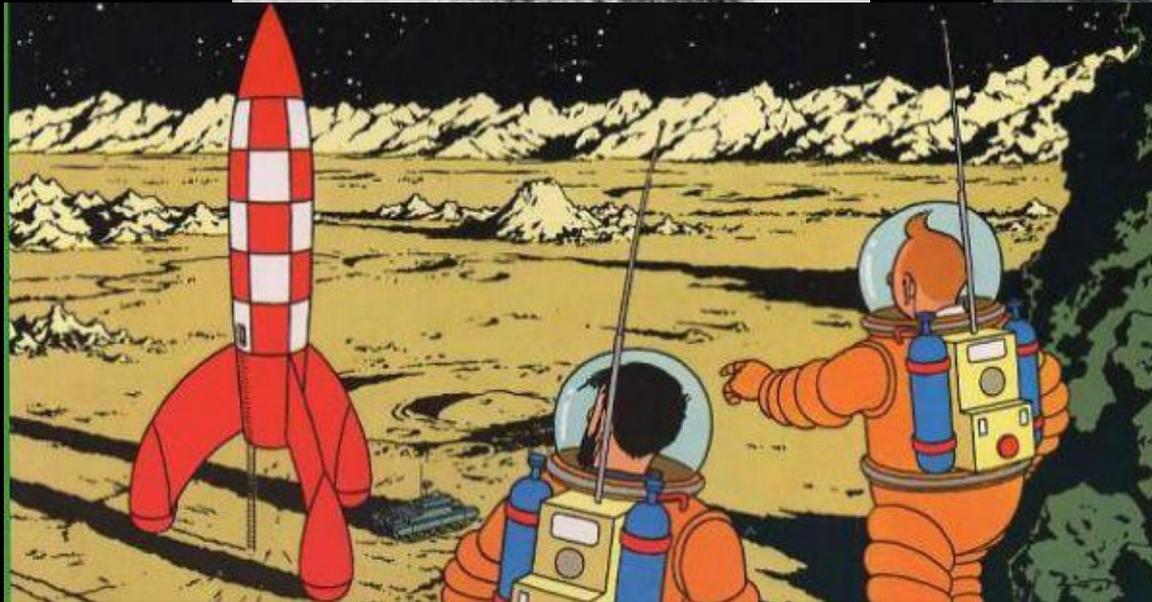
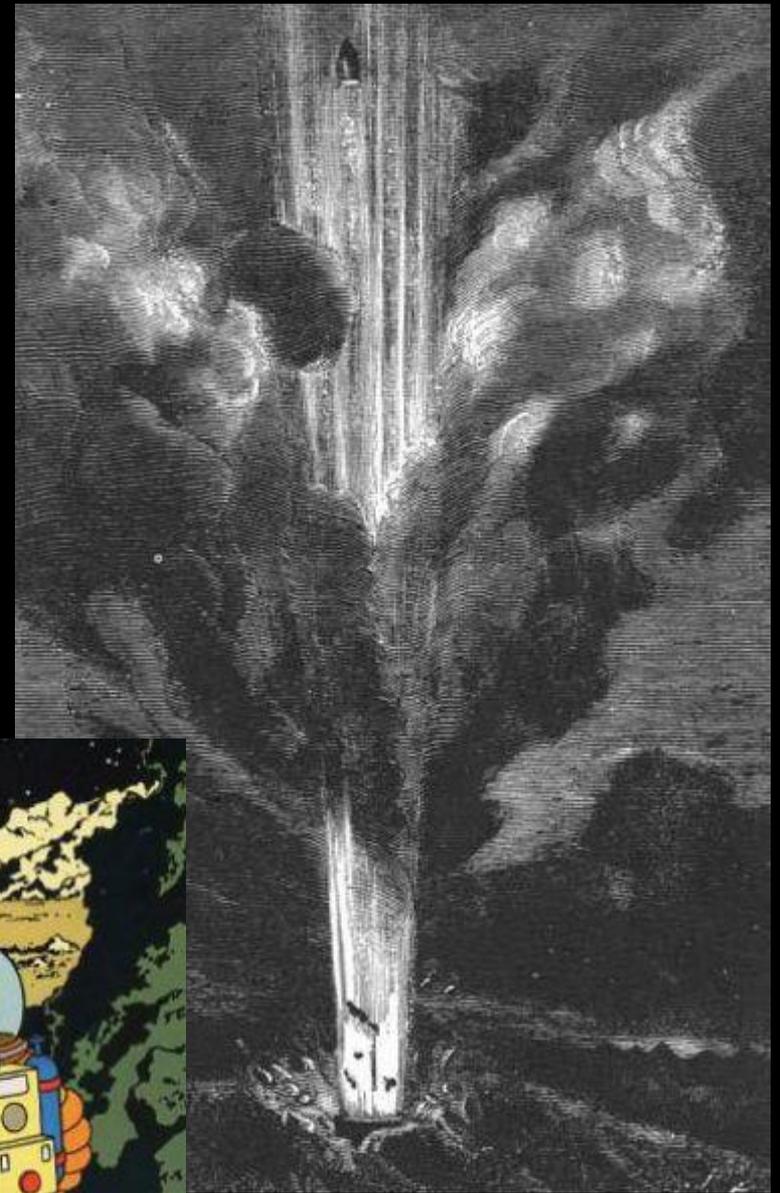


Příběh lunárního modulu

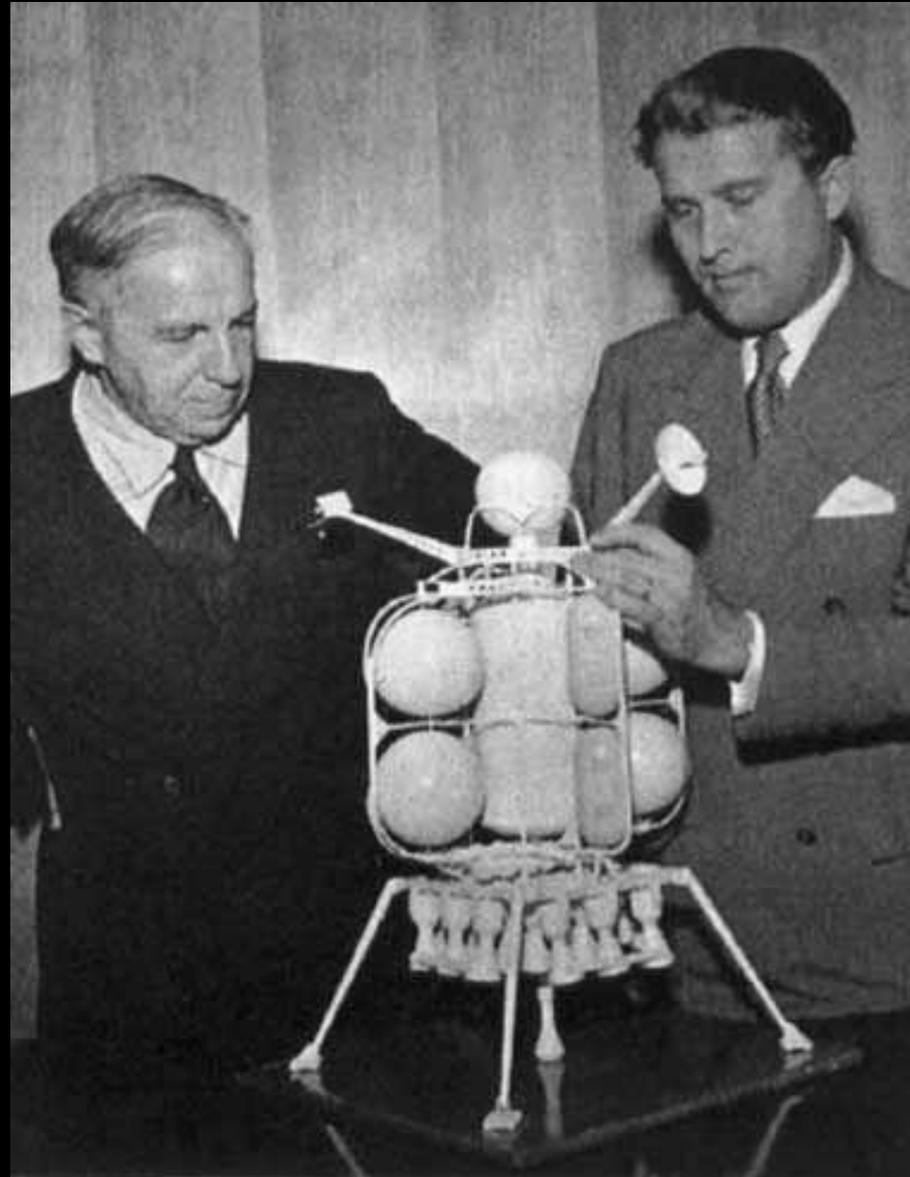


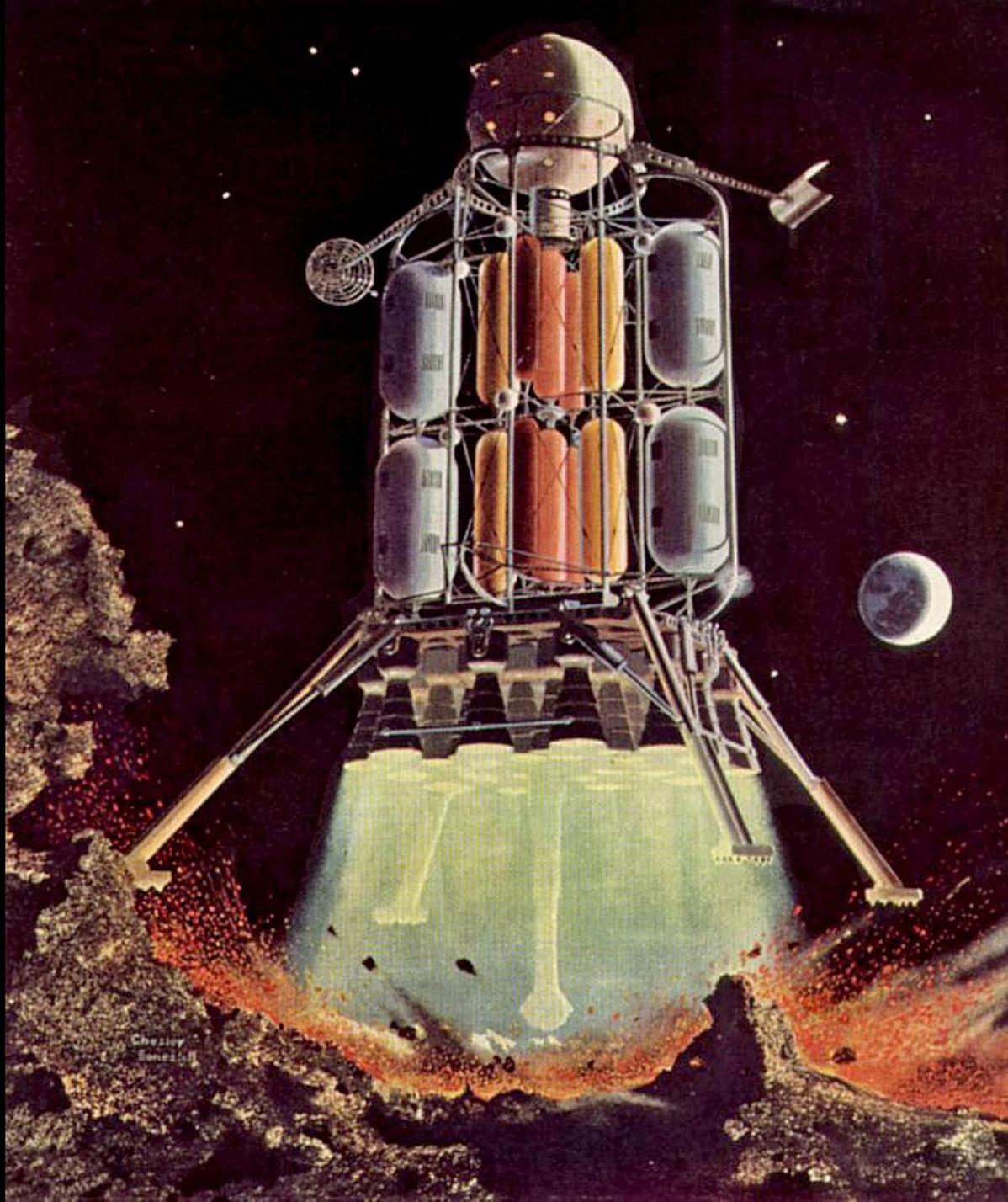






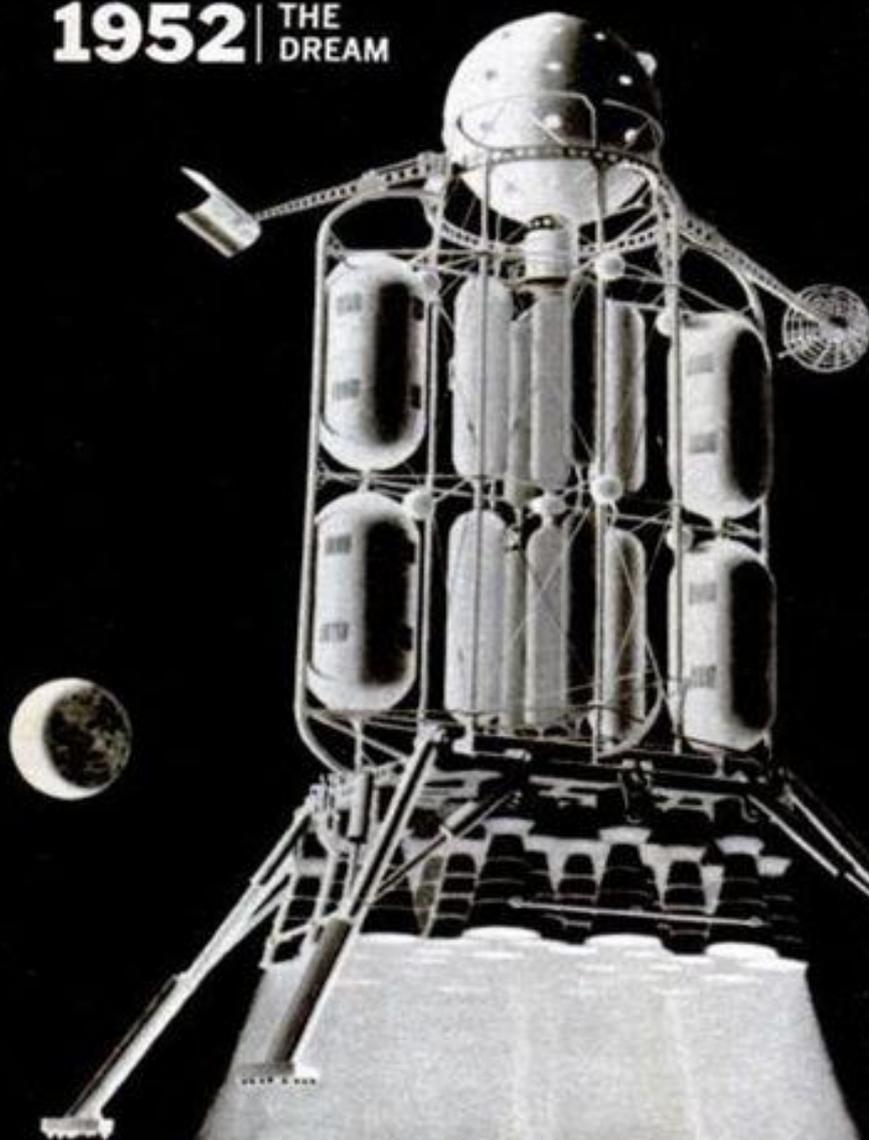
1952





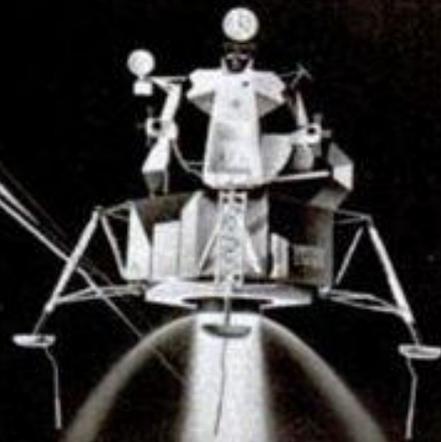
Chester
Gomez

1952 | THE DREAM

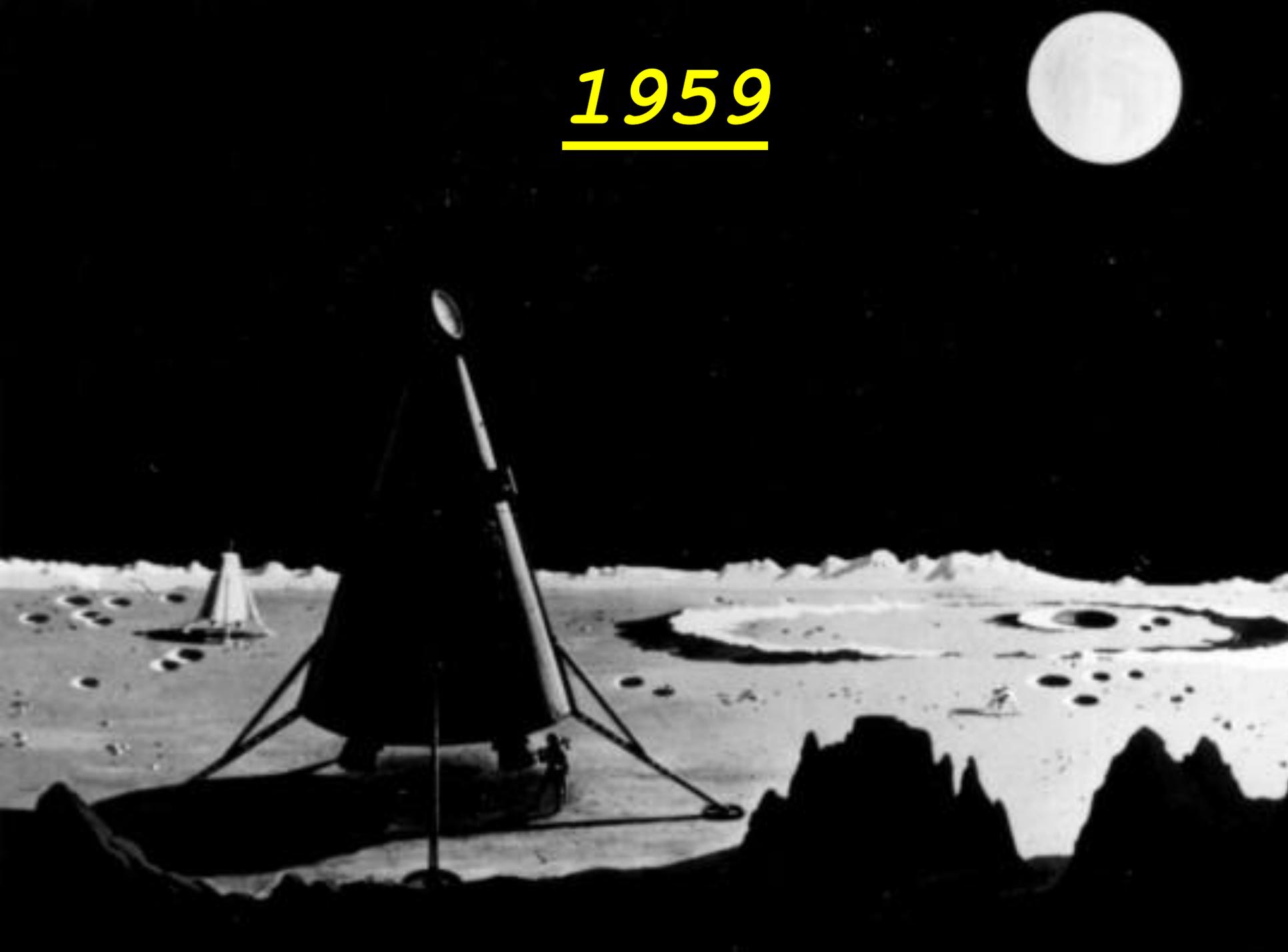


UNDER THE LM's thin aluminum skin is a configuration of fuel and oxygen tanks similar to that of its '52 cousin. The earlier "spider" was 160 feet high and 110 wide, designed to carry 20 men on a round trip from Earth orbit to the moon. The 23-foot-high LM is built to carry two men 140 miles and is destined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

1969 | THE REALITY

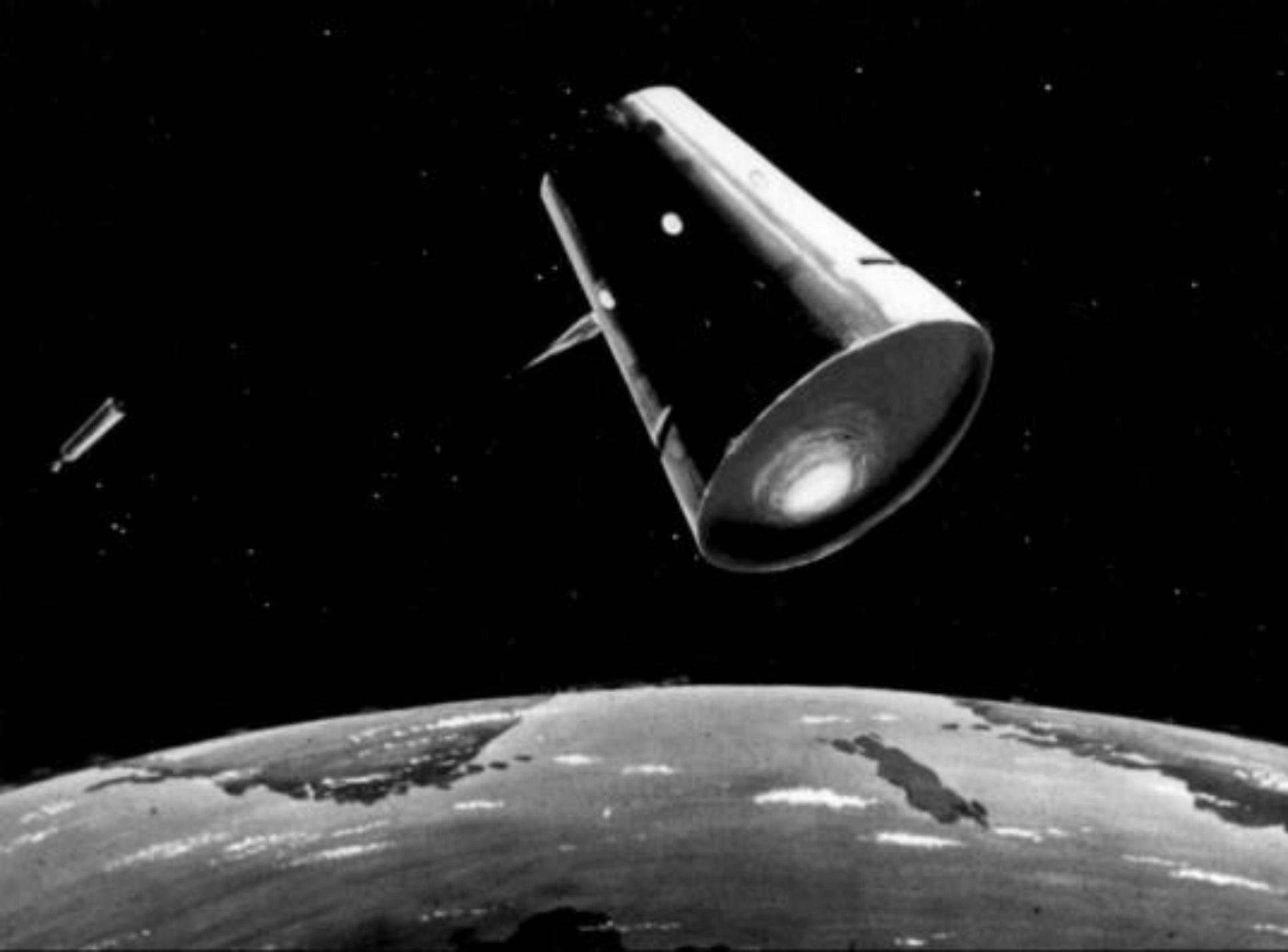


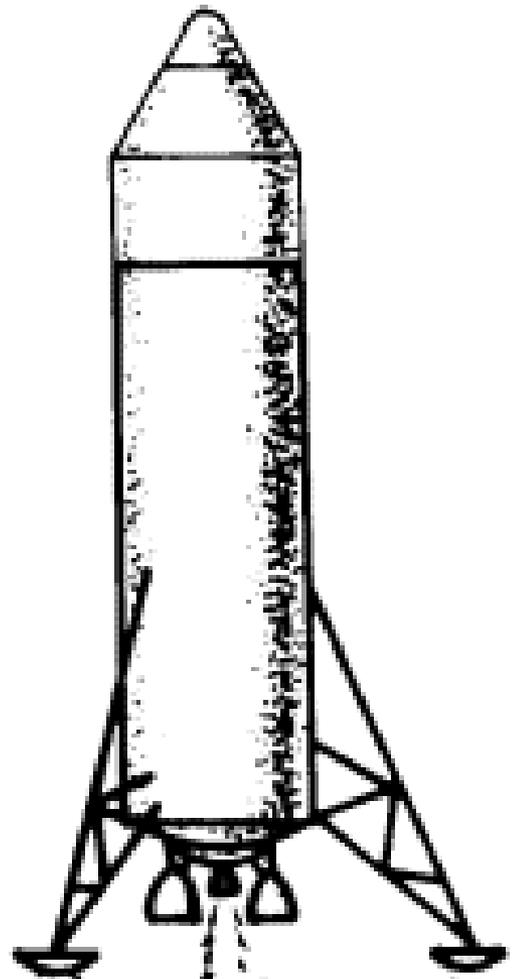
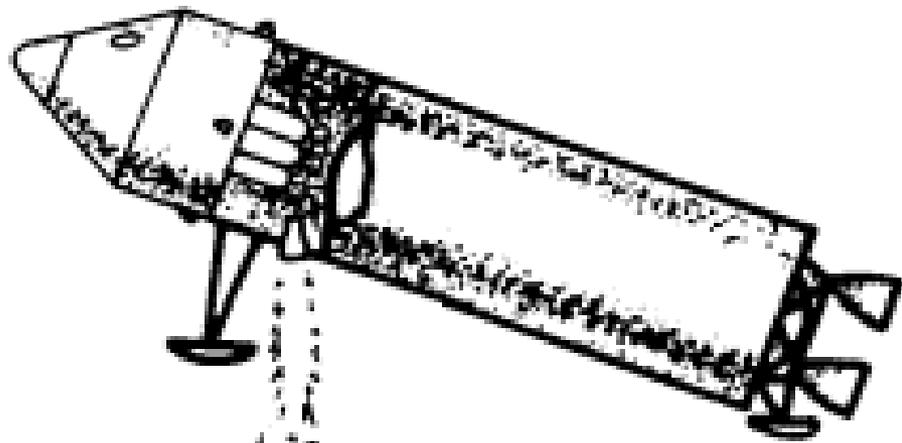
1959

