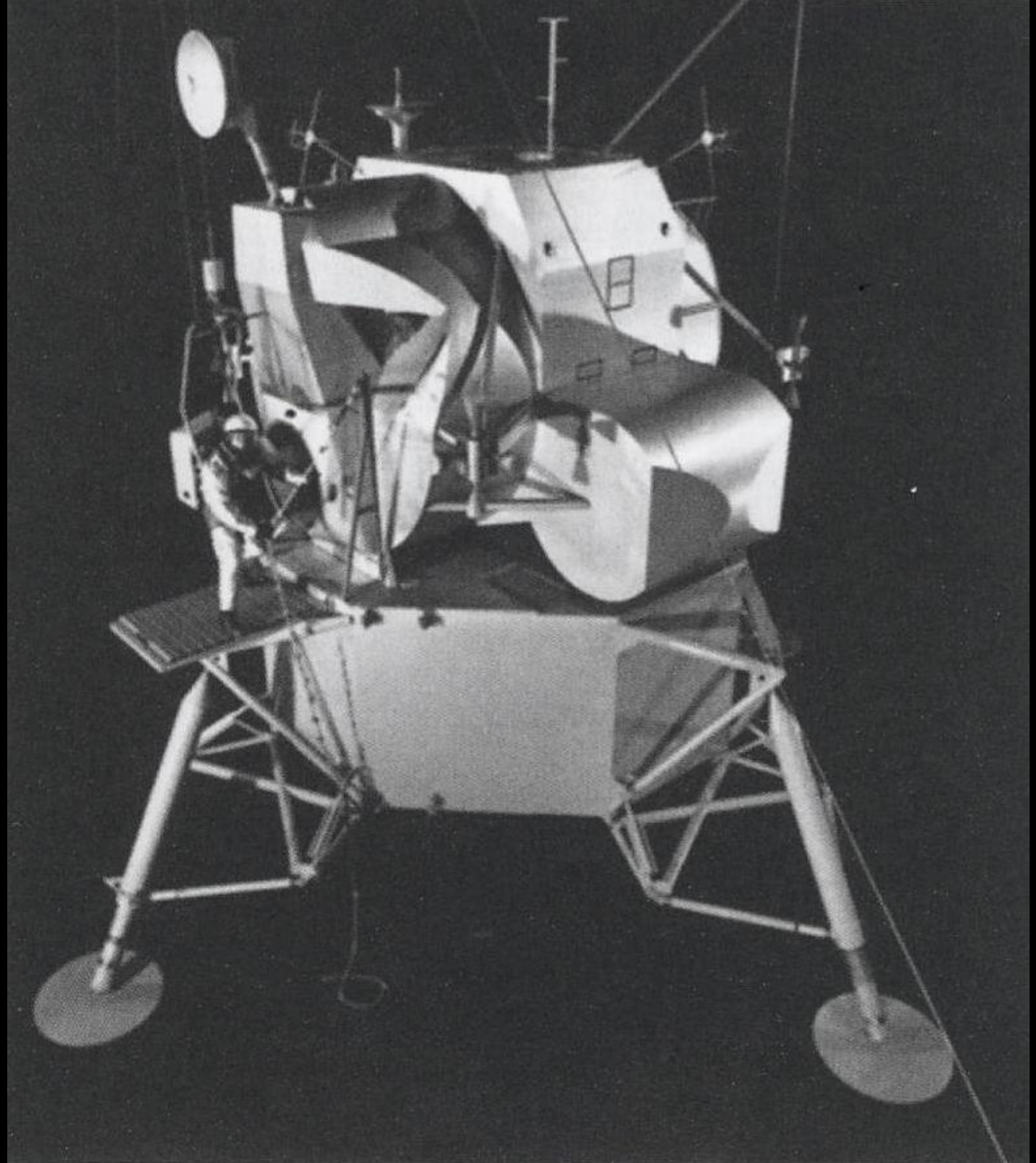
LEM – Lunar Excursion Module

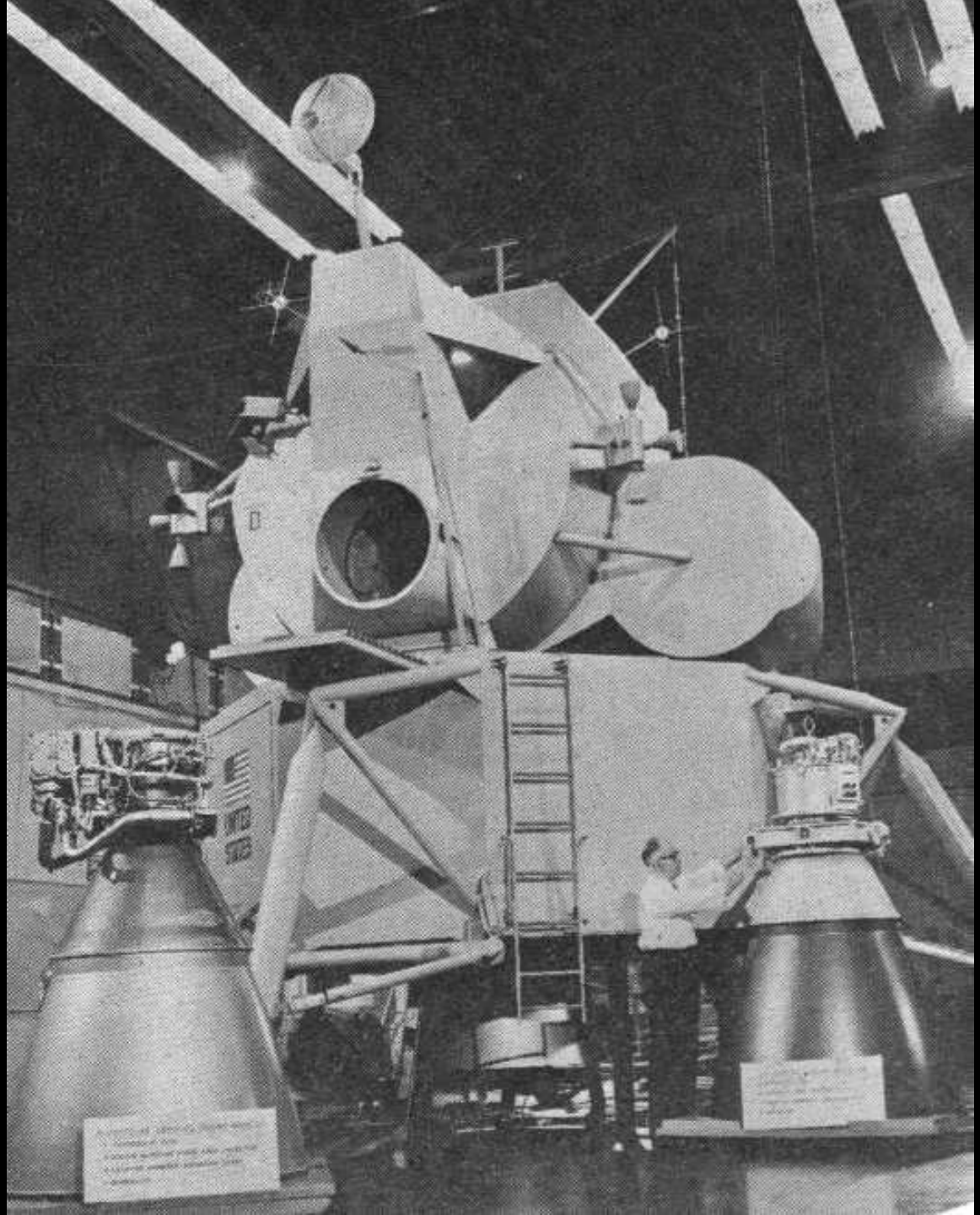
Červen 1966 – jen LM





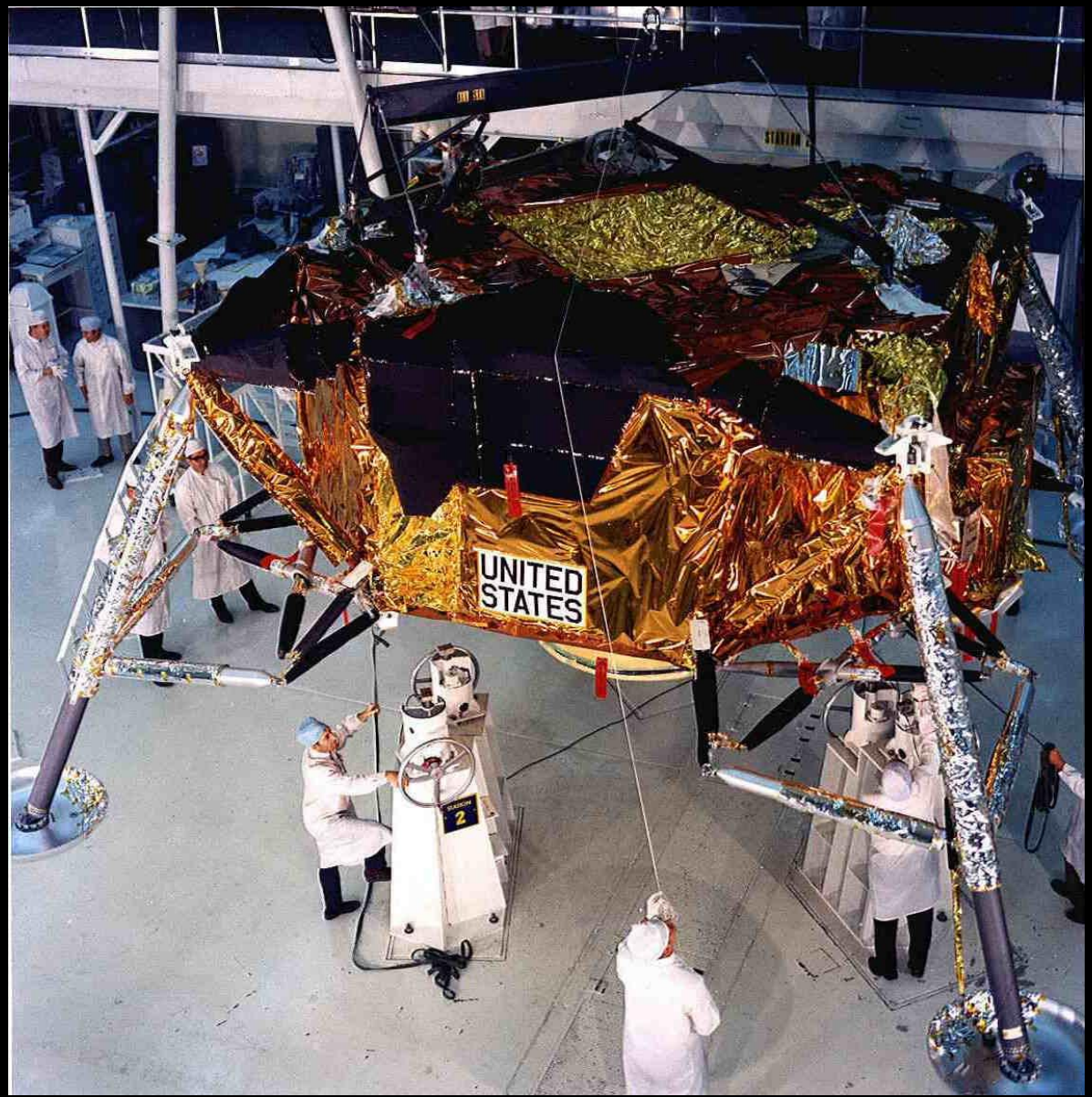

TO REPOSITION
DEPRESS BOTH
BUTTONS






UNITED STATES
UNITED STATES
UNITED STATES

Descent Stage



Rocketdyne Company a STL (Space Technology Laboratories)


Nakonec STL:
10 až 65 a
92,5 až 100
procent

Oxid dusičitý a aerozine-50 (asymetrický dimetylhydrazin, monometylhydrazin

Přistání – tři 170 cm tyče

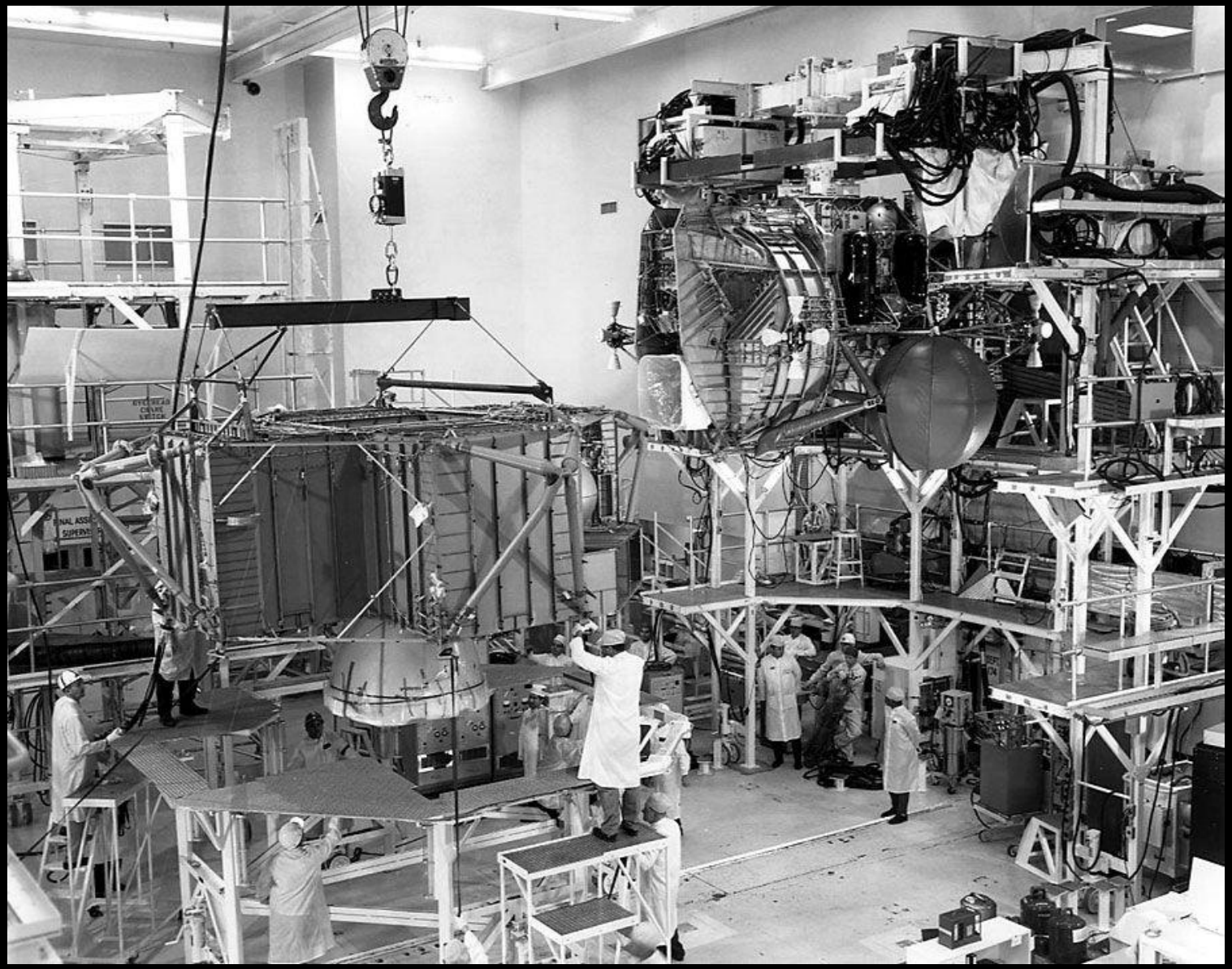
Ascent Stage

Průměr 234 cm, délka 107 cm

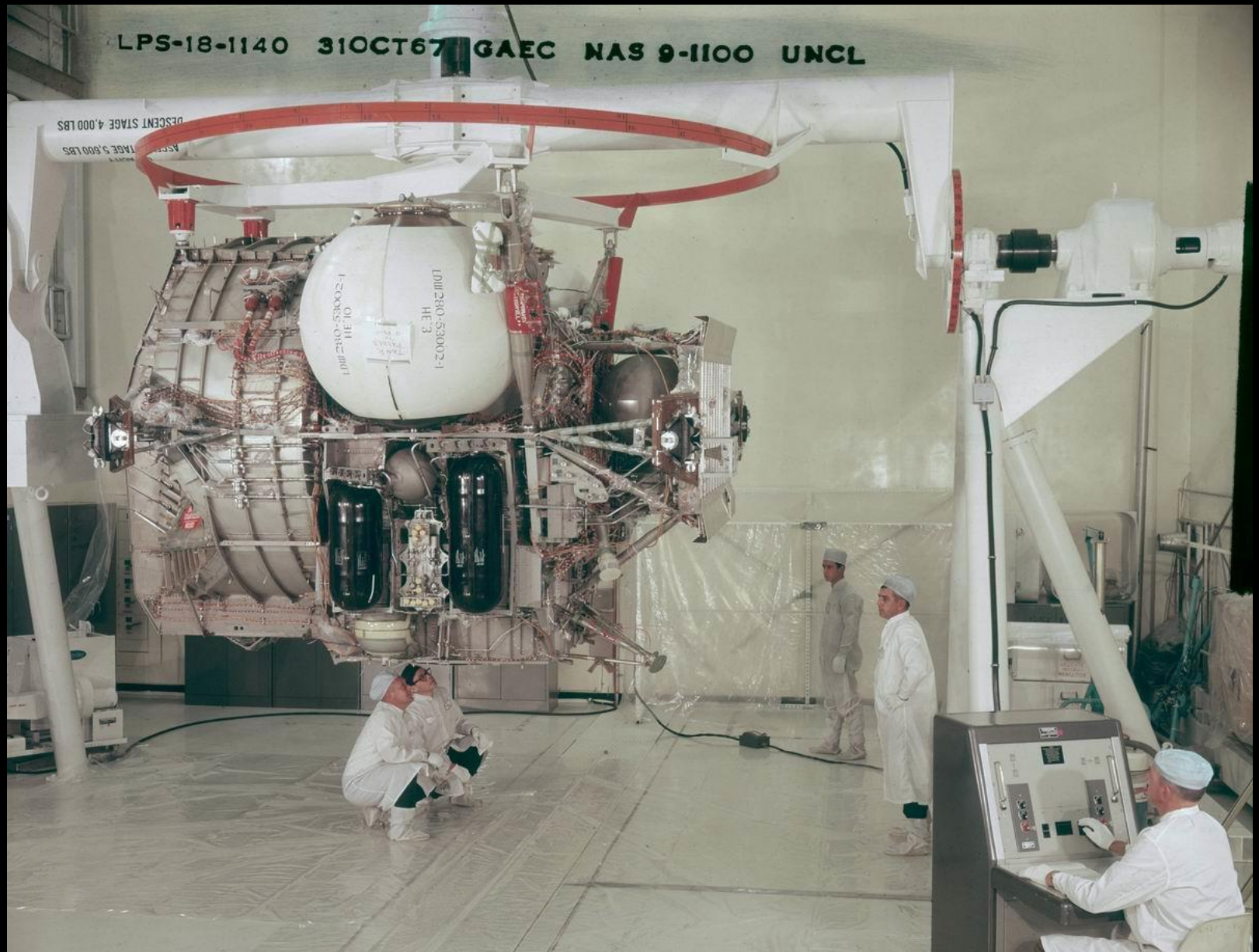
Nejjednodušší motor

Bell, Rocketdyne

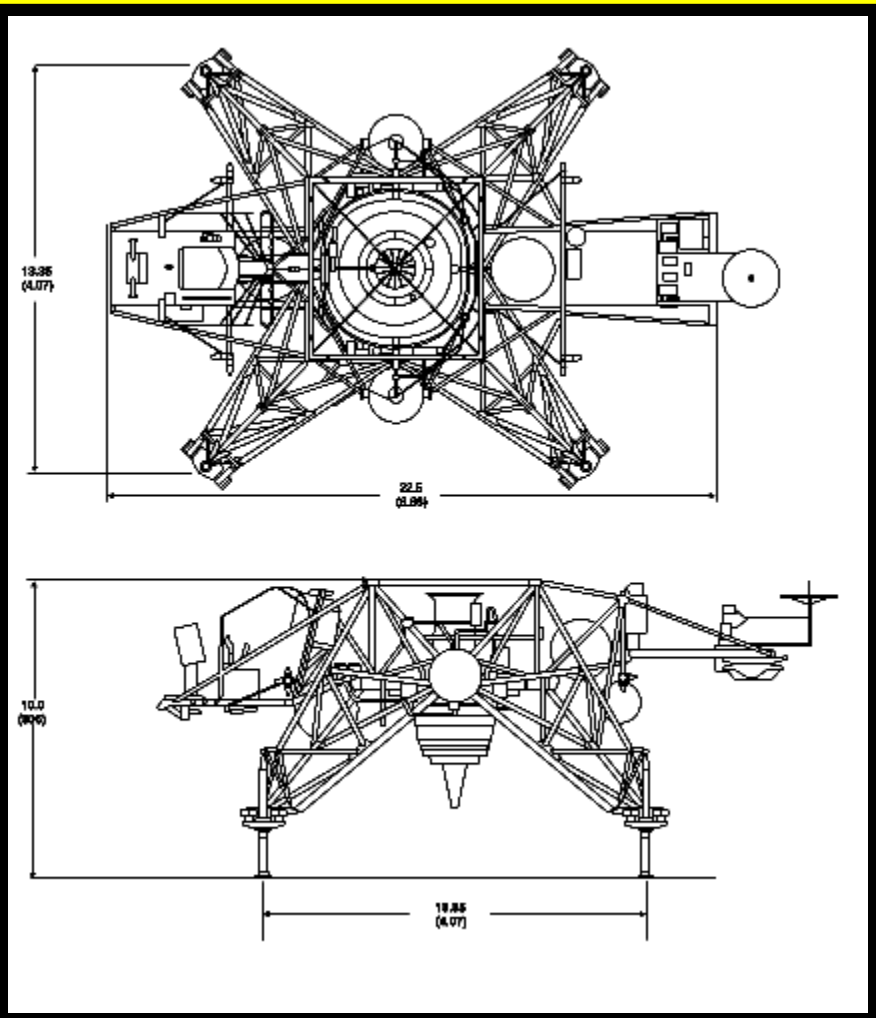
Problém s nadváhou



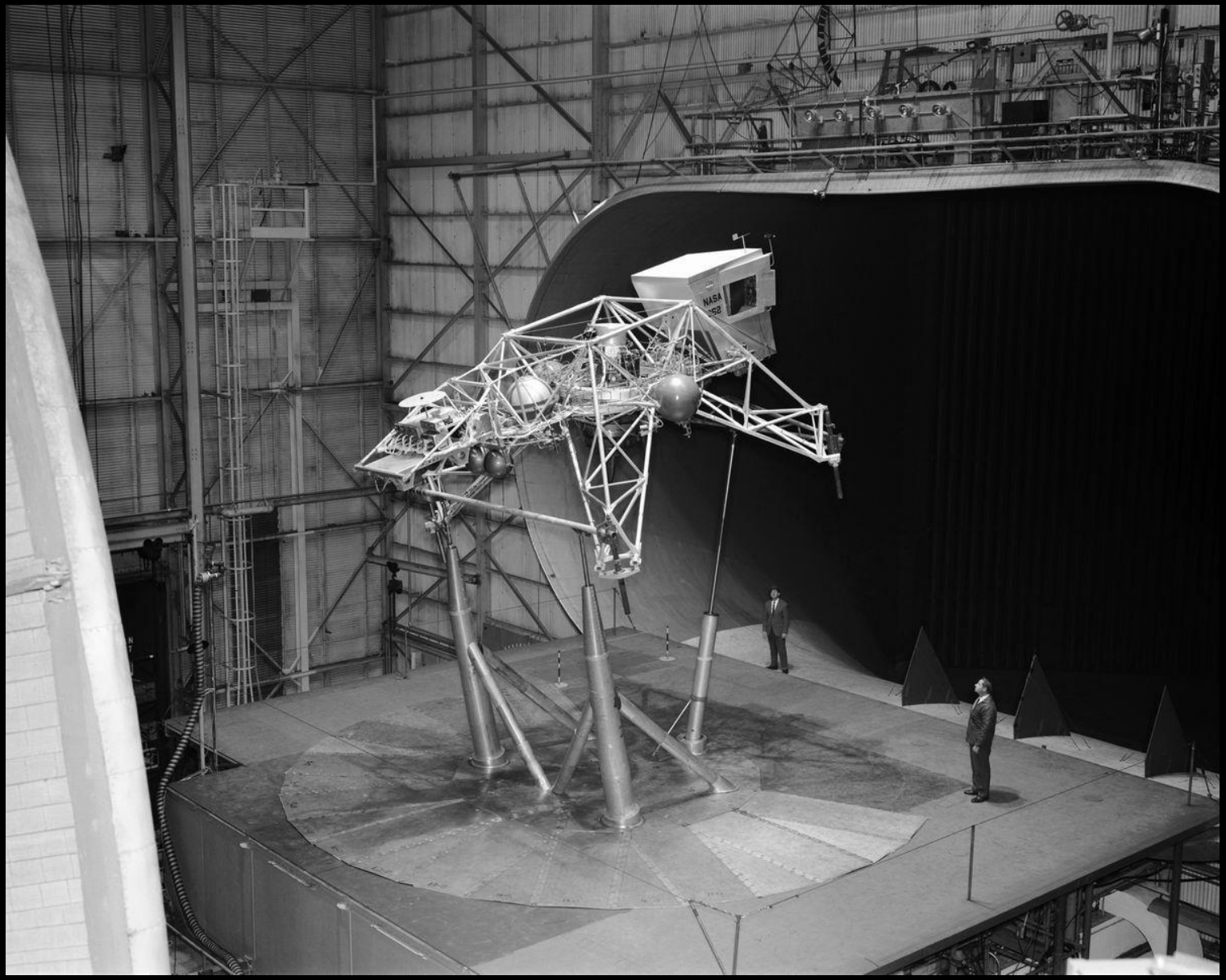
Červenec 1965 – 25 tisíc USD



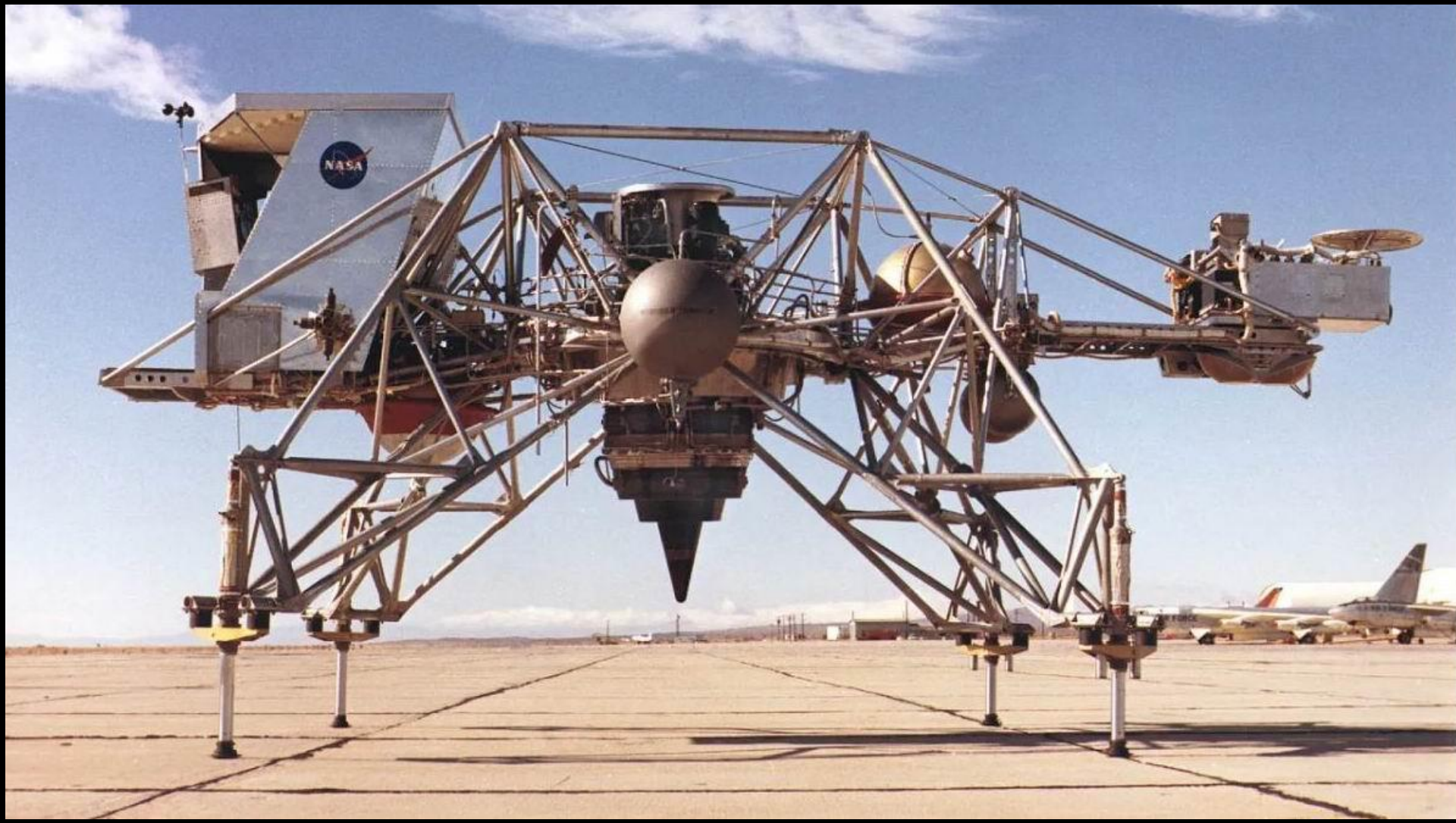
1962: NASA Flight Research Center



Lunar Landing Research Vehicle



30. října 1964



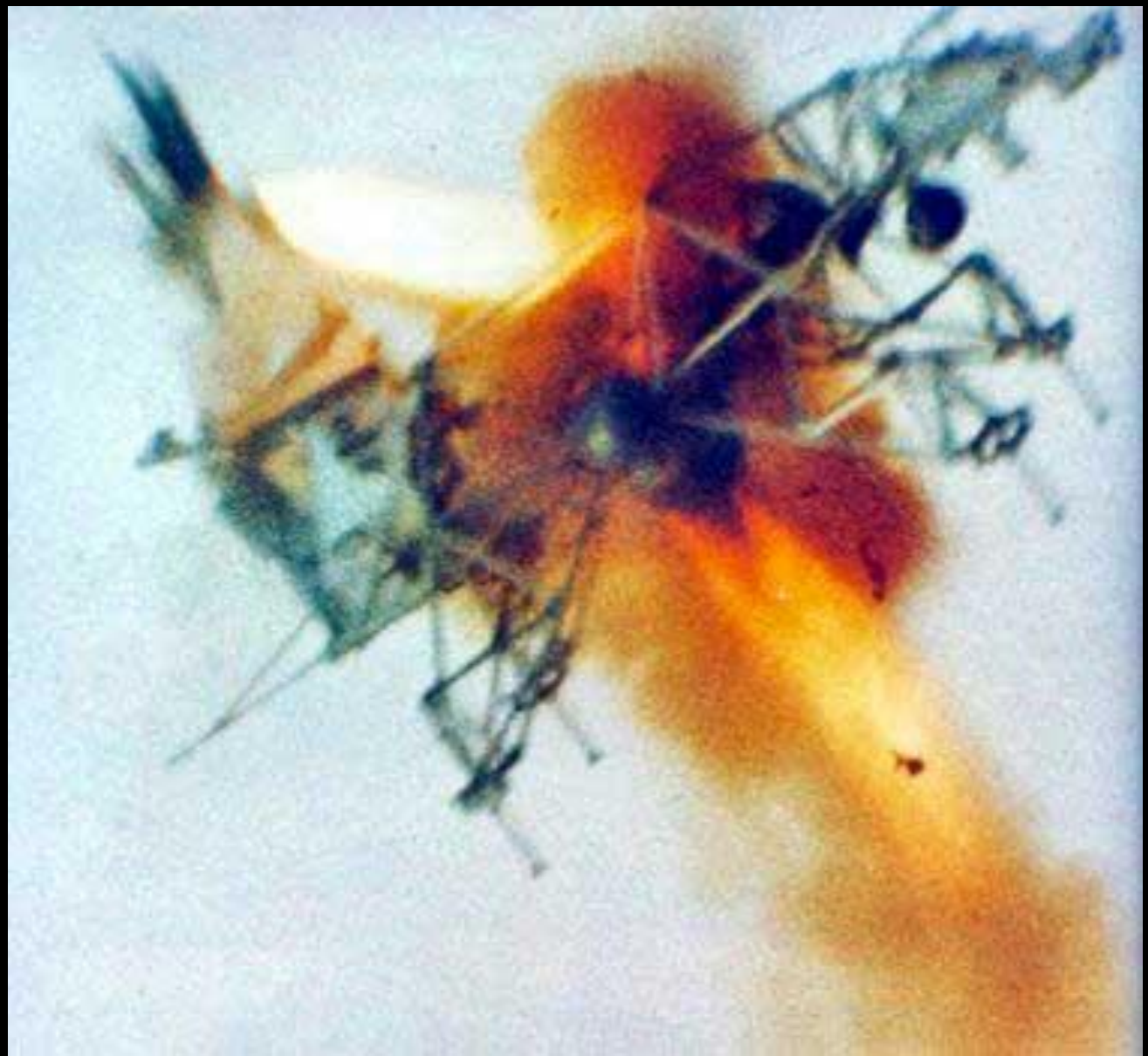
16. listopadu 1964

„Lunární režim“

LLTV (Lunar Landing Traing Vehicle)