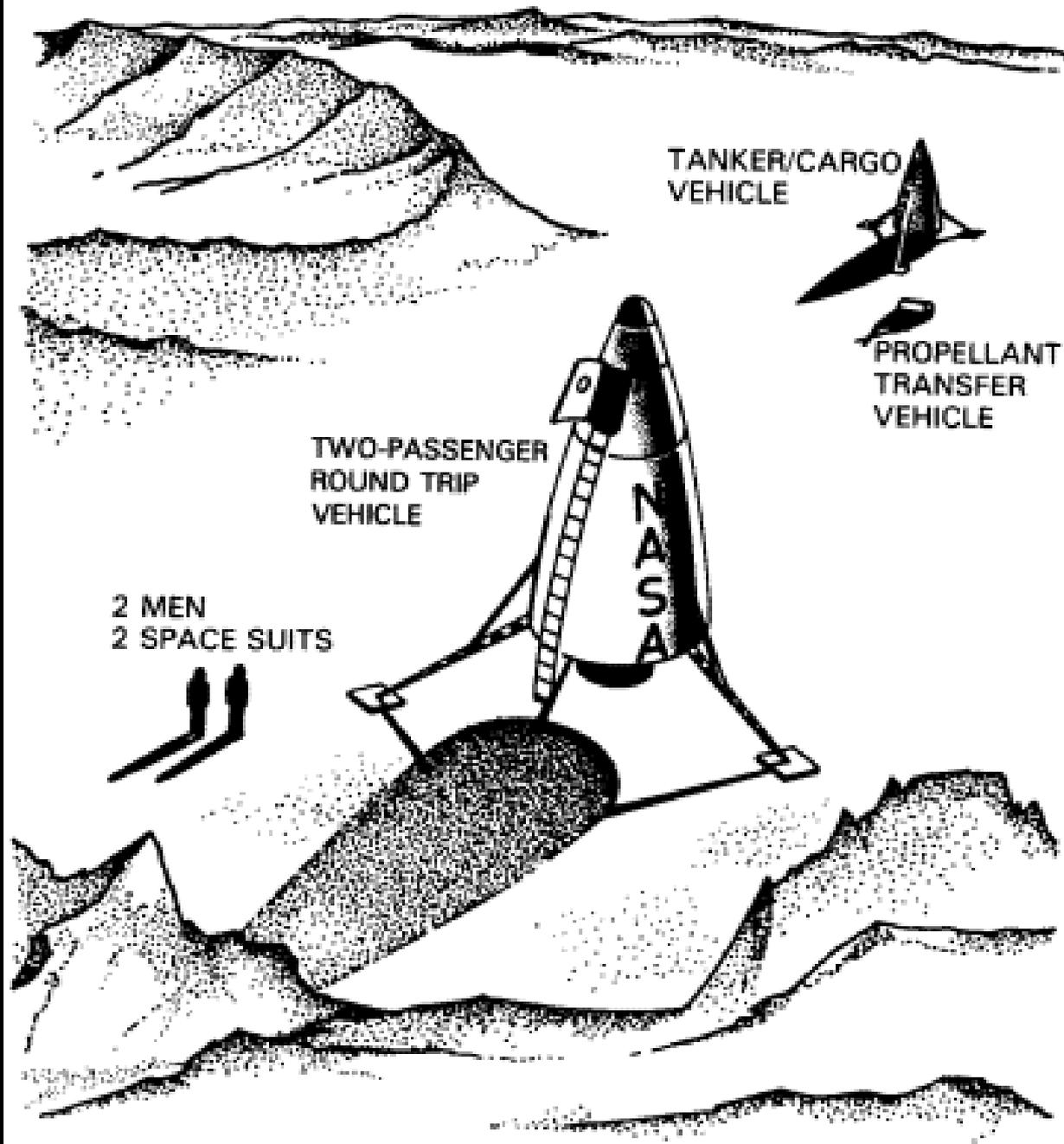


LUNAR
RETURN MISSION
TAKE-OFF FROM MOON
WITH FIFTH STAGE









TANKER/CARGO
VEHICLE

PROPELLANT
TRANSFER
VEHICLE

TWO-PASSENGER
ROUND TRIP
VEHICLE

2 MEN
2 SPACE SUITS

N
A
S
A

PROJECT APOLLO

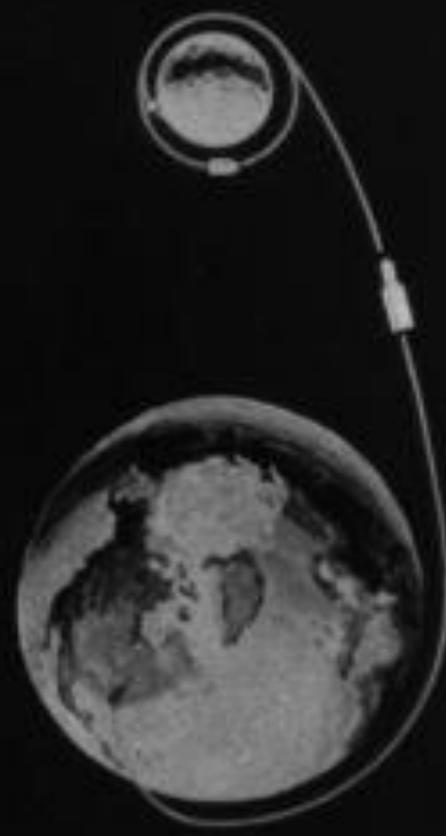
LUNAR LANDING FLIGHT TECHNIQUES



DIRECT



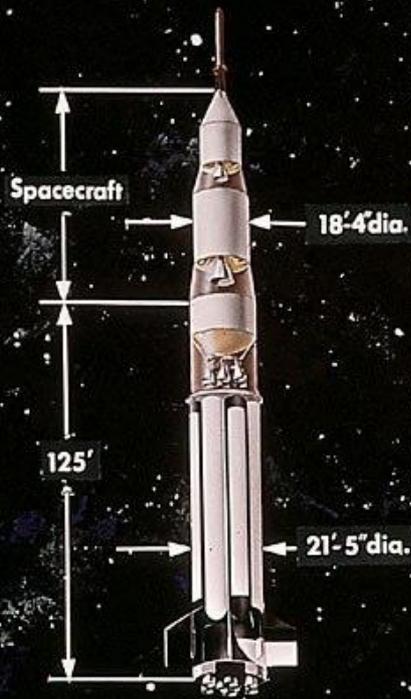
**EARTH ORBIT
RENDEZVOUS**



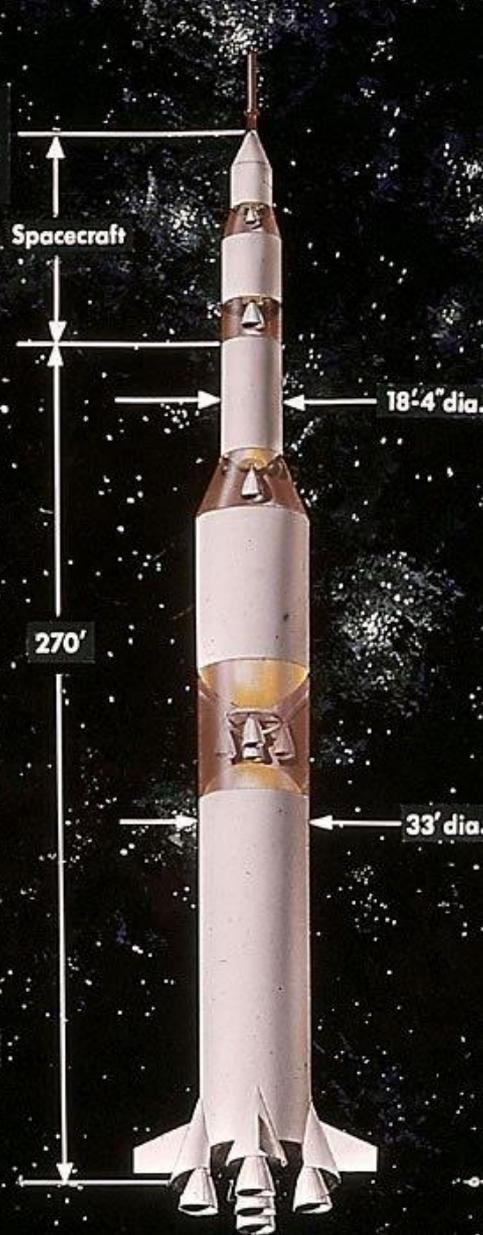
**LUNAR ORBIT
RENDEZVOUS**

SATURN-NOVA

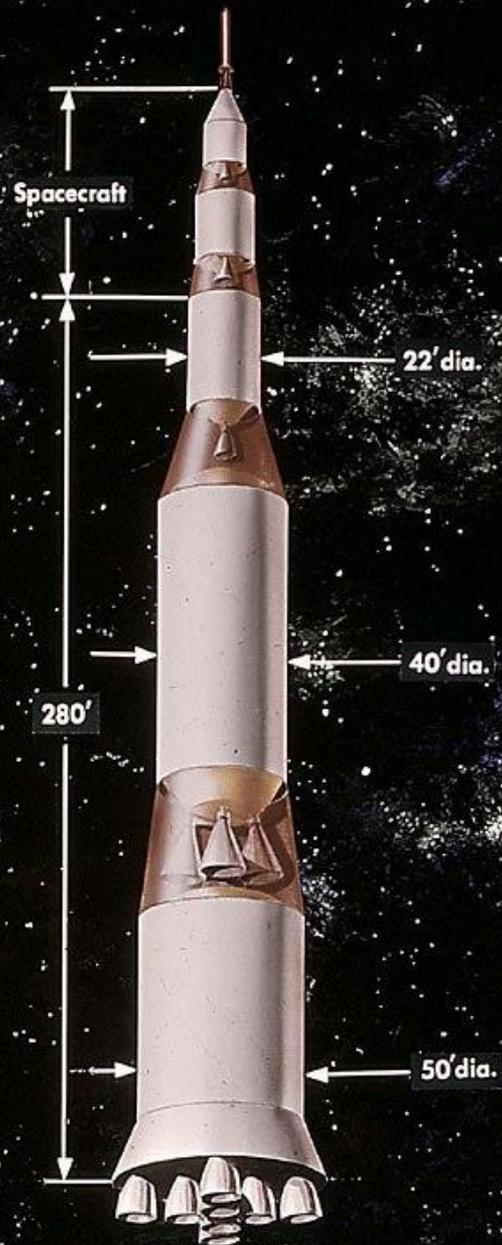
COMPARISON



C-1



C-5



NOVA

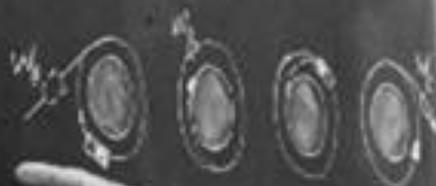
John Houbolt

VEHICLE



C.M. SM. L.E.V.

ESCAPE WEIGHTS
L.O.R.



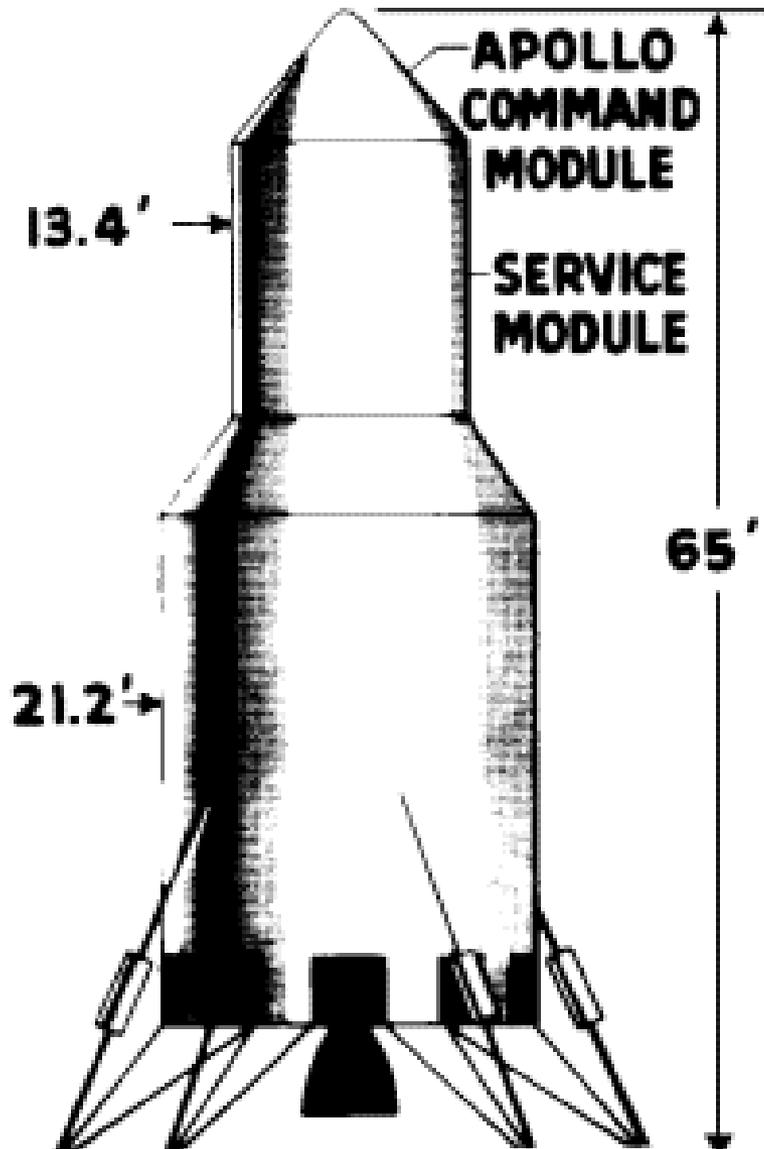
MISSION





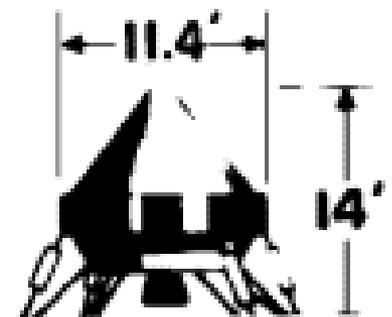
COMPARISON OF LANDER SIZES

DIRECT LANDING



LUNAR FERRY OF LUNAR RENDEZVOUS

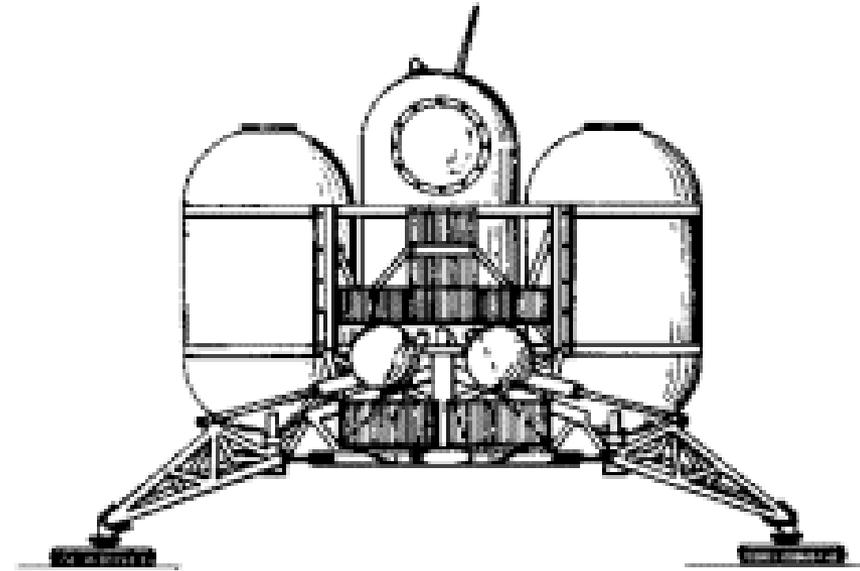
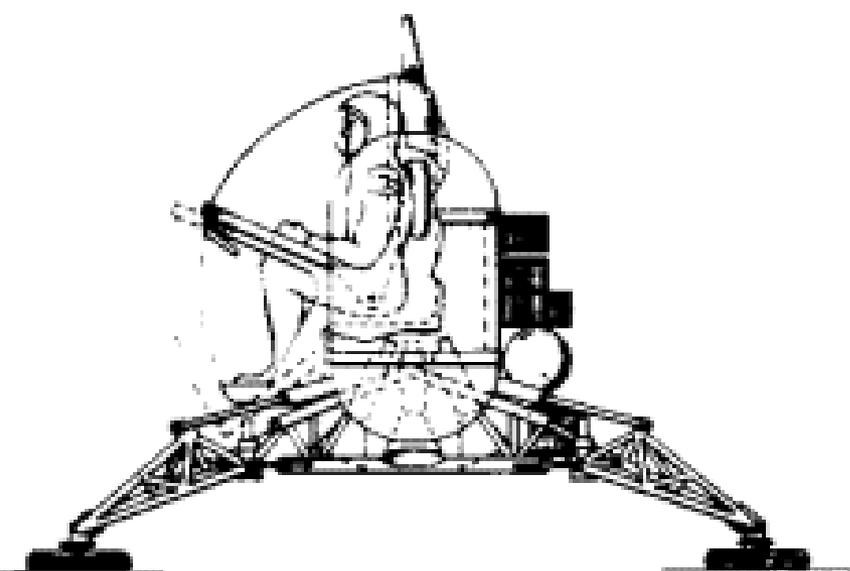
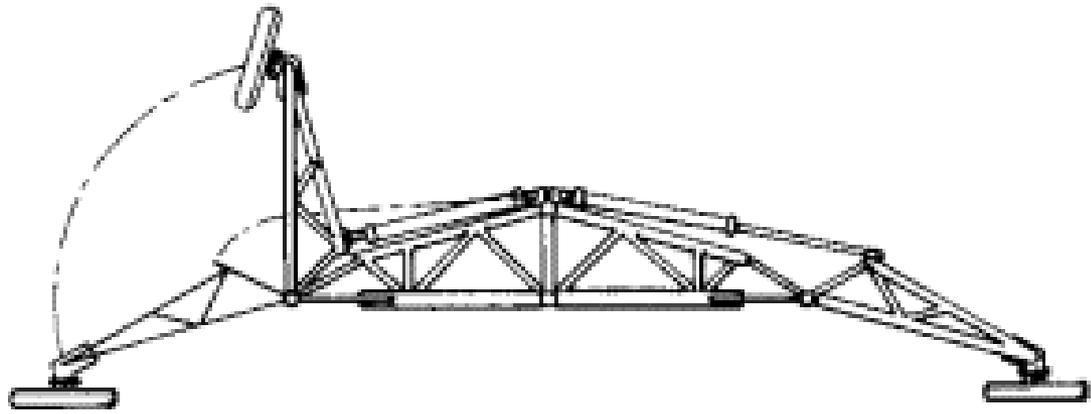
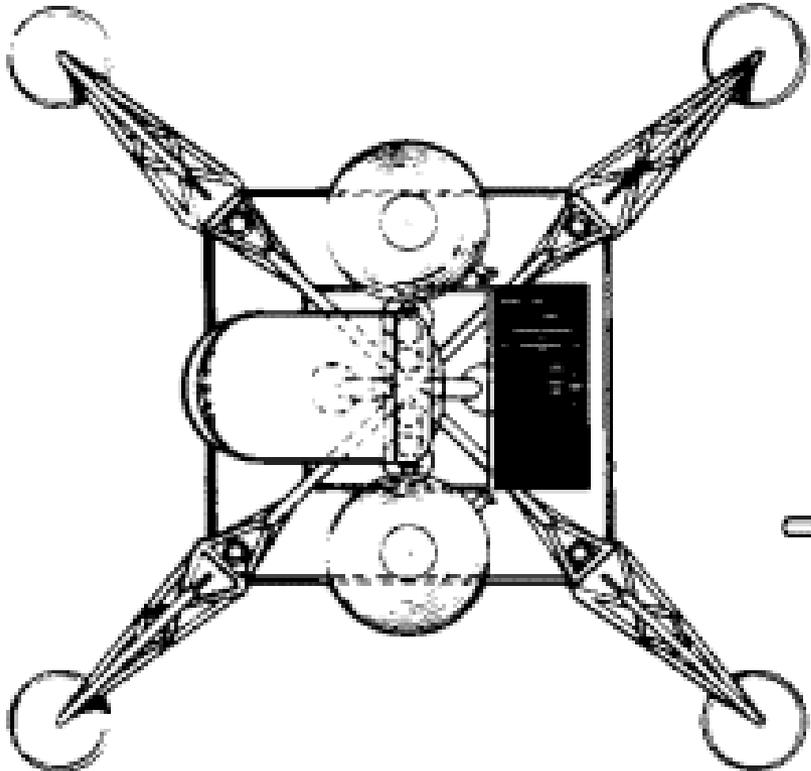
LUNAR EXCURSION VEHICLE



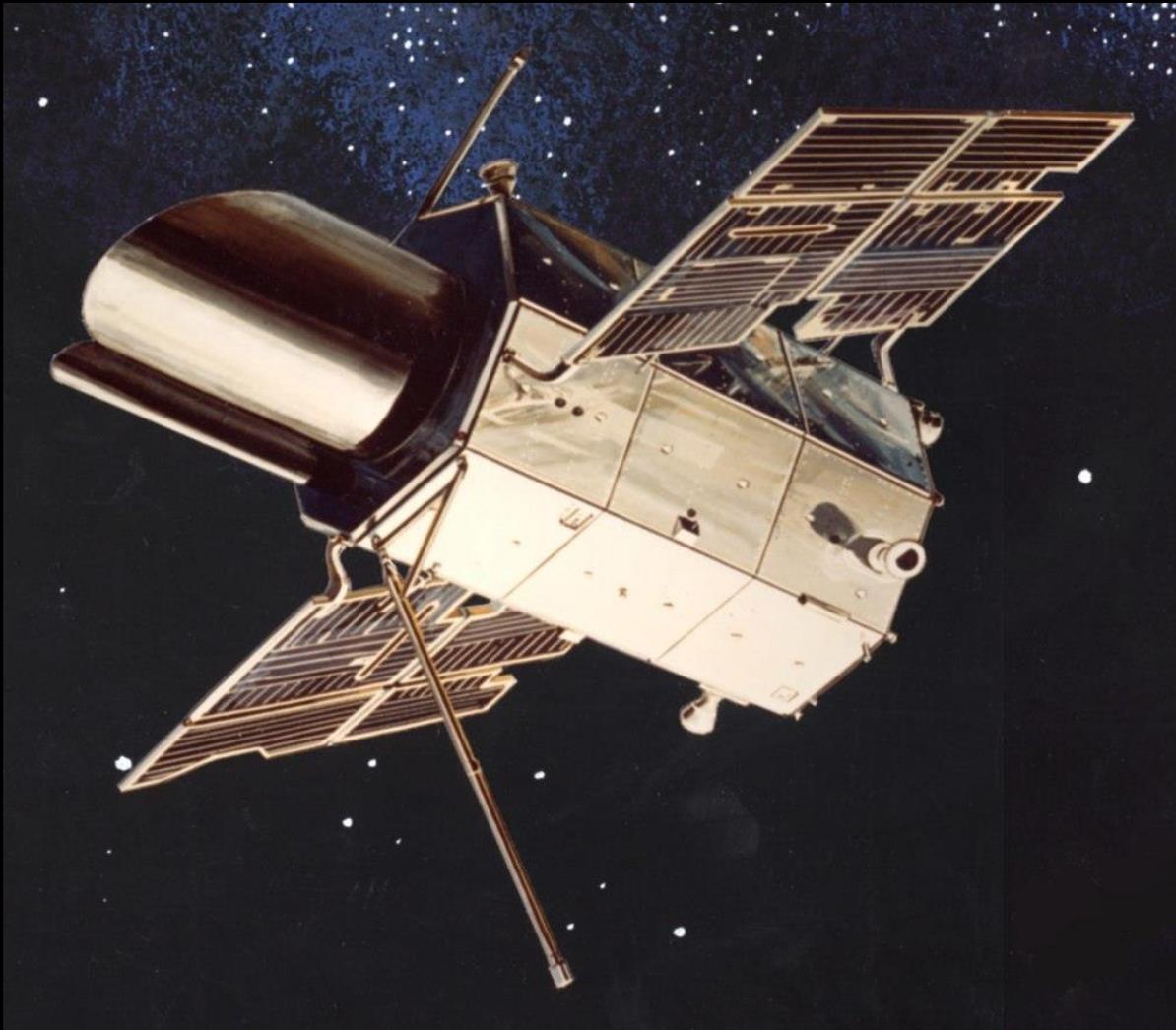
LUNAR LANDER-ONE MAN

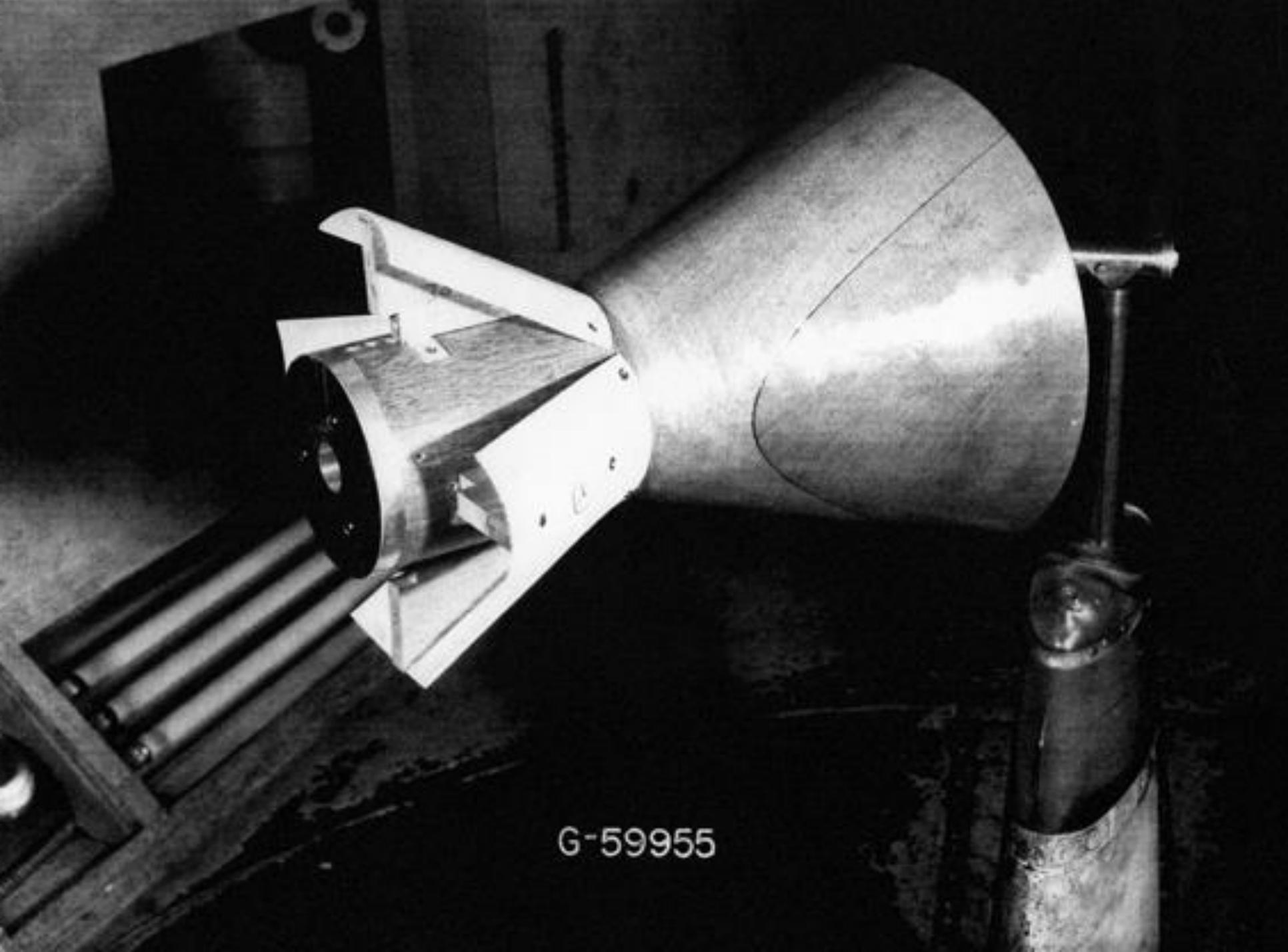


	<u>LB</u>
1 MAN AND LIFE SUPPORT	220
CONTROLS	50
STRUCTURE	230
ENGINE AND TANKAGE	220
FUEL AND OXIDIZER	<u>2500</u>
TOTAL	3220