Ellington Field

6. května 1968



8. prosince 1968, Joe Algranti

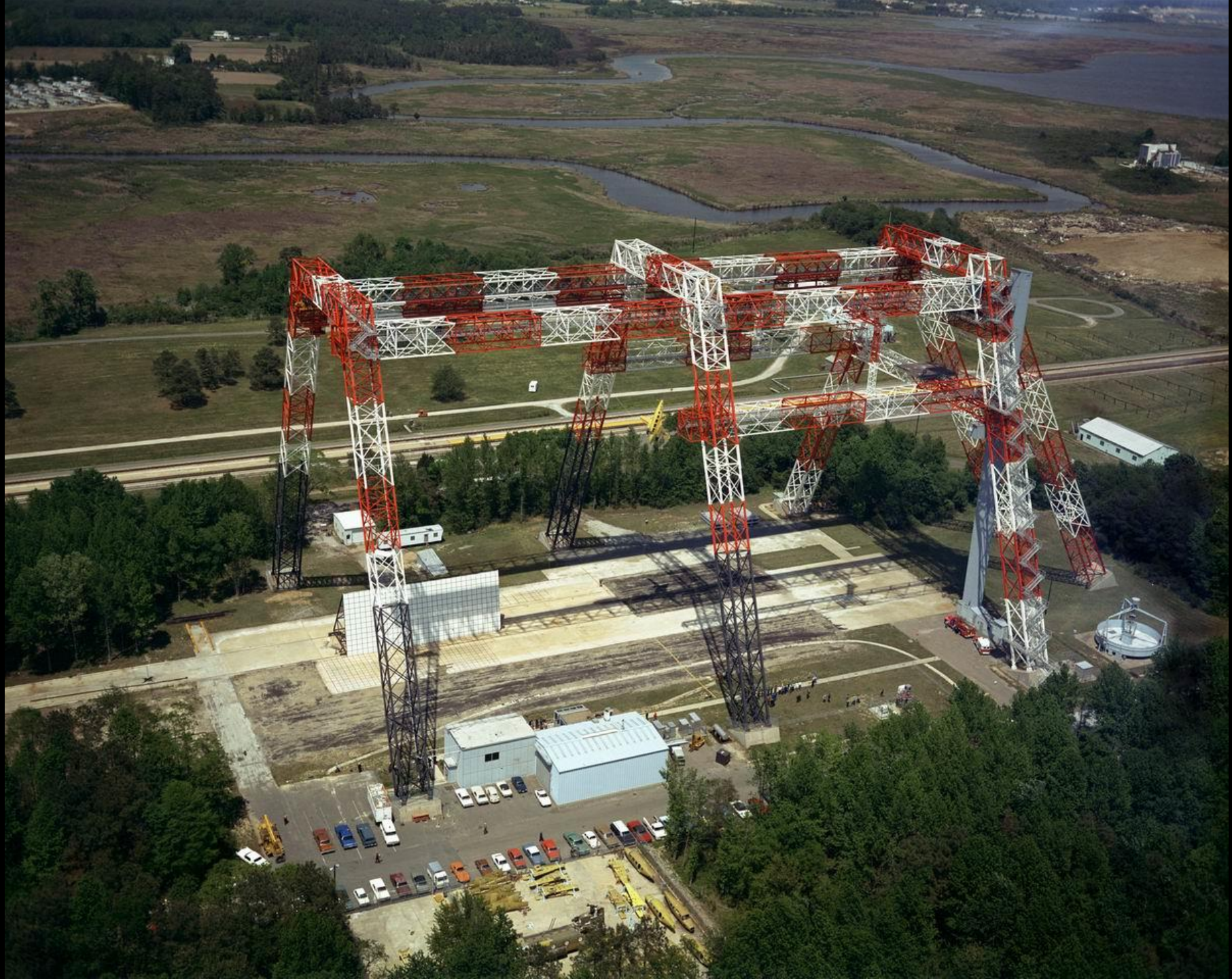
14. června 1969

LLTV-2, leden 1971

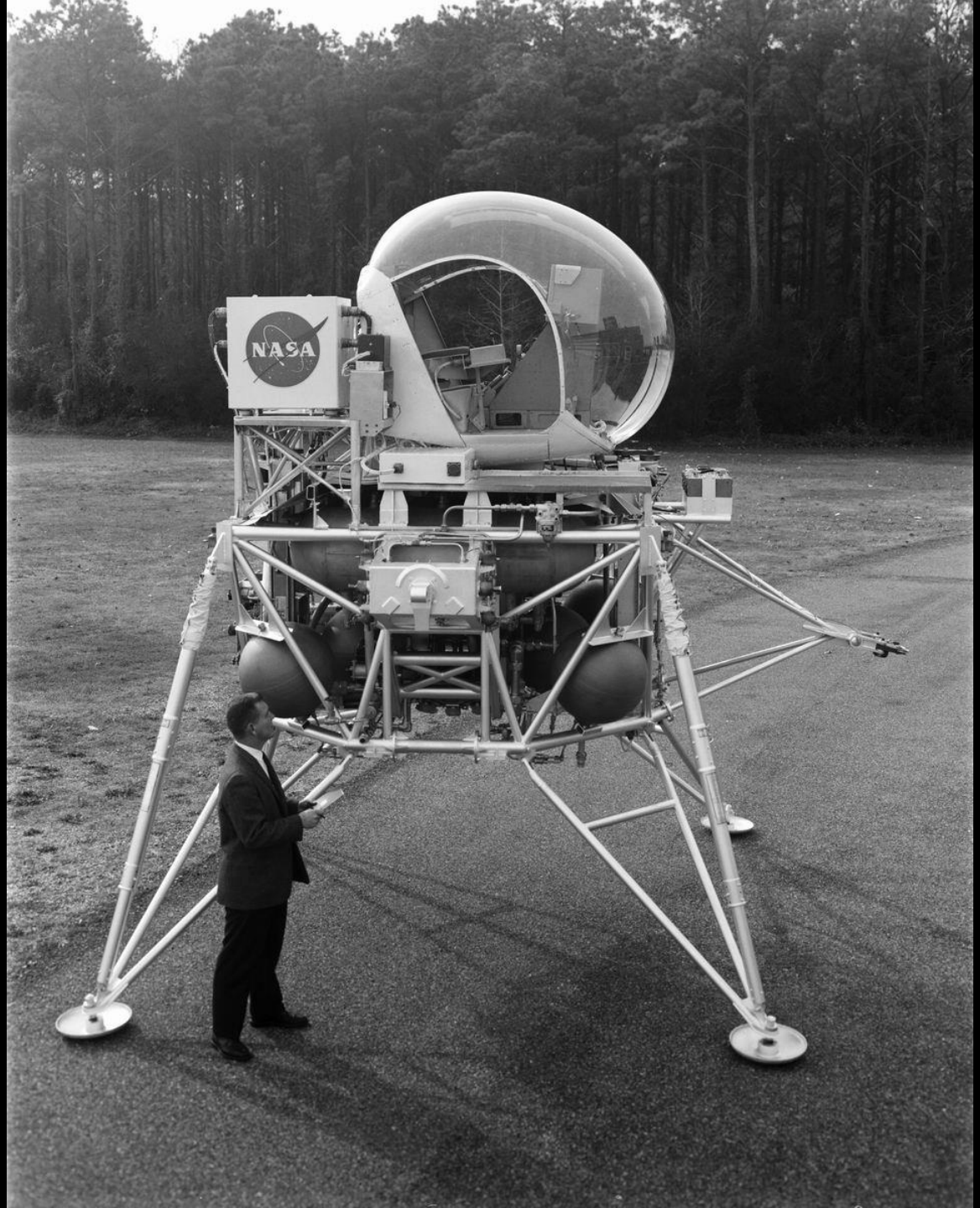
LLRV-2: Edwards AFB

LLTV-3: Johnsonovo středisko NASA (Houston)

LLRF (Lunar Landing Research Facility)

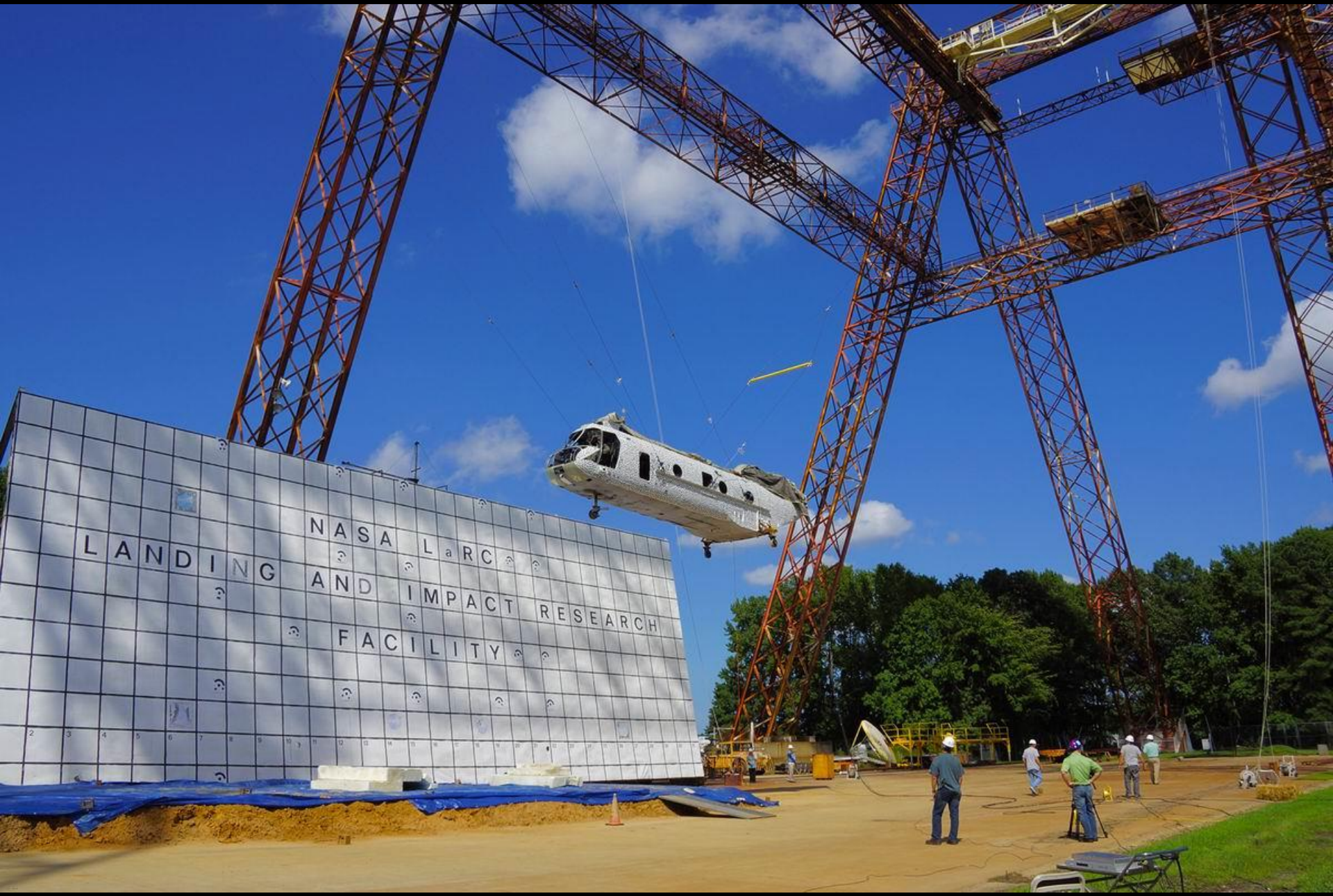



LANGLEY RESEARCH CENTER
NASA

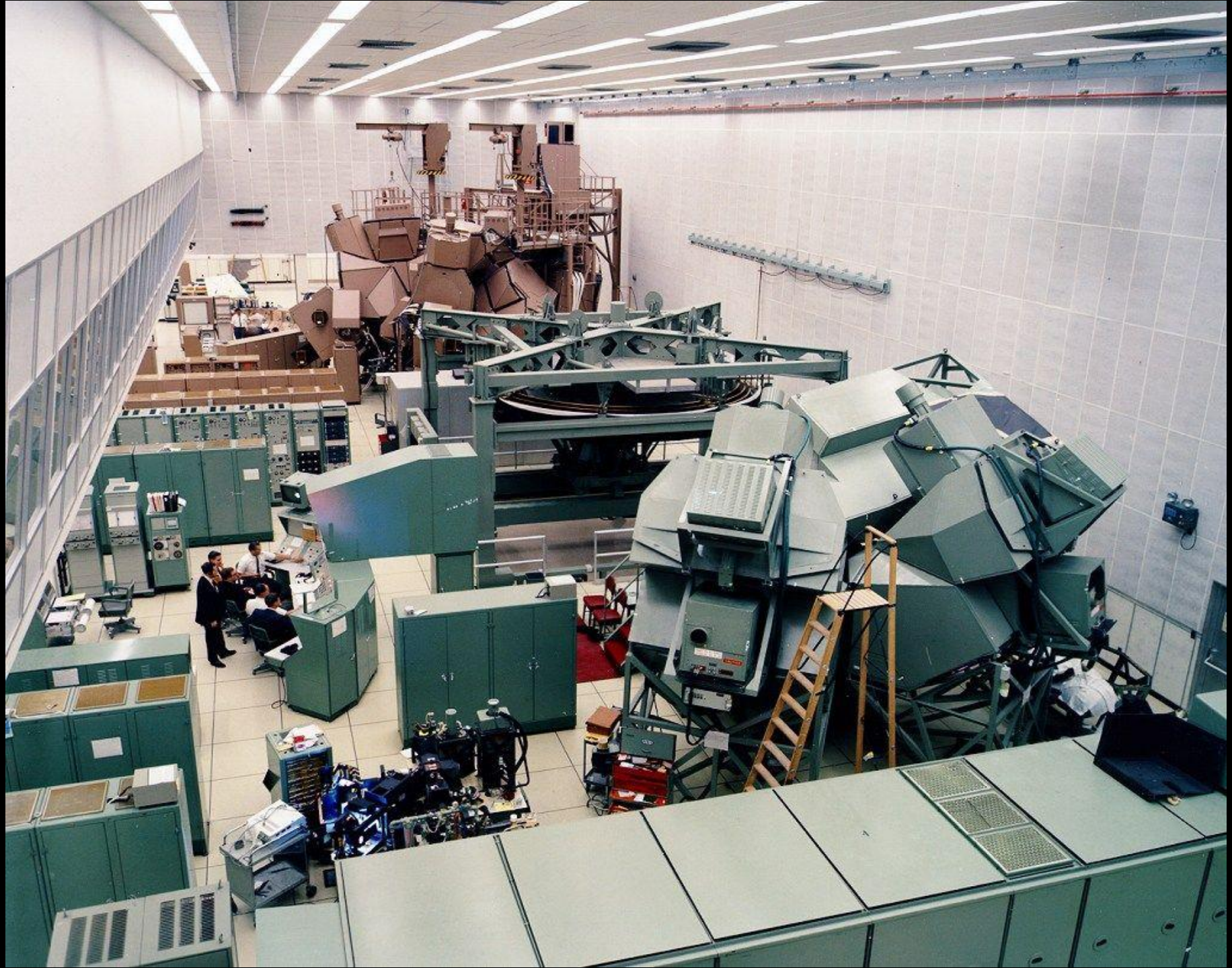

NASA


NASA


Link-Belt

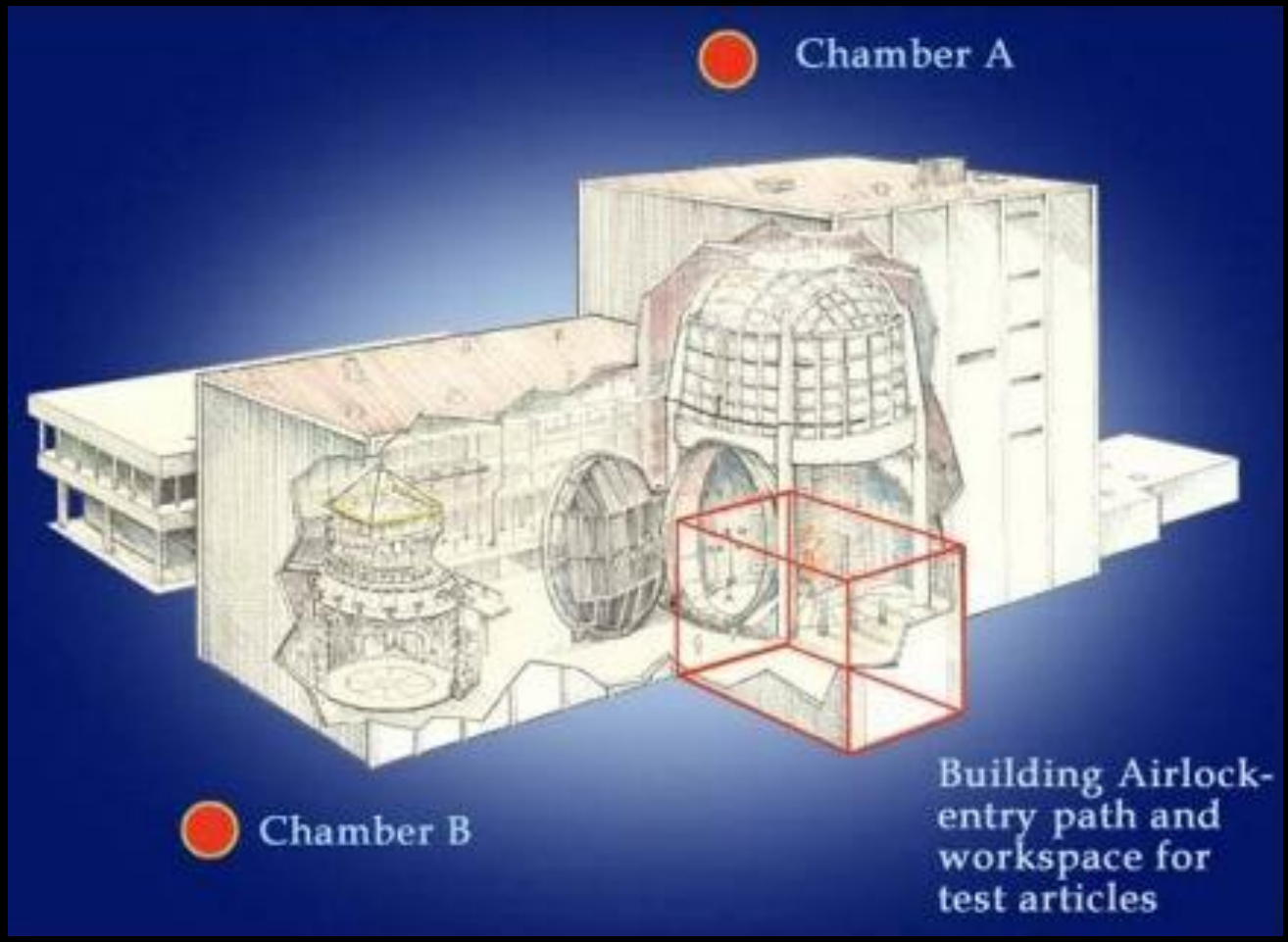

NASA LaRC
LANDING AND IMPACT RESEARCH
FACILITY


16
17
23
16
17
23



Space Environment Simulation Laboratory

17 m/36 m – 14 m/13m

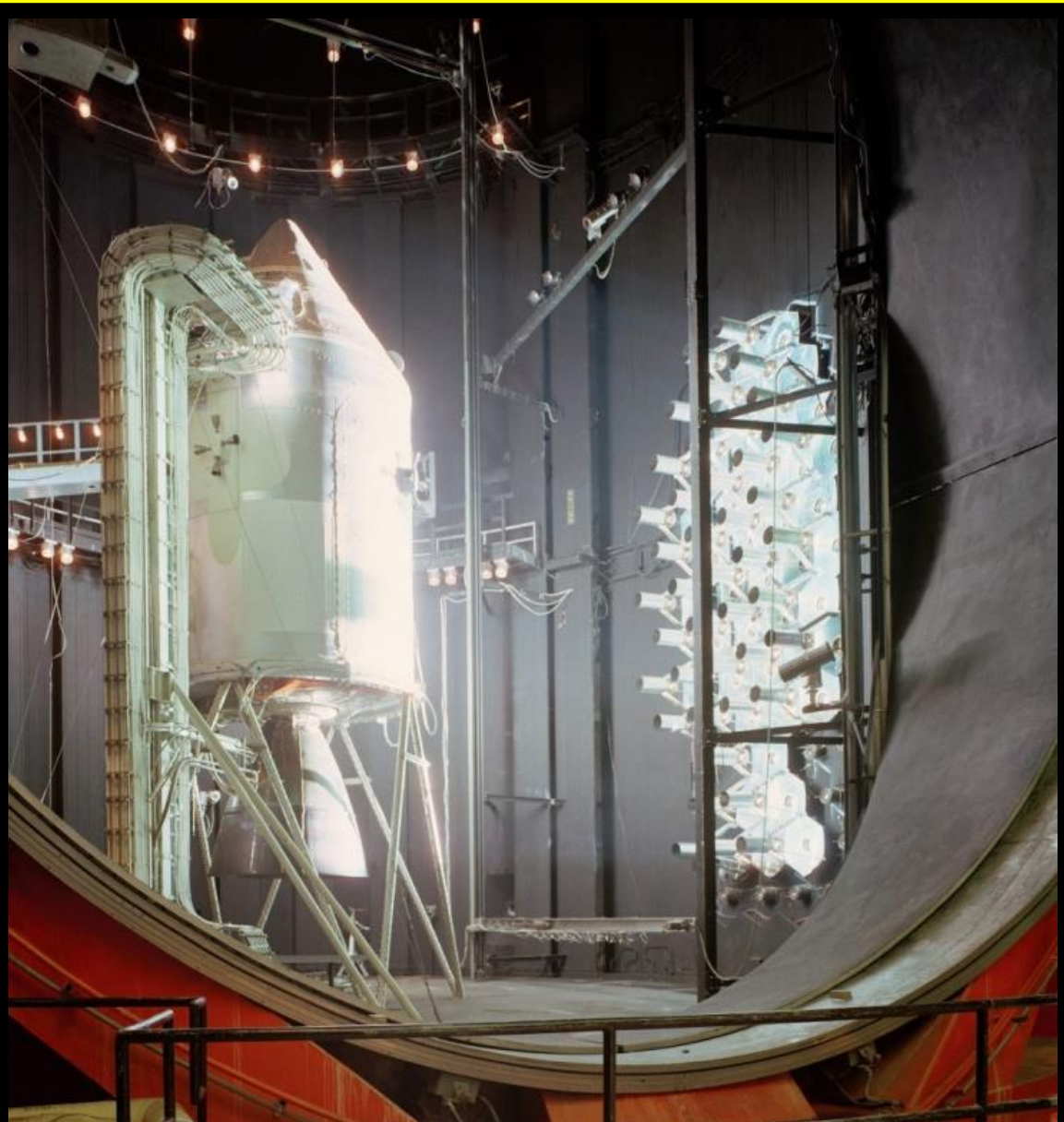


Přechodové komory

Vstup bokem/vrchem

95 stupňů, mínus 140 stupňů

Konec 1966: CSM-008

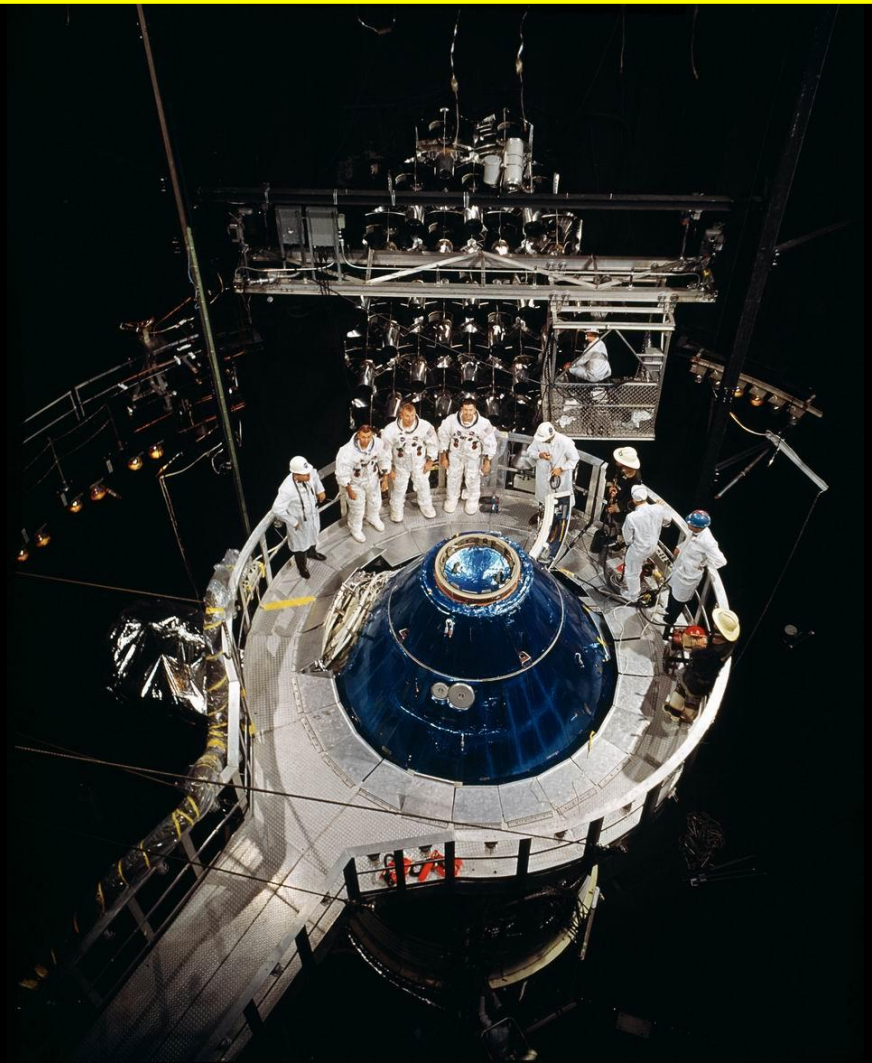


83 dní

92 h bezpilotní, 163 h pilotovaný

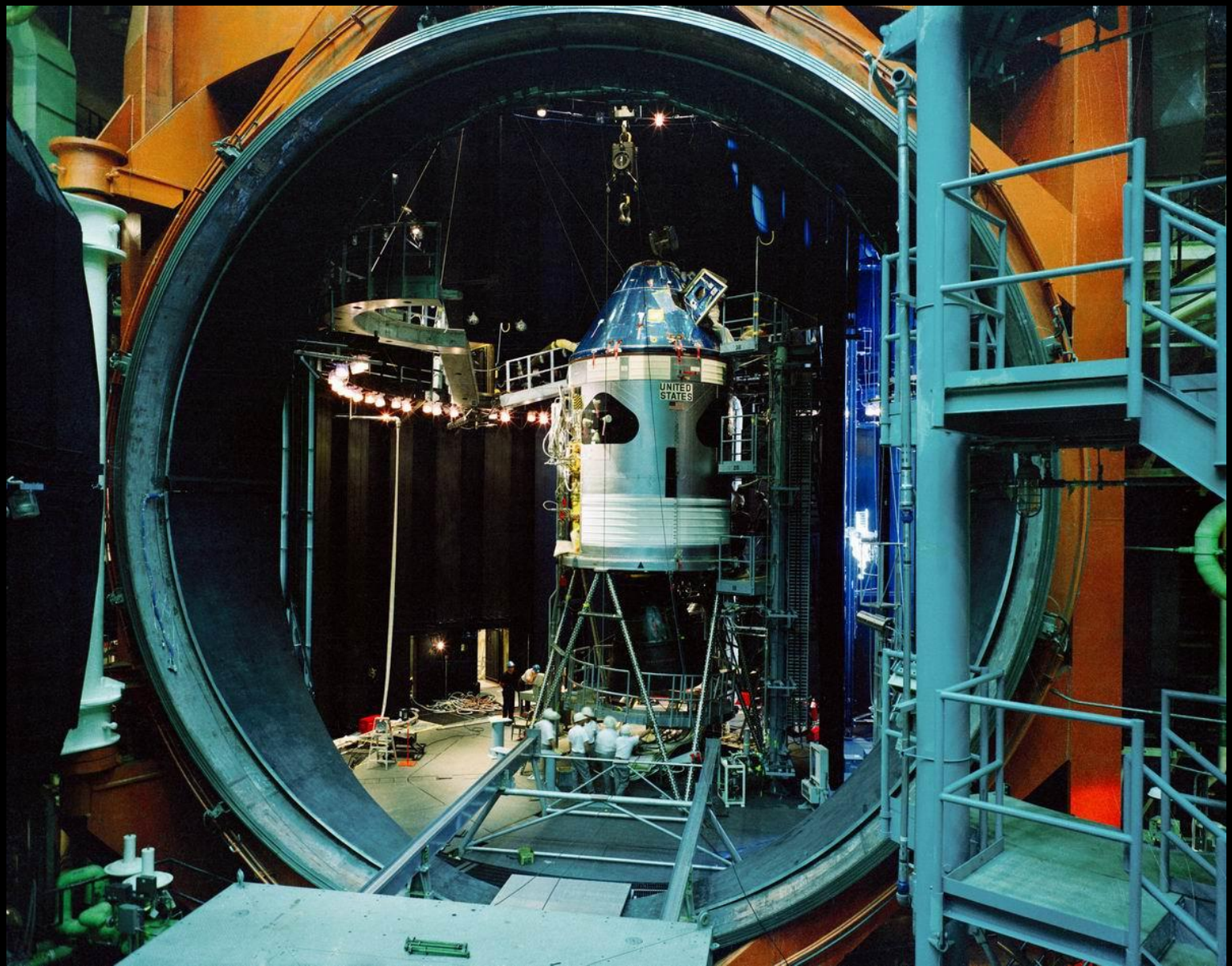
Ed Gives, Joe Kerwin, Joe Gagliano

Joe Kerwin, Vance Brand, Joe Engle



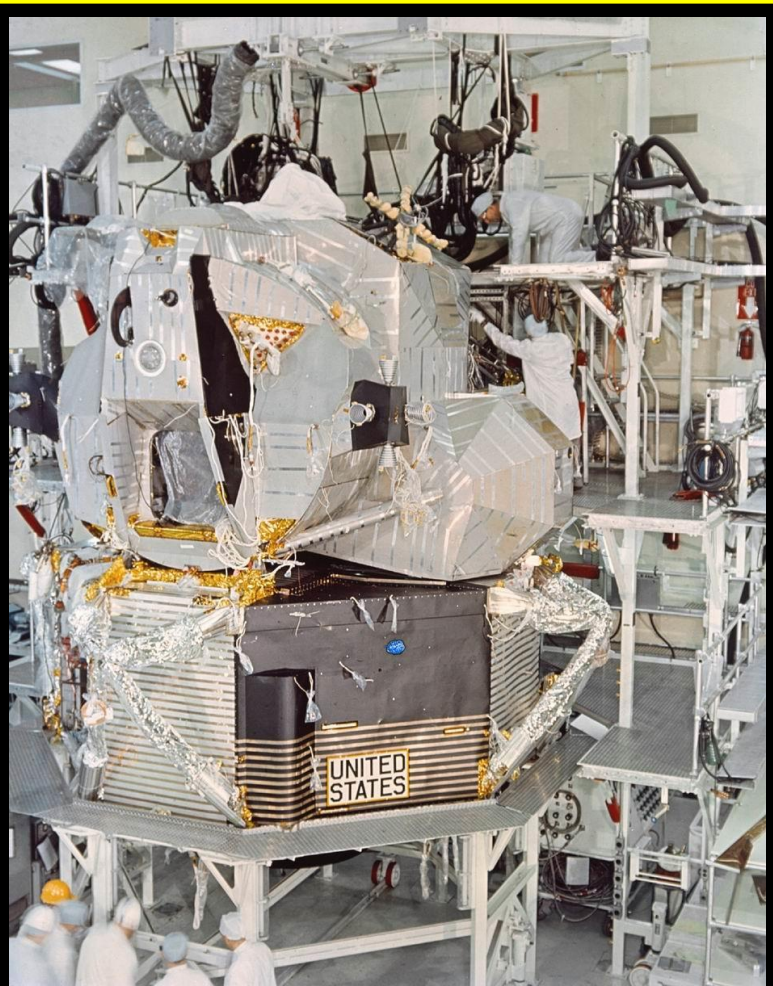

ARROGANS AVIS
2TV-1
CAUDA GRAVIS

16. až 24. června 1968



LTA-7: kompletní test

LTA-8 a -9 létající

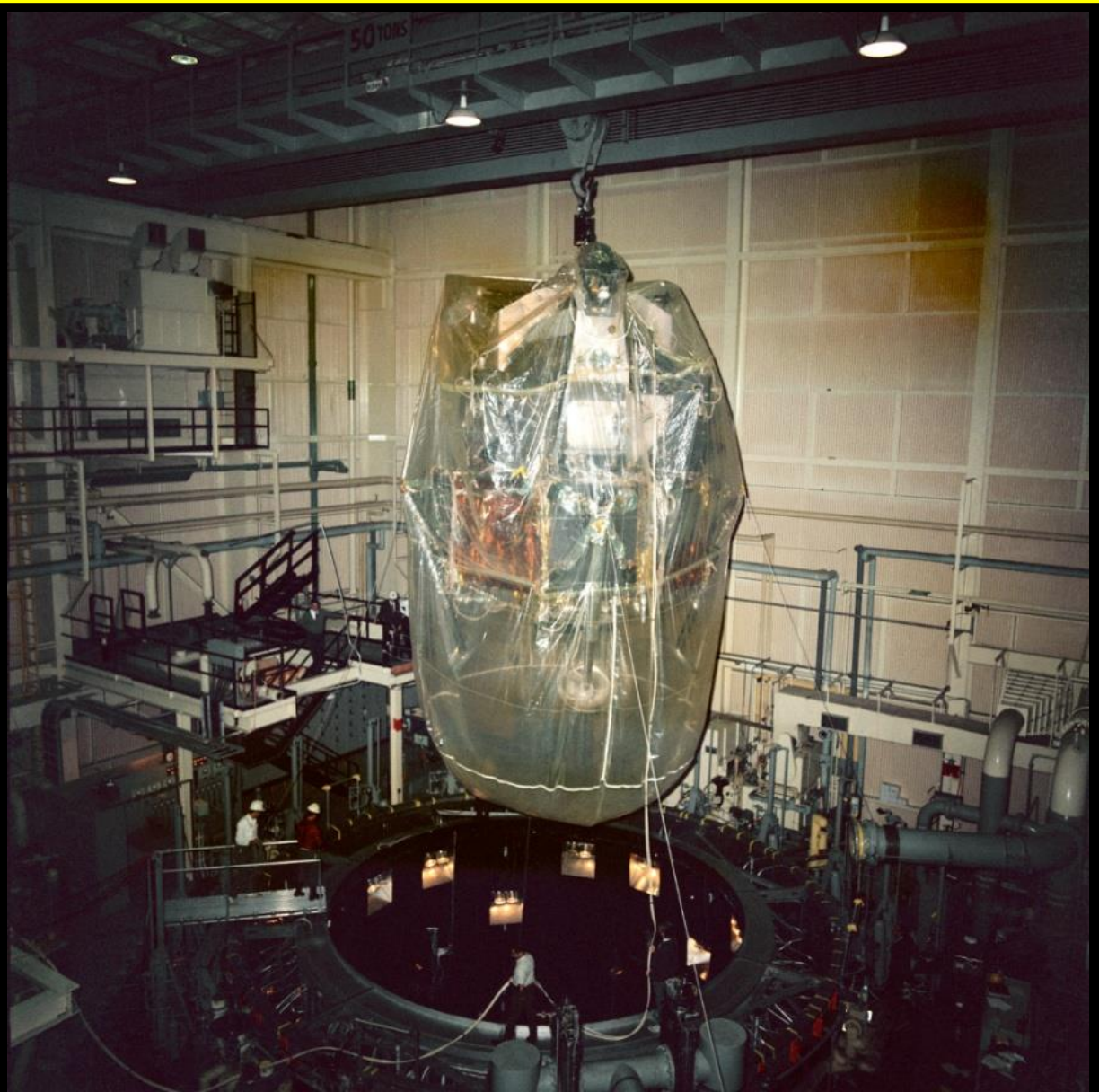


James Irwin

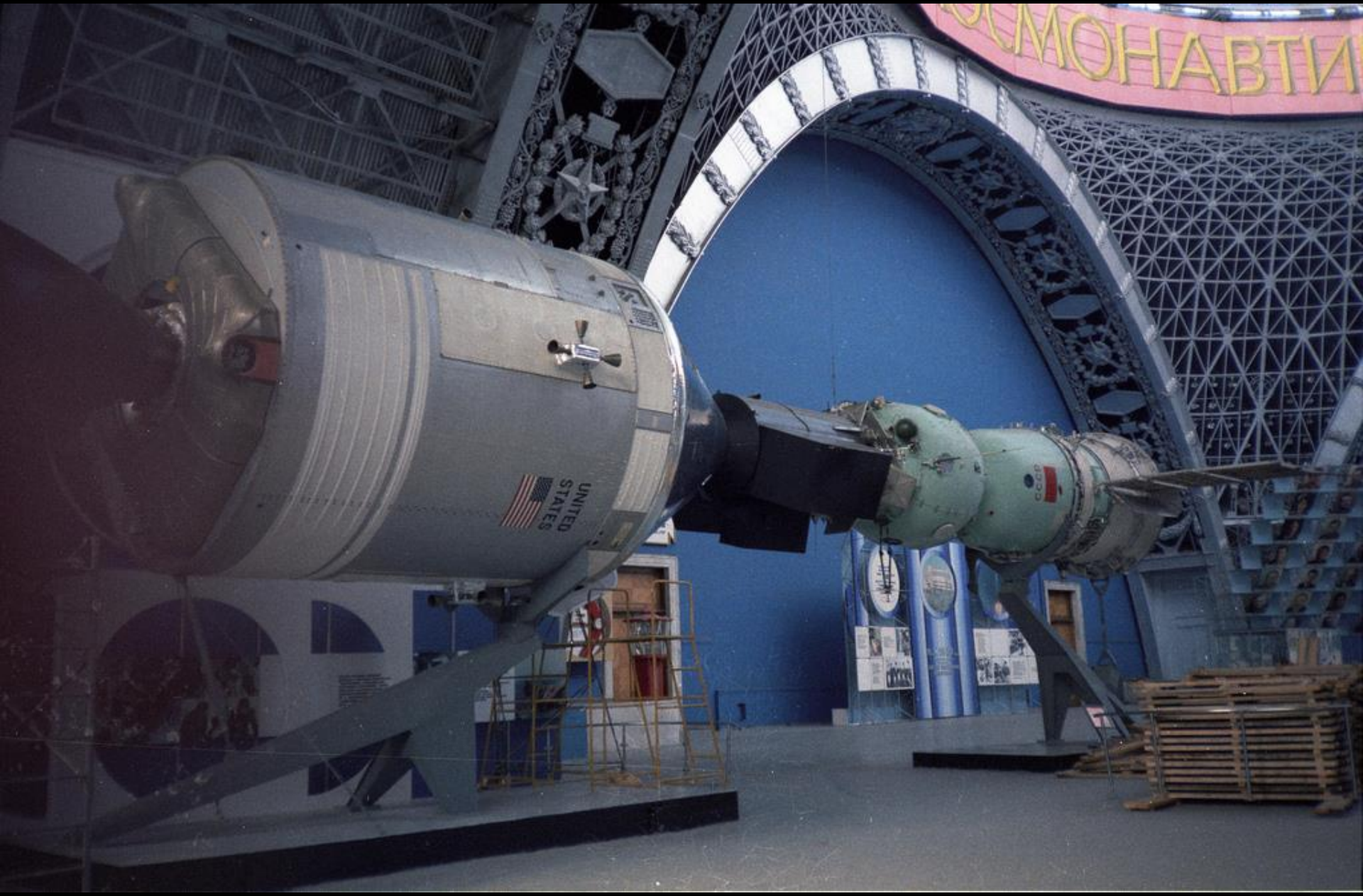
John Bull

Gerry Gibbons

Květen 1968: 161 h

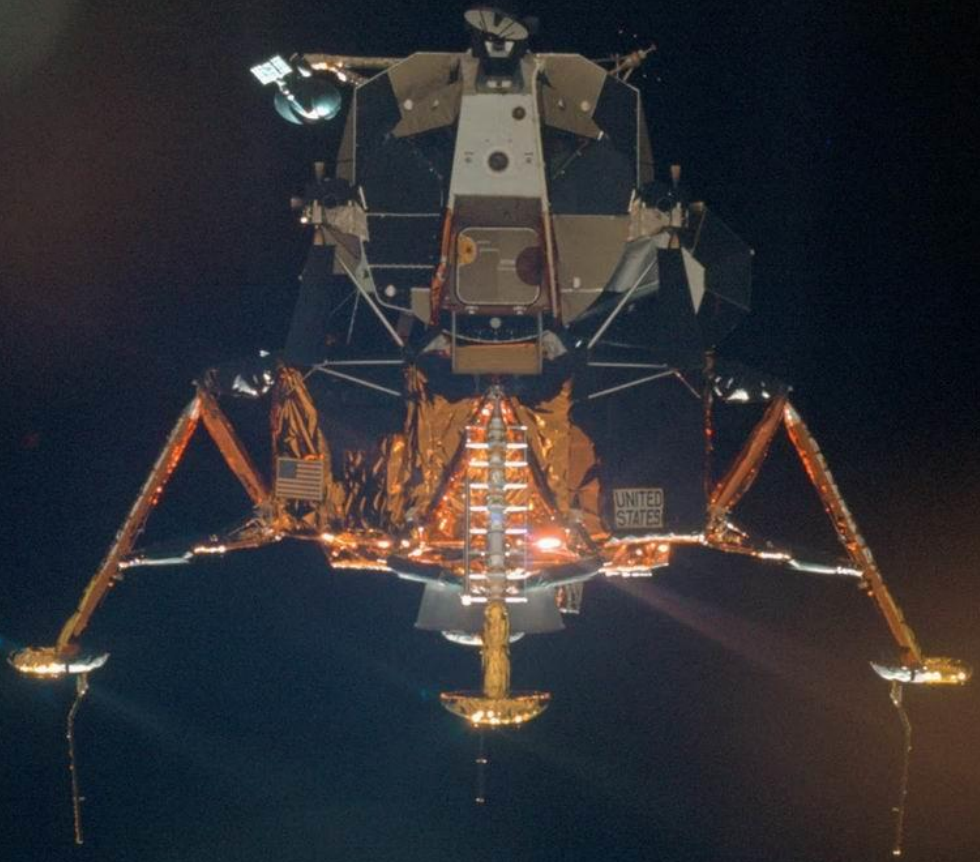



STARSHIP

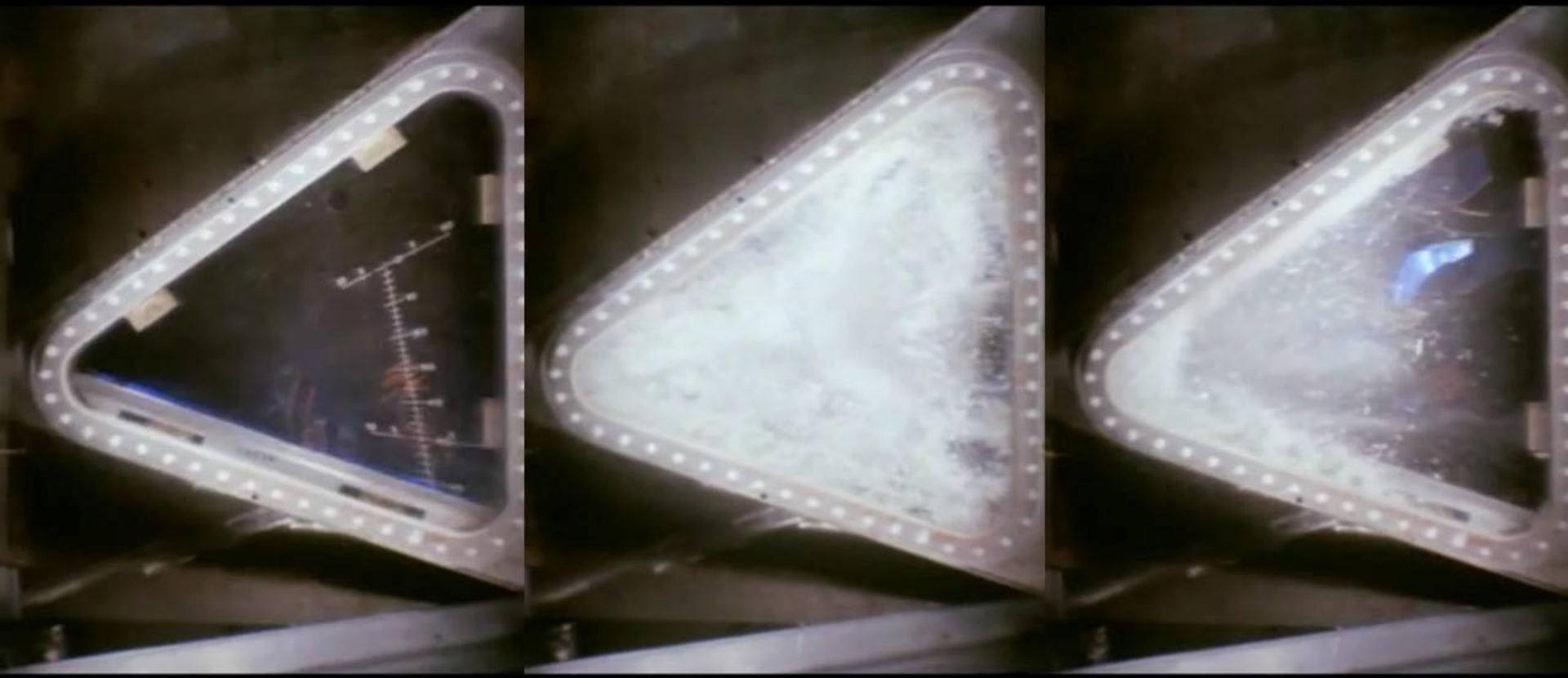

UNITED STATES
CCCP

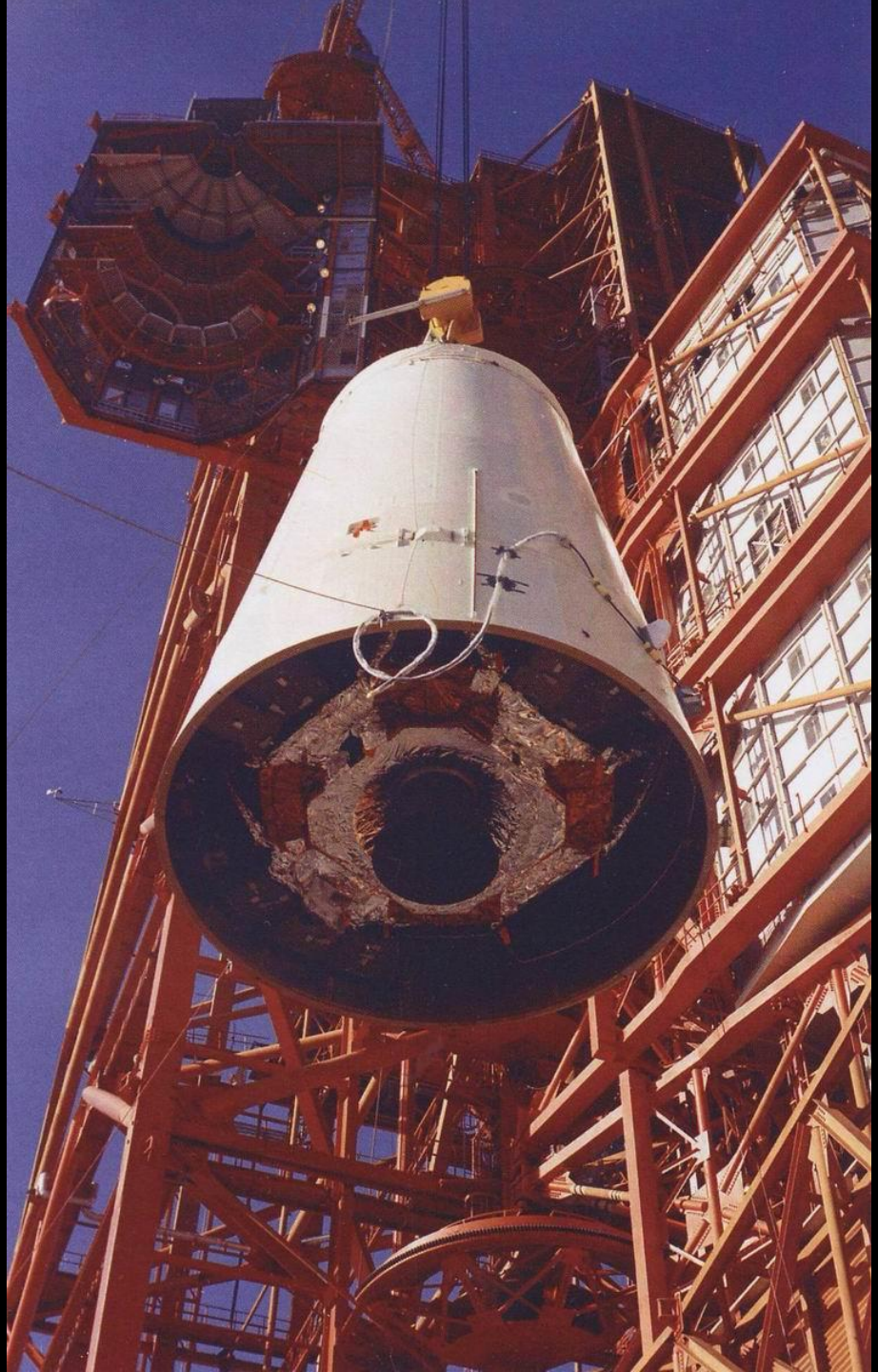
Apollo 5

Prosinec 1967



Prasklé okno LM-5



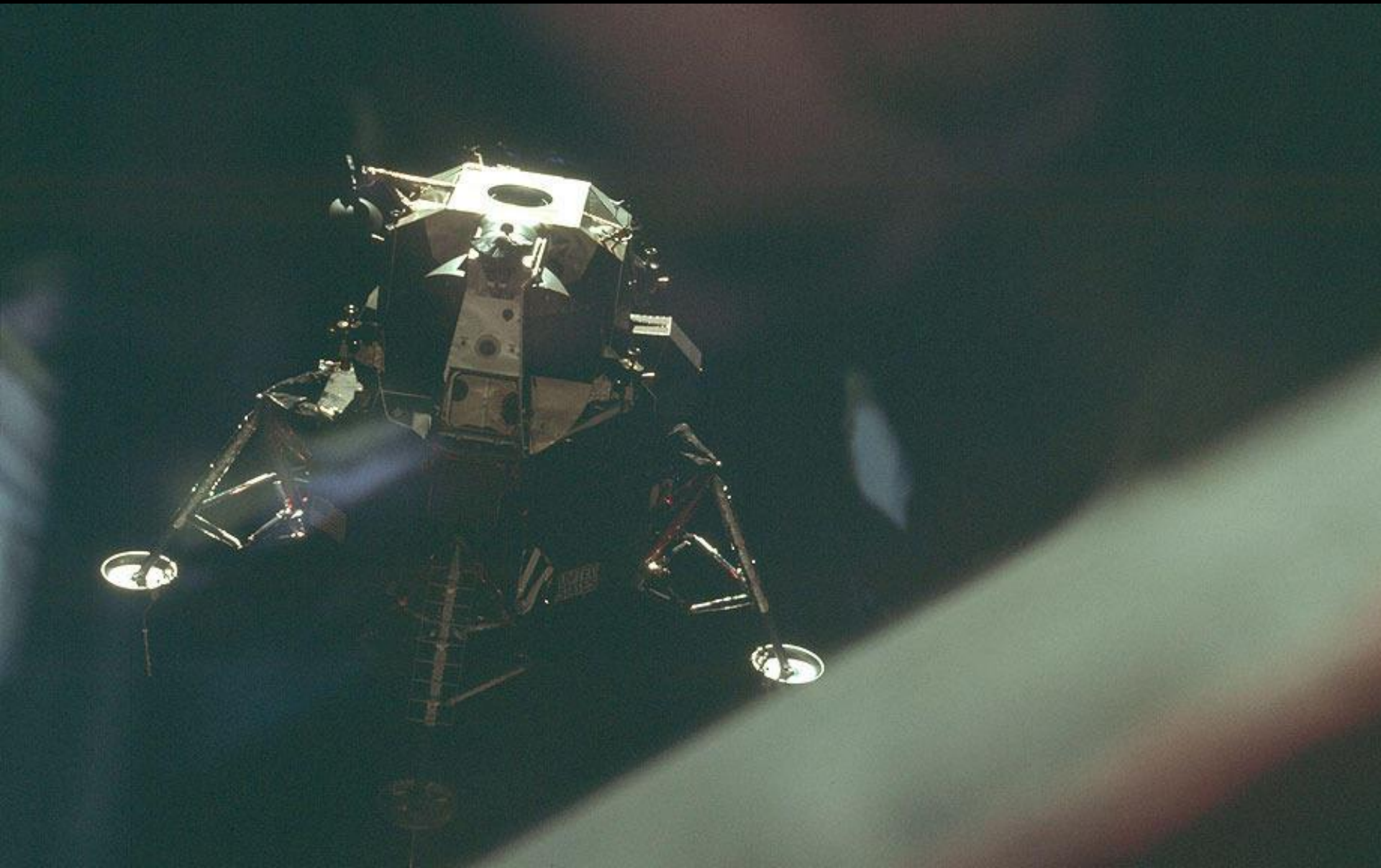


22. ledna 1968

LM 2

Apollo 9

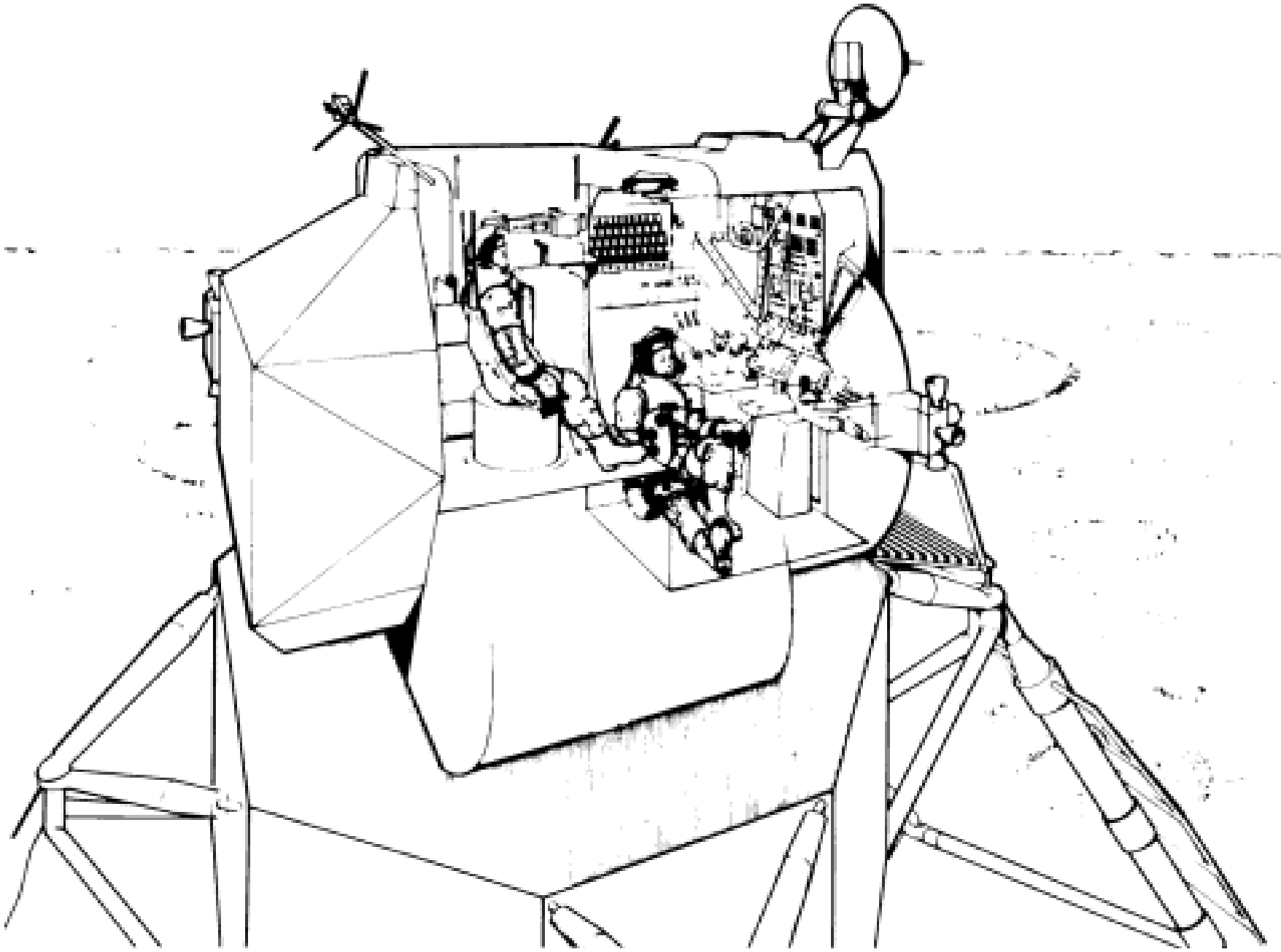
Apollo 10

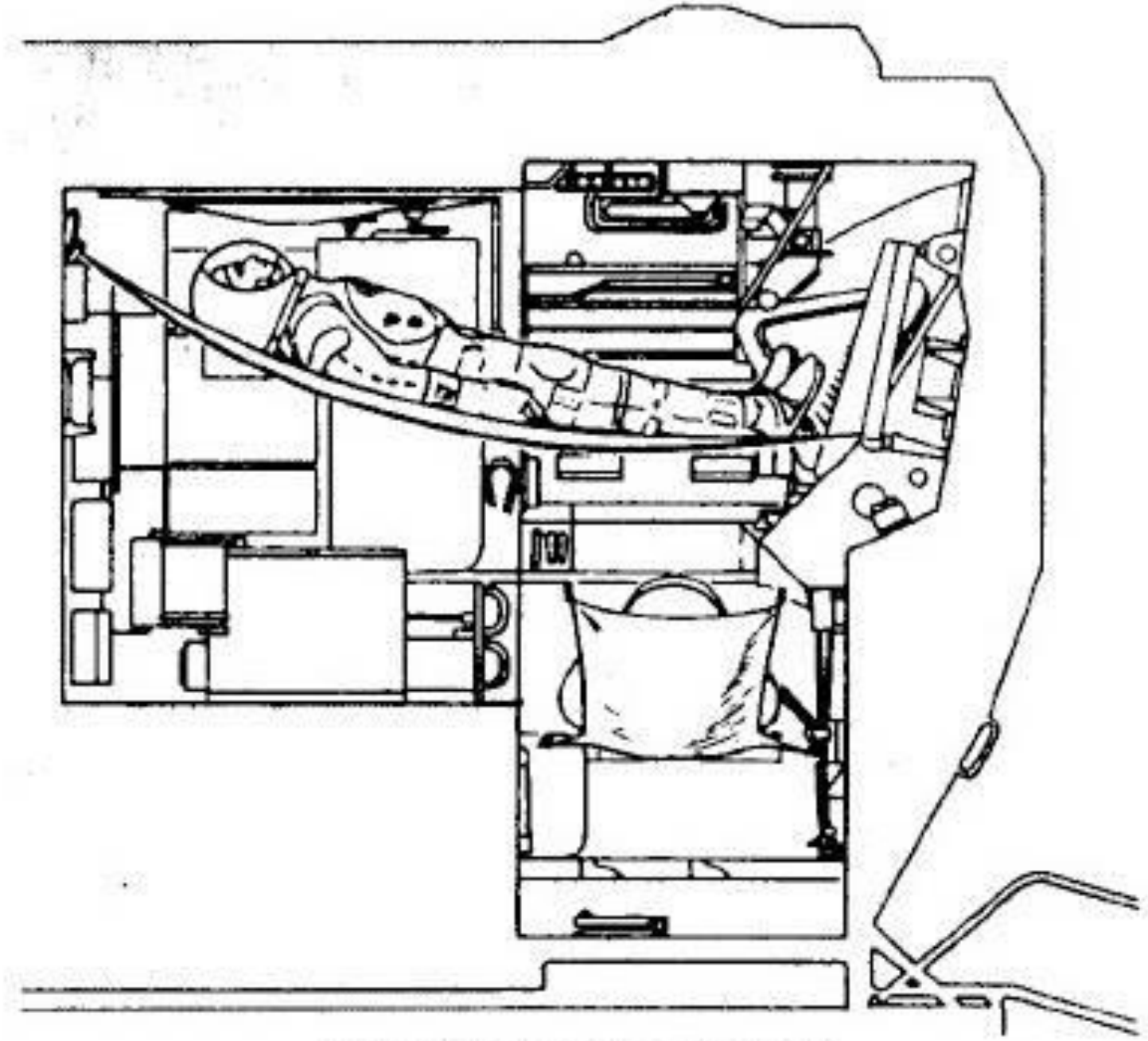