*Grumman Aircraft
Engineering Corporation*





G-59955

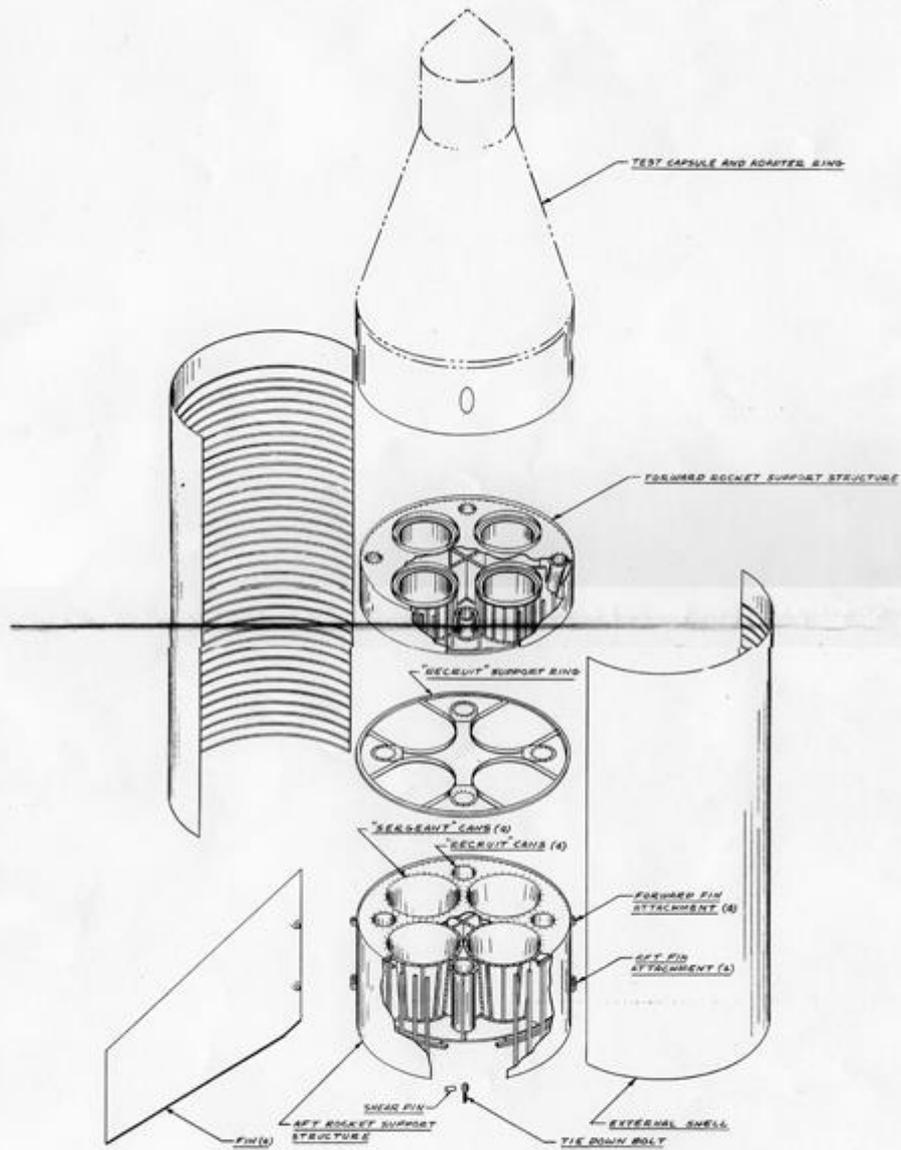
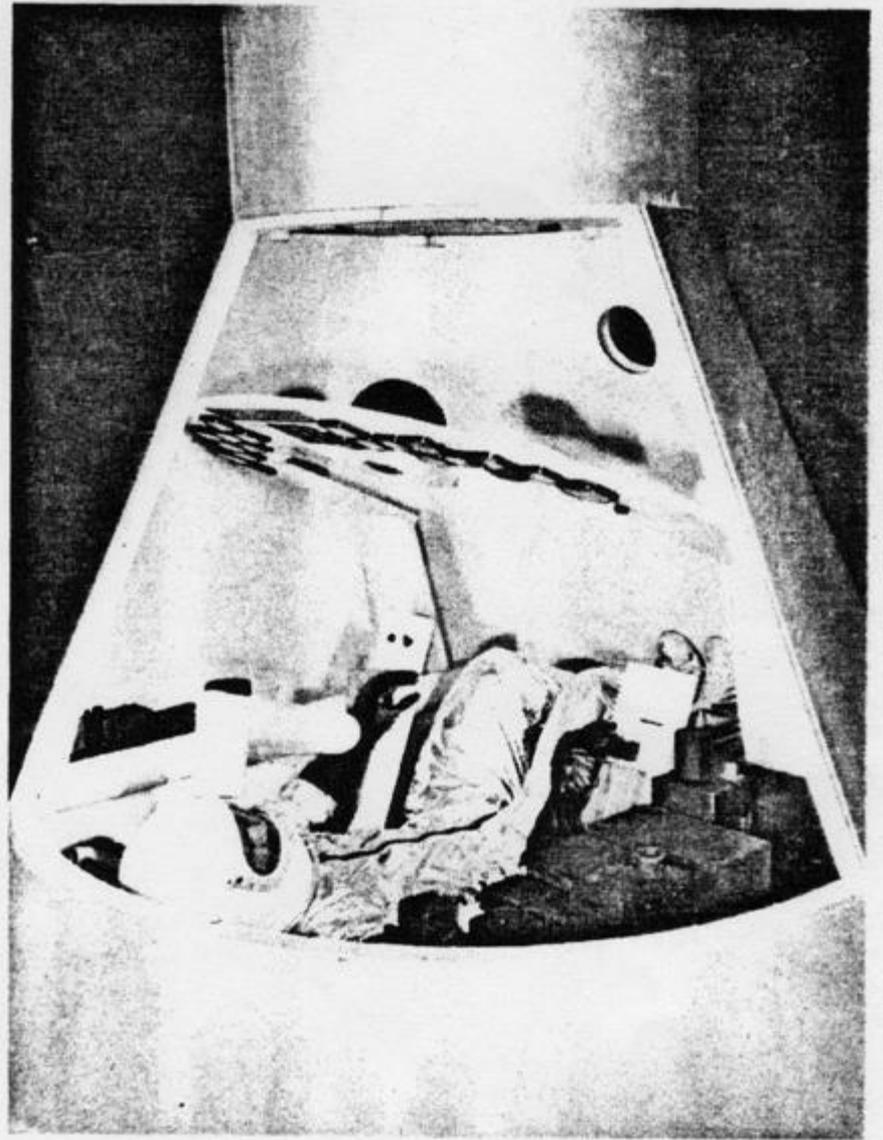
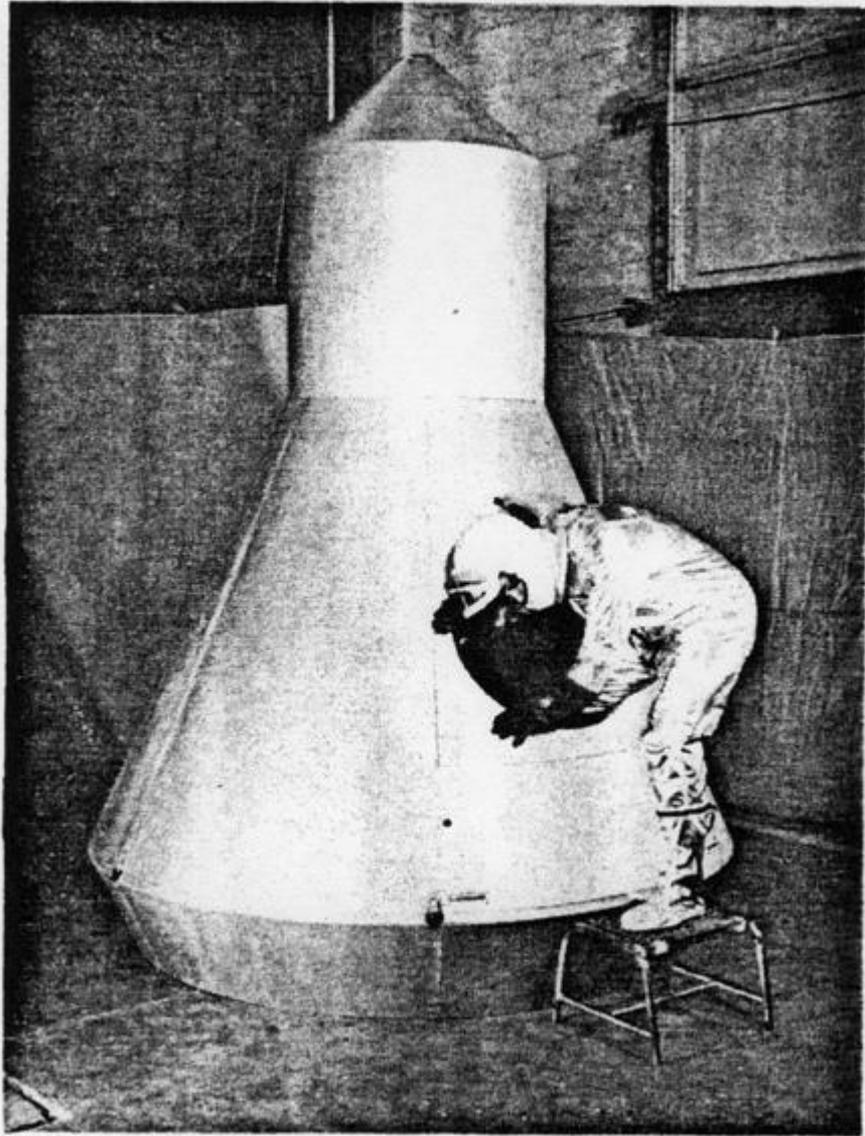
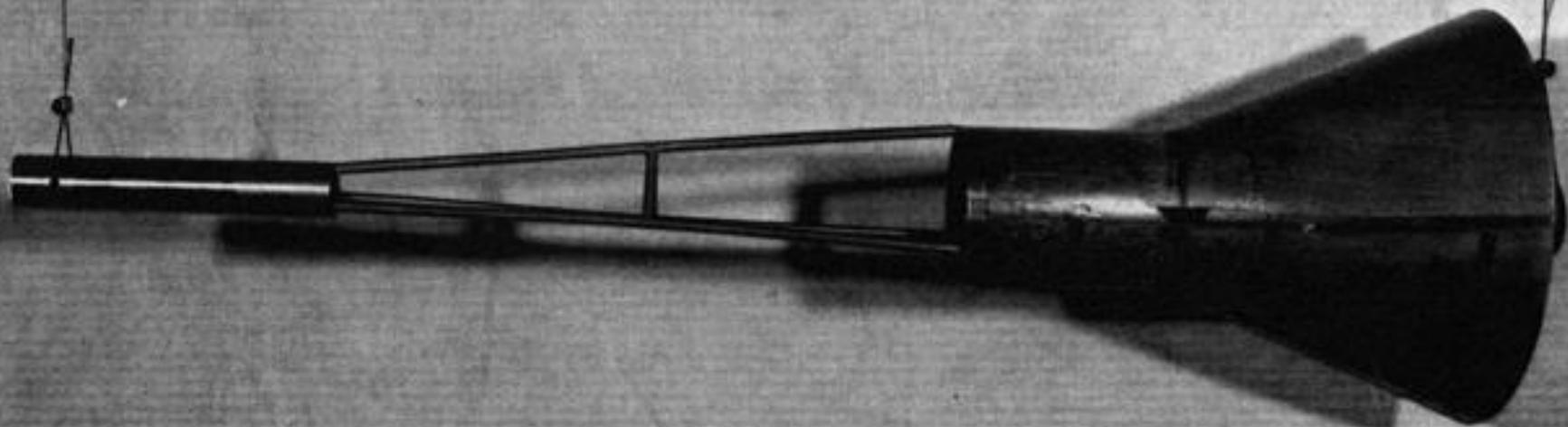
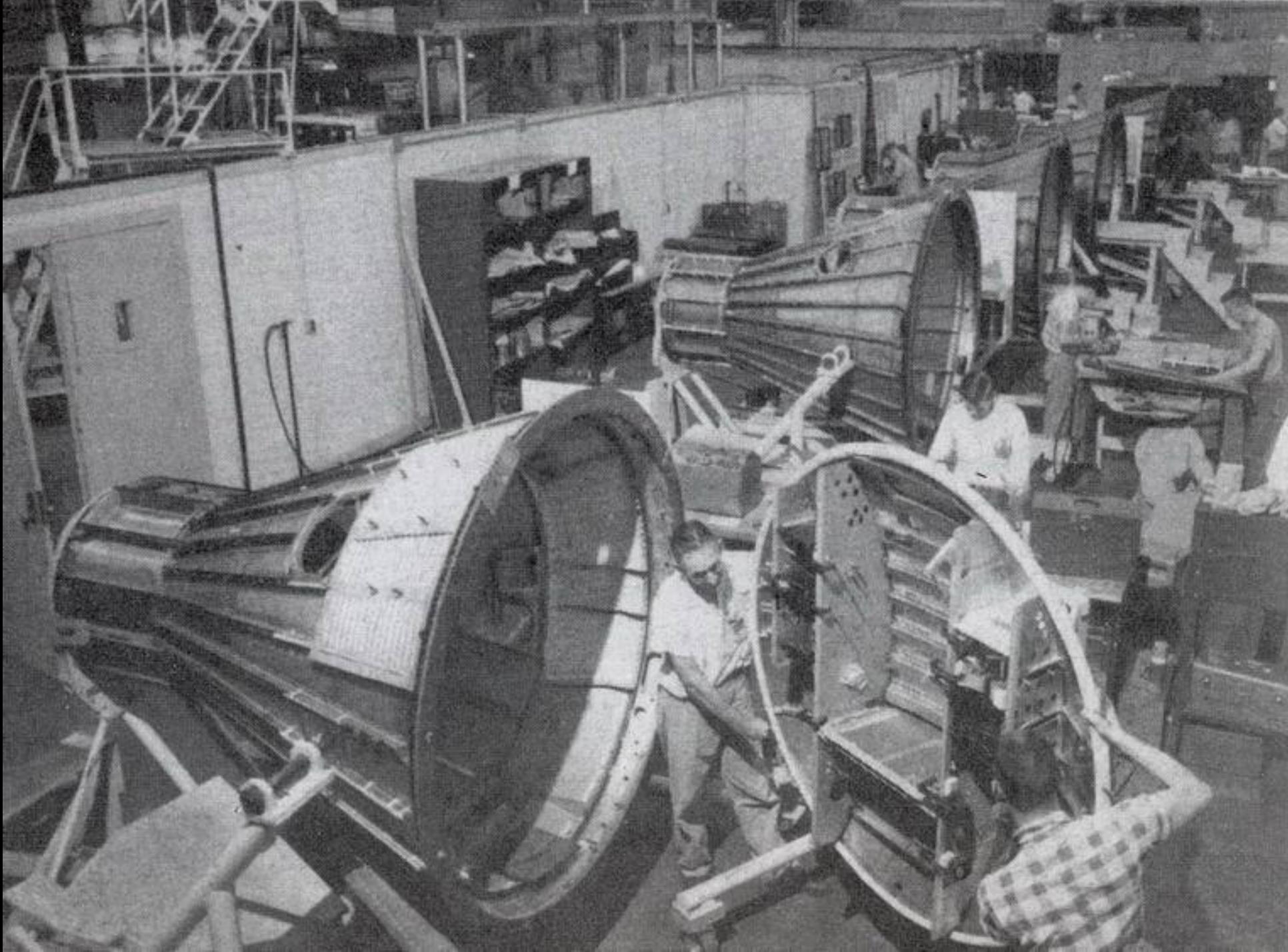


FIG. 1
 ISOMETRIC CUT-A-WAY
 TRANSPORT VEHICLE
 MAJOR STRUCTURAL COMPONENTS





G-59962





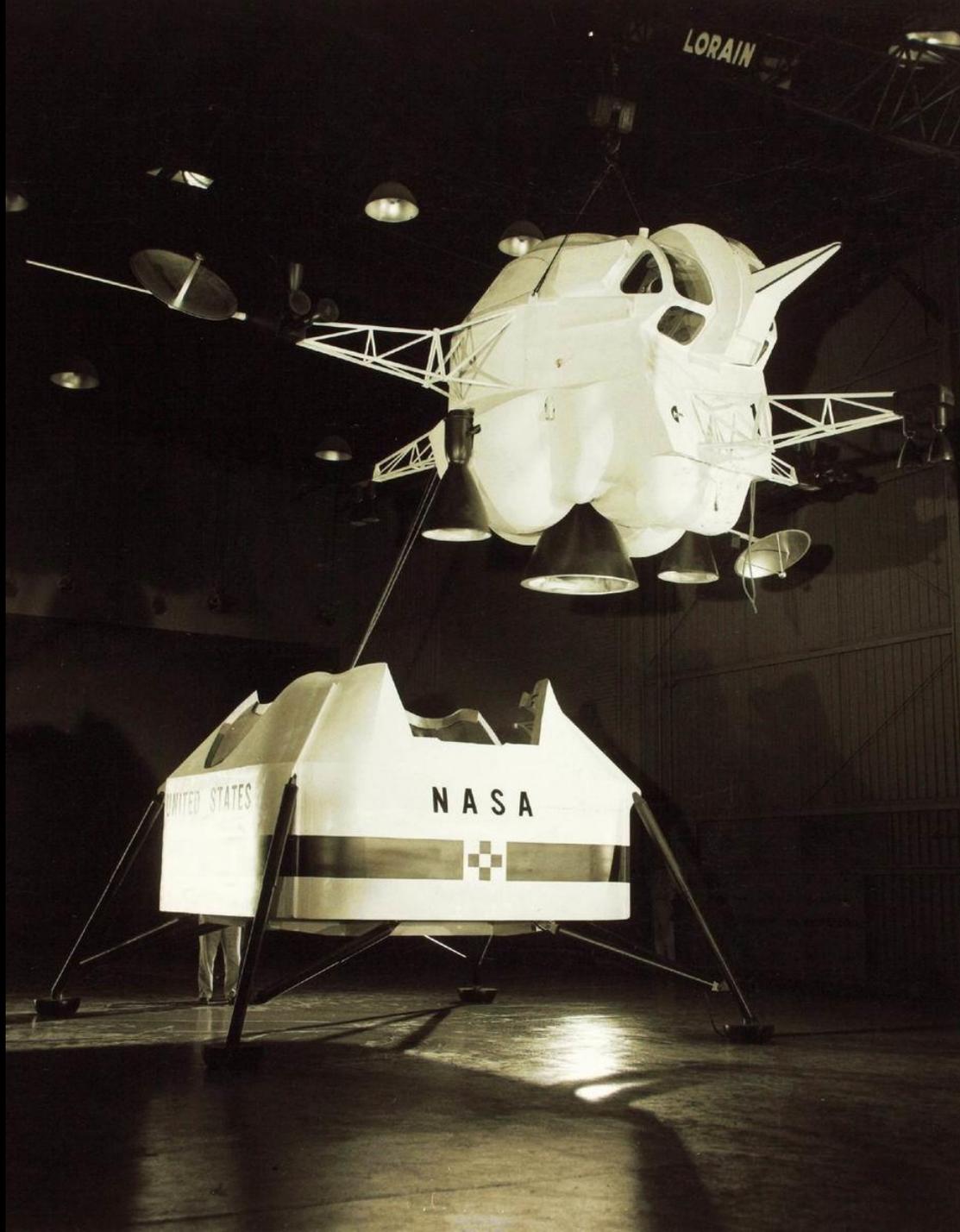


UNITED
STATES



General Electric



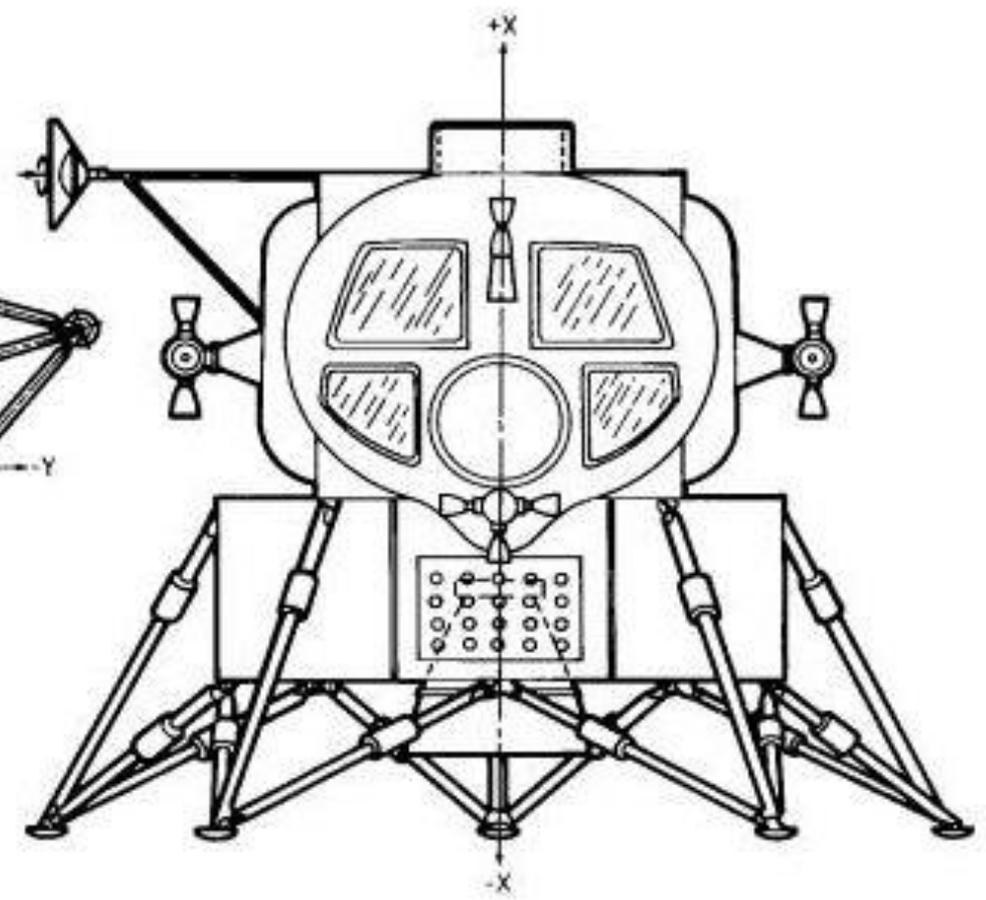
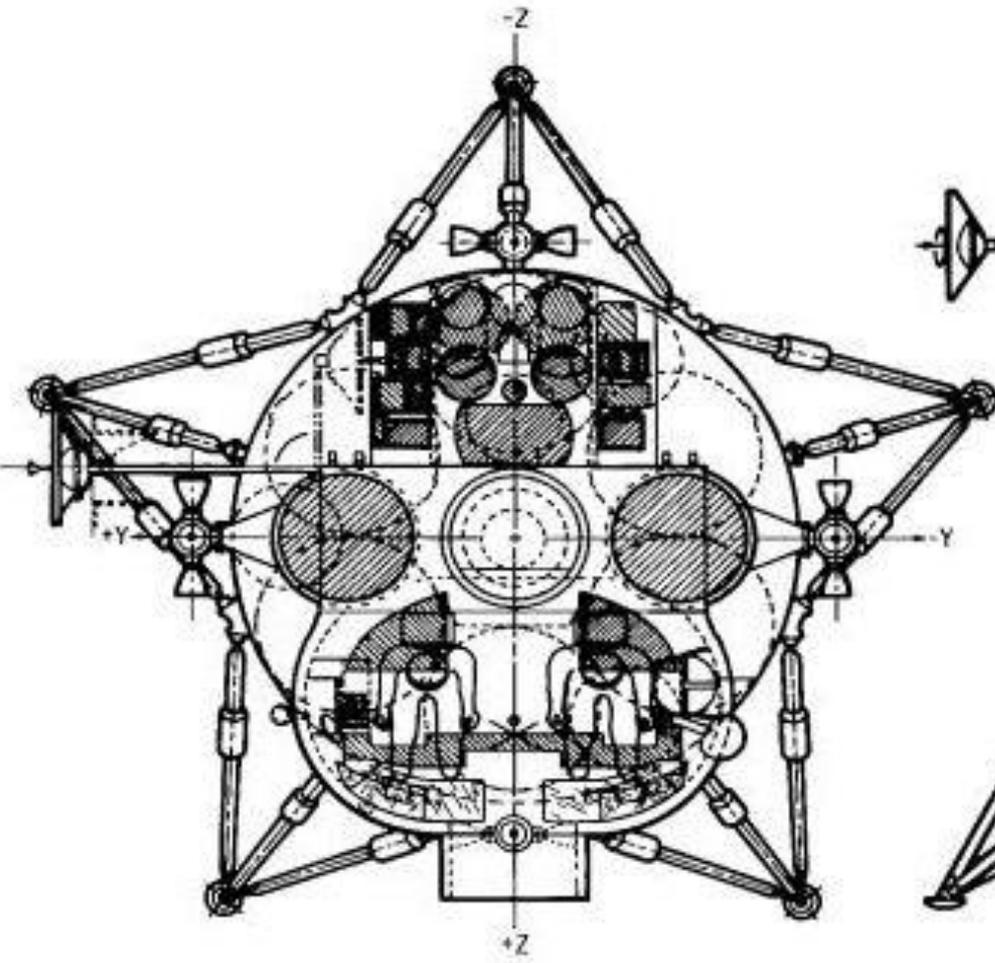






„Made in Grumman“







Listopad 1961 – Apollo

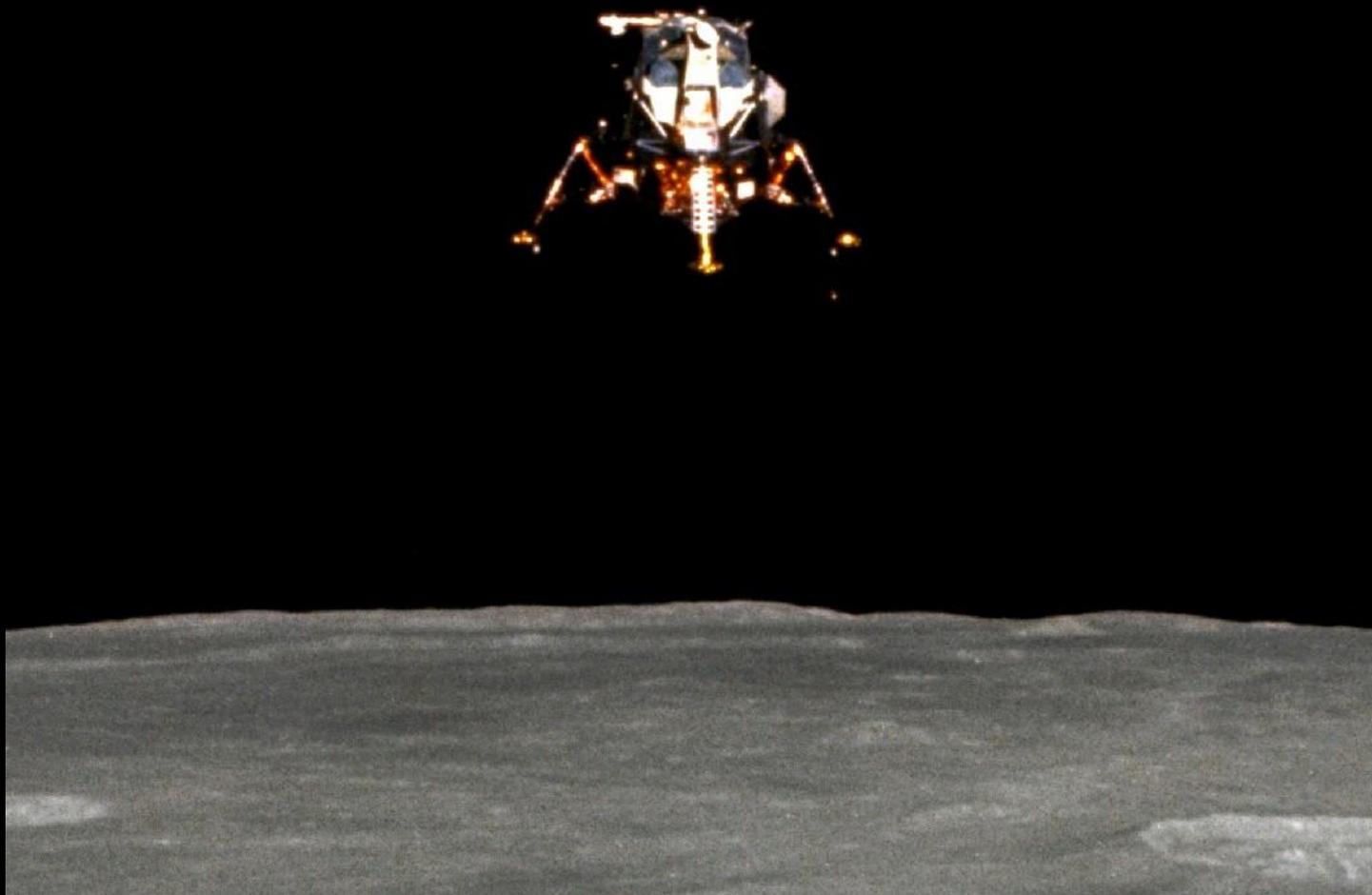
Září až prosinec – Saturn V

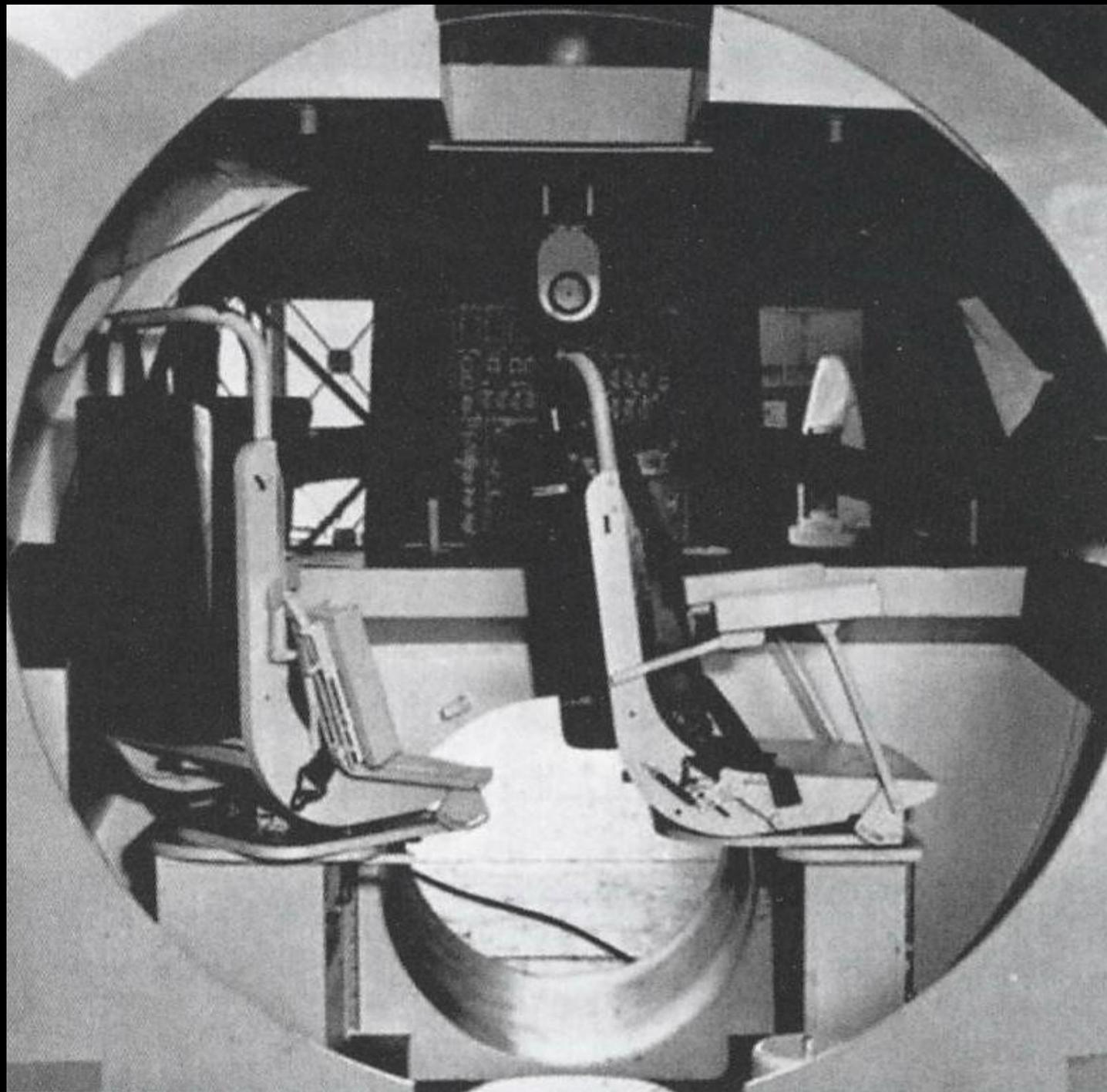
Listopad 1962 – LM



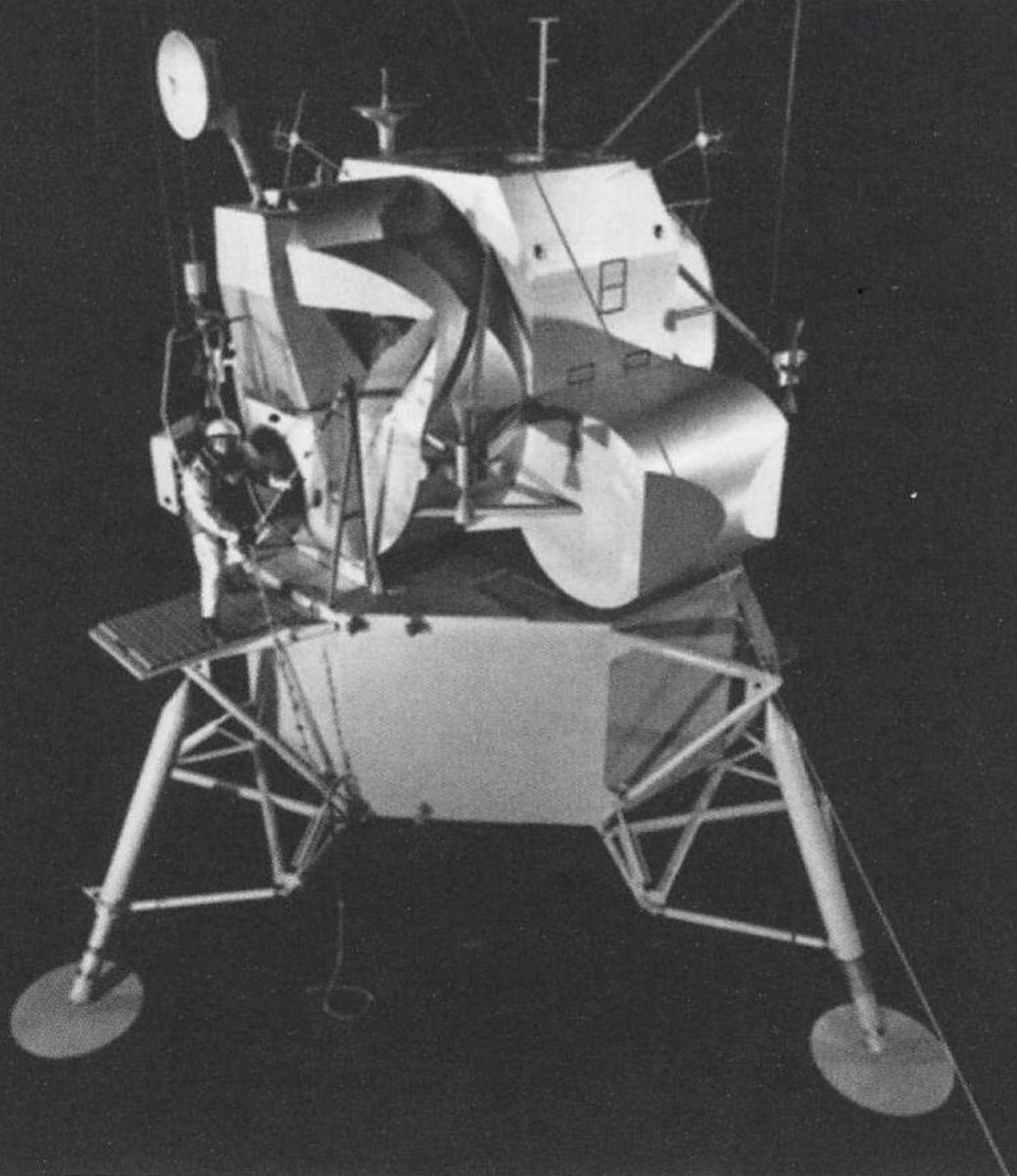
LEM – Lunar Excursion Module

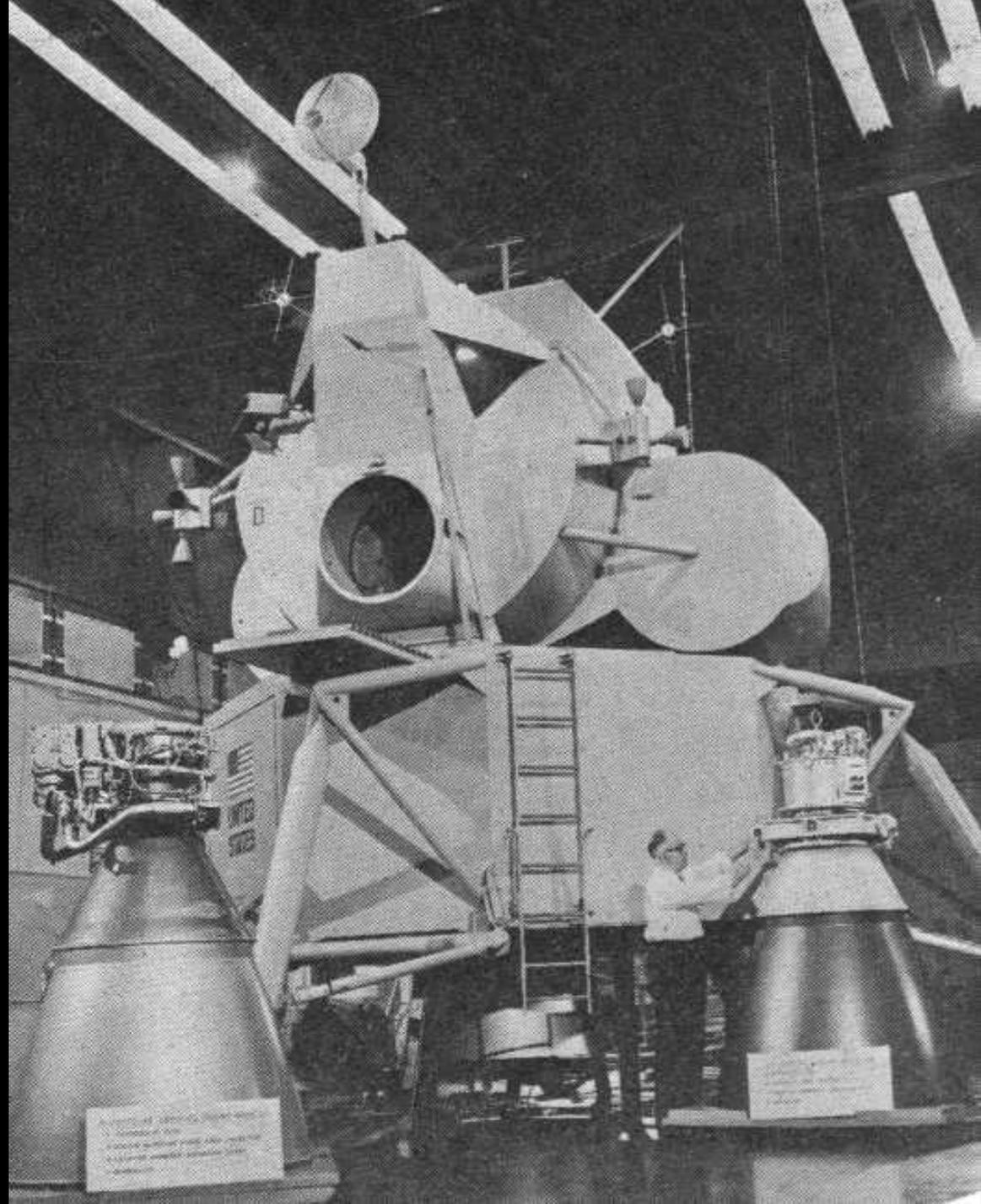
Červen 1966 – jen LM





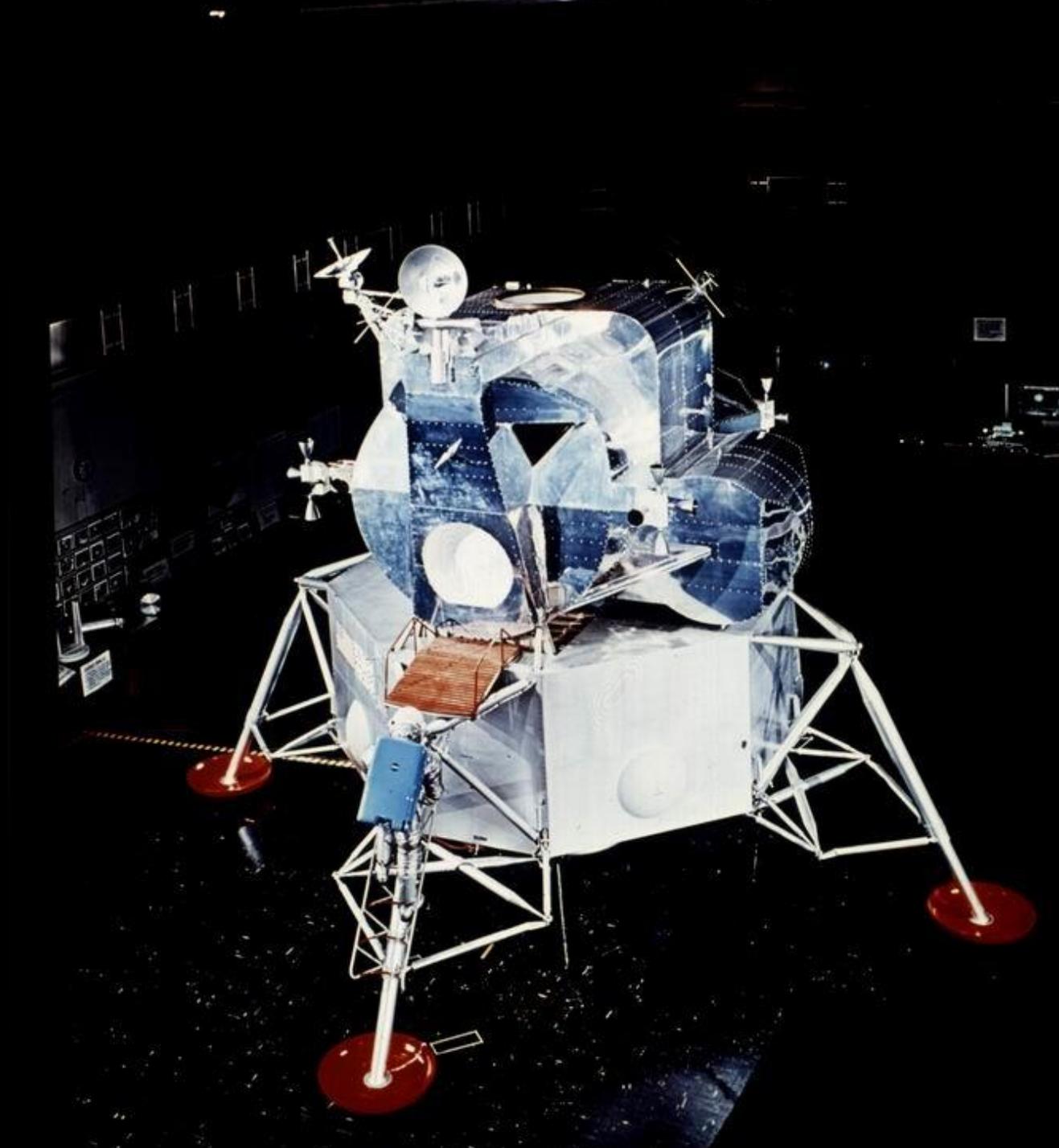






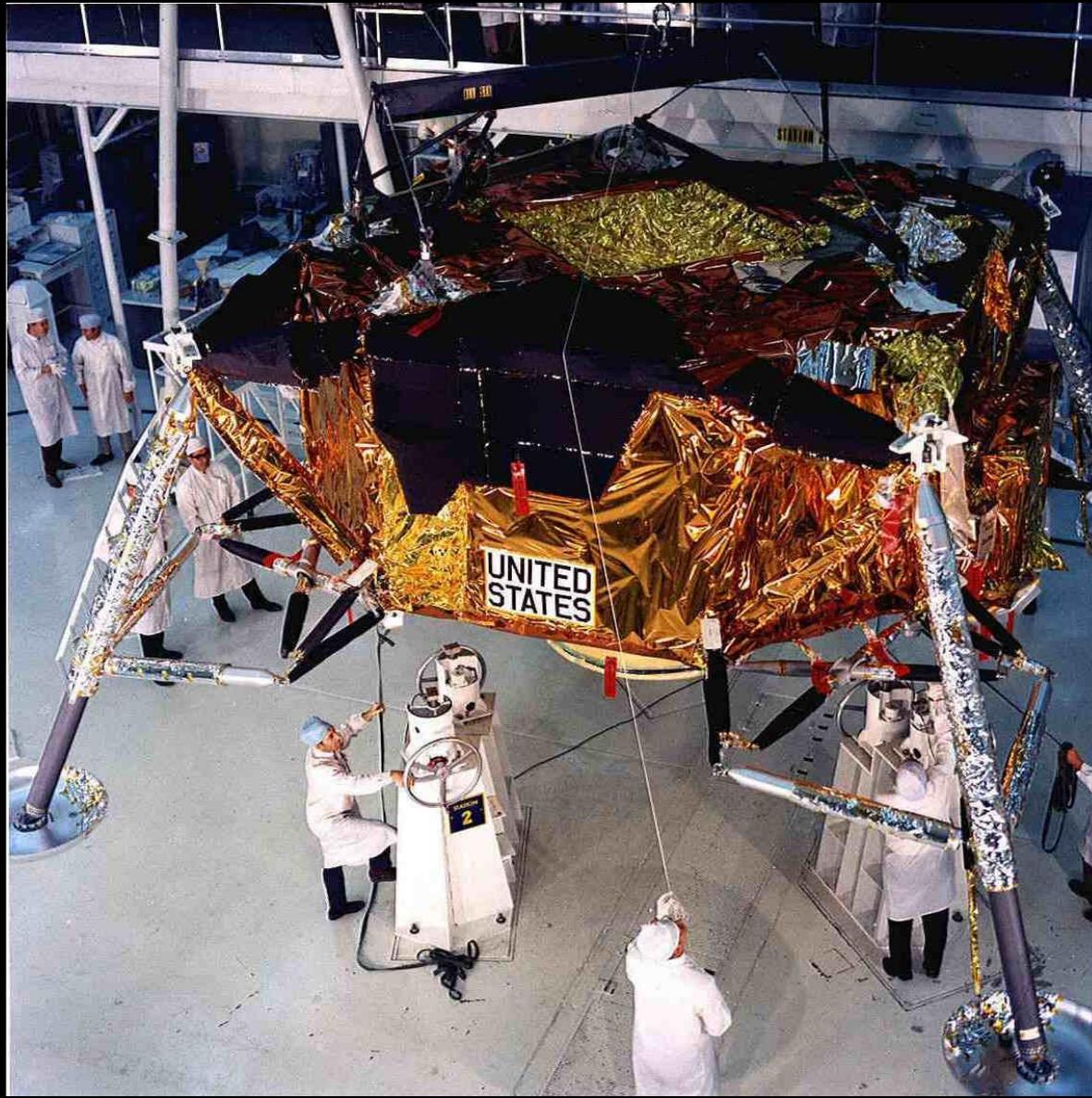
APOLLO 11 LUNAR MODULE
The Lunar Module was the only part of the Apollo spacecraft that landed on the Moon. It was designed to carry two astronauts from the Command Module in Earth orbit to the Moon and back. The LM consisted of a descent stage and an ascent stage. The descent stage was used for landing and ascent, while the ascent stage was used for returning the astronauts to Earth orbit. The LM was launched on the Apollo 11 mission on July 16, 1969, and landed on the Moon on July 20, 1969. It was the first human-made object to land on the Moon.

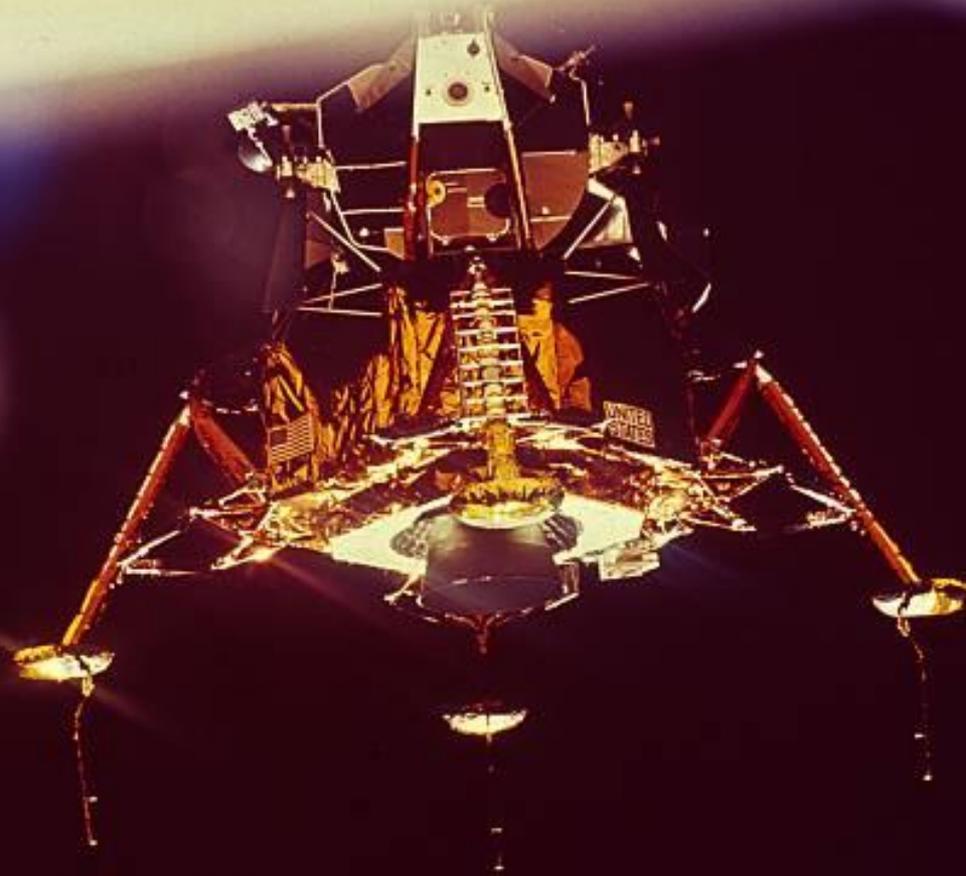
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Descent Stage