Apollo 11

NASA-S-66-6141-JUN

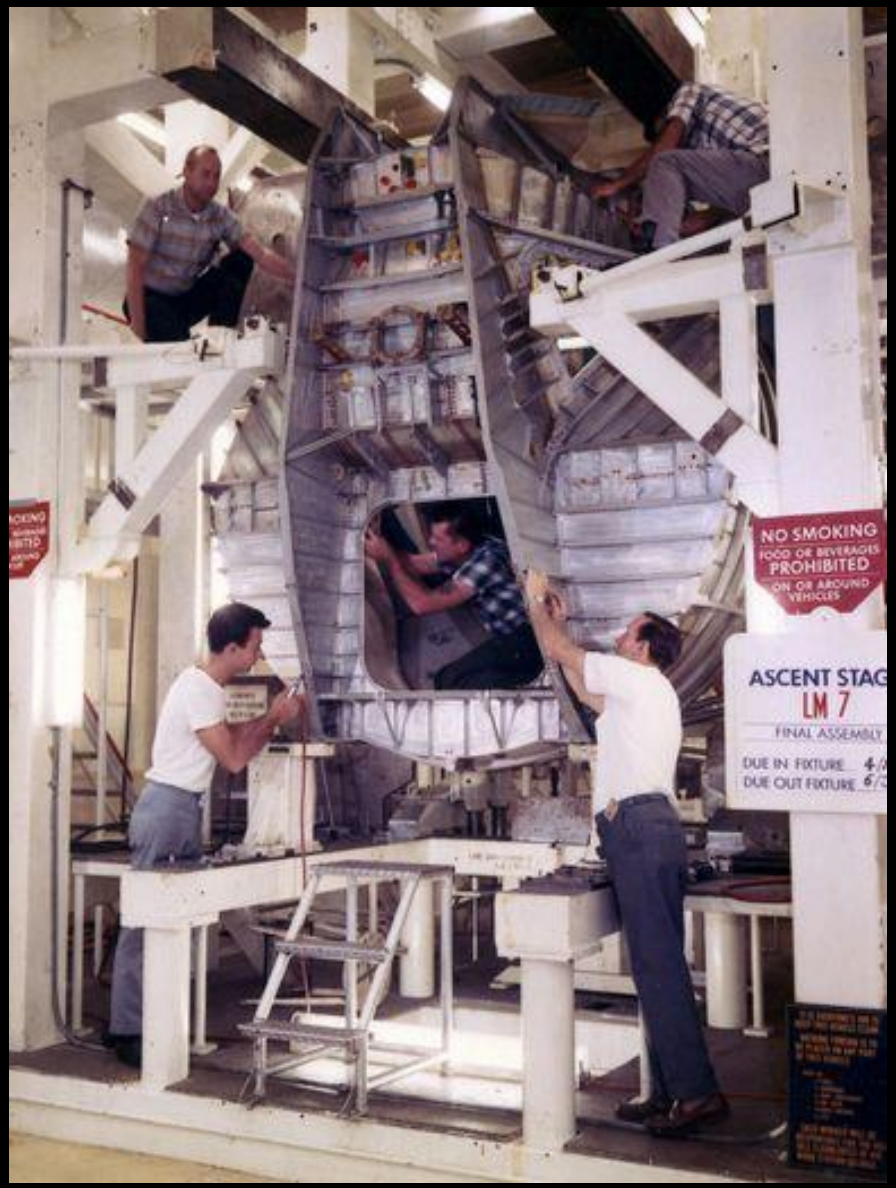
LM SLEEP STATIONS



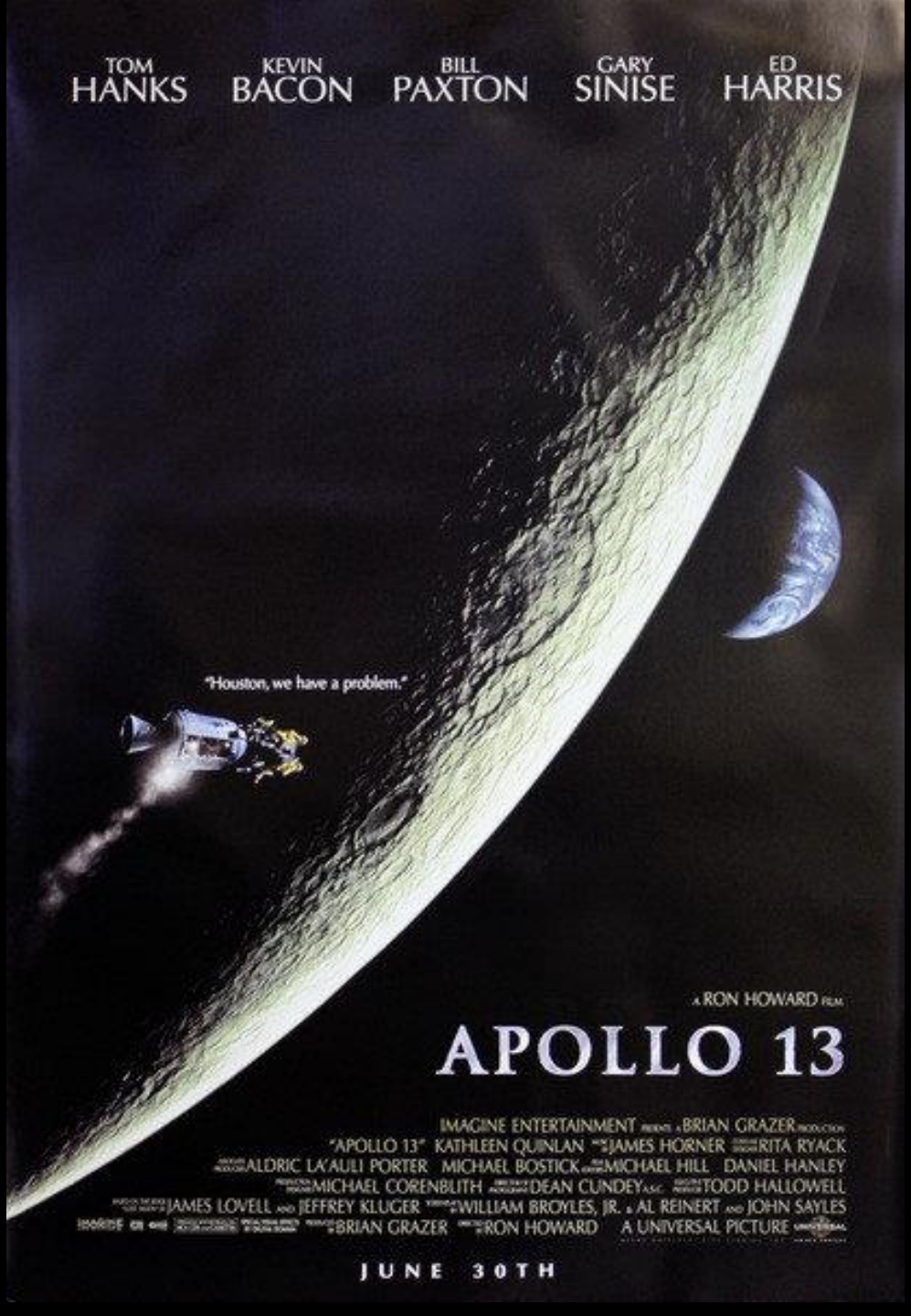


ASTRONAUT REST POSITIONS

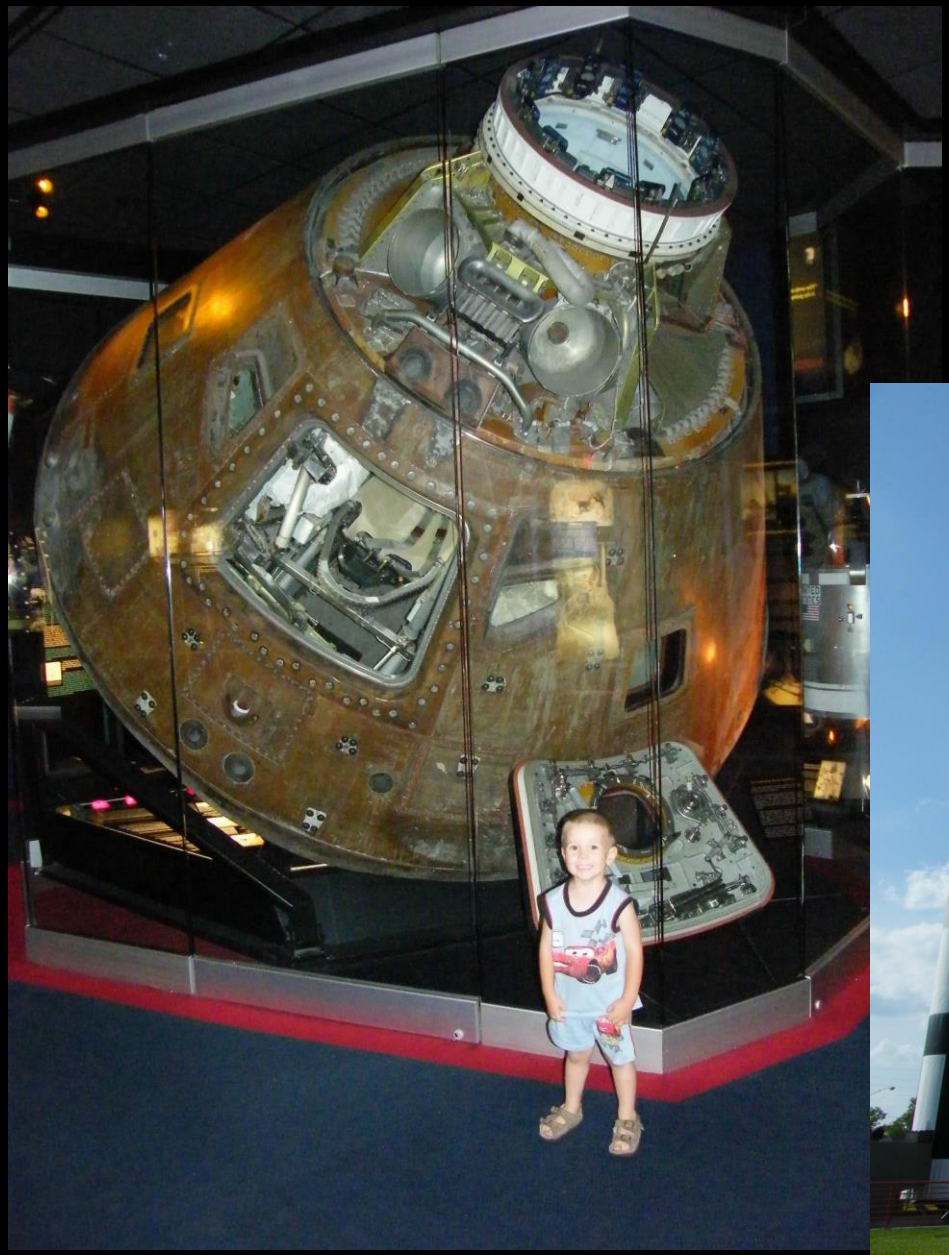
Apollo 13

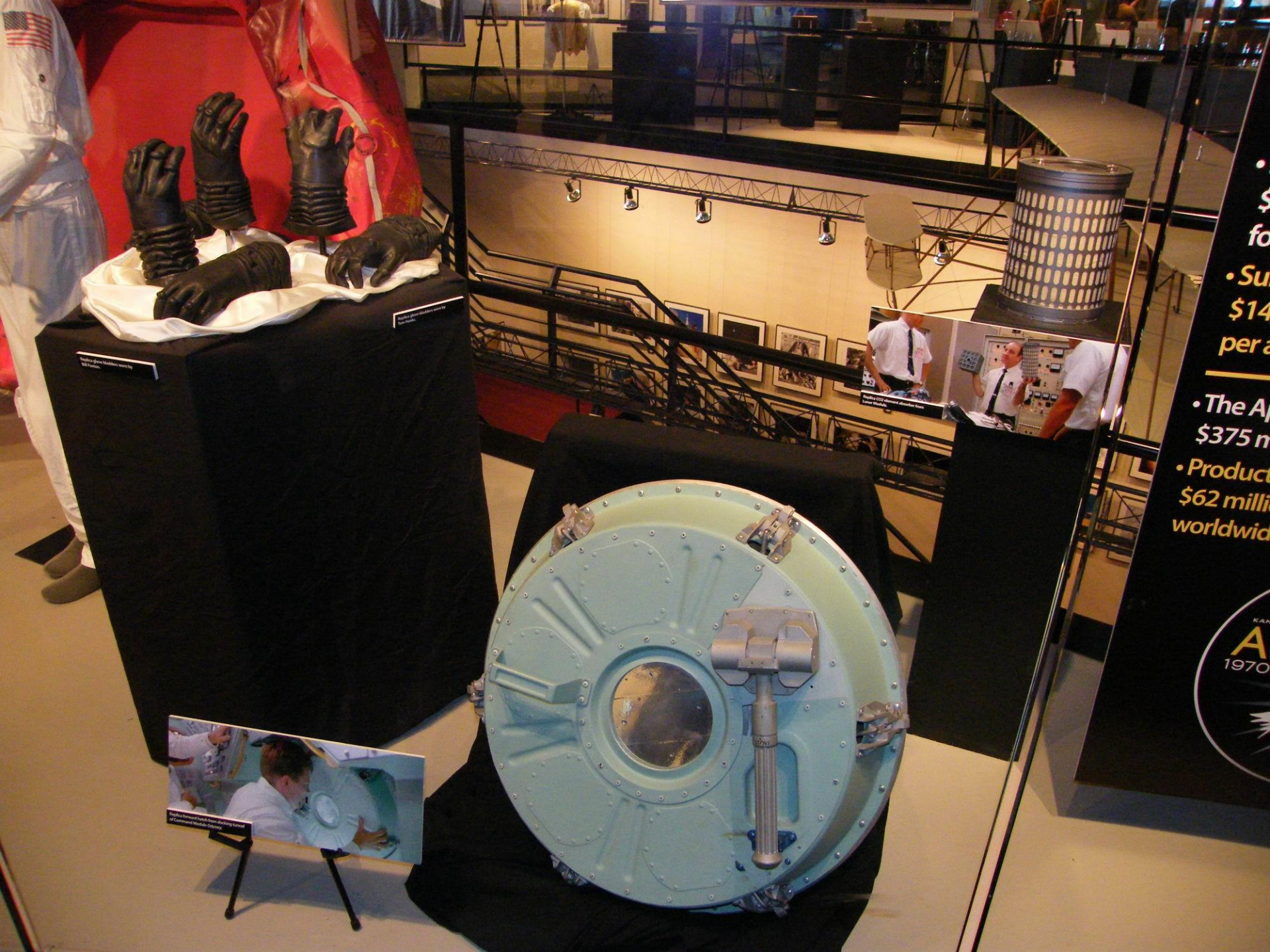

NO SMOKING
FOOD OR BEVERAGES
PROHIBITED
ON OR AROUND
VEHICLES
ASCENT STAG
LM 7
FINAL ASSEMBLY
DUE IN FIXTURE
DUE OUT FIXTURE


APOLLO XIII
EX LUNA, SCIENTIA


TOM HANKS
KEVIN BACON
BILL PAXTON
GARY SINISE
ED HARRIS
"Houston, we have a problem."
A RON HOWARD FILM
APOLLO 13
IMAGINE ENTERTAINMENT PRESENTS A BRIAN GRAZER PRODUCTION
"APOLLO 13" KATHLEEN QUINLAN MUSIC BY JAMES HORNER EDITED BY RITA RYACK
ALDRIC LA'AULI PORTER MICHAEL BOSTICK AND MICHAEL HILL DANIEL HANLEY
PRODUCED BY MICHAEL CORENBLITH DIRECTOR OF PHOTOGRAPHY DEAN CUNDEY A.S.C. EXECUTIVE PRODUCER TODD HALLOWELL
BASED ON THE BOOKS BY JAMES LOVELL AND JEFFREY KLUGER SCREENPLAY BY WILLIAM BROYLES, JR. & AL REINERT AND JOHN SAYLES
STORY BY BRIAN GRAZER DIRECTED BY RON HOWARD A UNIVERSAL PICTURE
JUNE 30TH

Hutchinson Kansas

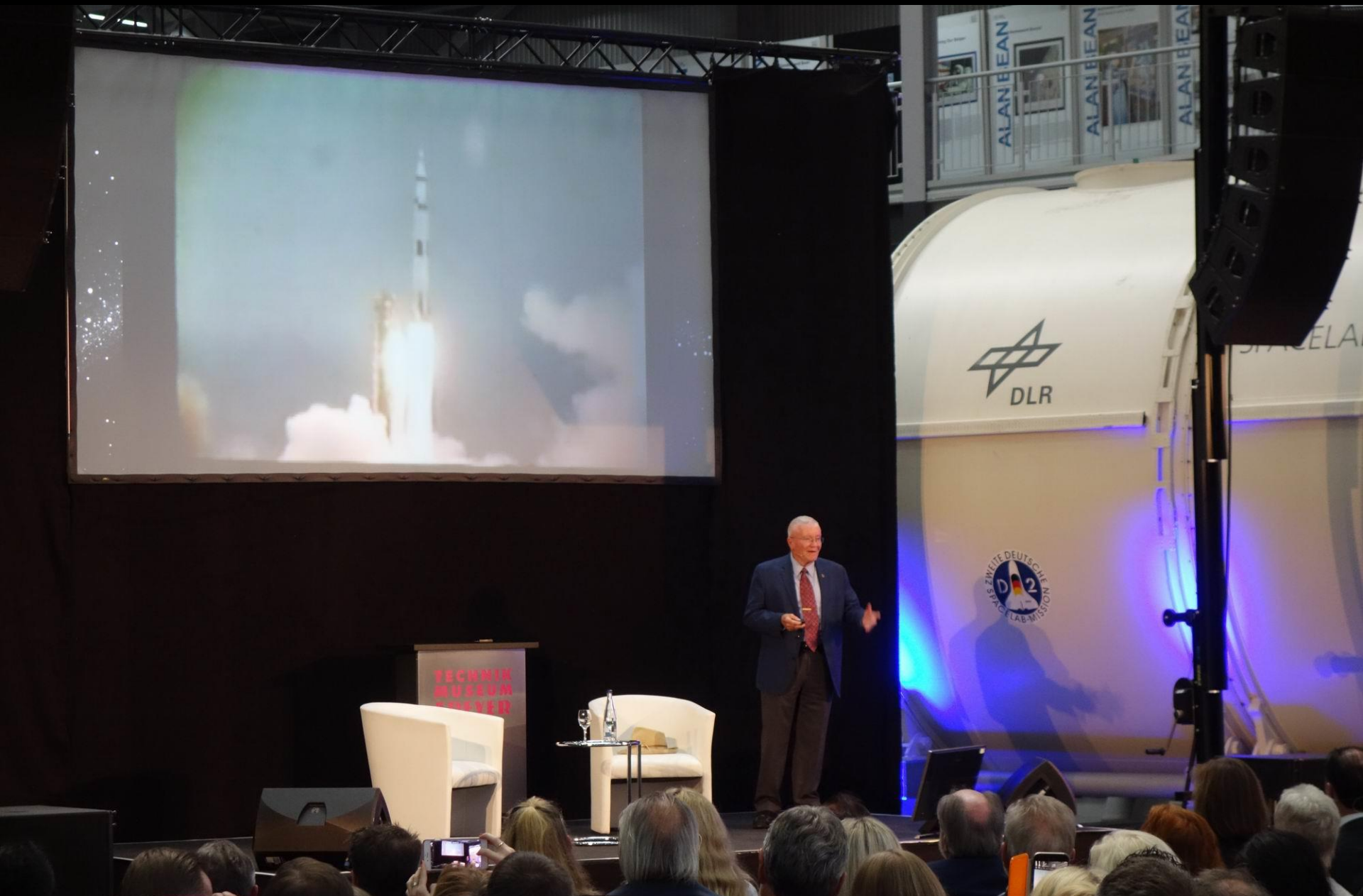


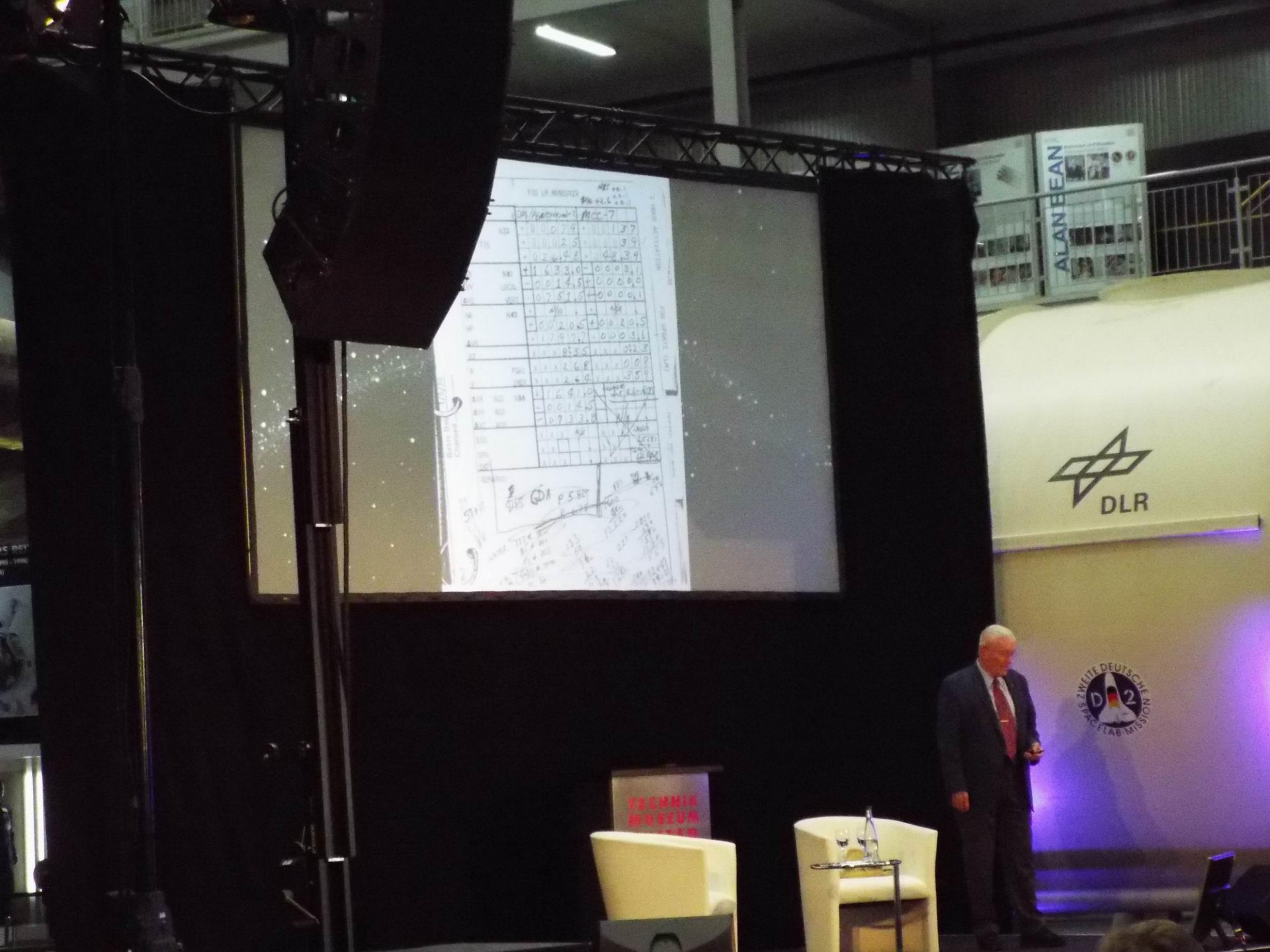

Replica CO2 element absorber from Lunar Module.
Replica forward hatch from docking tunnel of Command Module Odyssey.
• The A
$375 m
• Product
$62 milli
worldwid
1970