*Rocketdyne Company a STL (Space
Technology Laboratories)*

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





Oxid dusičitý a aeroxine-50
(asymetrický dimetylhydrazin,
monometylhydrazin

Přistání - tři 170 cm tyče



Ascent Stage



Průměr 234 cm, délka 107 cm

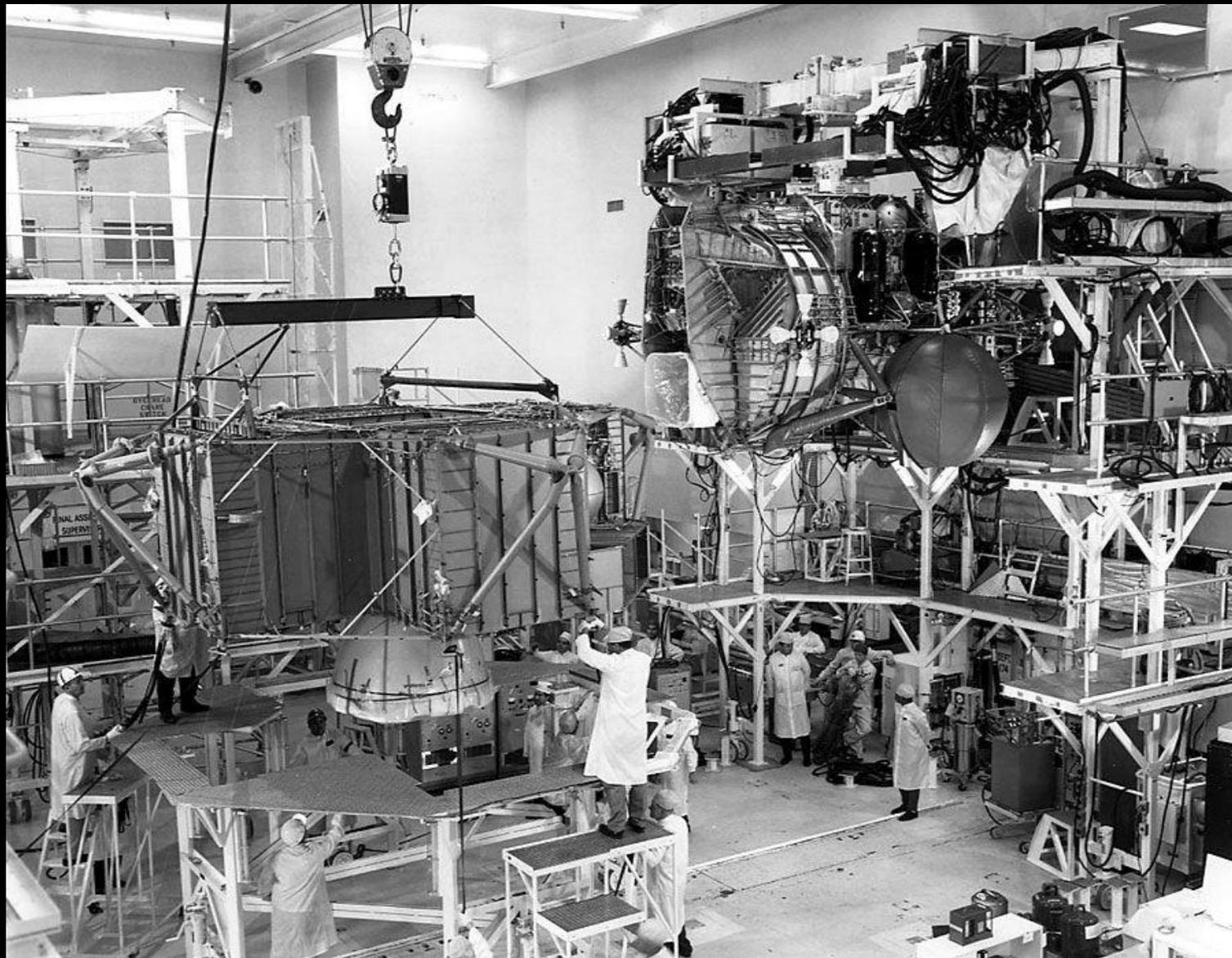
Nejjednodušší motor



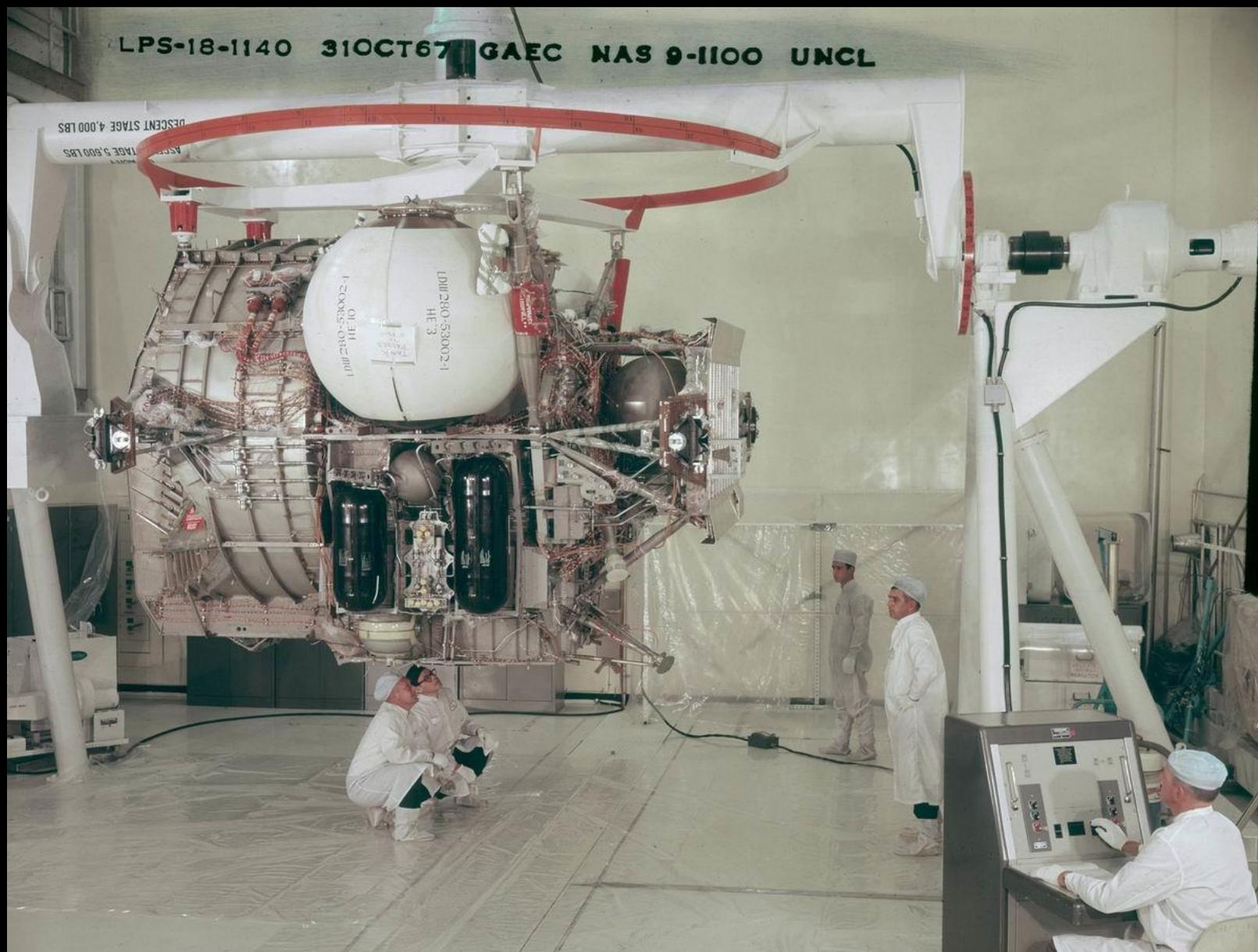
Bell, Rocketdyne



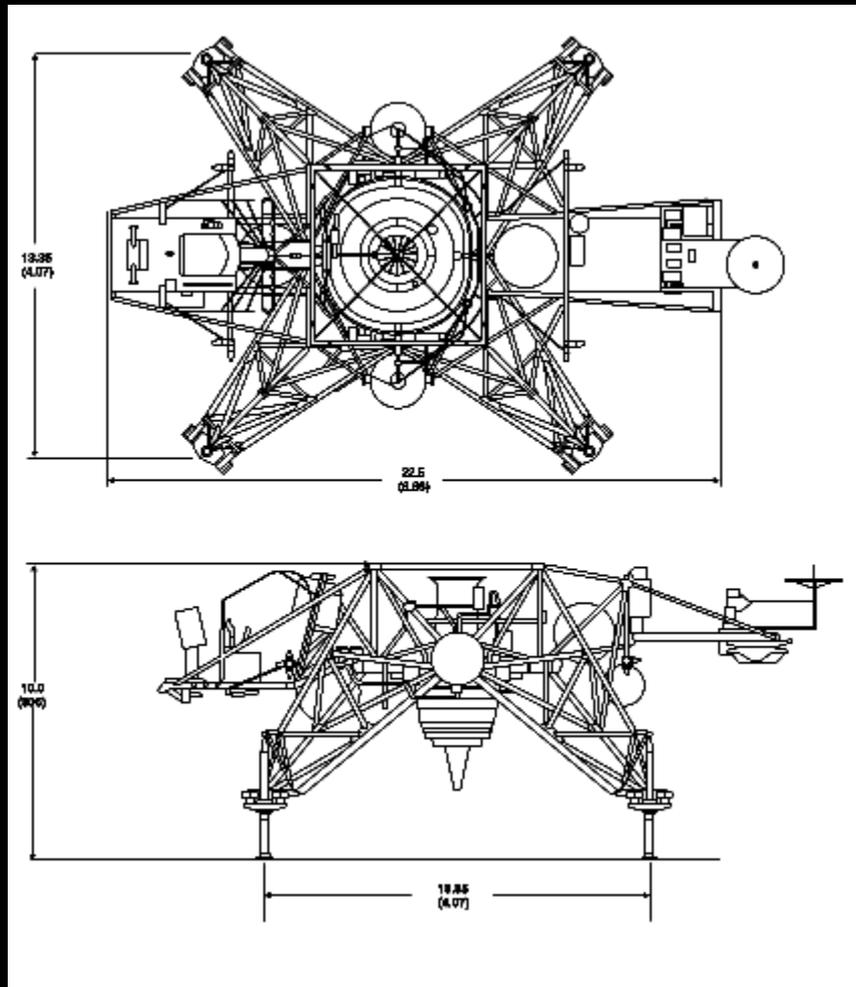
Problém s nadváhou



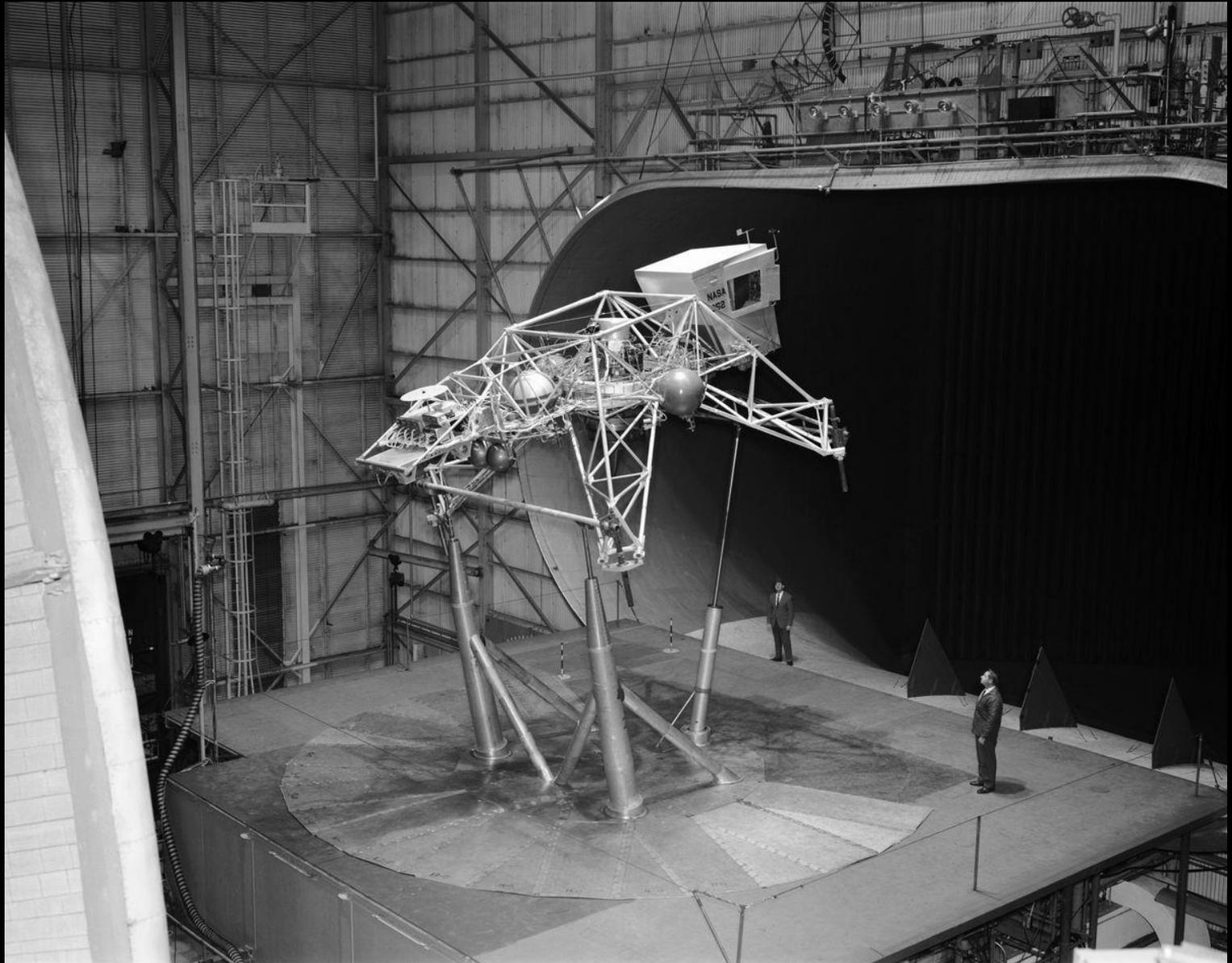
Červenec 1965 – 25 tisíc USD



1962: NASA Flight Research Center



Lunar Landing Research Vehicle



16. listopadu 1964



„Lunární režim“



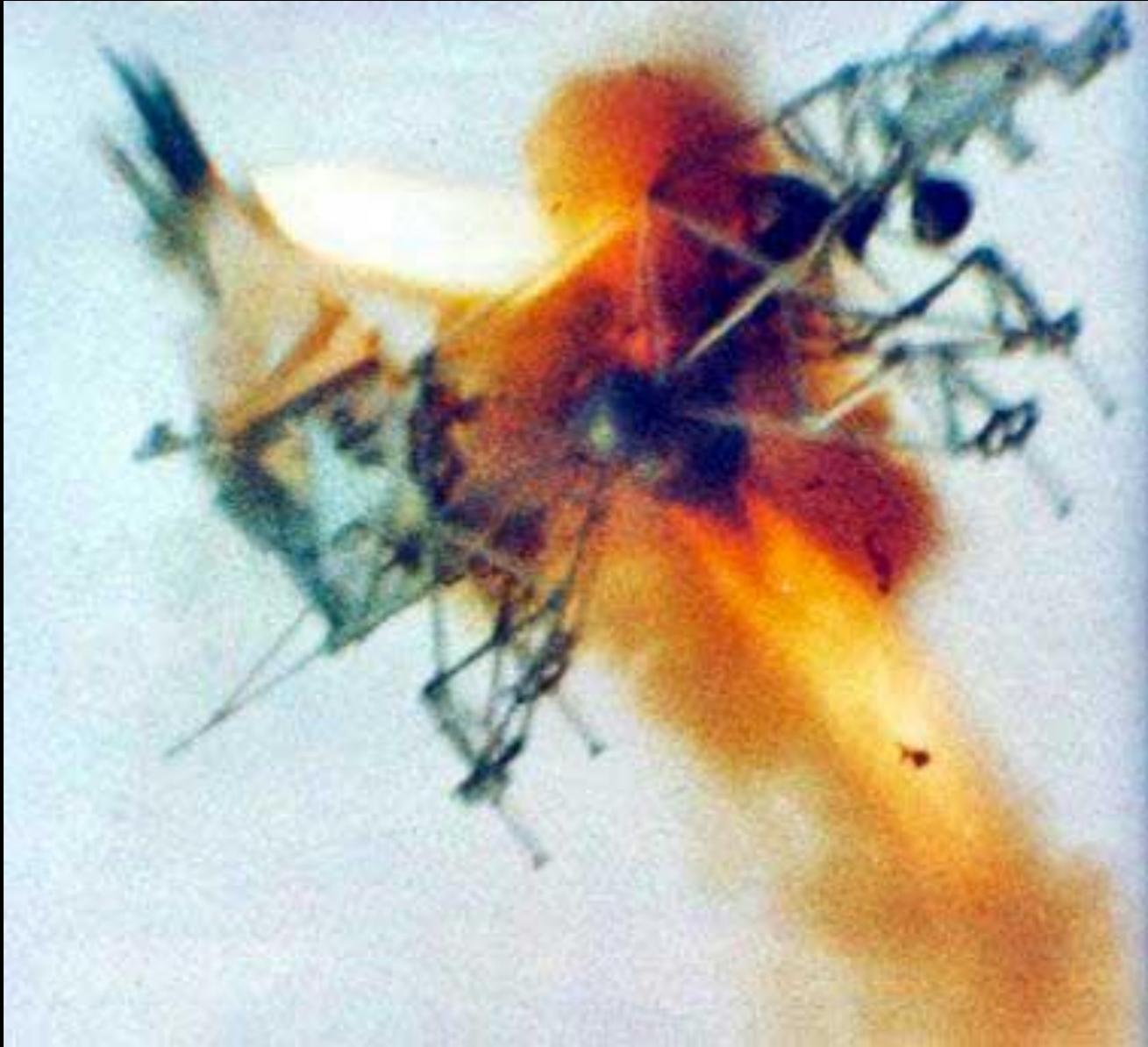
LLTV (Lunar Landing Training Vehicle)



Ellington Field



6. května 1968

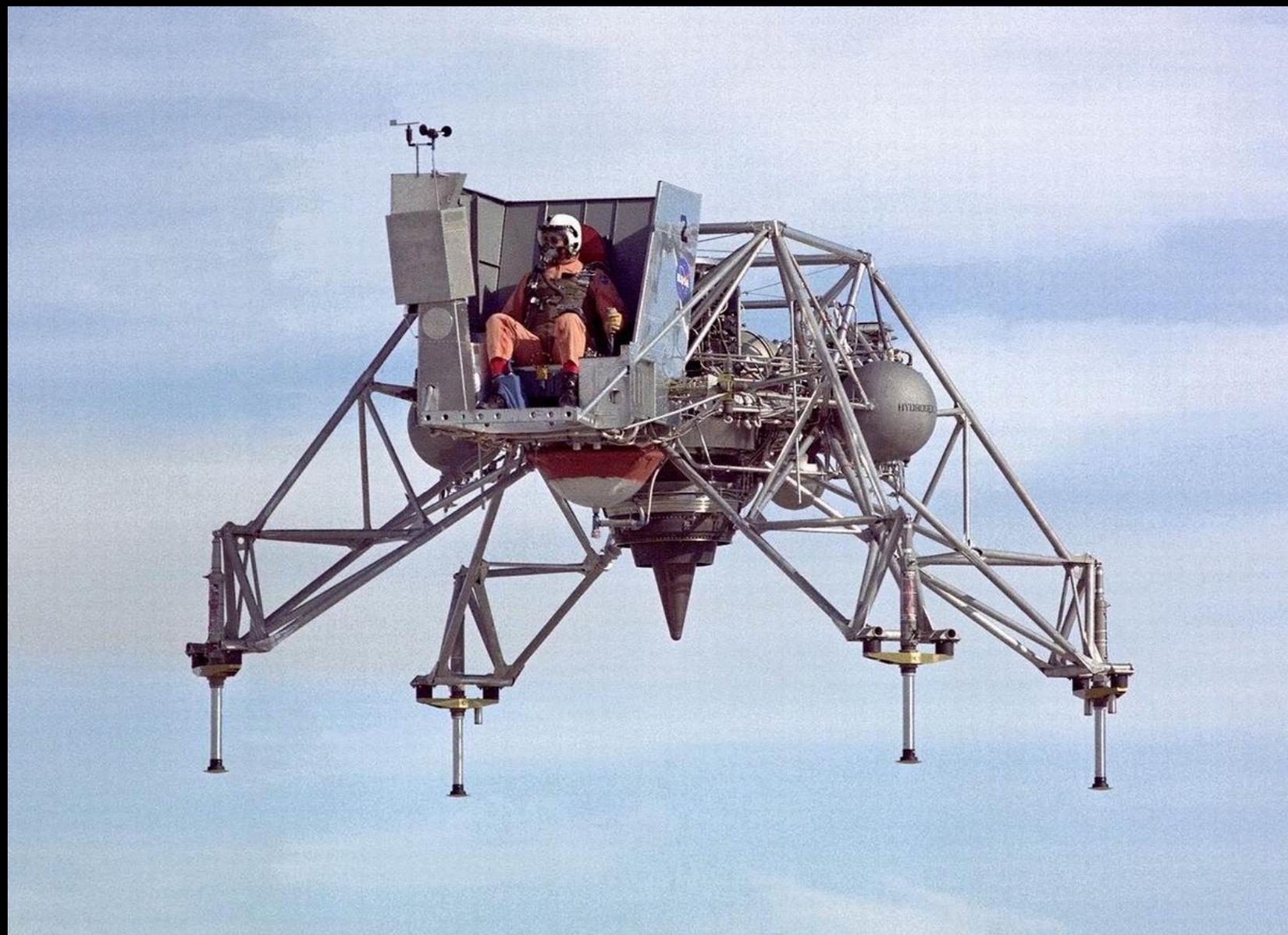




8. prosince 1968, Joe Algranti



14. června 1969



LLTV-2, leden 1971



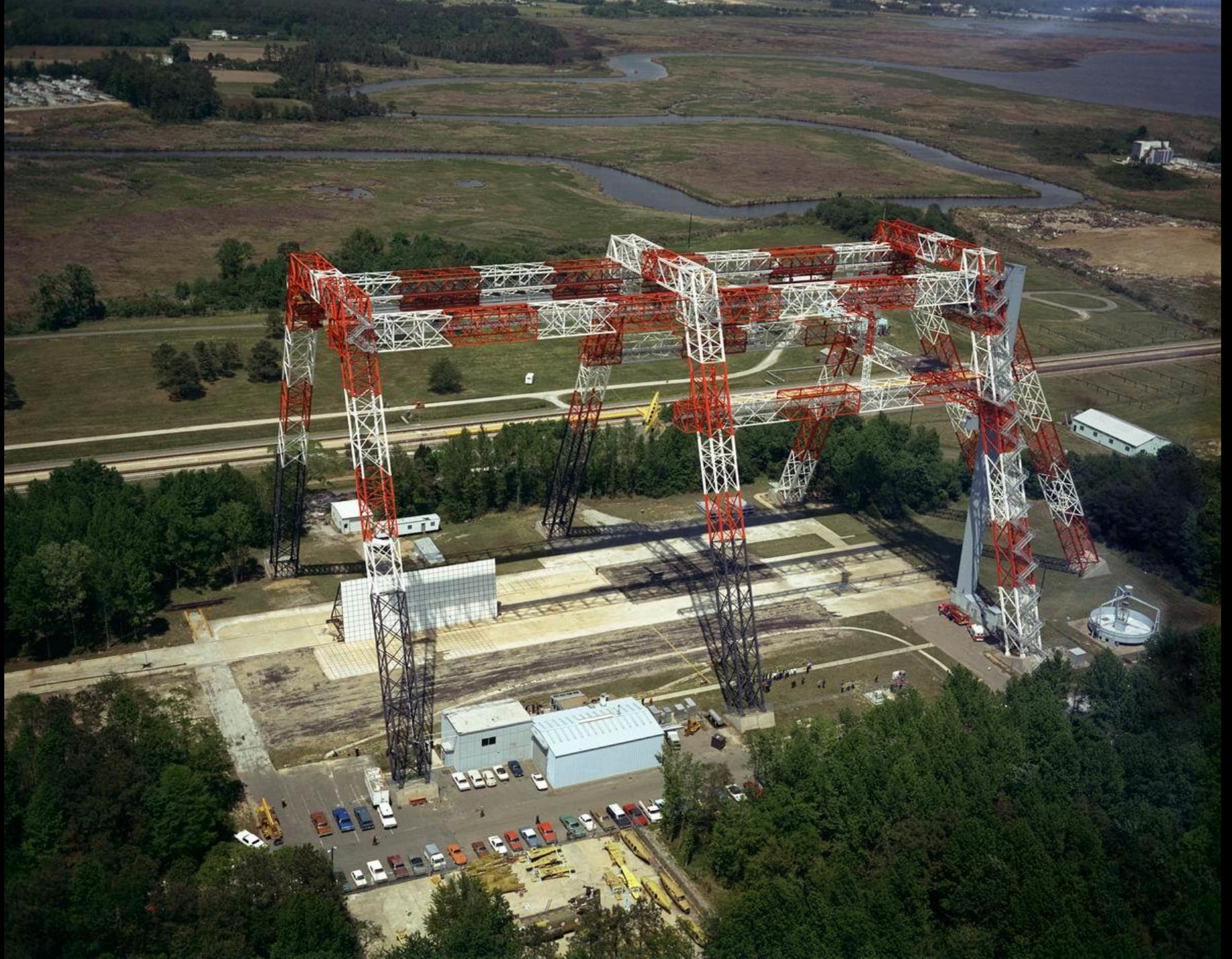
LLRV-2: Edwards AFB

*LLTV-3: Johnsonovo středisko NASA
(Houston)*



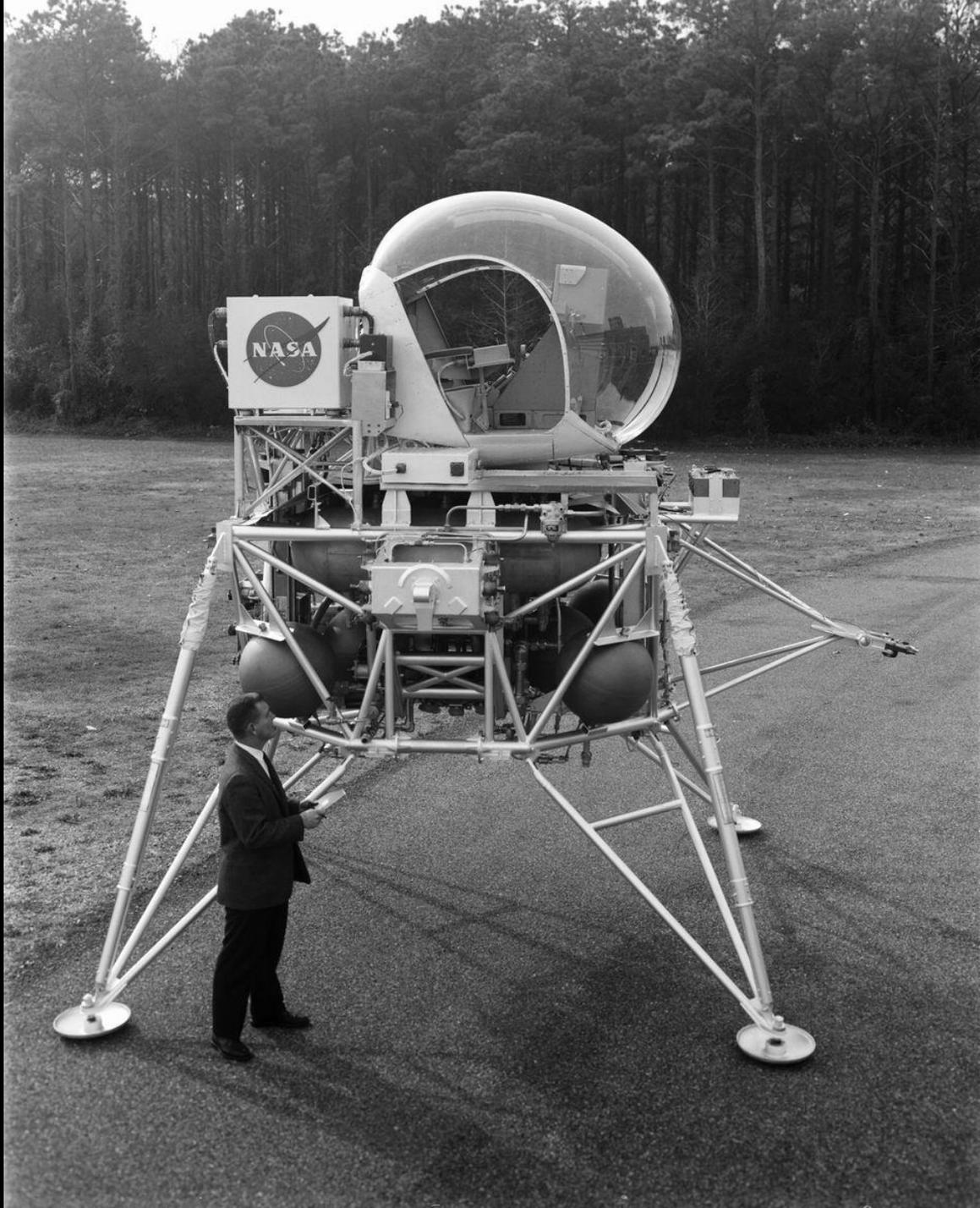
LLRF (Lunar Landing Research Facility)





LANGLEY RESEARCH CENTER



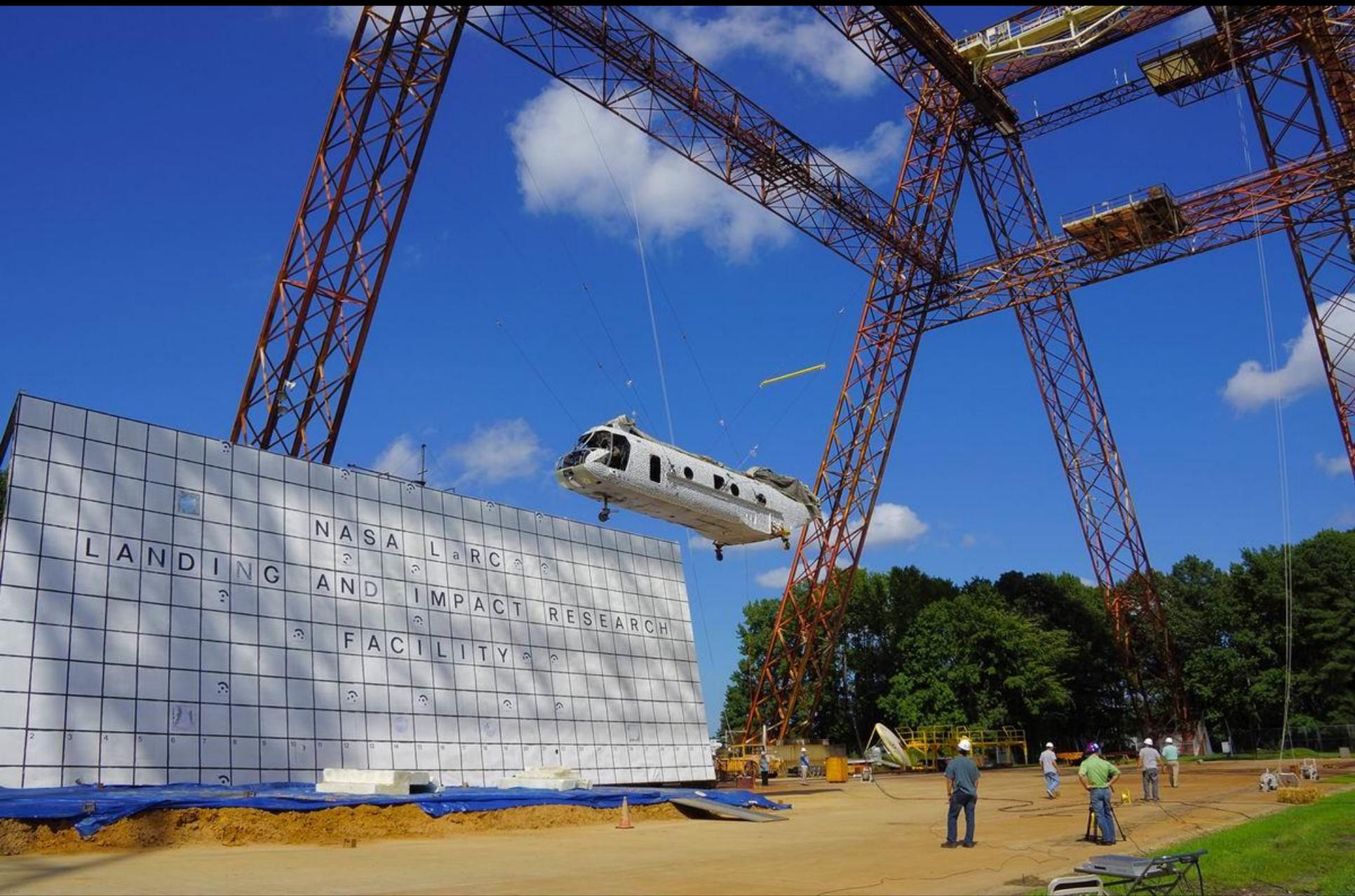




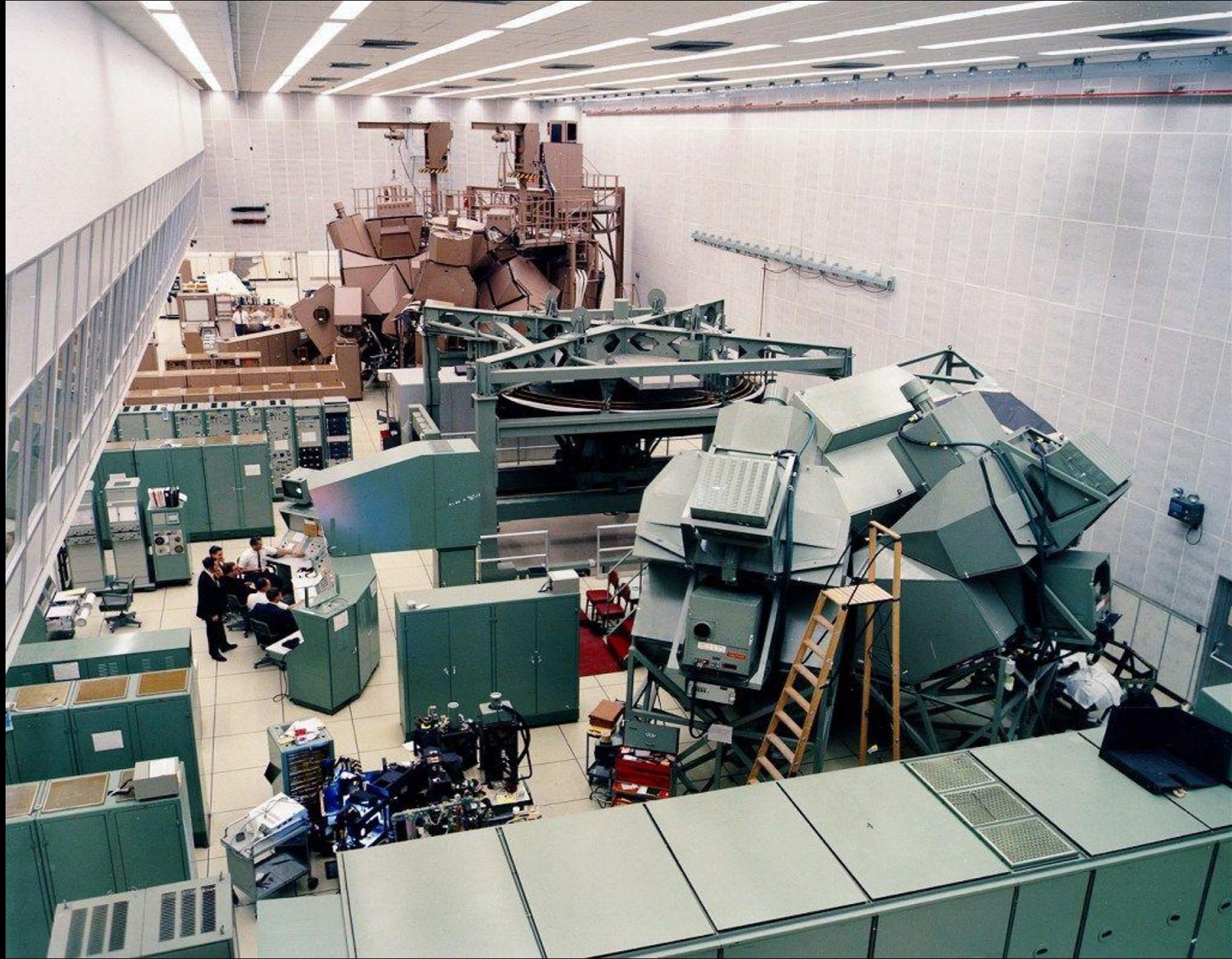








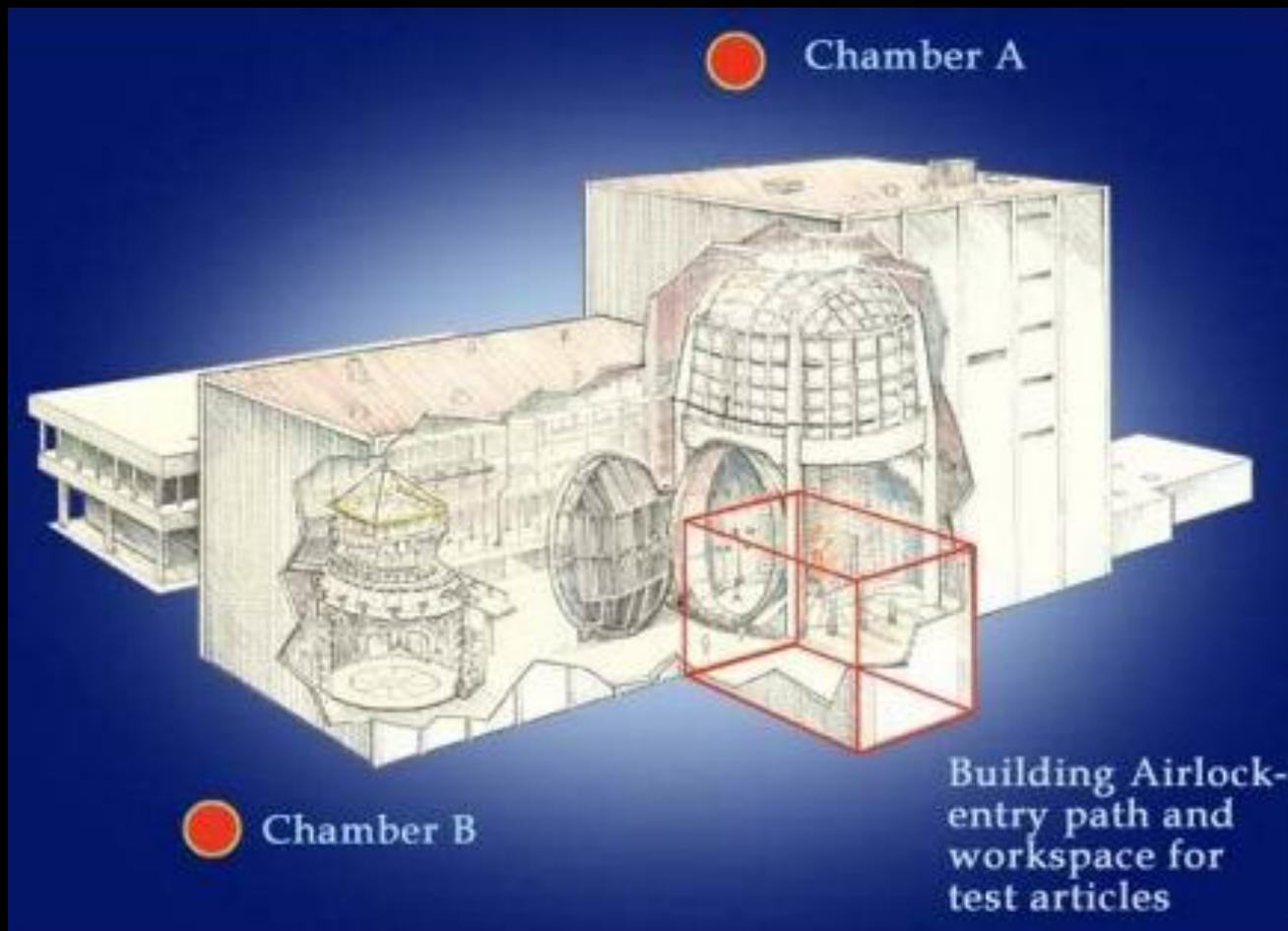




Space Environment Simulation Laboratory



17 m/36 m – 14 m/13m

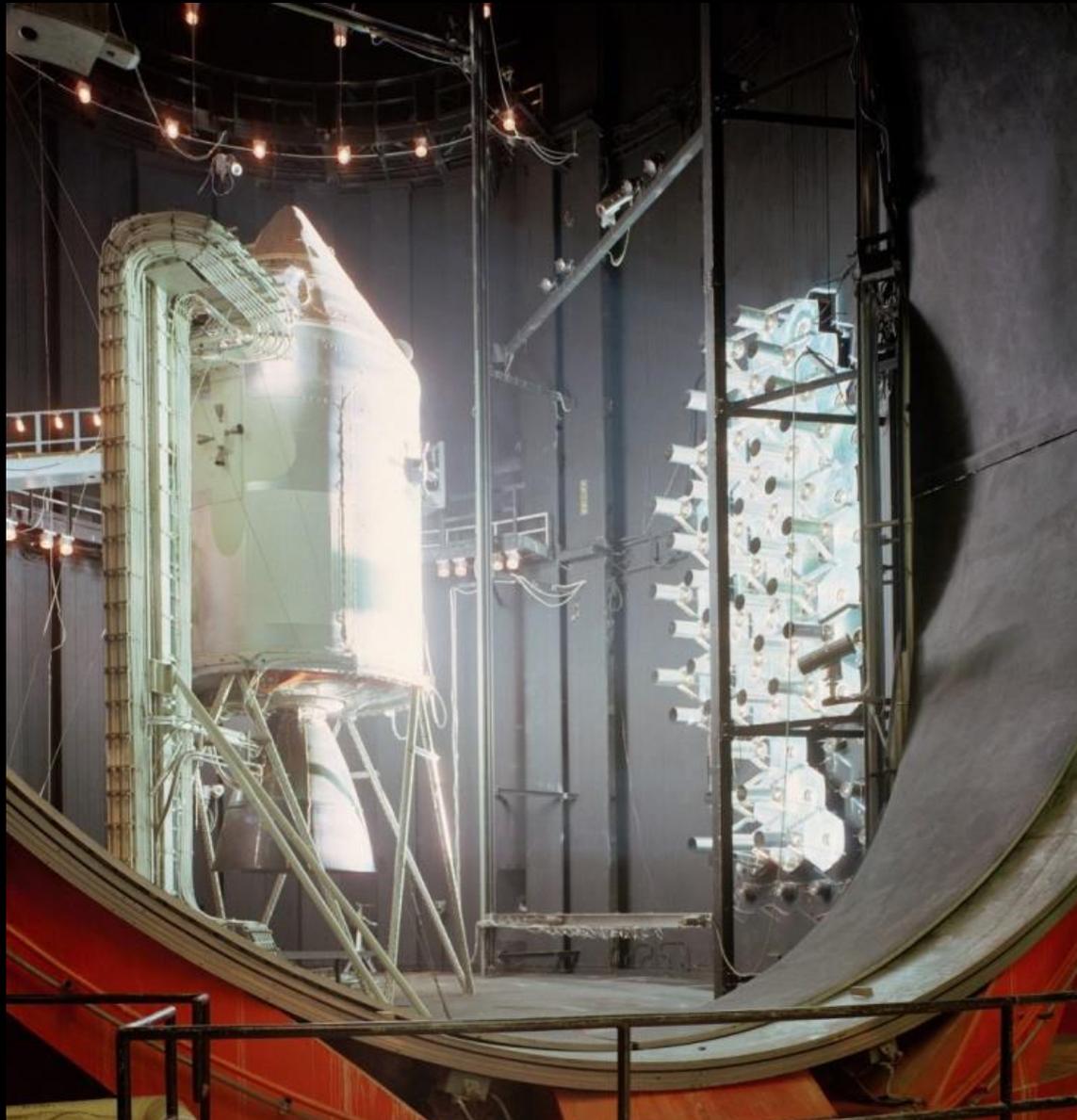


Přechodové komory

Vstup bokem/vrchem

95 stupňů, minus 140 stupňů

Konec 1966: CSM-008



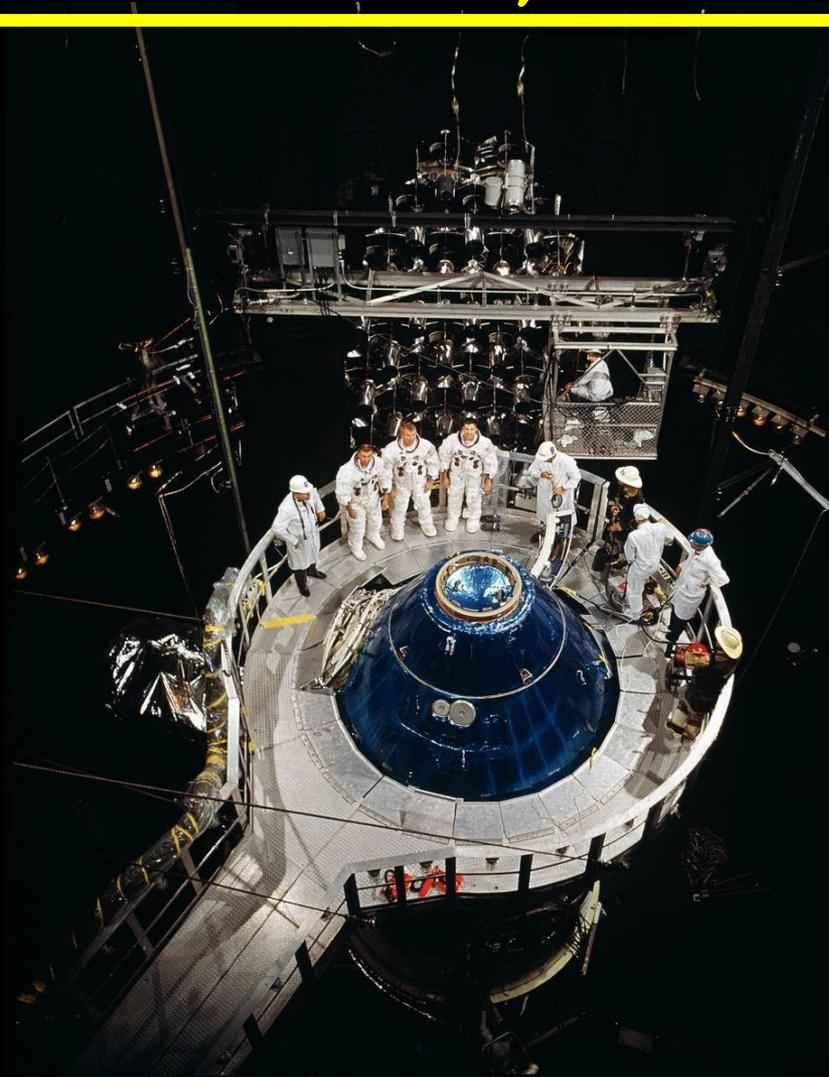
83 dní



92 h bezpilotní, 163 h pilotovaný

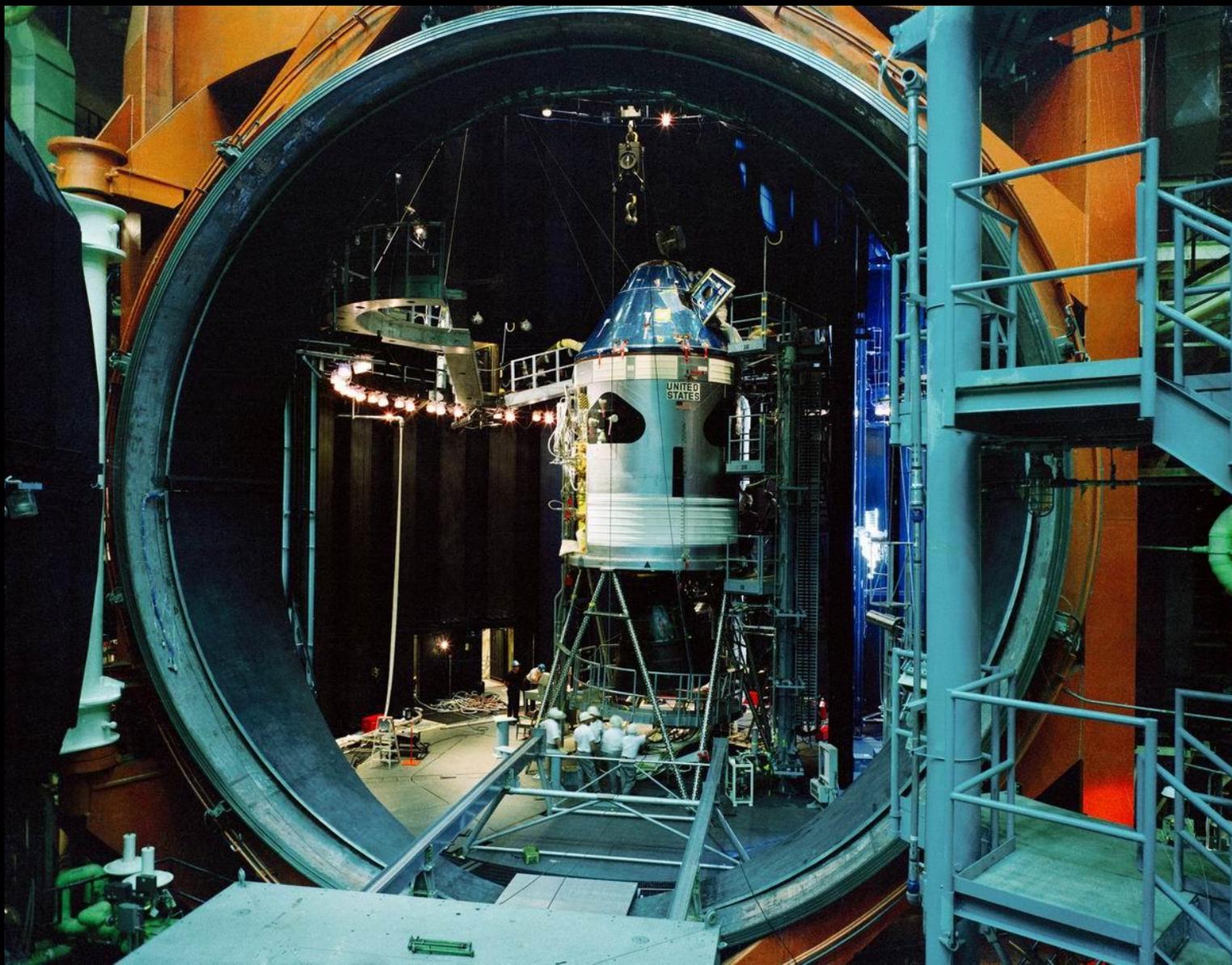
Ed Gives, Joe Kerwin, Joe Gagliano

Joe Kerwin,
Vance Brand, Joe Engle





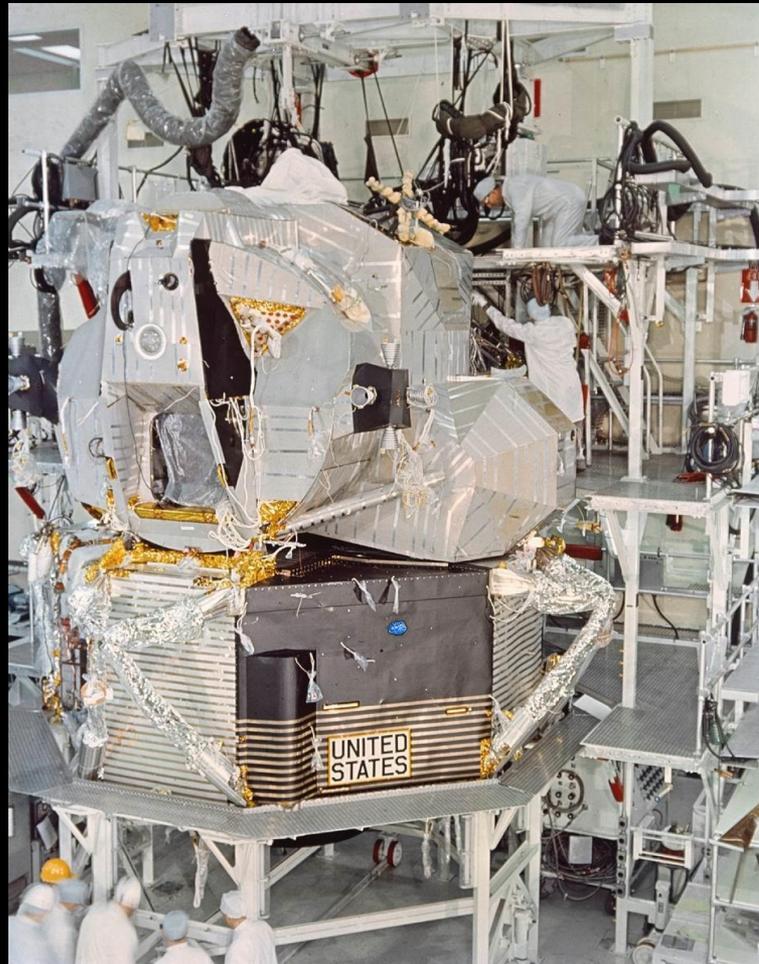
16. až 24. června 1968





LTA-7: kompletní test

LTA-8 a -9 létající





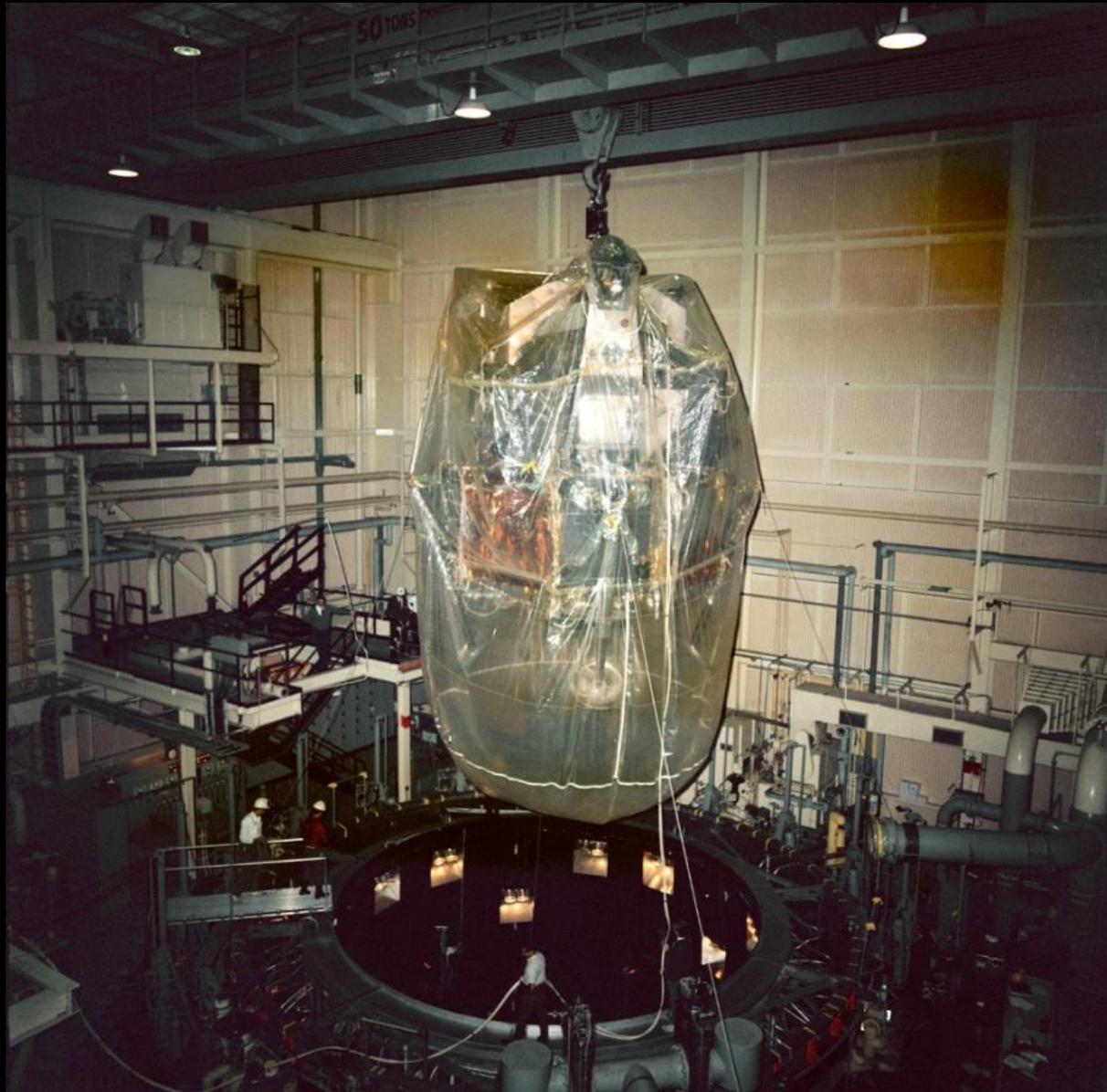
James Irwin

John Bull

Gerry Gibbons

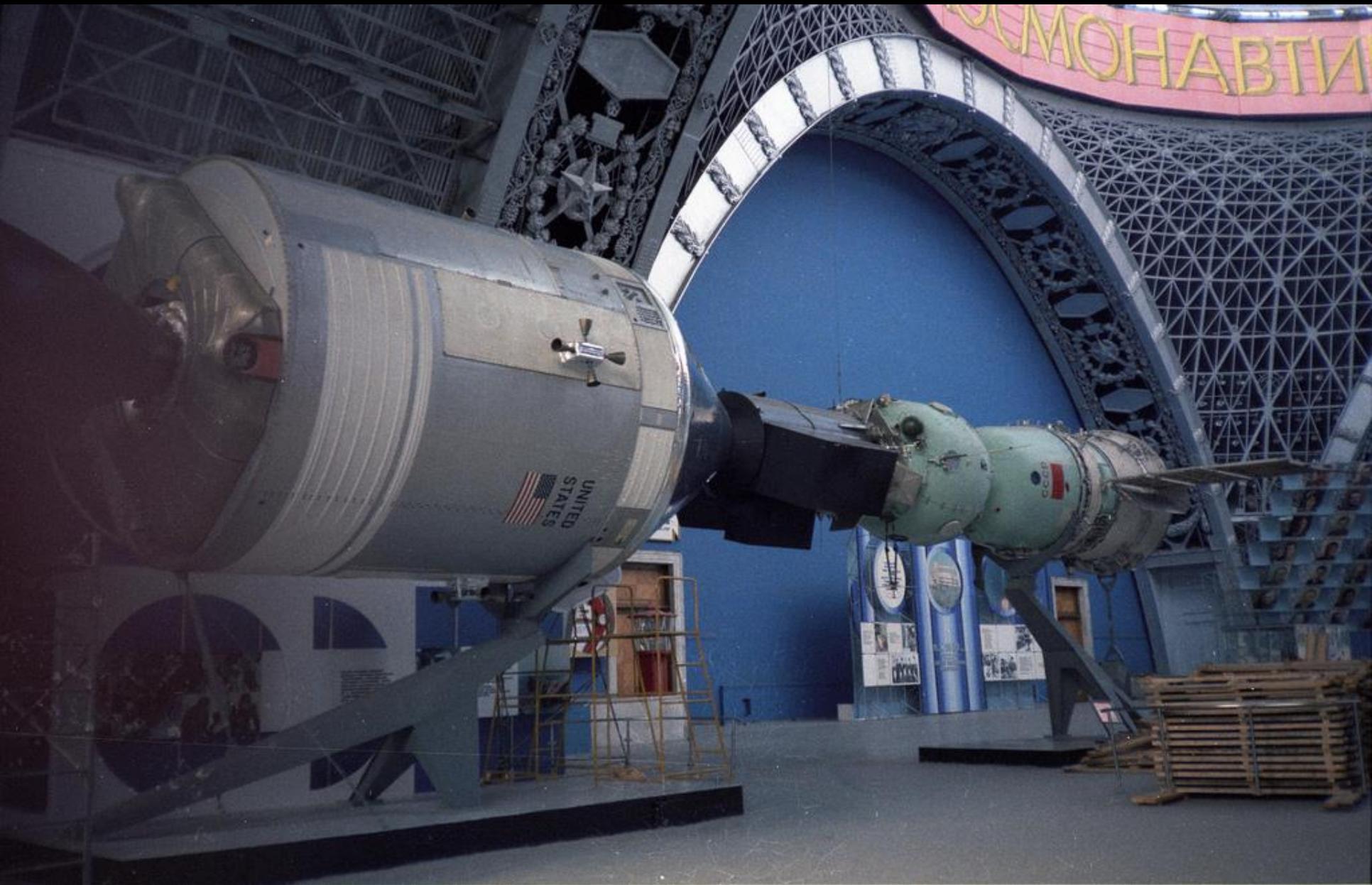


Květen 1968: 161 h

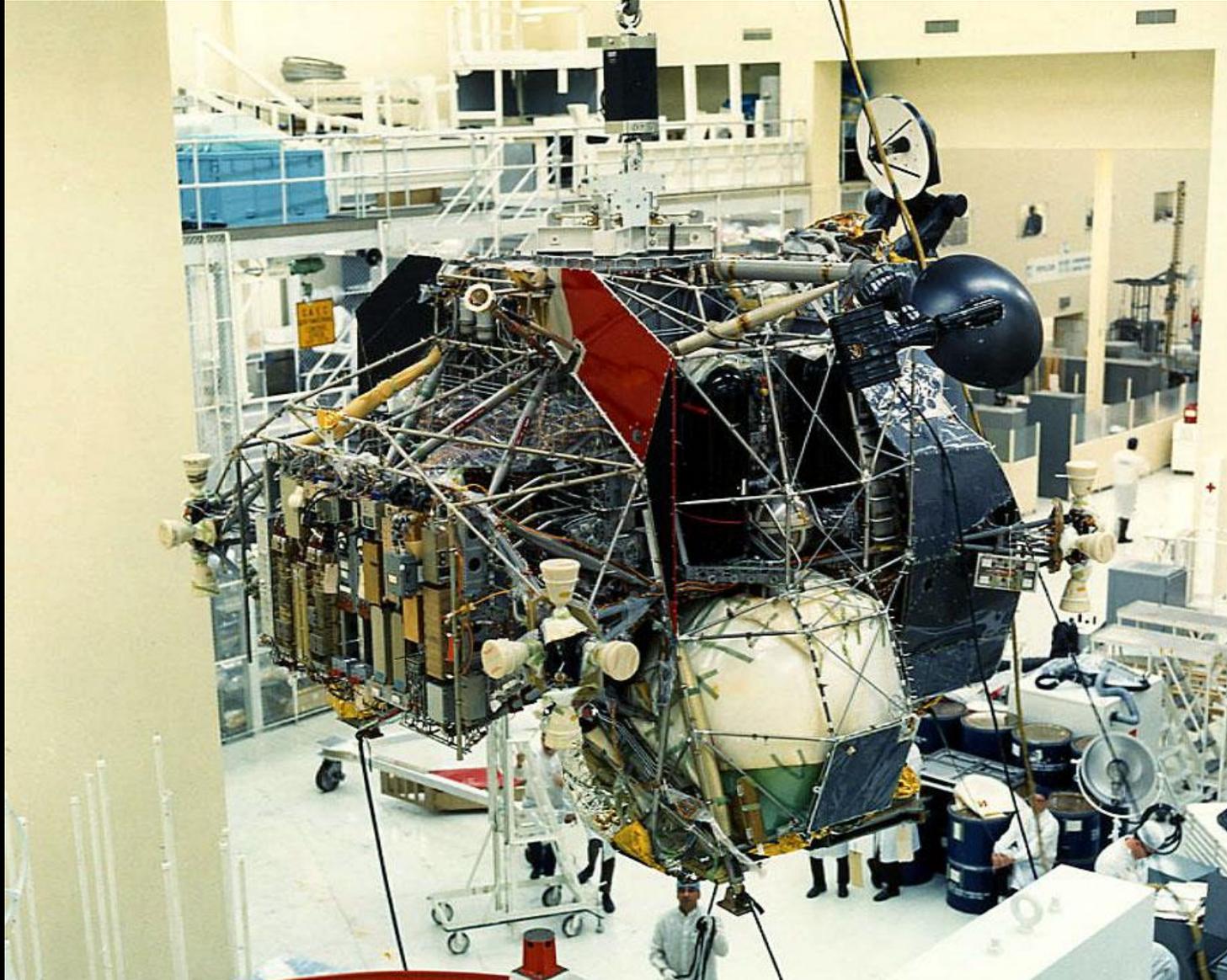




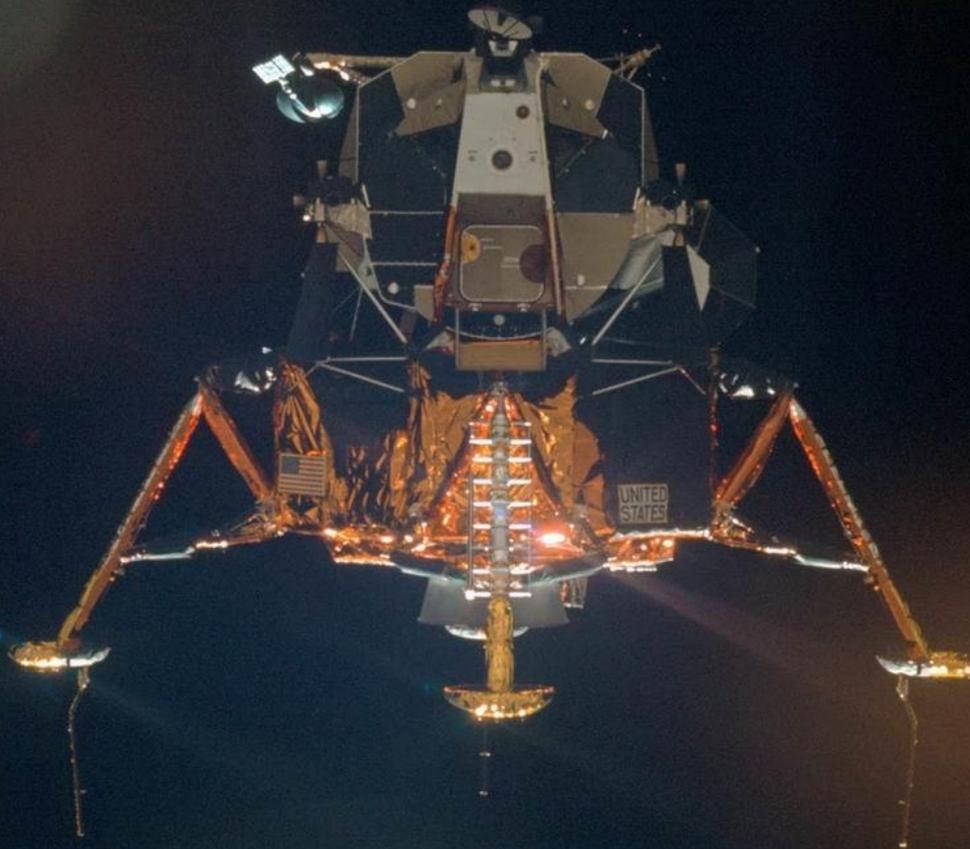
STARSHIP C



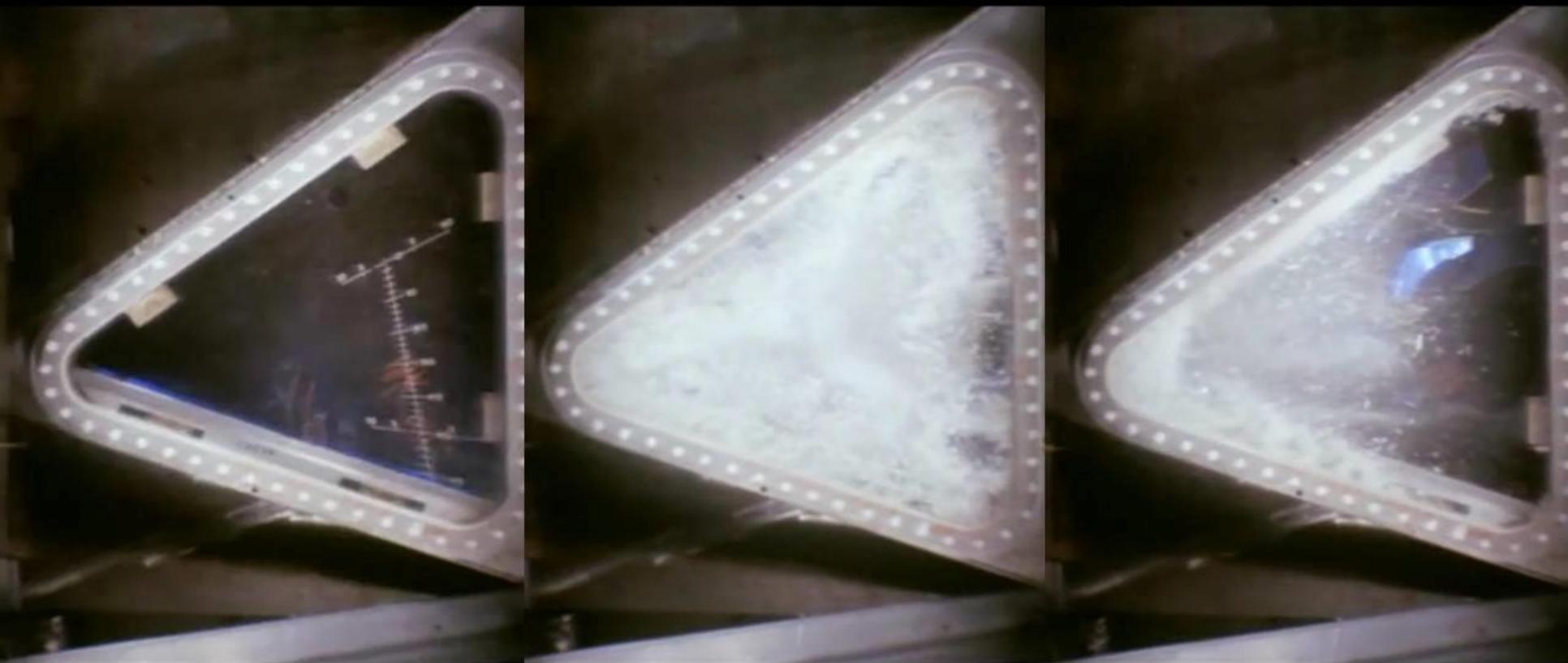
Apollo 5

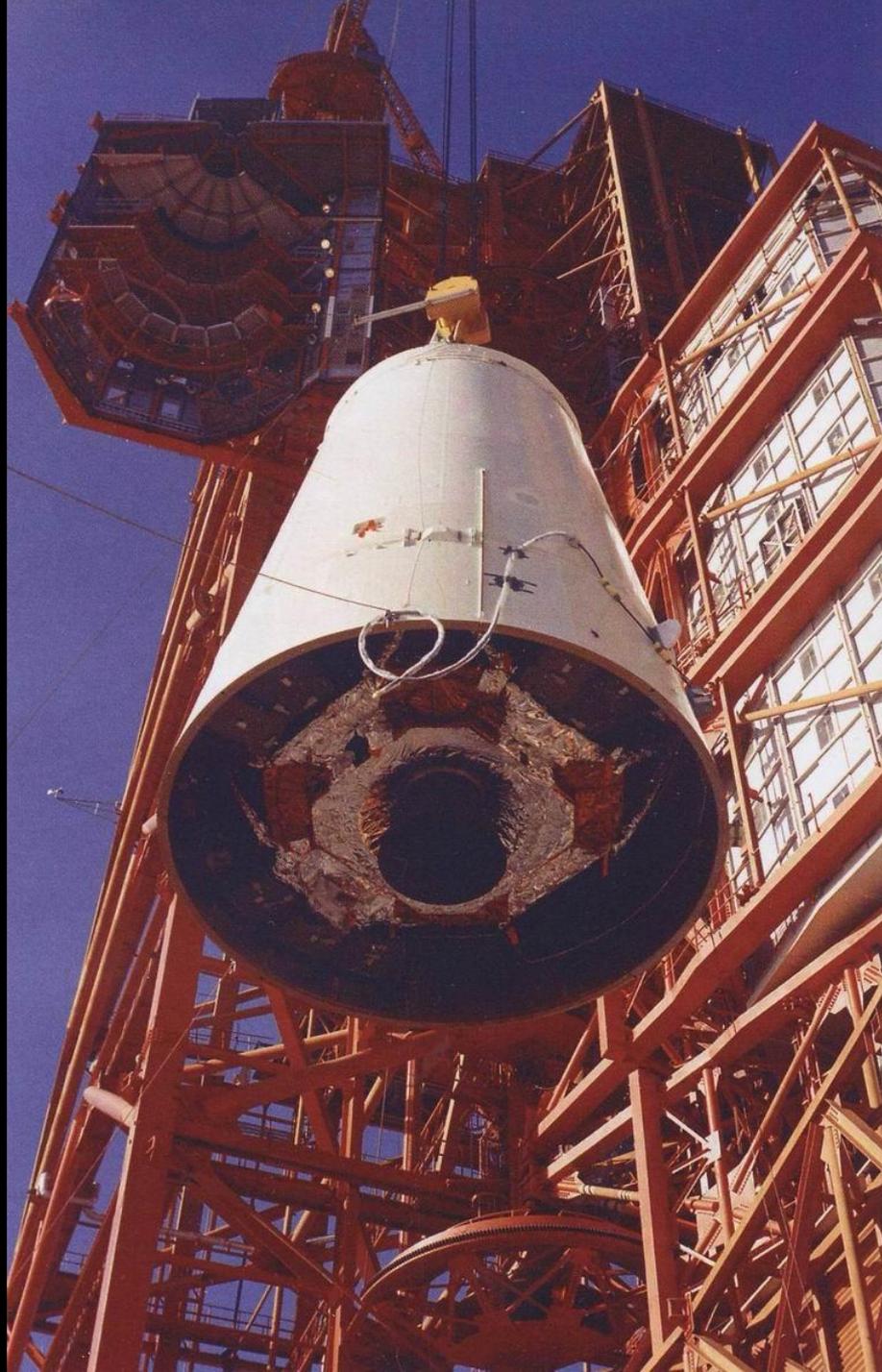


Prosinec 1967



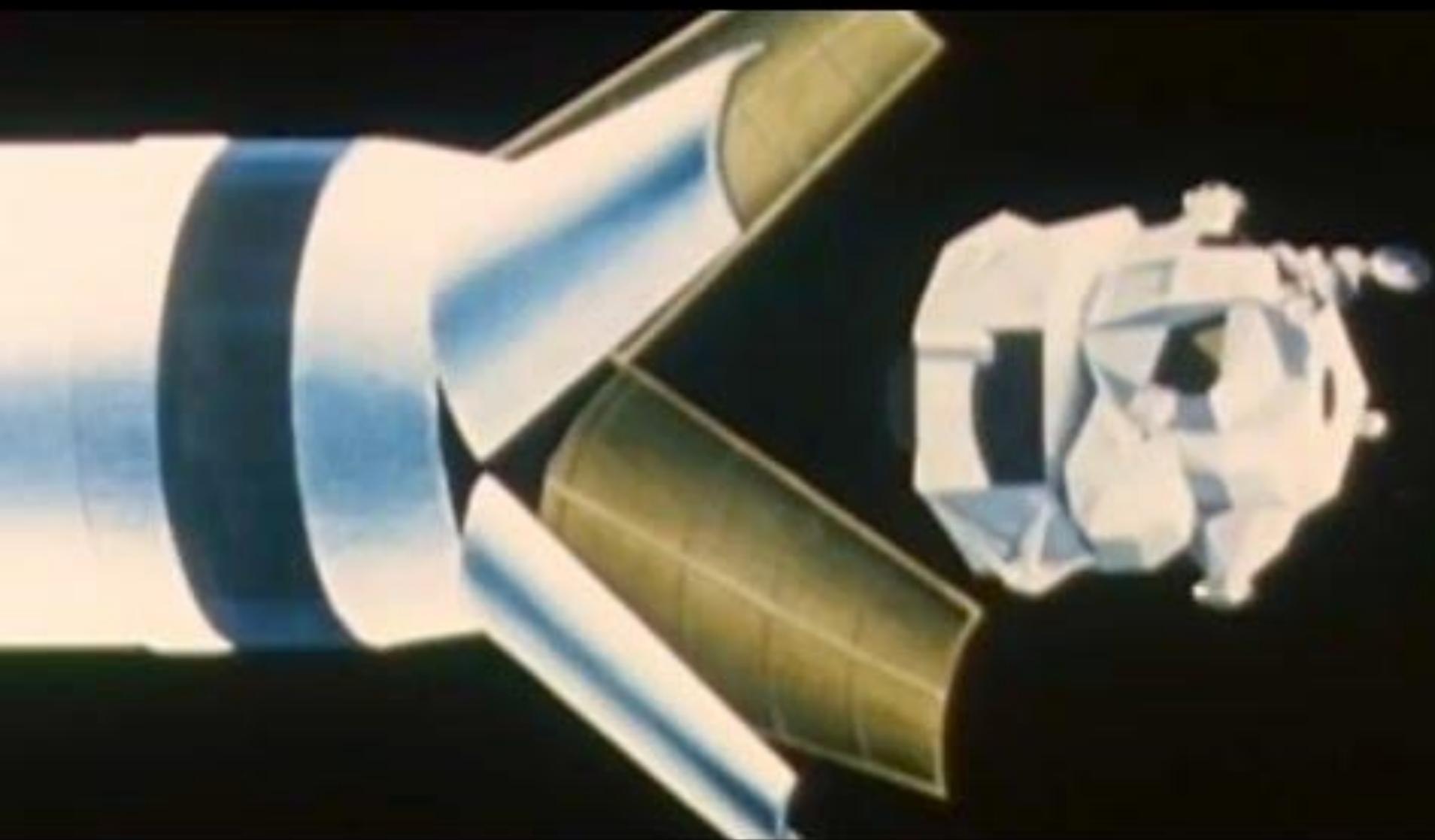
Prasklé okno LM-5



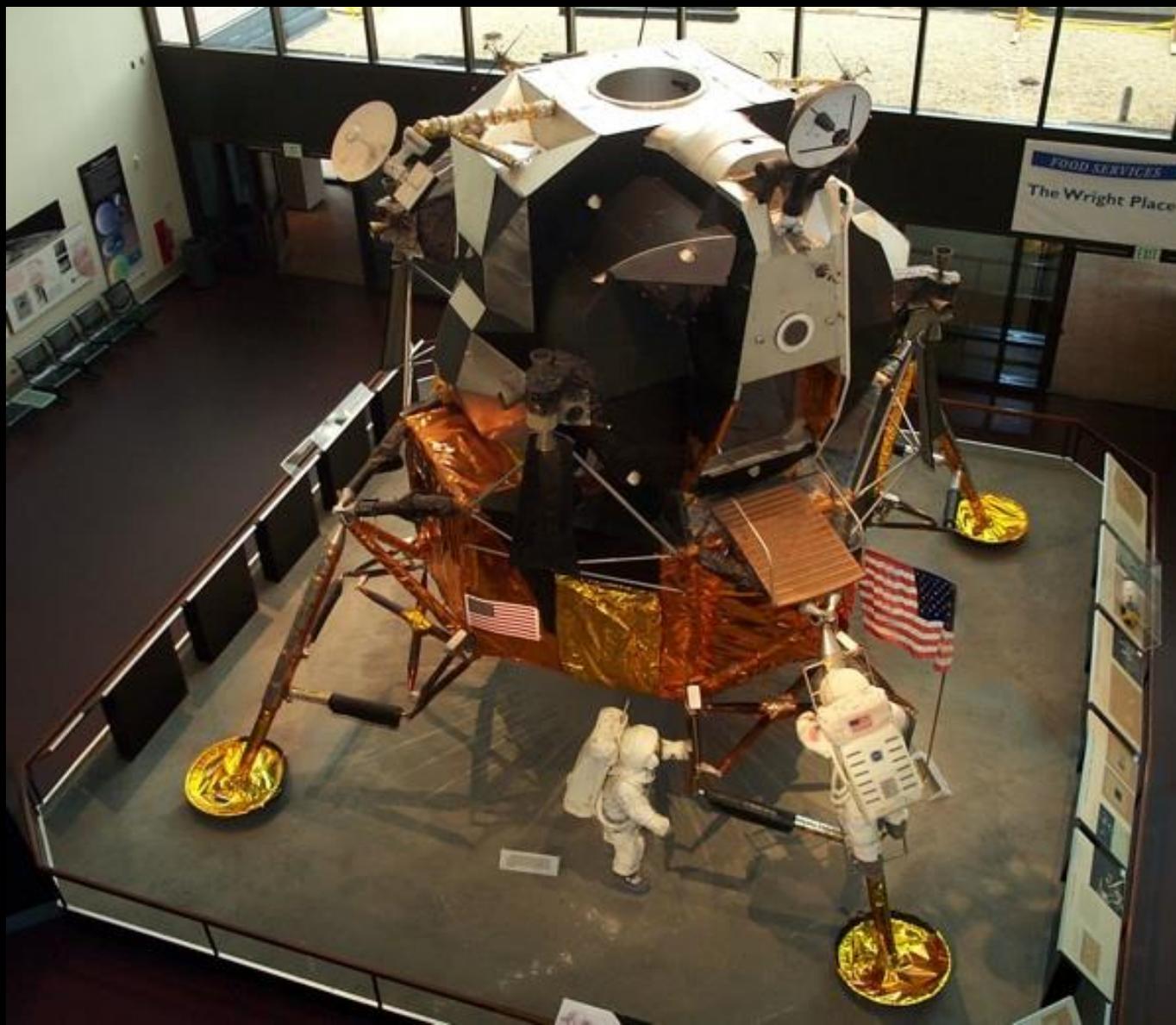


22. Iedna 1968





LM 2

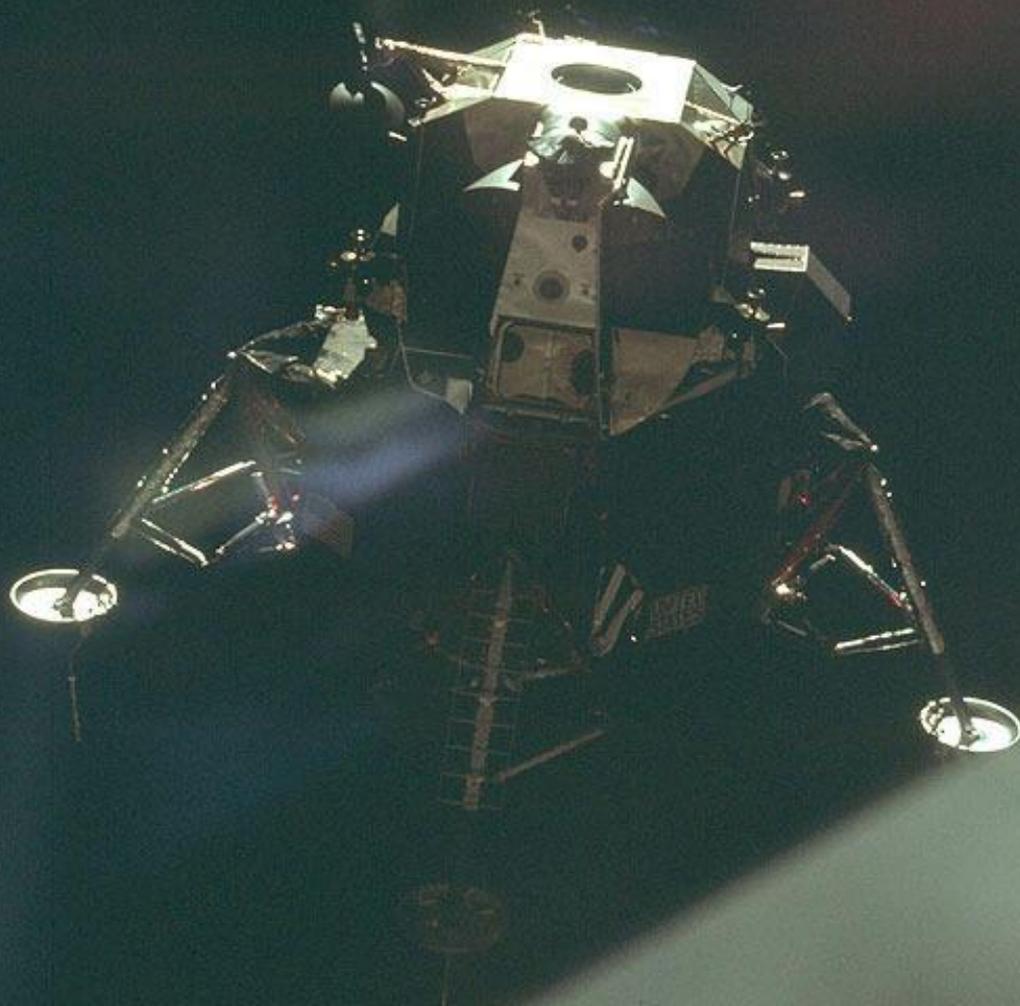


Apollo 9





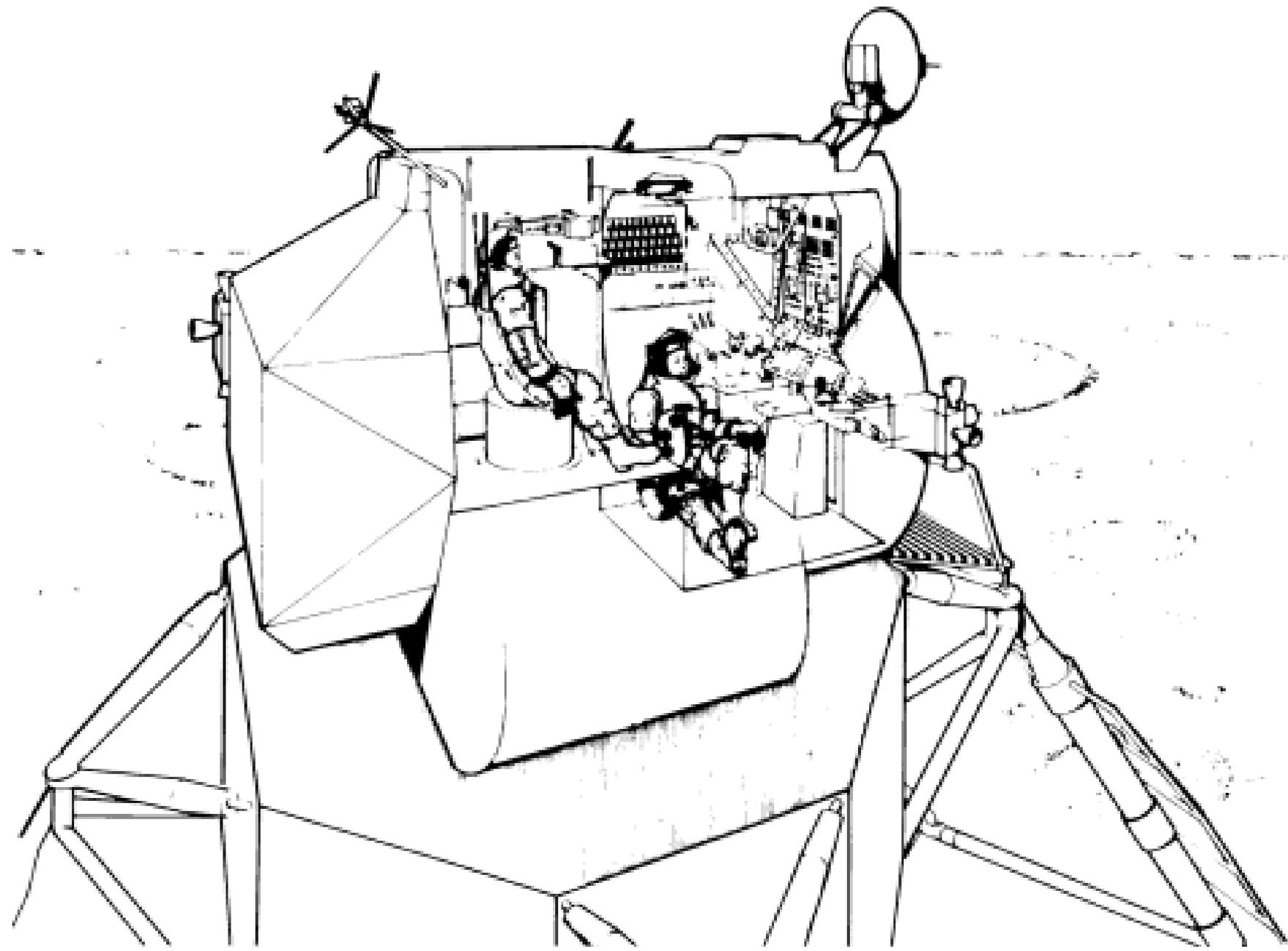
Apollo 10

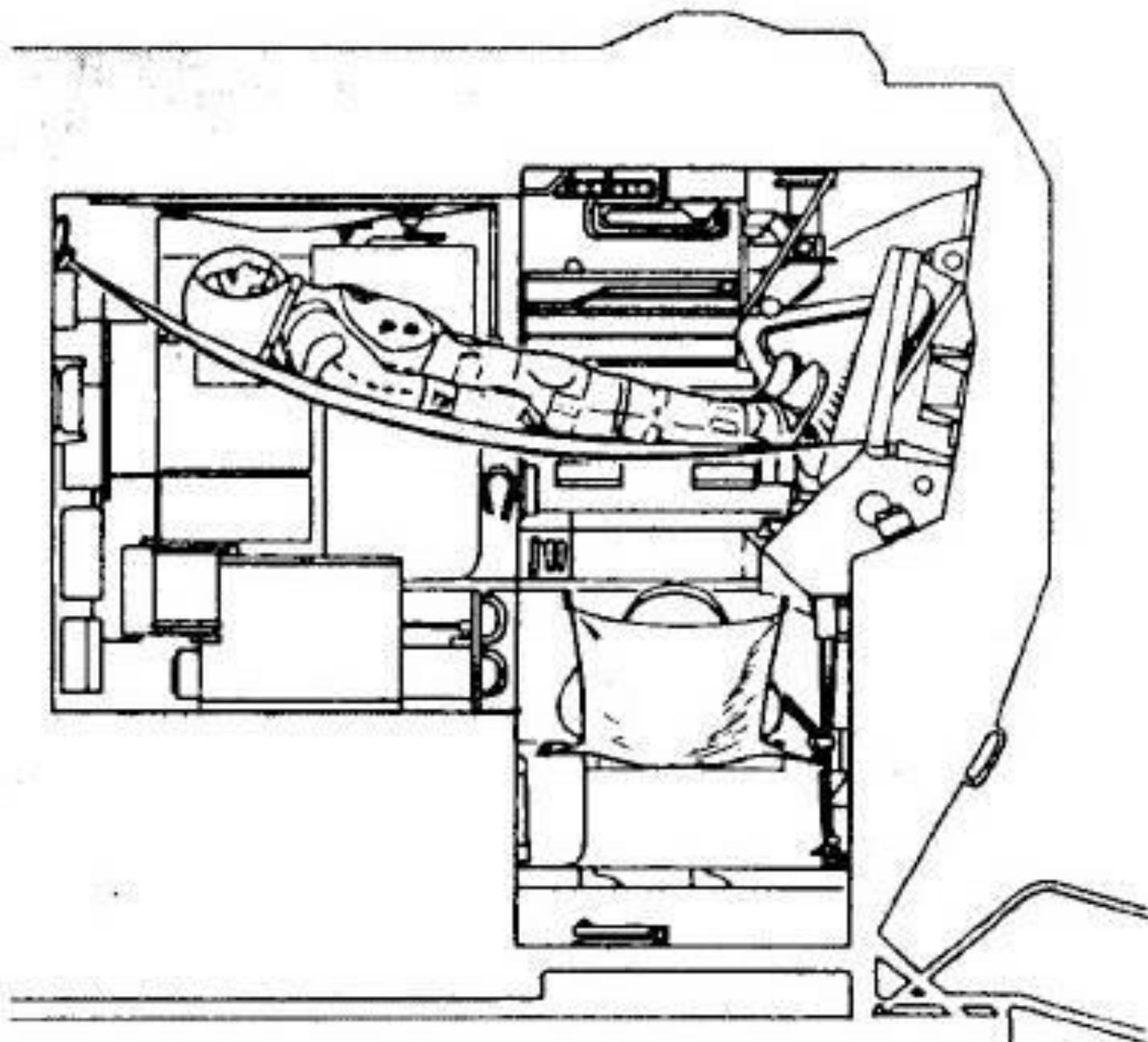


Apollo 11



LM SLEEP STATIONS





ASTRONAUT REST POSITIONS



TOM
HANKS

KEVIN
BACON

BILL
PAXTON

GARY
SINISE

ED
HARRIS

"Houston, we have a problem."



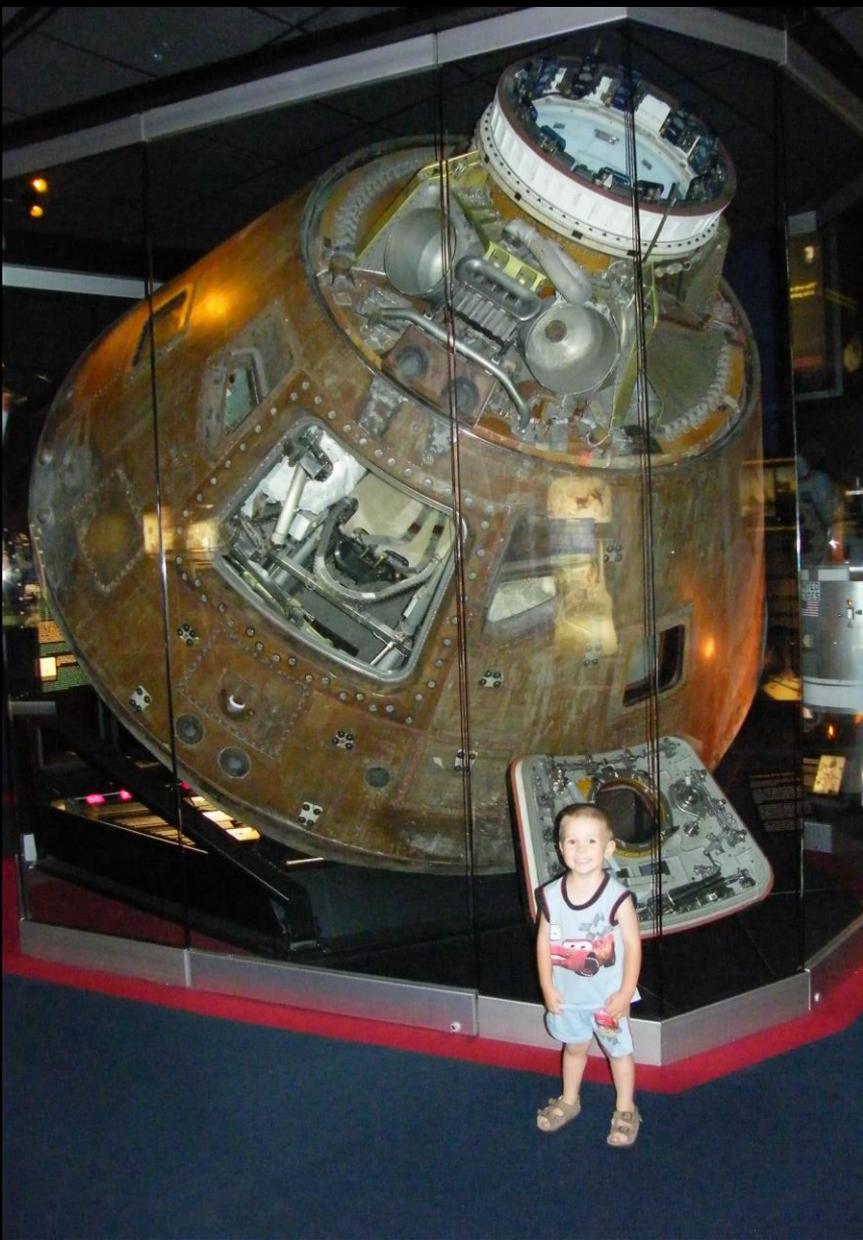
A RON HOWARD FILM

APOLLO 13

IMAGINE ENTERTAINMENT PRESENTS A BRIAN GRAZER PRODUCTION
"APOLLO 13" KATHLEEN QUINLAN MUSIC BY JAMES HORNER COSTUME DESIGNER RITA RYACK
EXECUTIVE PRODUCERS ALDRIC LA'ULI PORTER MICHAEL BOSTICK PRODUCED BY MICHAEL HILL DANIEL HANLEY
PRODUCED BY MICHAEL CORENBLITH EXECUTIVE PRODUCERS DEAN CUNDEY AND TODD HALLOWELL
WRITTEN BY JAMES LOVELL AND JEFFREY KLUGER DIRECTED BY WILLIAM BROYLES, JR. EXECUTIVE PRODUCERS AL REINERT AND JOHN SAYLES