Lovellovo planetárium, Chicago

Vehicle Assembly Building

Speyer, říjen 2018




DLR
ZWEITE DEUTSCHE
SPACELAB-MISSION
D2

-4:00 RATE/ERR MON (BOTH) - LDG RDR/CMPTR
ATT MON (BOTH) - AGS
RATE SCALE - 5°/SEC
THR CONT - MAN
MAN THROT - CDR
ATT/TRANSL - 4 JET
BAL CPL - OFF
ENG GMBL - ENABLE
DES ENG CMD OVRD - OFF
DEADBAND - MIN
ATT CONT: ROLL - PULSE
PITCH - PULSE
YAW - MODE CONT
MODE CONT (BOTH) - ATT HOLD (BOTH)
PRPLNT QTY MON - DES 1

TTCA (CDR) - THROT (MIN) FOR DPS, JETS FOR RCS
TTCA (LMP) - JETS

-1:00 MASTER ARM - ON

- :35 V32E
F 16 83 ΔVX,Y,Z (All Zero) (.1fps)
ENG ARM - DES

10 (10) MANUAL ULLAGE (LMP)

- :02 EMC MODE - FREE

ACA - Out of Detent (Yaw) (Zero Error Needles)

:00 ENG START (CDR) - PUSH +X ULLAGE
Ignition

+ :05 TTCA (CDR) - Throttle Up As Req'd
ATT CONT: PITCH, ROLL - As Req'd

+:15 MASTER ARM - OFF

Basic Date 1/6/70
Changed 3/23/70

LM-7

Záloha Apolla 11

Apollo 13

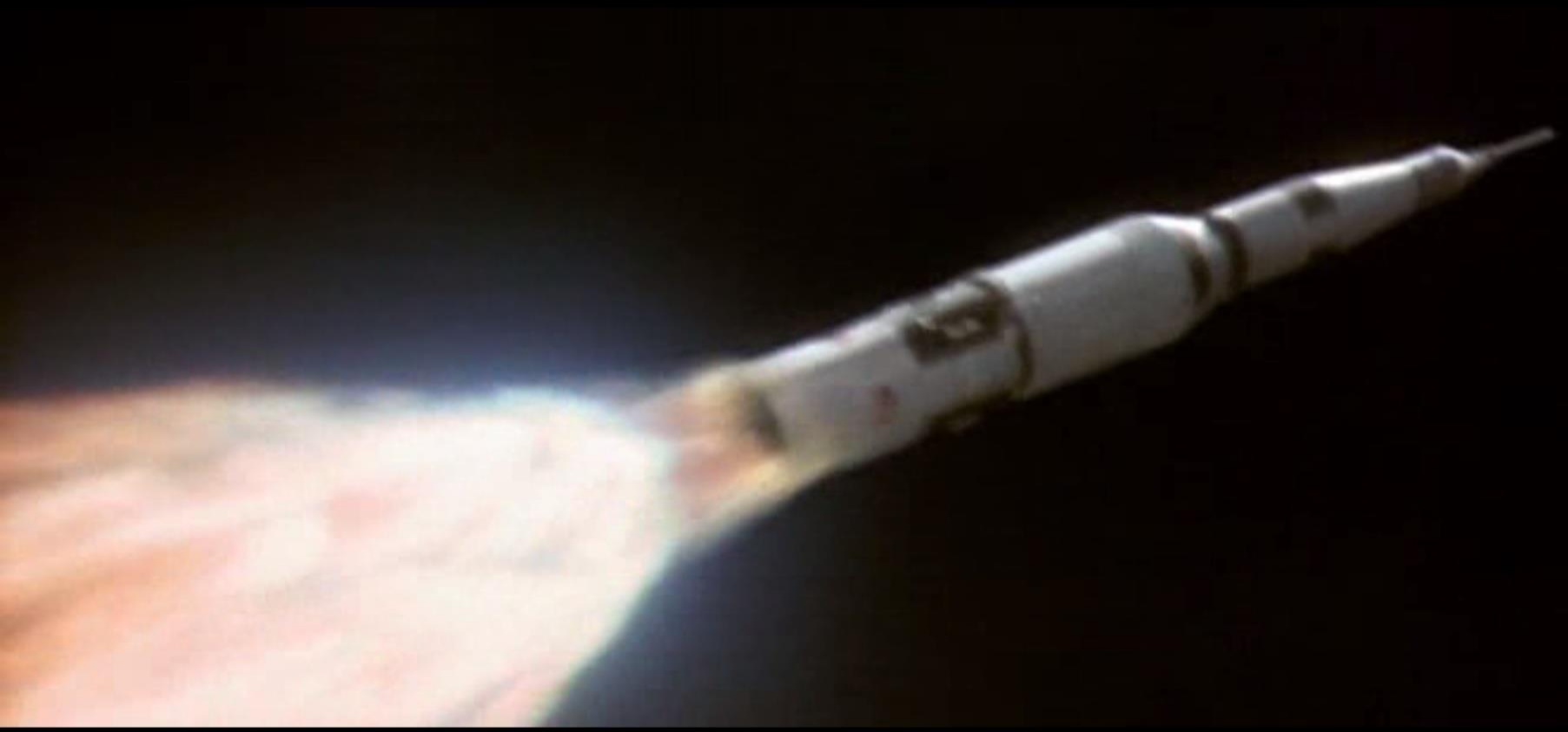
Záloha Apolla 16

Apollo 19


ATLANTIS
ATLANTIS

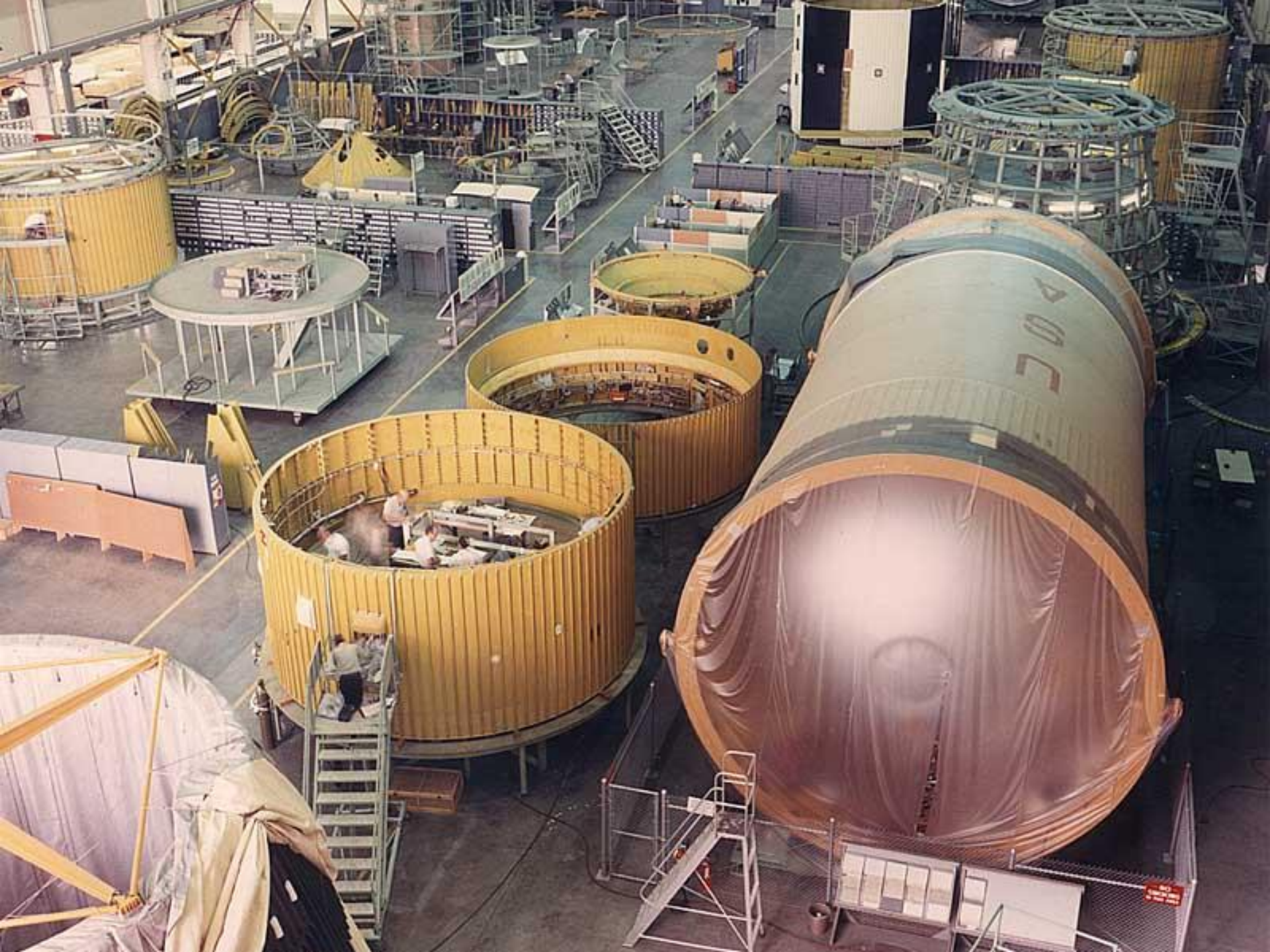
Gene Kranz

Barevné provedení Saturnu V

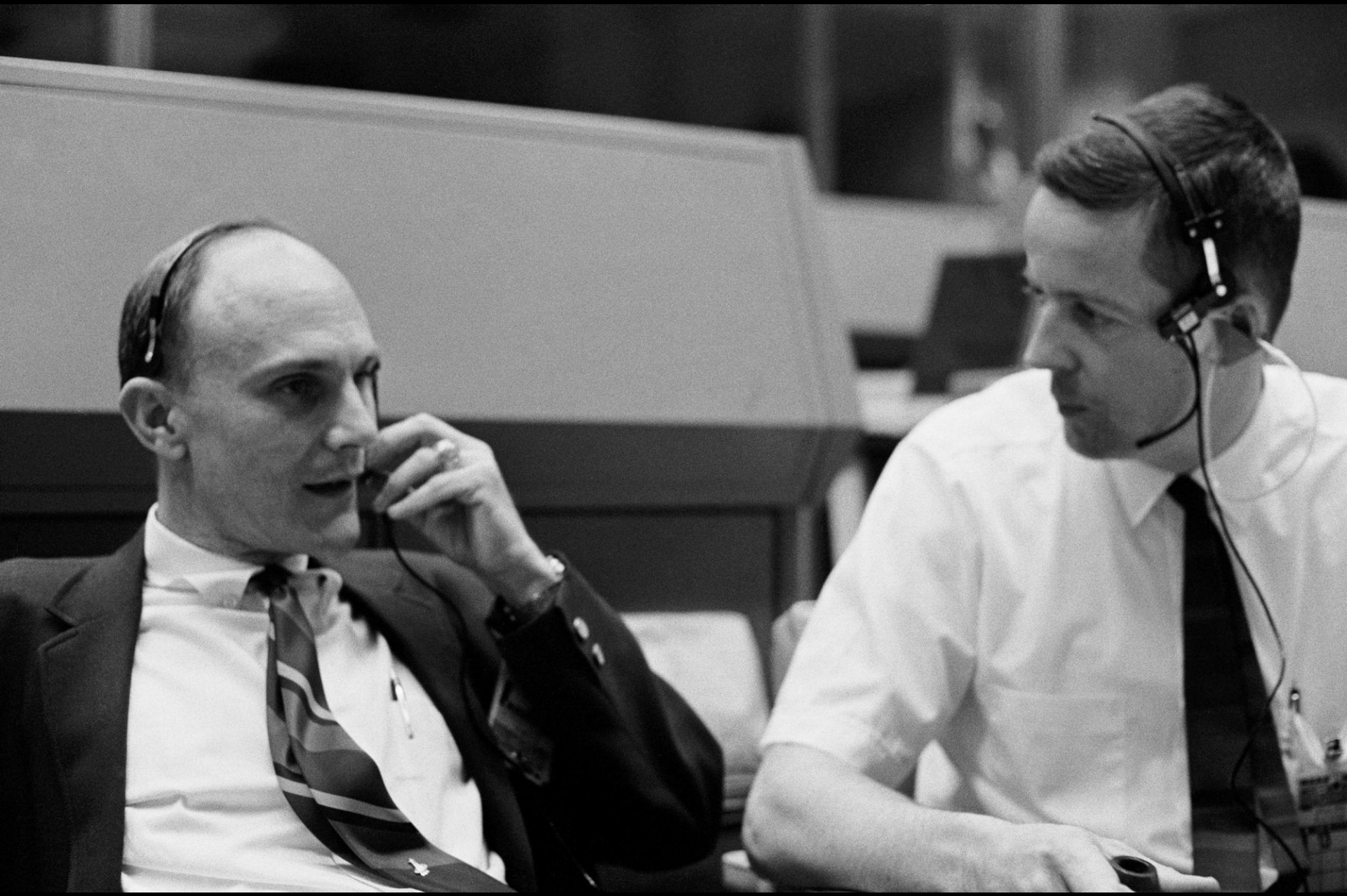


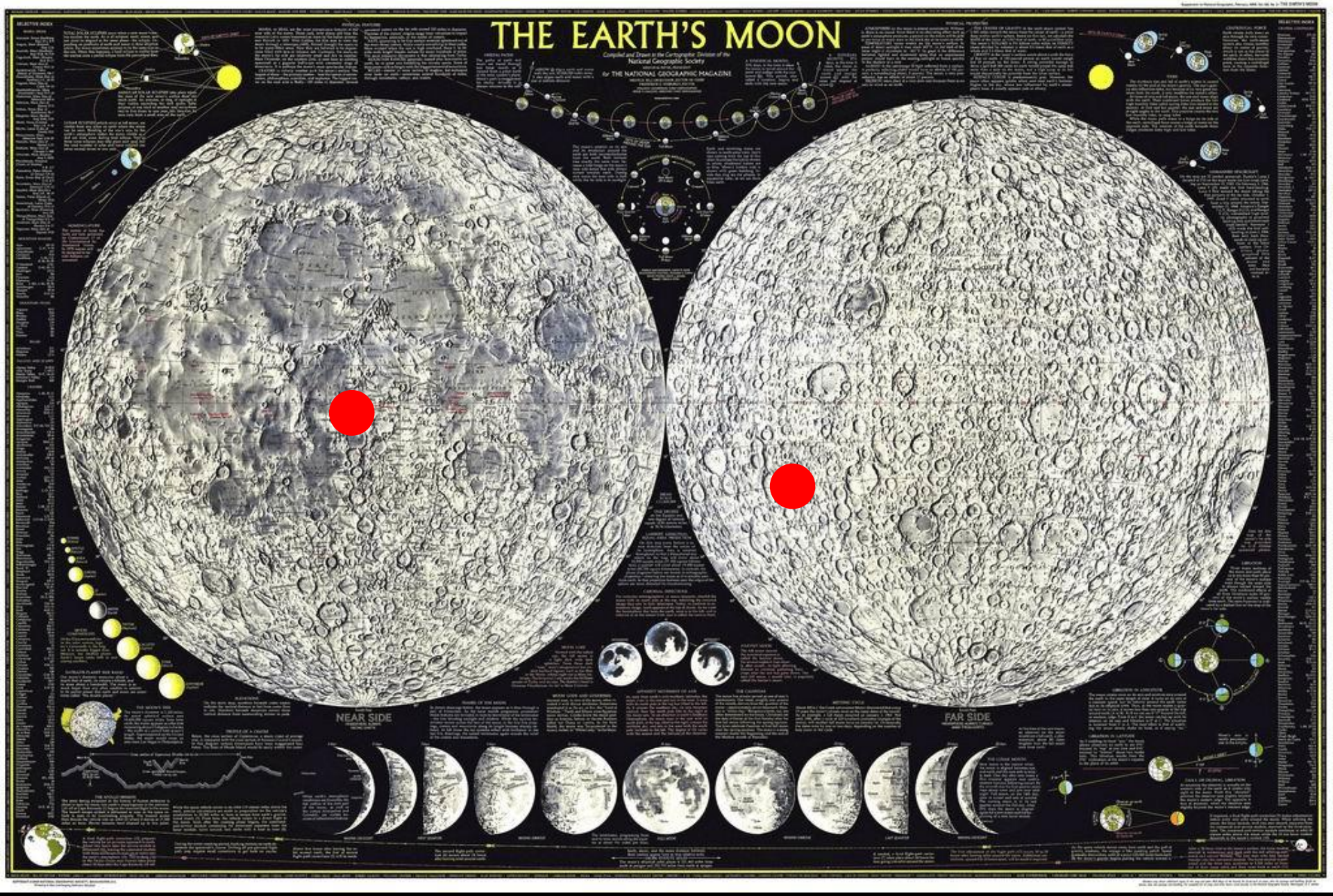

USA
USA

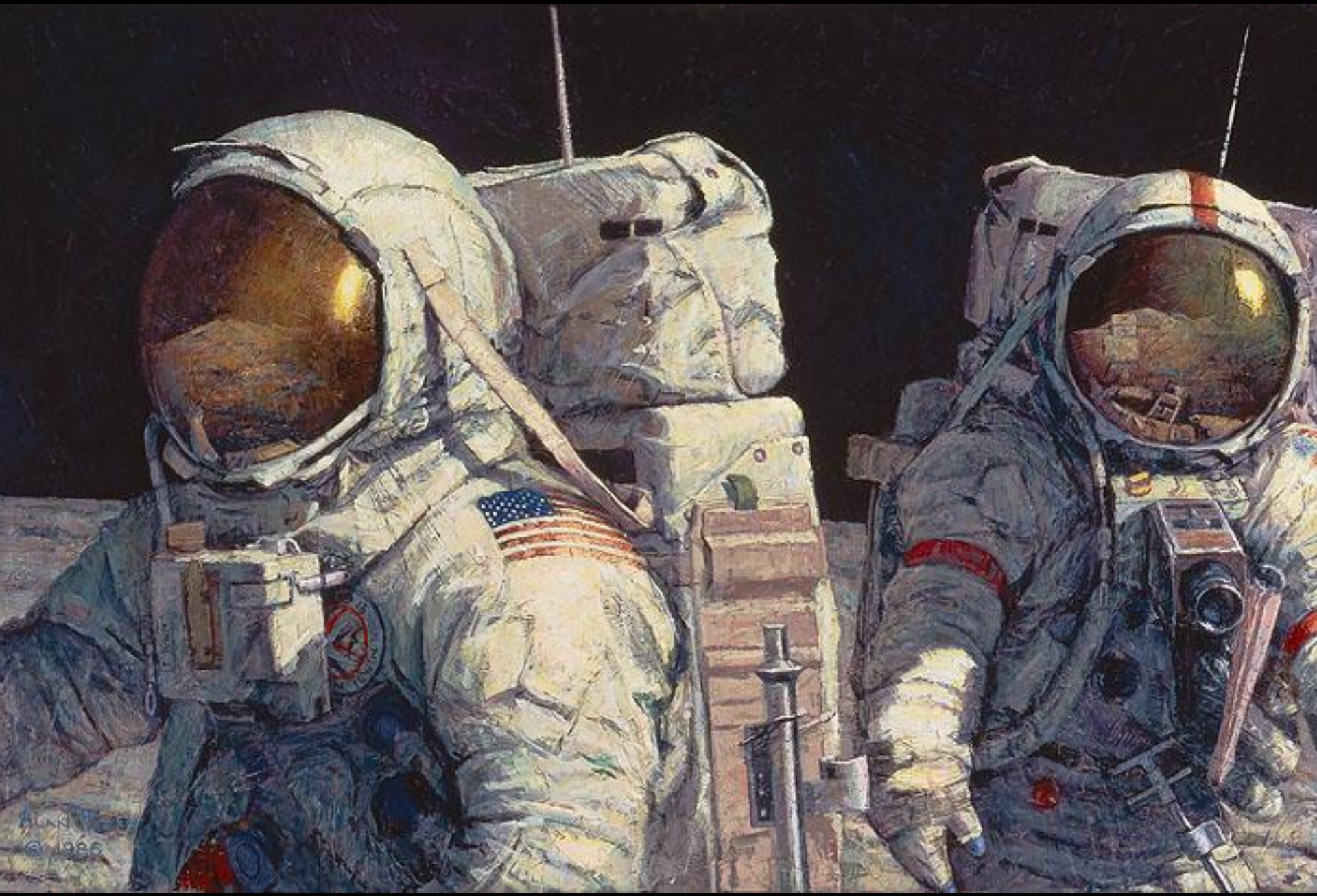

SA



Ken Mattingly na startu?




THE EARTH'S MOON
Compiled and Drawn in the Cartographic Division of the
National Geographic Society
for THE NATIONAL GEOGRAPHIC MAGAZINE
NEAR SIDE
FAR SIDE

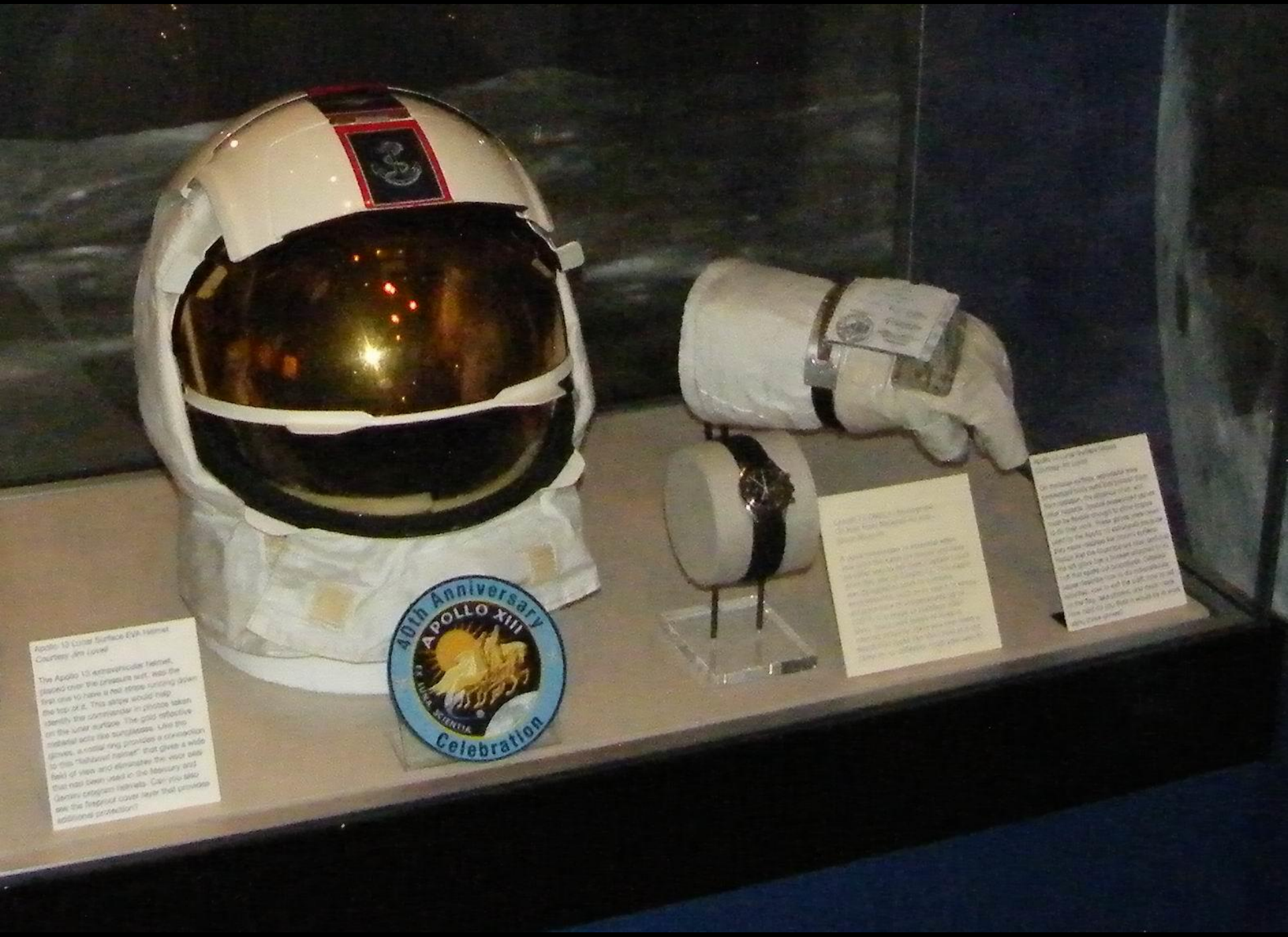


Apollo 14 - Alan Shepard

Apollo 15 - David Scott

Apollo 16 – John Young

Apollo 17 - Eugene Cernan


40th Anniversary
APOLLO XIII
Celebration

BOULDER TIPS
FILLET SAMPLE - CRYSTALLINE OR TOUGH BRECCIA
DUST
REF SOIL
FILLET
0.3 - 0.5M
5M
7' XSUN STEREO AFTER FILLET
7' XSUN & CLOSE-UP AFTER CHIP
REF SOIL - STD PROCEDURES
GIANT MARKER (>5M)
CRYSTALLINE
FLIGHT LINE STEREO
GET CHIP FROM EACH LAYER
2nd CHIP FROM BEST LAYER (OTHER SIDE IF CAN)
IF NO LAYERS, CHIP BOTH ENDS
CLOSEOUT
TA 10
STA 9
TA 8 CLOSEOUT
EVA 3
EVA HALF
BOULDER TIPS
SPLIT BOULDER (CRYSTALLINE)
1/2 OVERTURNABLE
7' XSUN STEREO BEFORE TOUCHING
3 MORE 7' STEREO's, OS & LOC SHOTS
CHIP & SAMPLE FILLET BEFORE OVERTURN IF NO FILLET SAMPLED
5M
REF SOIL
CLOSE-UP STEREO AFTER EACH CHIP
7' STEREO BEFORE, 7' AFTER SOILS
SPLIT 1-2 (OR ADJACENT BLOCKS)
WIDTH ≤ HT OF SPLIT(45° SHLD)
REF
5M
7'
STEREO
BEFORE
SOIL
SHADOWED SOIL
FILL SESC - SKIM SAMPLE
COLLECT SCOOP SAMPLE UNDER SKIM
STA 11 EGRESS LOAD UP RV PREP STA 11

CDR - EVA 2

+10 CDR EGRESS

PASS IEC TO LMP

+13 ETB TRANSFER

GEOLOGY TRAVERSE PREP

STOW ON HTC

- CONTRAST CHARTS
- EXTENSION HANDLE
- HAMMER
- SMALL SHOVEL
- GNOMON

PLACE SRC 2 ON MESA

ATTACH WEIGH BAG TO SCALE

ATTACH SADDLE BAG TO LMP

(LMP ATTACH PARTS BAG TO CDR)

UNSTOW CUTTING TOOL

(LMP STOW CUTTING TOOL IN BAG)

EMU MALF.

GEO TRAVERSE

DOCUMENTED CORE SAMPLE

DOCUMENTED SAMPLE

SURVEYOR

XFER A TERM.

SEEN ANY INTERESTING HILLS & VALLEYS ?

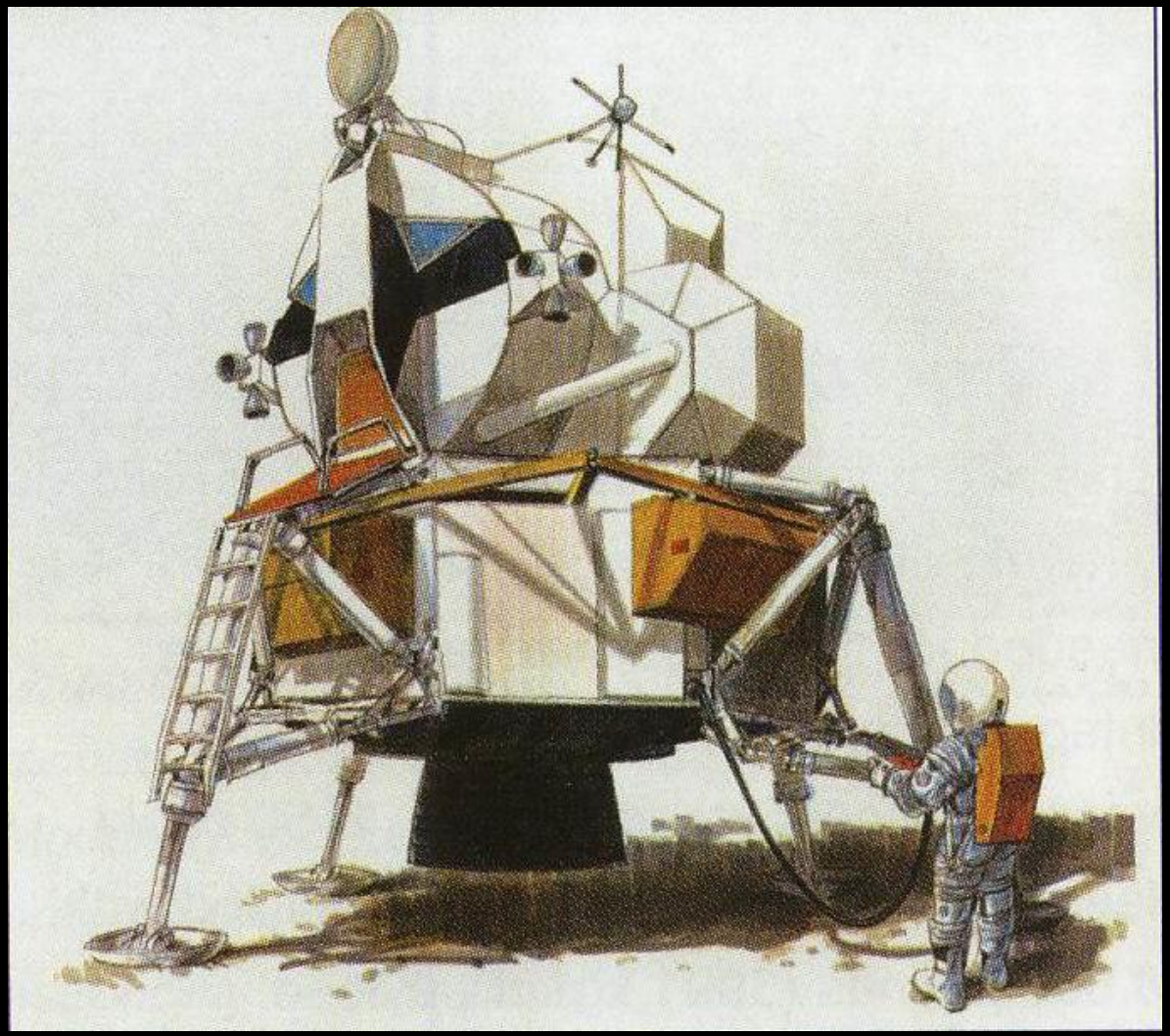
Nerealizované plány

Block I - bezpilotní

„Lehký“: 48 h samostatný, 36 h na Měsíci, 136 kg „dolů“, 45 kg „nahoru“

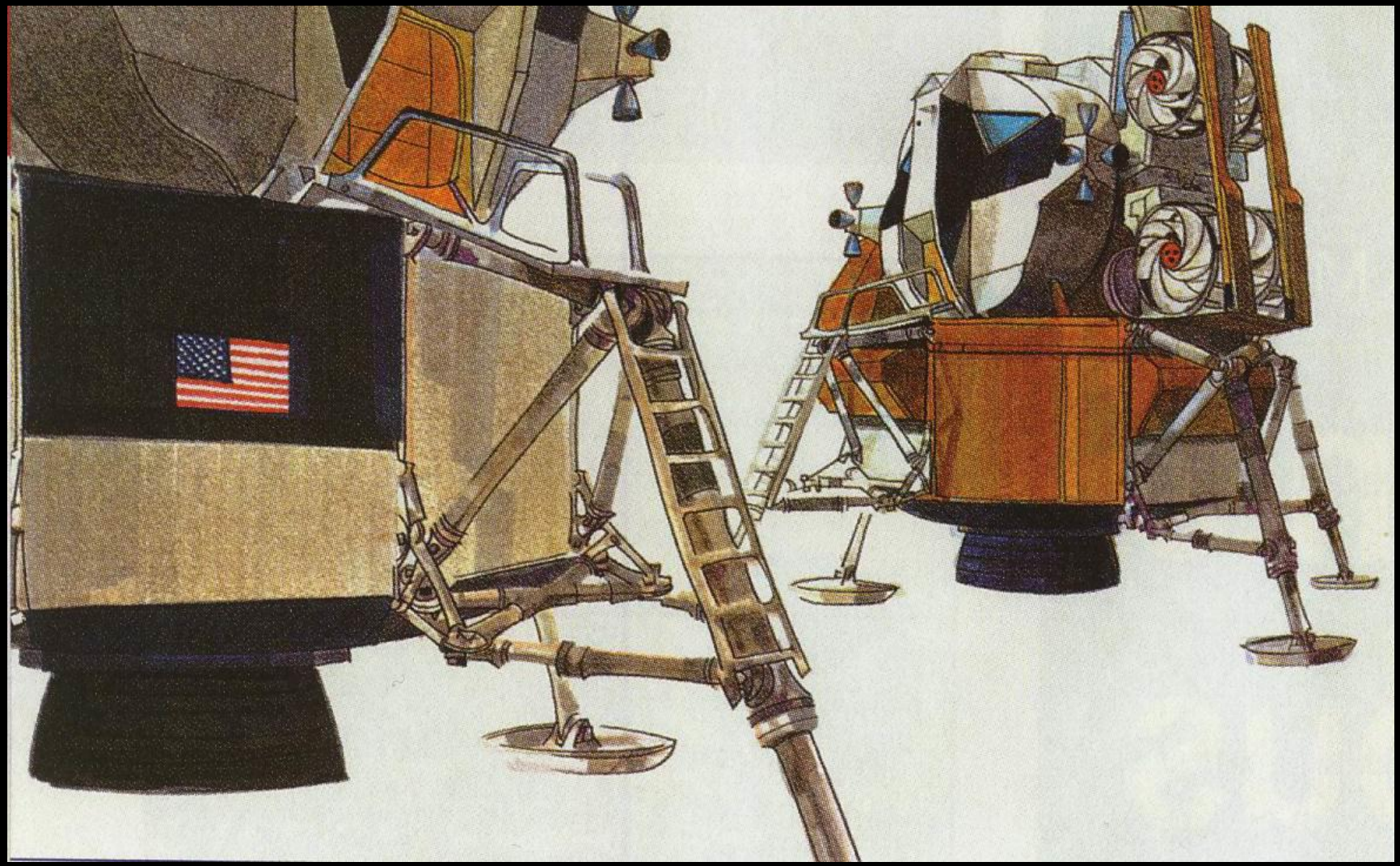
„Těžký“: 72 h samostatný, 450 kg „dolů“.

Augmented LM

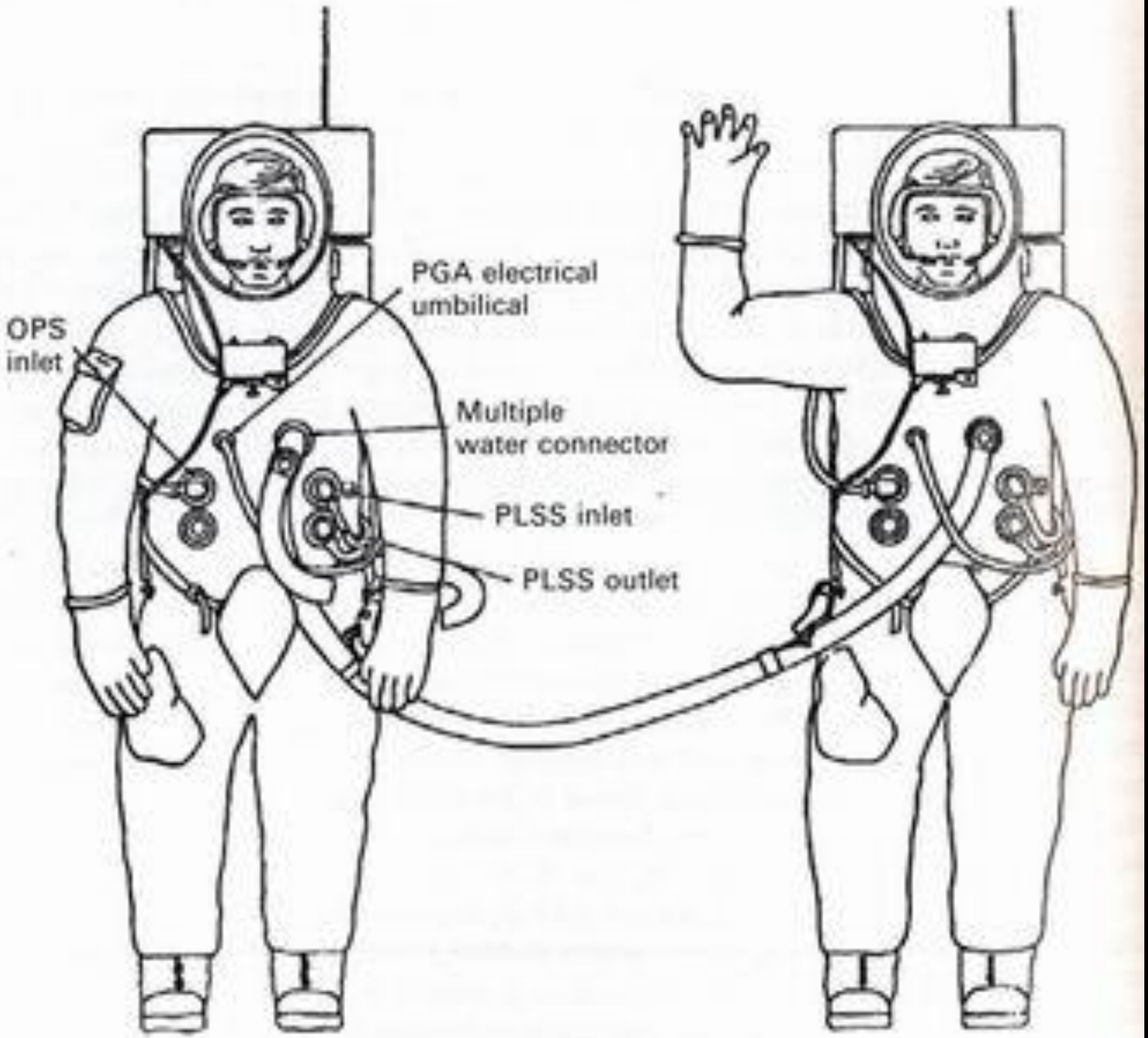


900 kg dolů (nebo 8 dní a 450 kg).

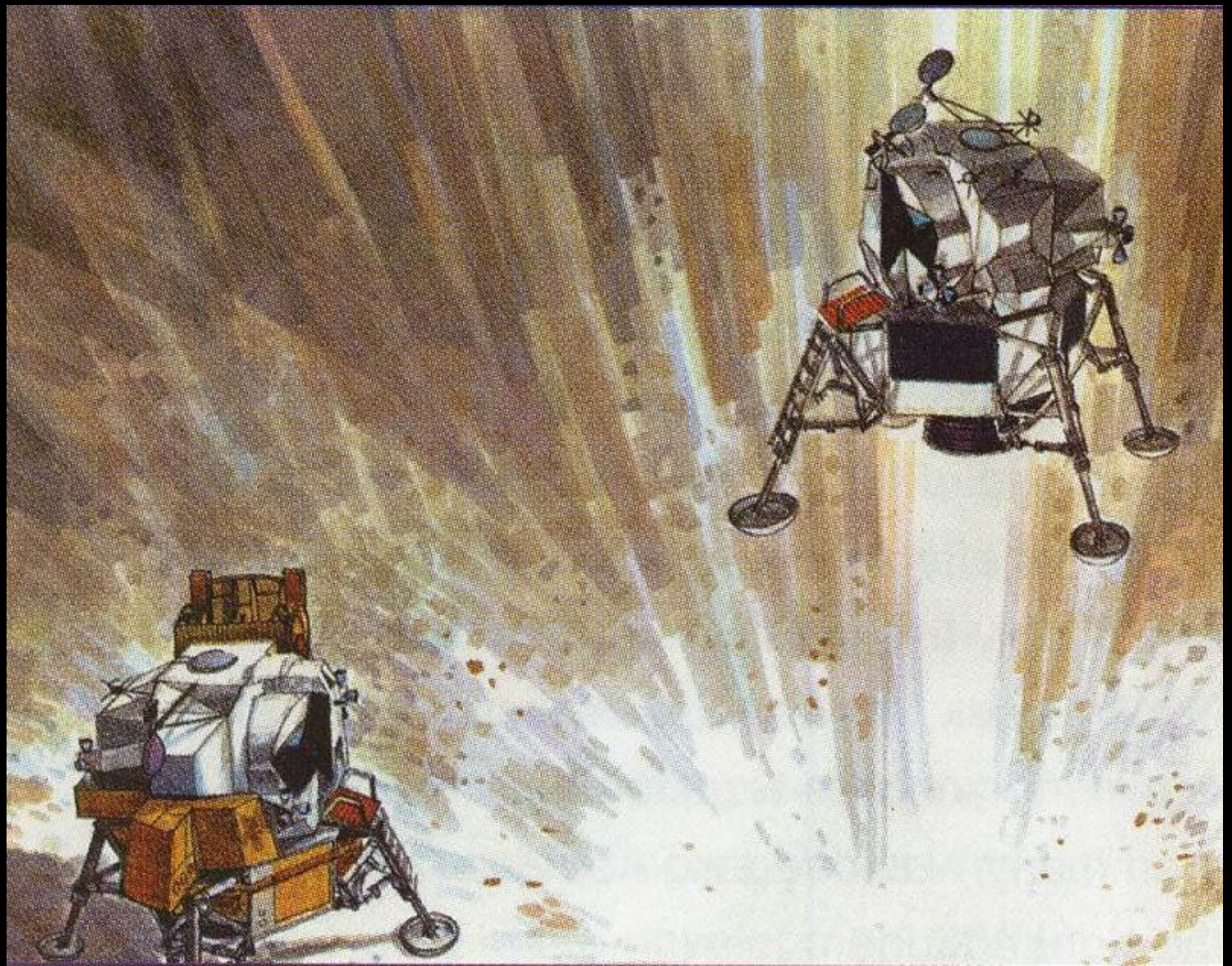
LM Taxi + LM Shelter



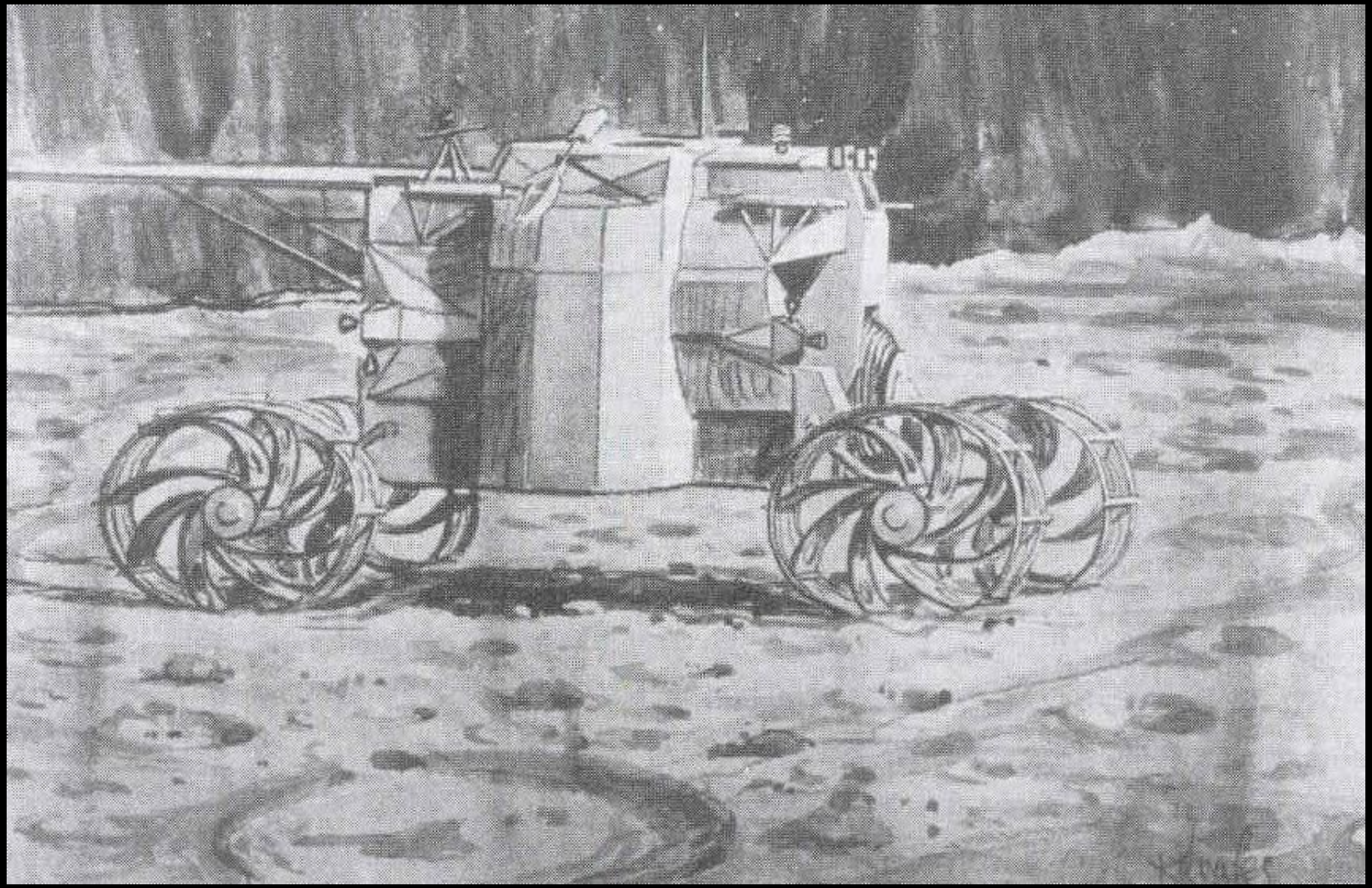
Taxi 14 dní, Shelter 60 dní

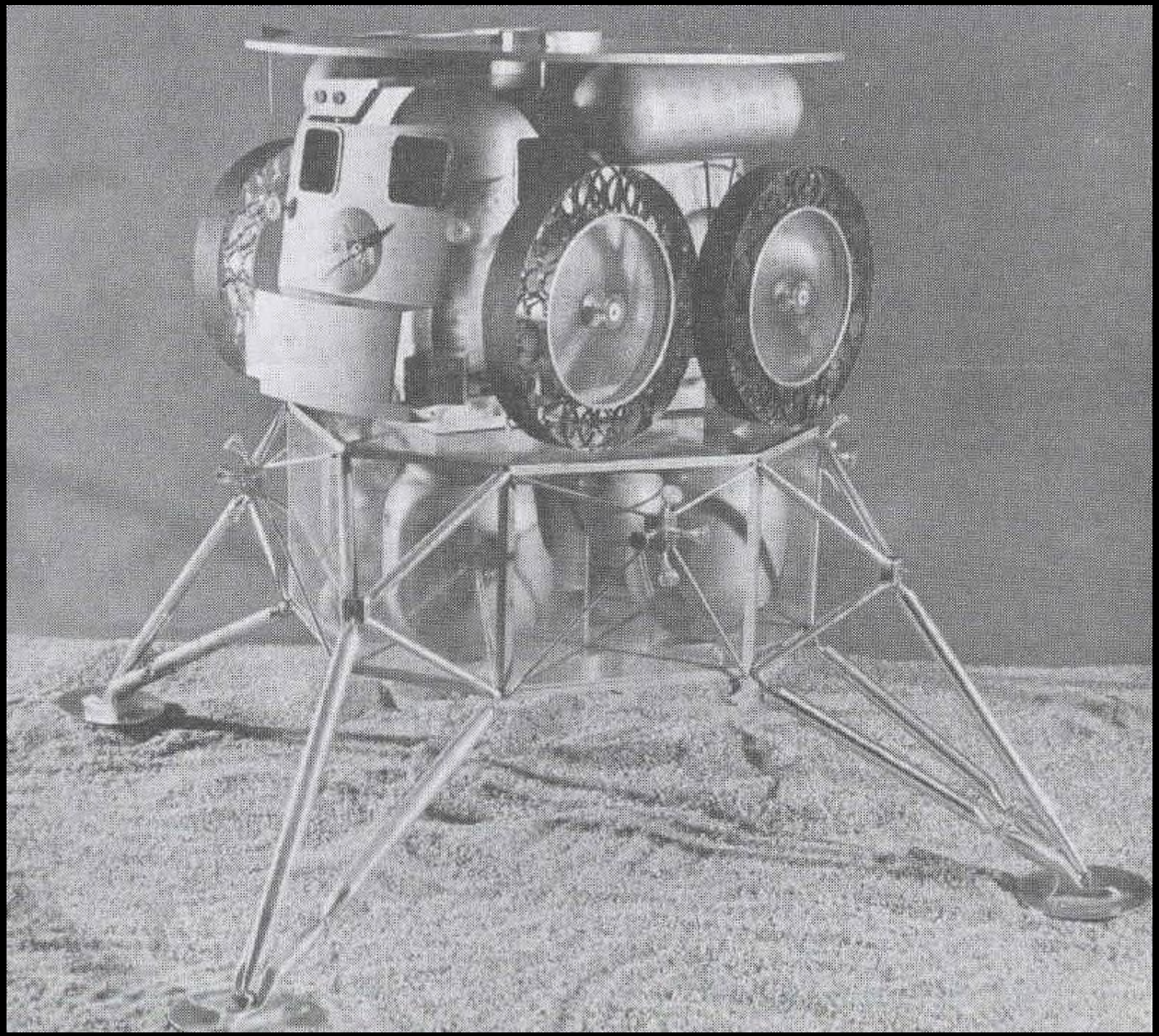

PGA electrical umbilical
OPS inlet
Multiple water connector
PLSS inlet
PLSS outlet

Duální start (Shelter + Taxi)

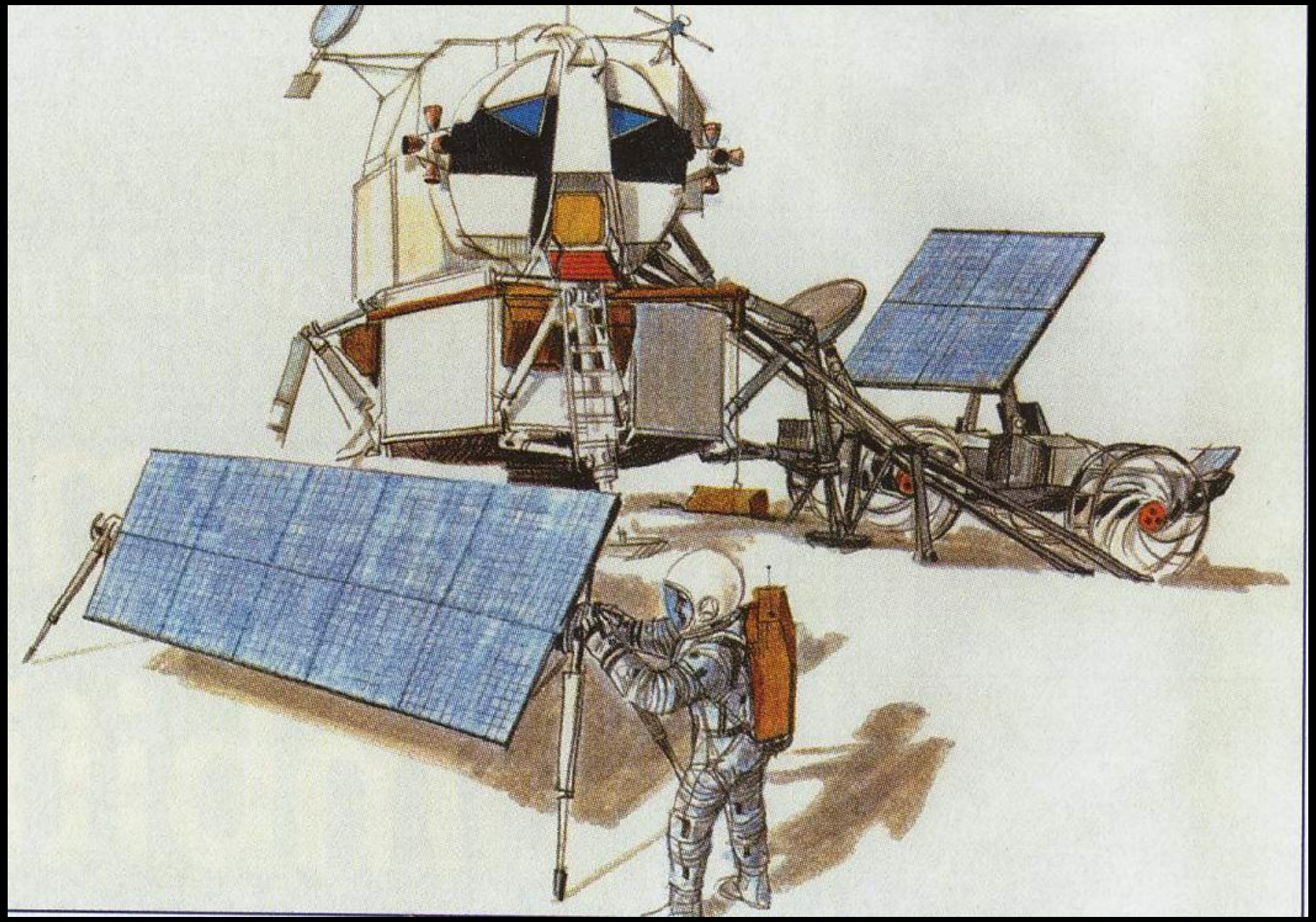


Molab (Mobile Laboratory)