PRODUCED BY BRIAN GRAZER DIRECTED BY RON HOWARD A UNIVERSAL PICTURE

JUNE 30TH

Hutchinson Kansas



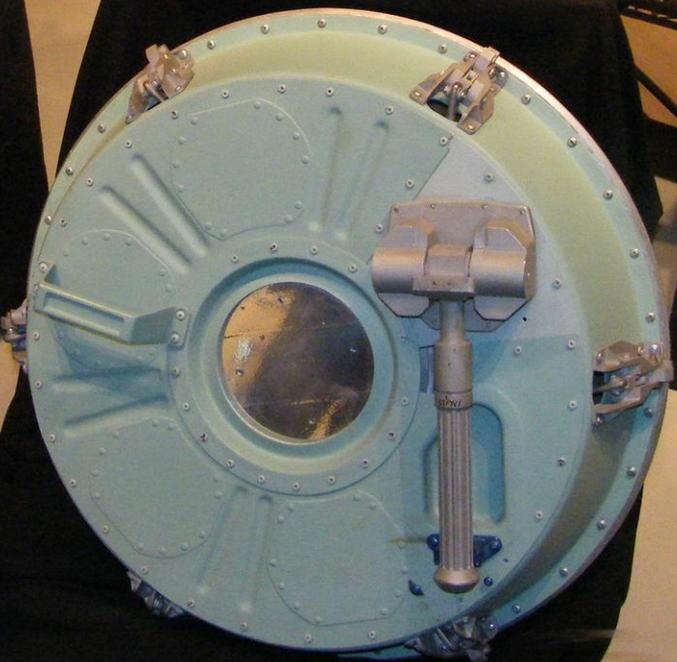


Space Shuttle gloves worn by
astronauts

Space Shuttle gloves worn by
astronauts



Space Shuttle hatch door
of Command Module (CM)



Public CO2 detector monitor from
Lunar Module



- \$
fo
- Su
\$14
per a
- The Ap
\$375 m
- Product
\$62 millio
worldwid



Loveellovo planetárium, Chicago



These identical charts might tempt you to a hasty decision about the race, but you will see a series of 27 color chips, the eight winners from a worldwide election. The chips also list the voter names for each vote. As the Apollo approaches, the space ship is docked at the lunar surface. The crew will make plans to land near the impact site, and provide an accurate account of the landing, and a list of the different items brought. Have they found it? Is it a crater? Which side of the mountain would you want to see of the crater?

April 12, 1968
The crew announced landing to the ground crew. Apollo 11 was the first time that the crew announced their landing to the ground crew. The crew also announced their landing to the ground crew. The crew also announced their landing to the ground crew.

The Apollo 11 flight was a landmark event in the history of space exploration. The crew of three astronauts, Neil Armstrong, Michael Collins, and Buzz Aldrin, spent 28 hours in space, including 21 hours on the lunar surface. The mission was a triumph for the United States and a major step in the exploration of space.

EXPLORER'S TOOL BELT
You used many different tools to complete your trip. Now head back to where you started your adventure to collect your reward.

The Apollo 11 mission was a landmark event in the history of space exploration. The crew of three astronauts, Neil Armstrong, Michael Collins, and Buzz Aldrin, spent 28 hours in space, including 21 hours on the lunar surface. The mission was a triumph for the United States and a major step in the exploration of space.