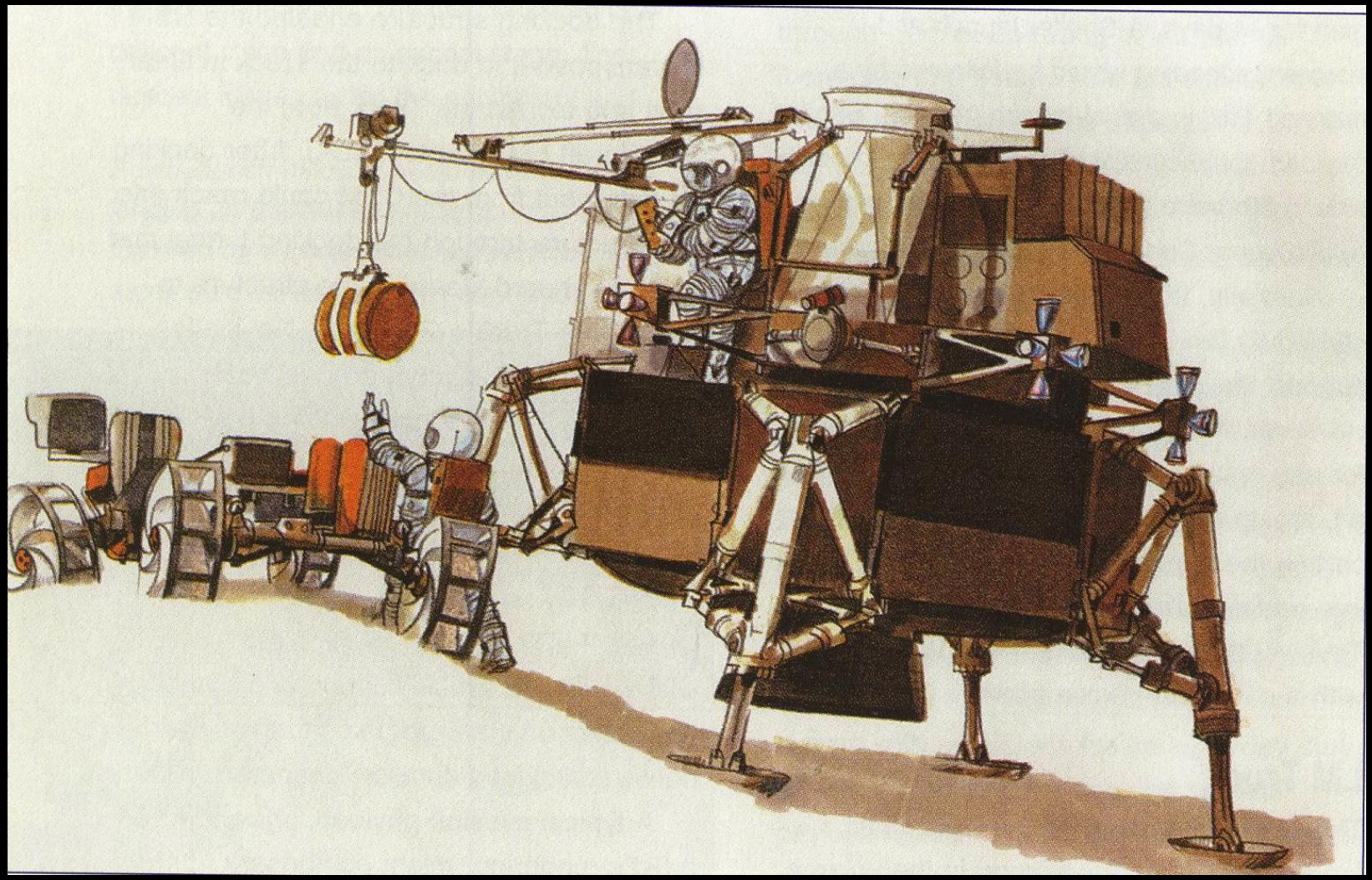


LM Payload Module

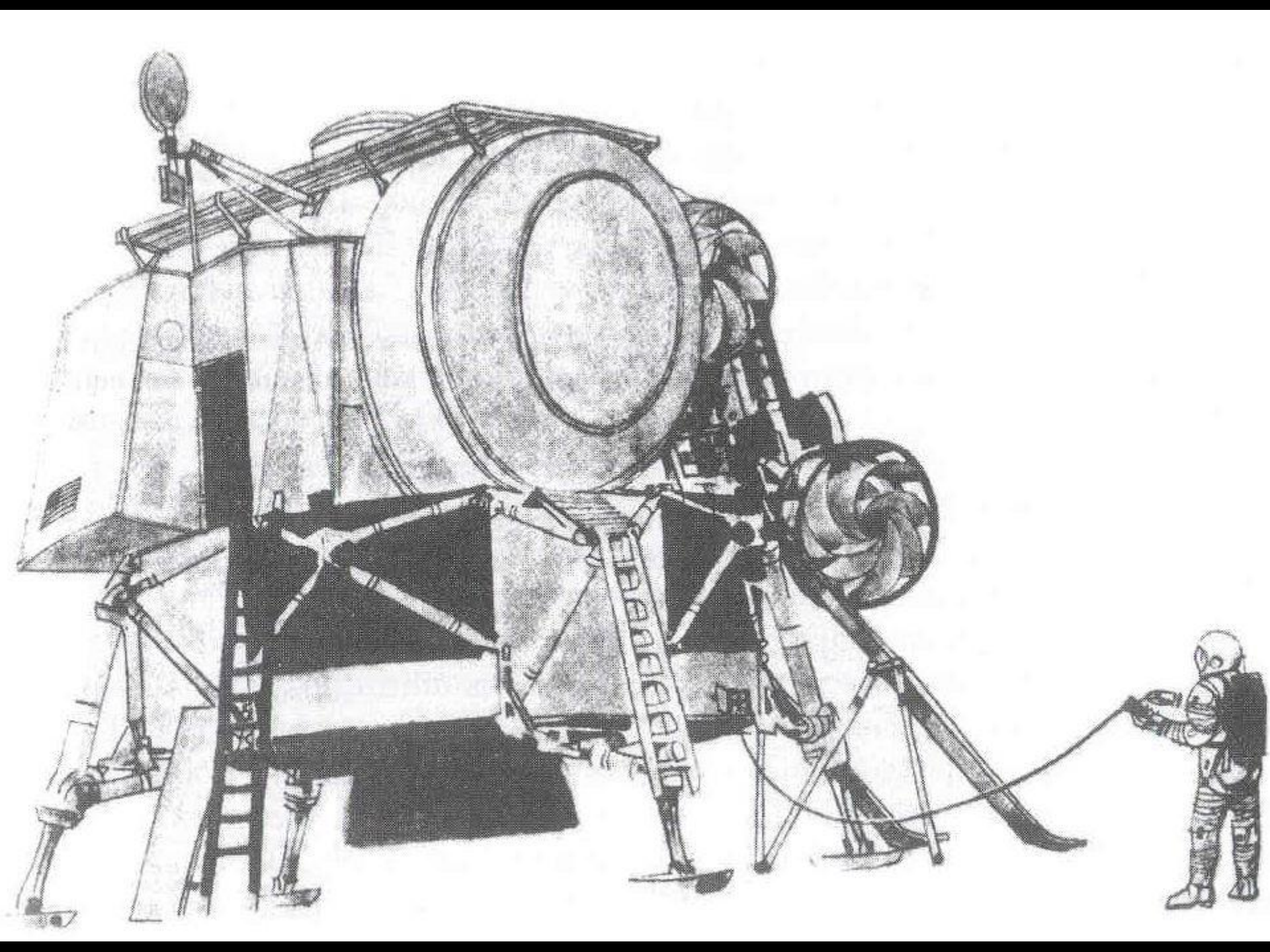


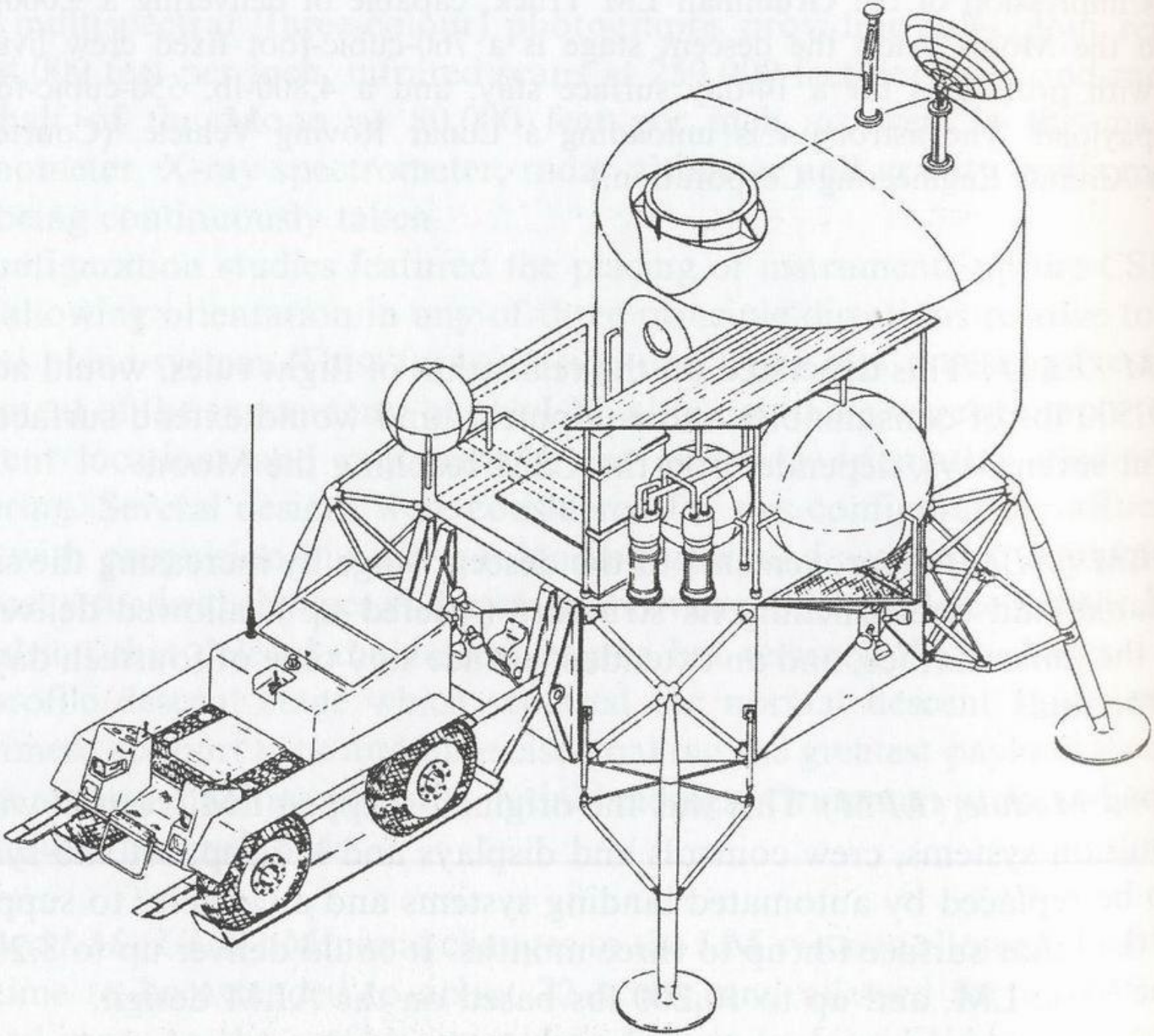
„Nákladní“ (bezpilotní, neobyvatelný).

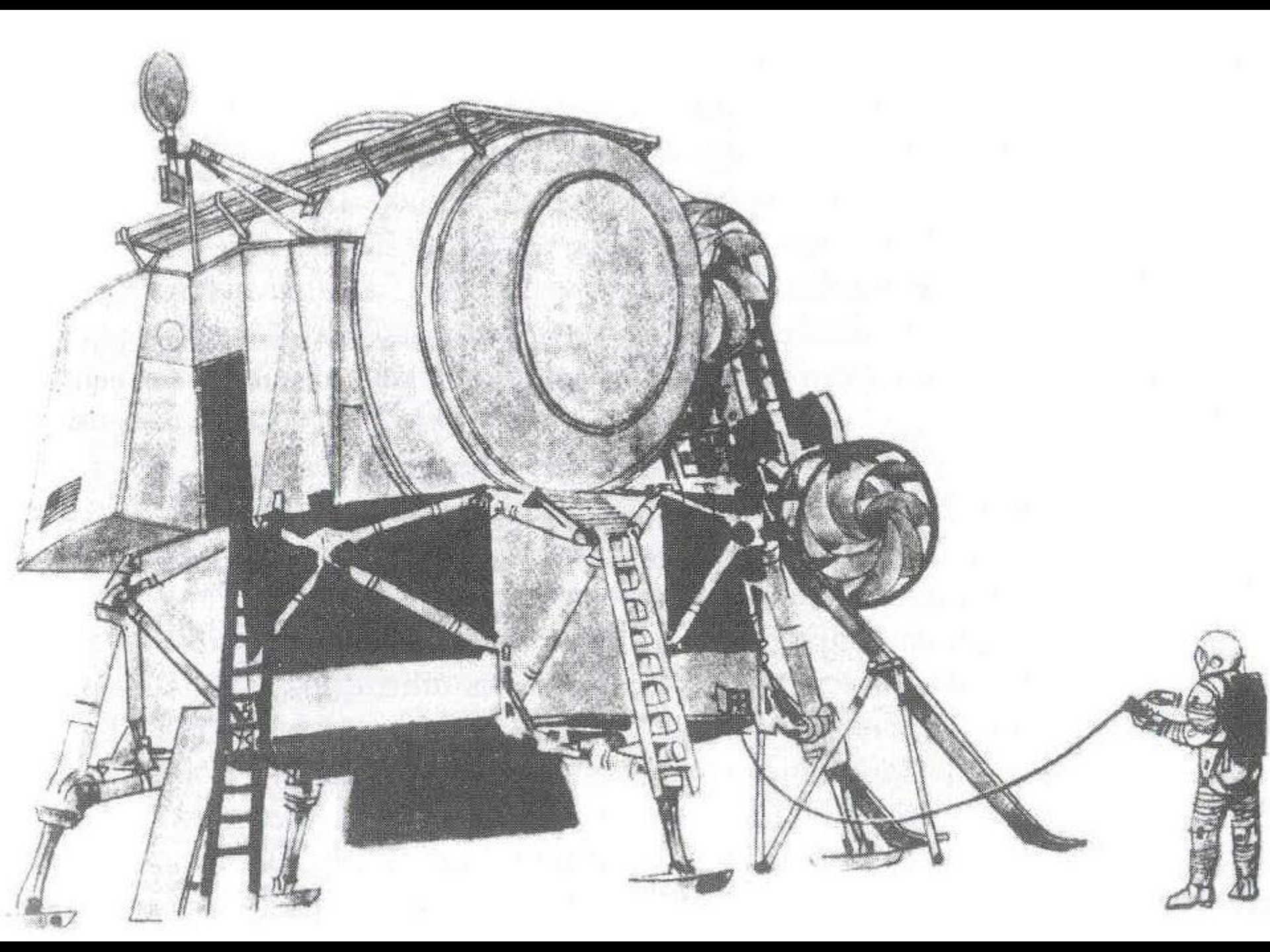
LM Truck



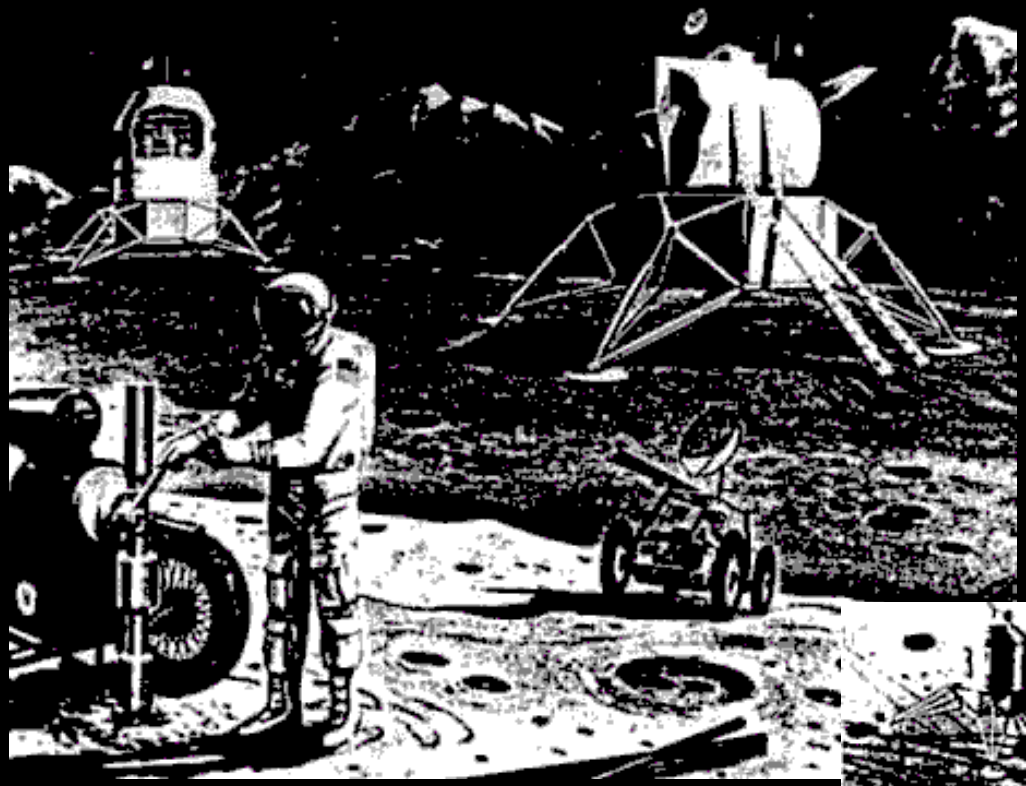
Nákladní plošina, nahoře stykovací.

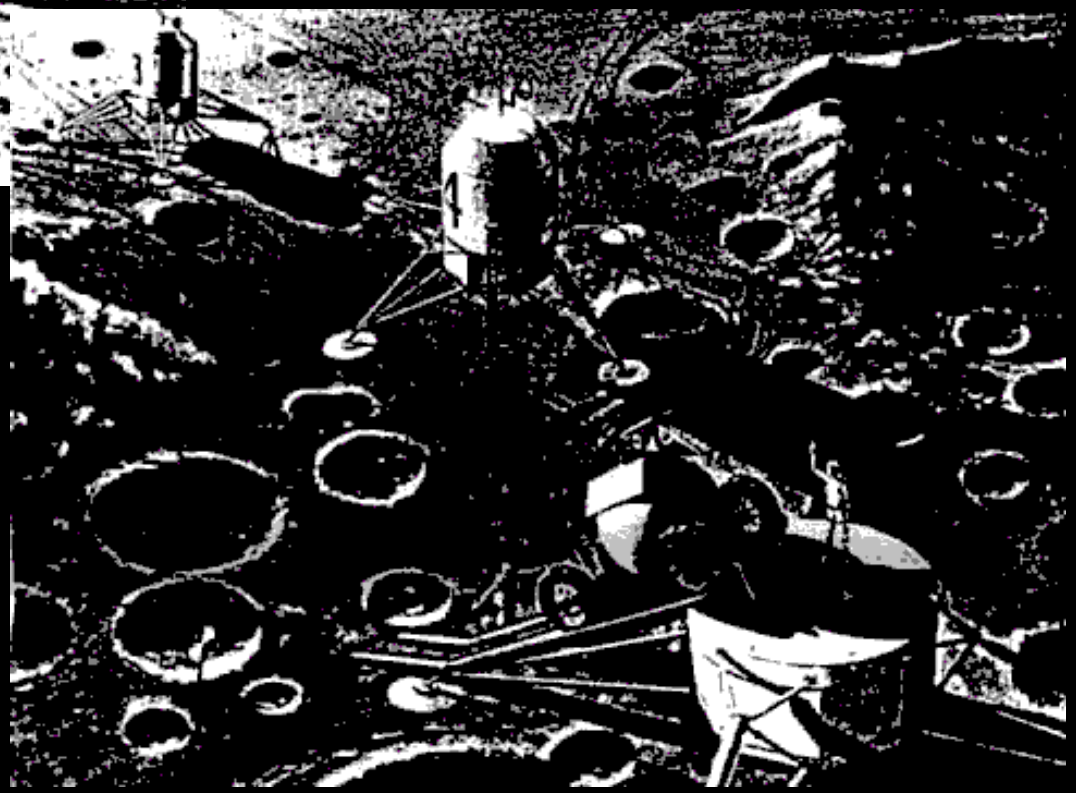




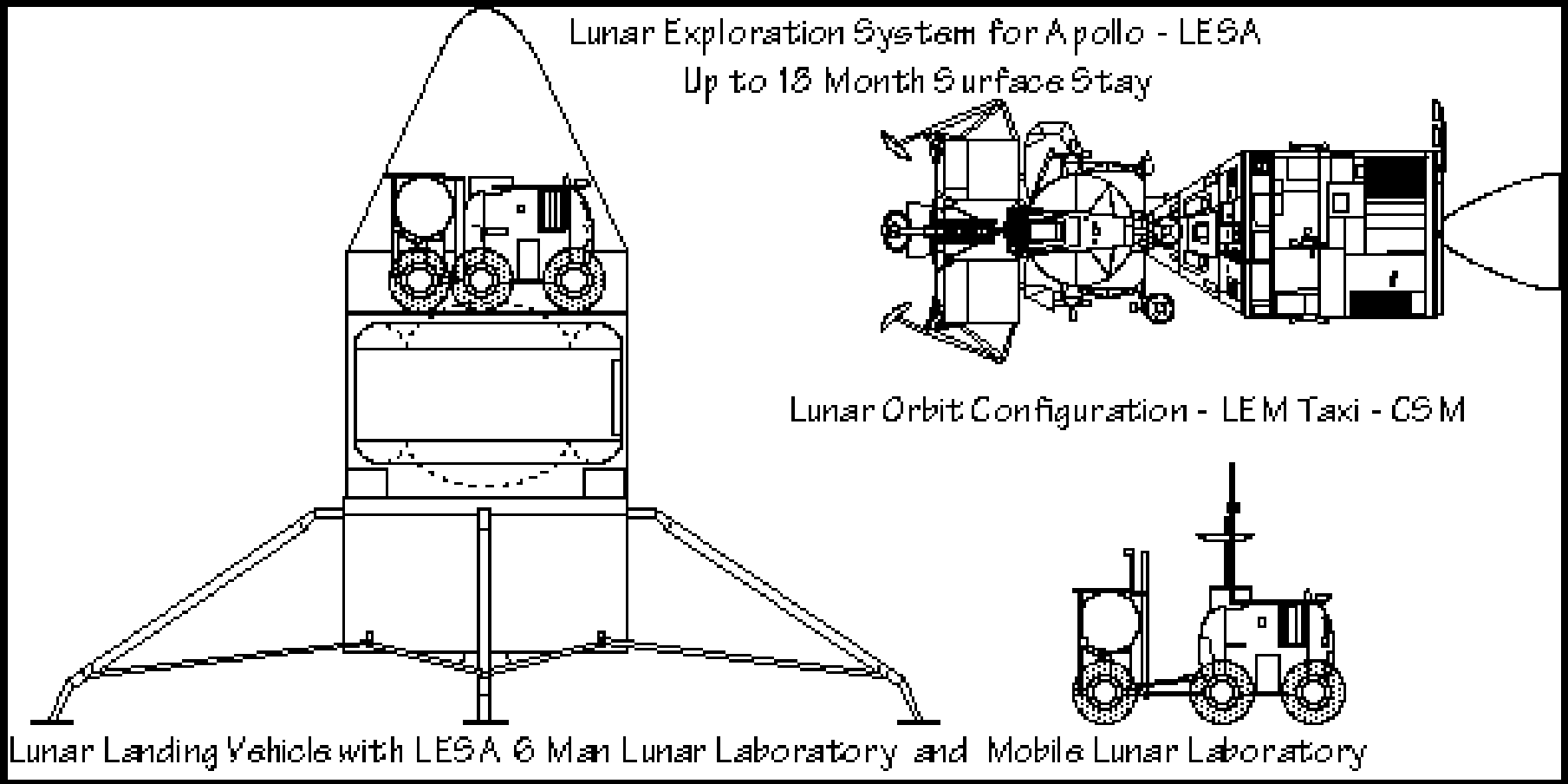


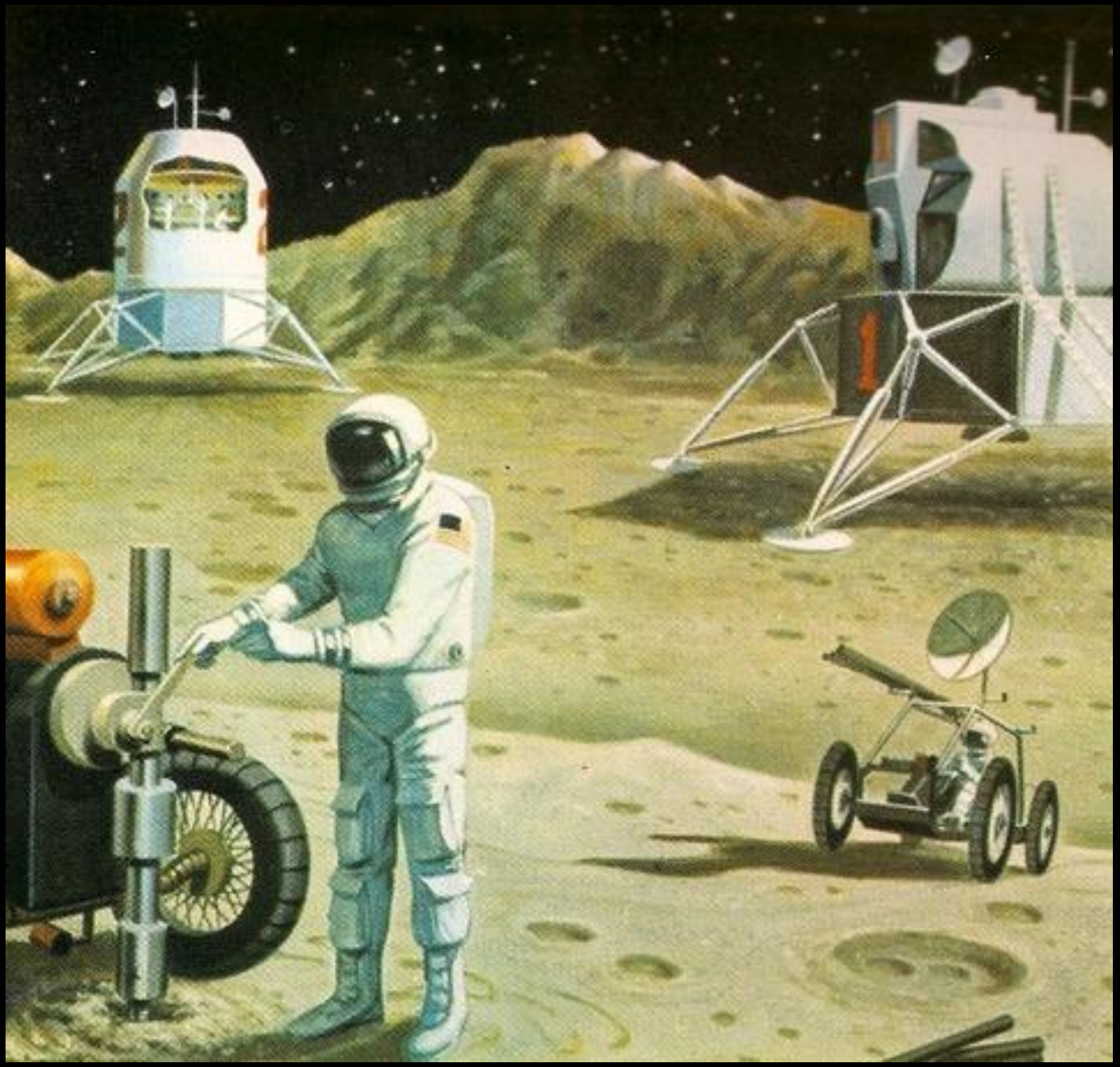
Celá základna



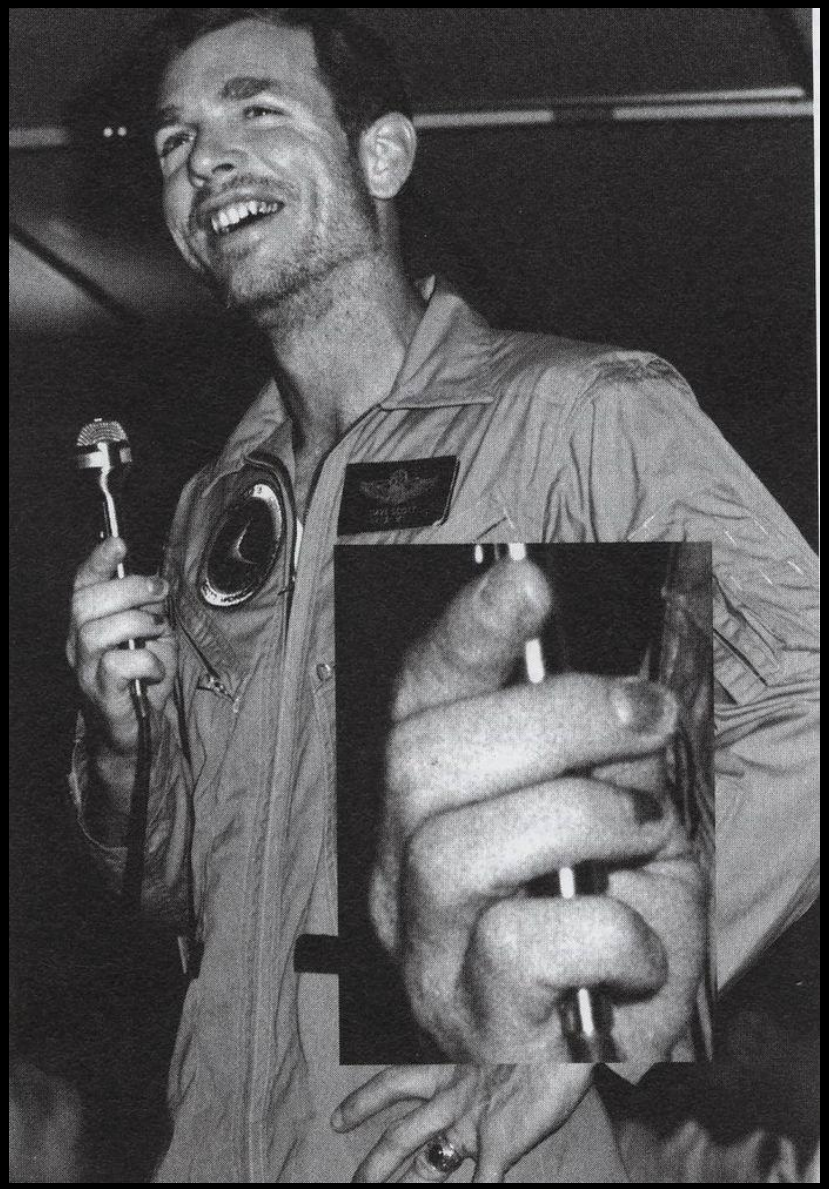


LESA (Lunar Exploration System for Apollo)

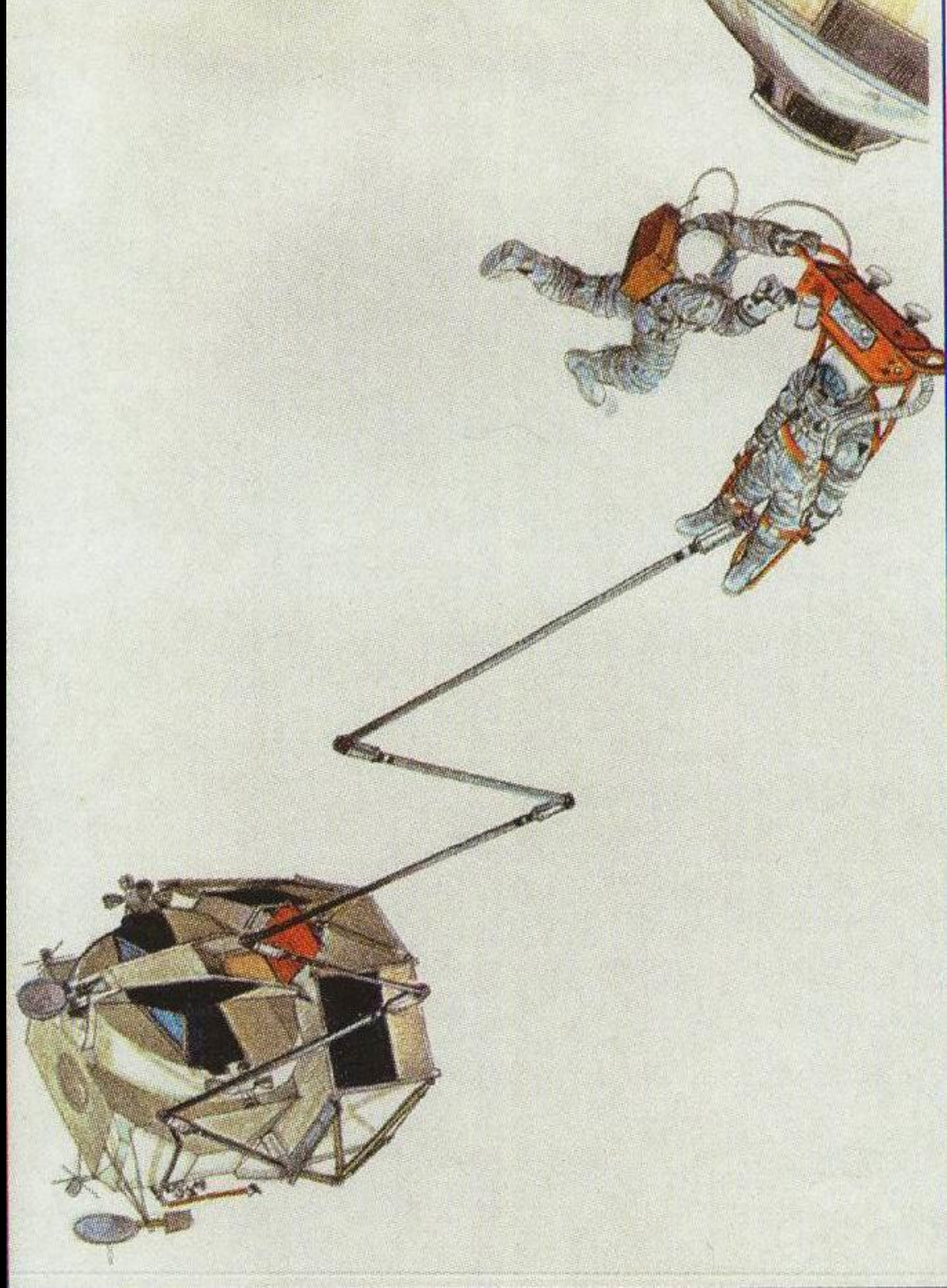


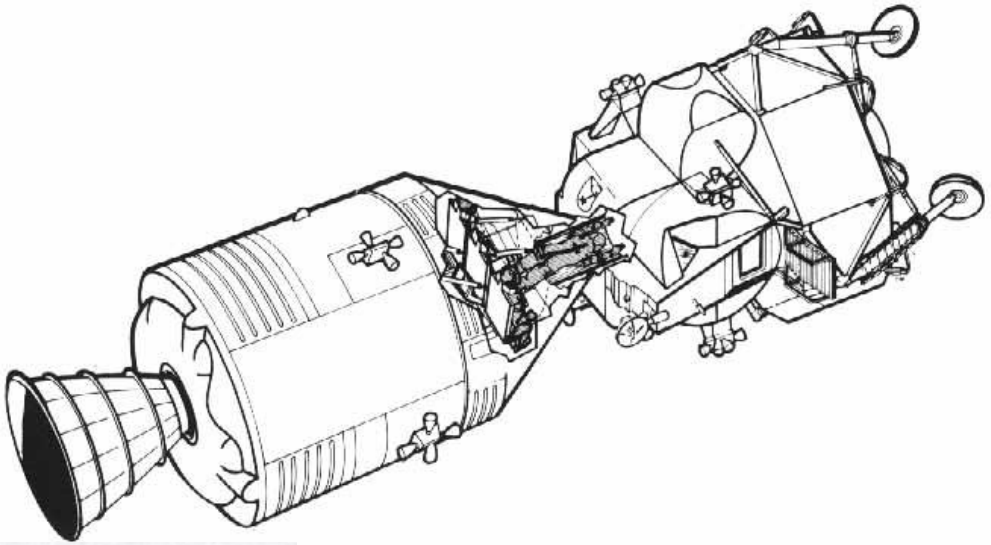


14 dní na Měsíci?

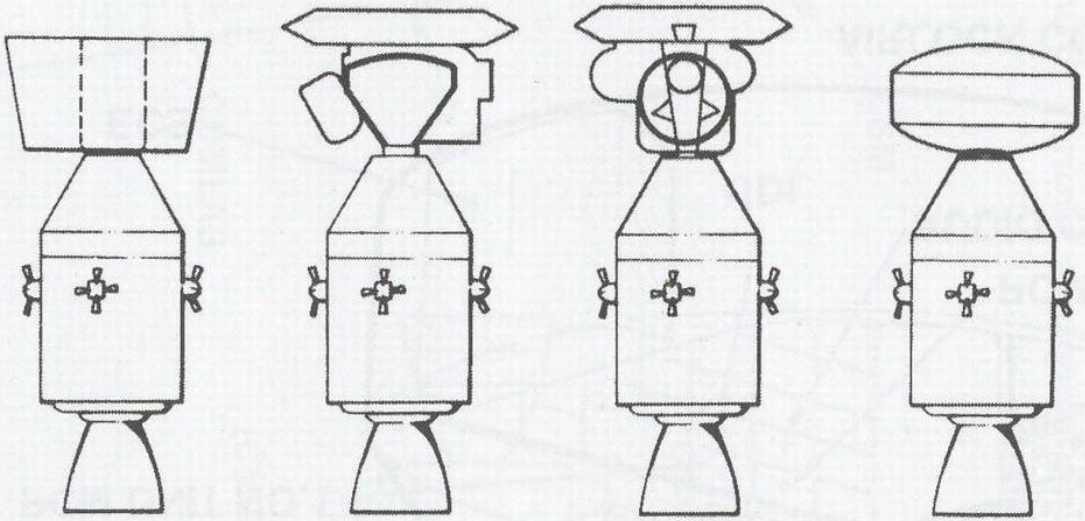


Záchranný LM





EARLY LABORATORY

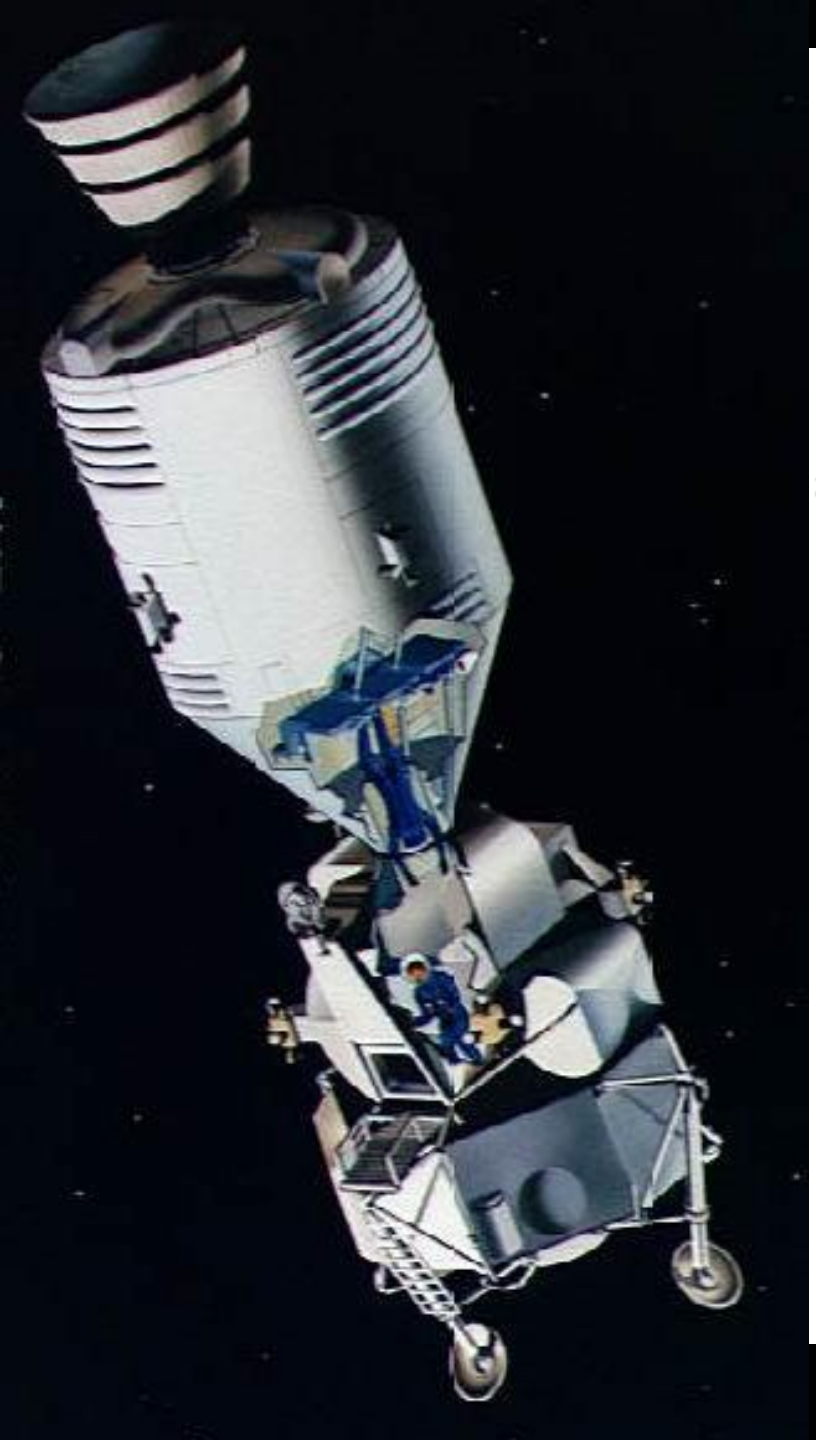


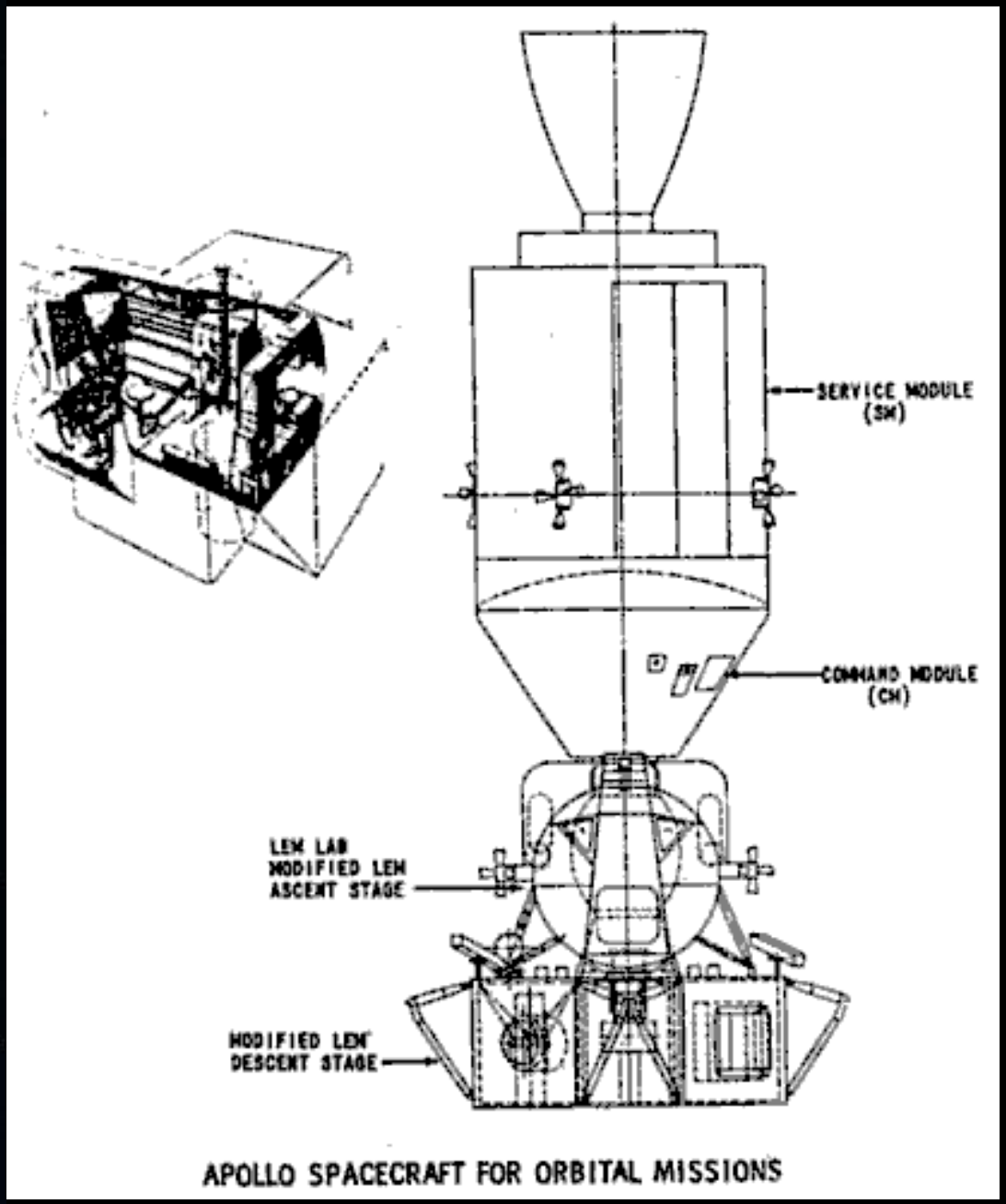
EXTENDED APOLLO SYSTEM UTILISATION STUDY

COMMAND MODULE LAB (COMLAB)

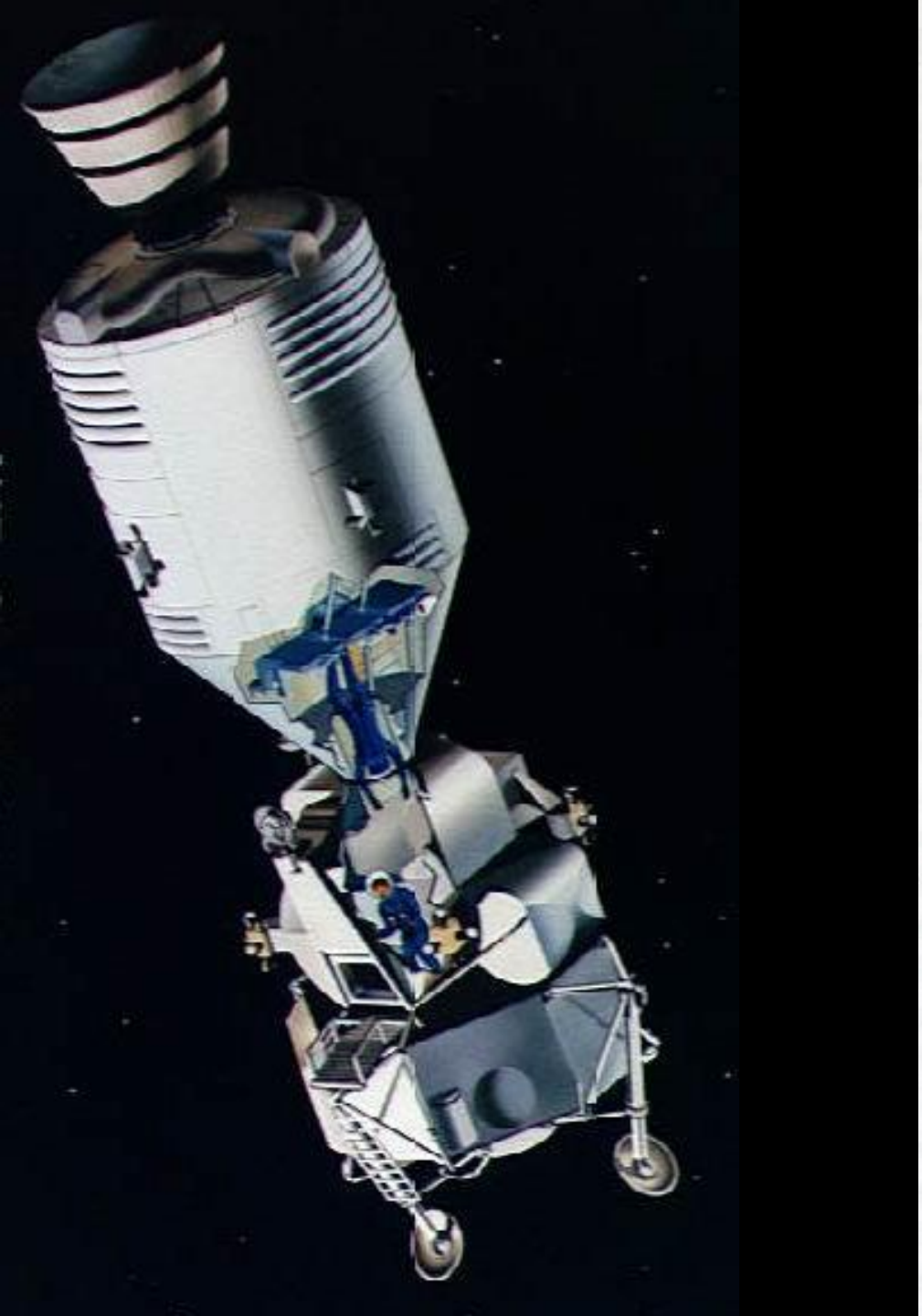
LEM LAB

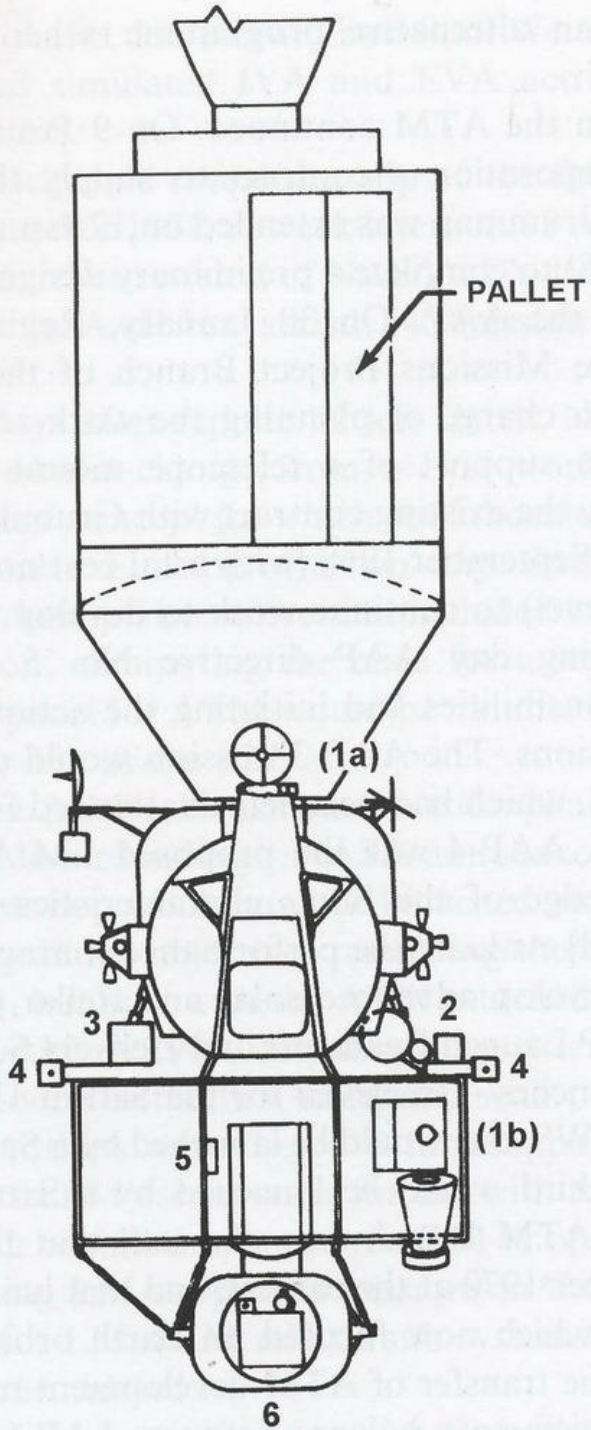
NEW LAB MODULE

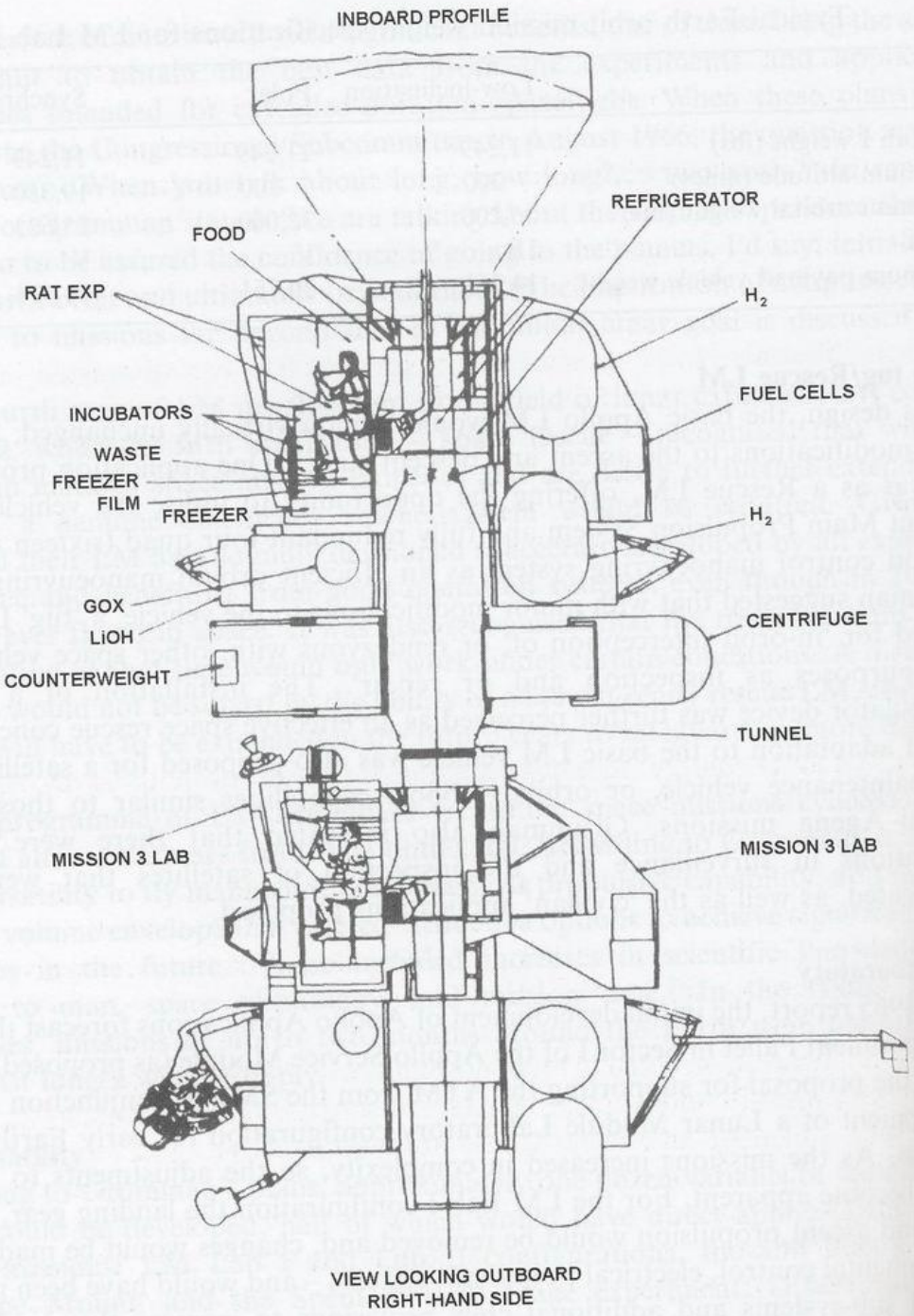


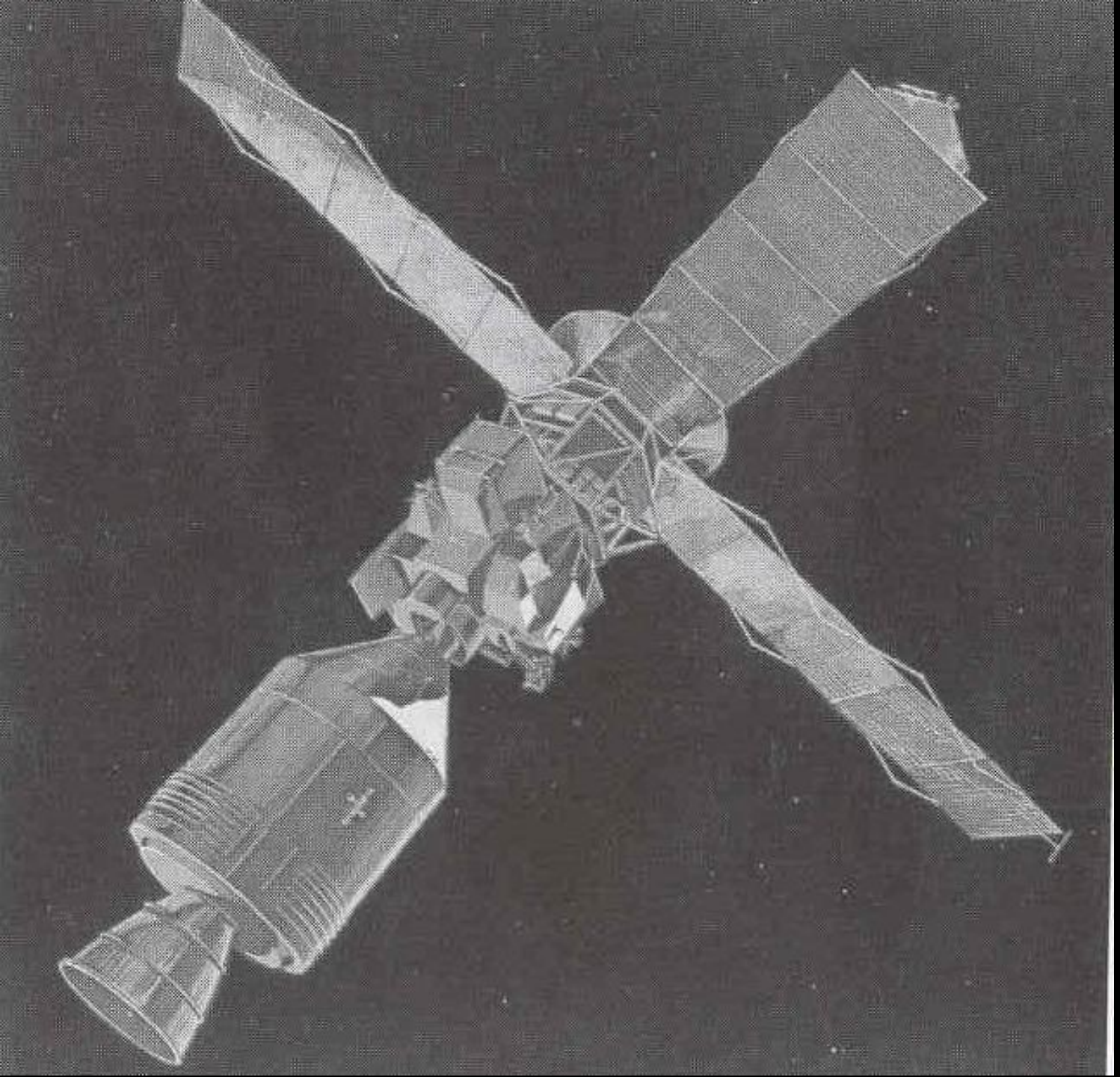


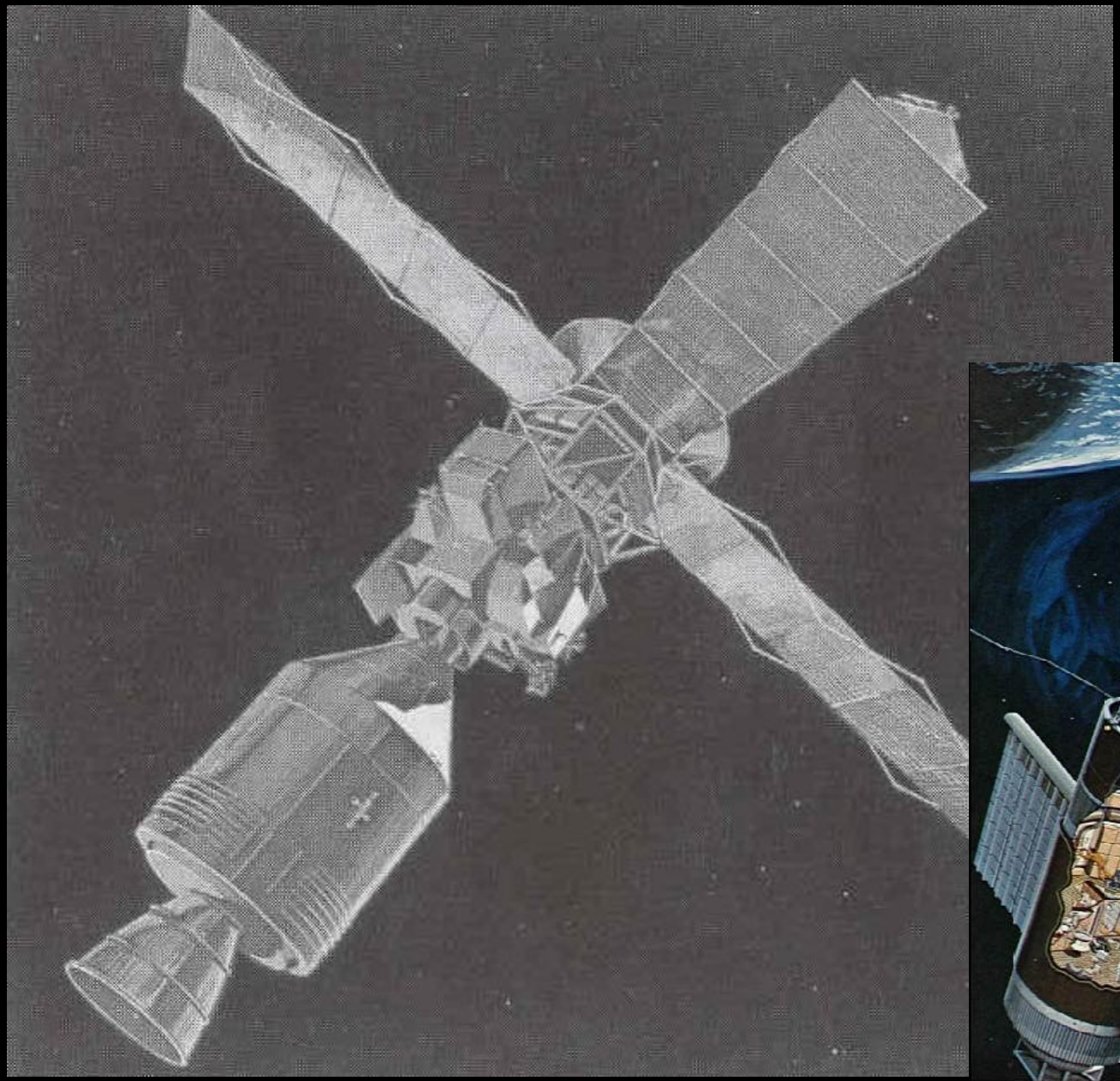
APOLLO SPACECRAFT FOR ORBITAL MISSIONS




PALLET
(1a)
3
2
4
4
(1b)
5
6


INBOARD PROFILE
REFRIGERATOR
FOOD
RAT EXP
H_2
FUEL CELLS
INCUBATORS
WASTE
FREEZER
FILM
FREEZER
H_2
GOX
LiOH
CENTRIFUGE
COUNTERWEIGHT
TUNNEL
MISSION 3 LAB
MISSION 3 LAB
VIEW LOOKING OUTBOARD
RIGHT-HAND SIDE





Děkujeme za pozornost!

Tomáš a Michal Přibylovi

tomas.pribyl@seznam.cz