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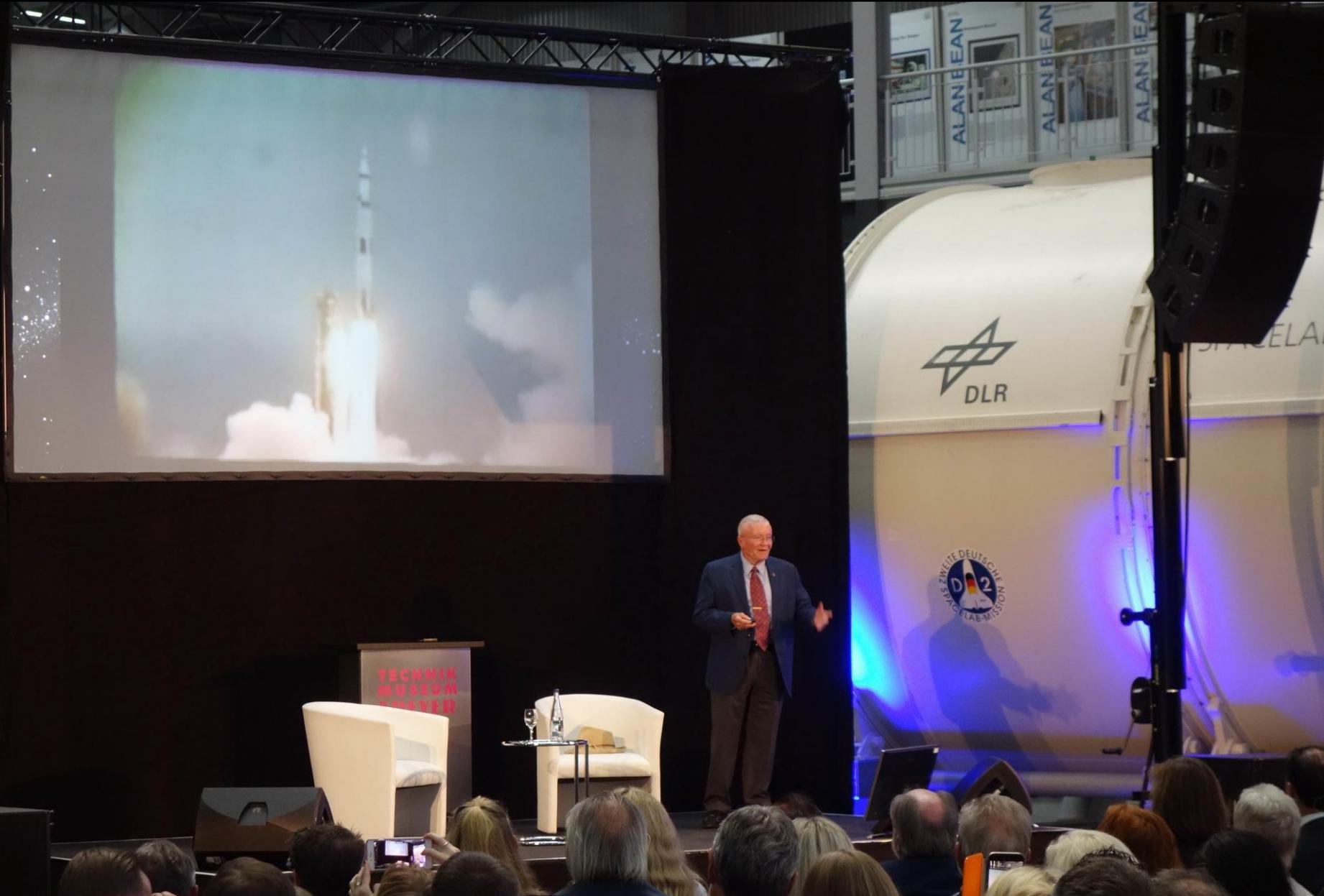
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Vehicle Assembly Building



Speyer, říjen 2018



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

TTCA (CDR) - THROT (MIN) *FOR DPS, Jets FOR ACS*
 TTCA (LMP) - JETS

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

-1:00 ~~MASTER ARM - ON~~

- :35 ~~Y32E~~
~~F 16 83 ΔVX, Y, Z (All Zero) (.1fps)~~
~~ENG ARM - DES~~

~~10/10~~ ~~MANUAL ULLAGE (LMP)~~

- :02 ~~CMC MODE - FREE~~

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

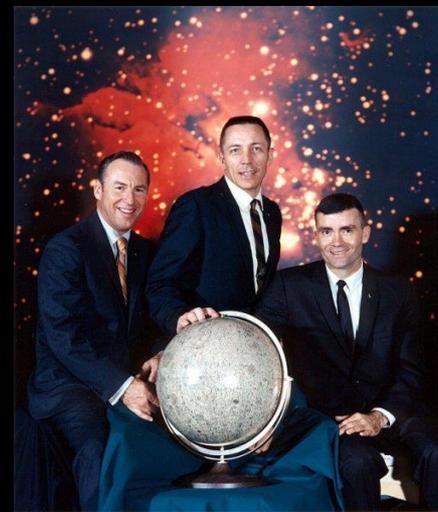
:00 ~~ENG START (CDR) - PUSH +X ULLAGE~~
~~Ignition~~

~~7:01~~ ~~7:02~~ ~~7:03~~ ~~7:04~~ ~~7:05~~ ~~7:06~~ ~~7:07~~ ~~7:08~~ ~~7:09~~ ~~7:10~~ ~~7:11~~ ~~7:12~~ ~~7:13~~ ~~7:14~~ ~~7:15~~ ~~7:16~~ ~~7:17~~ ~~7:18~~ ~~7:19~~ ~~7:20~~ ~~7:21~~ ~~7:22~~ ~~7:23~~ ~~7:24~~ ~~7:25~~ ~~7:26~~ ~~7:27~~ ~~7:28~~ ~~7:29~~ ~~7:30~~ ~~7:31~~ ~~7:32~~ ~~7:33~~ ~~7:34~~ ~~7:35~~ ~~7:36~~ ~~7:37~~ ~~7:38~~ ~~7:39~~ ~~7:40~~ ~~7:41~~ ~~7:42~~ ~~7:43~~ ~~7:44~~ ~~7:45~~ ~~7:46~~ ~~7:47~~ ~~7:48~~ ~~7:49~~ ~~7:50~~ ~~7:51~~ ~~7:52~~ ~~7:53~~ ~~7:54~~ ~~7:55~~ ~~7:56~~ ~~7:57~~ ~~7:58~~ ~~7:59~~ ~~8:00~~ ~~8:01~~ ~~8:02~~ ~~8:03~~ ~~8:04~~ ~~8:05~~ ~~8:06~~ ~~8:07~~ ~~8:08~~ ~~8:09~~ ~~8:10~~ ~~8:11~~ ~~8:12~~ ~~8:13~~ ~~8:14~~ ~~8:15~~ ~~8:16~~ ~~8:17~~ ~~8:18~~ ~~8:19~~ ~~8:20~~ ~~8:21~~ ~~8:22~~ ~~8:23~~ ~~8:24~~ ~~8:25~~ ~~8:26~~ ~~8:27~~ ~~8:28~~ ~~8:29~~ ~~8:30~~ ~~8:31~~ ~~8:32~~ ~~8:33~~ ~~8:34~~ ~~8:35~~ ~~8:36~~ ~~8:37~~ ~~8:38~~ ~~8:39~~ ~~8:40~~ ~~8:41~~ ~~8:42~~ ~~8:43~~ ~~8:44~~ ~~8:45~~ ~~8:46~~ ~~8:47~~ ~~8:48~~ ~~8:49~~ ~~8:50~~ ~~8:51~~ 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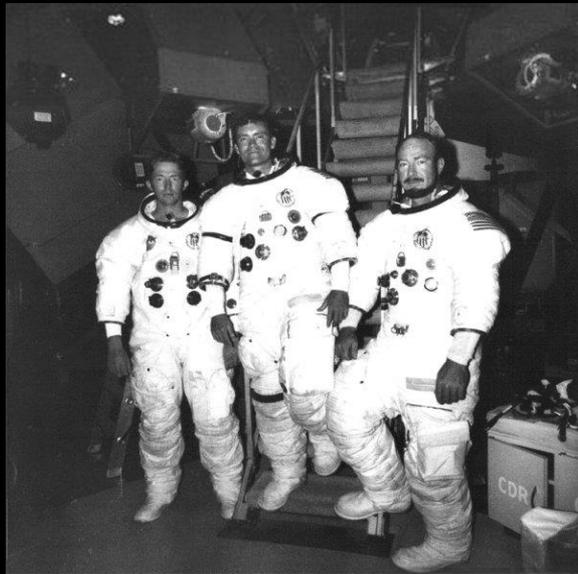




Záloha Apollo 11



Apollo 13



Záloha Apollo 16



Apollo 19

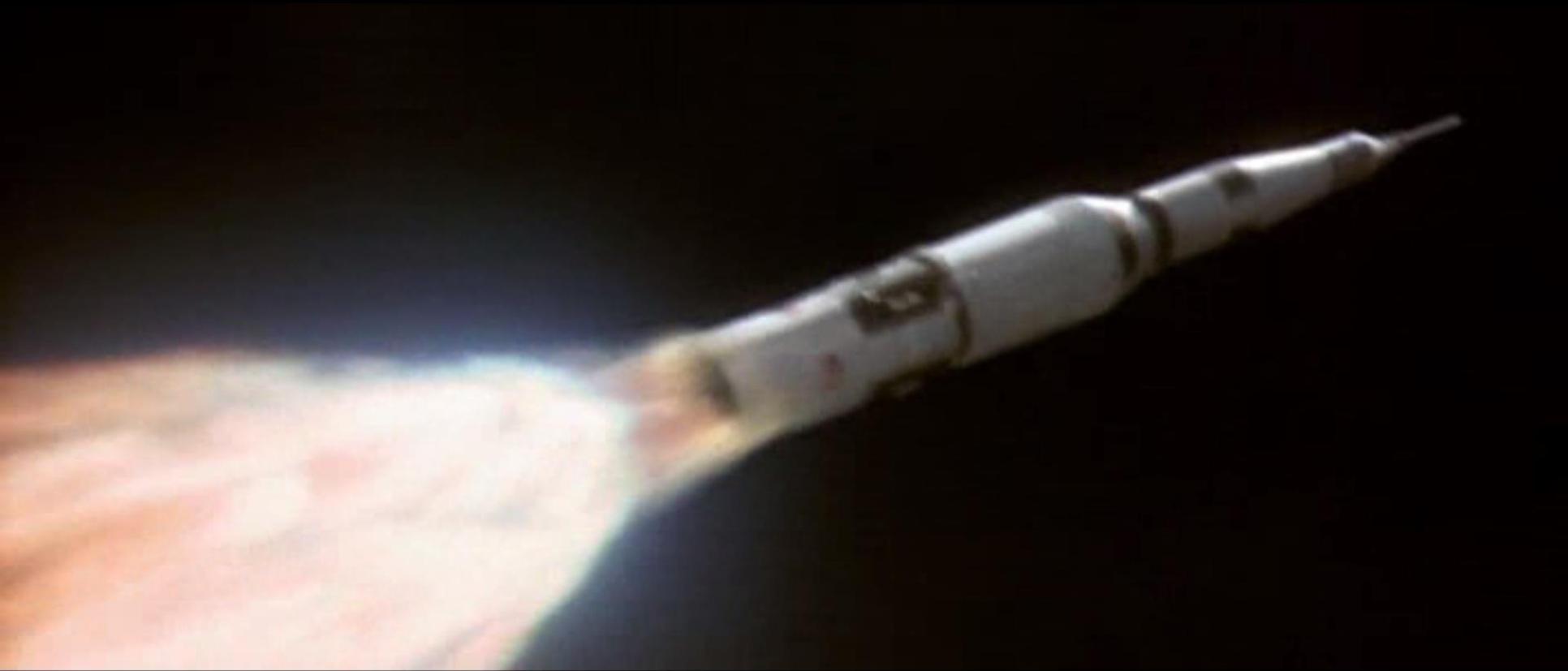




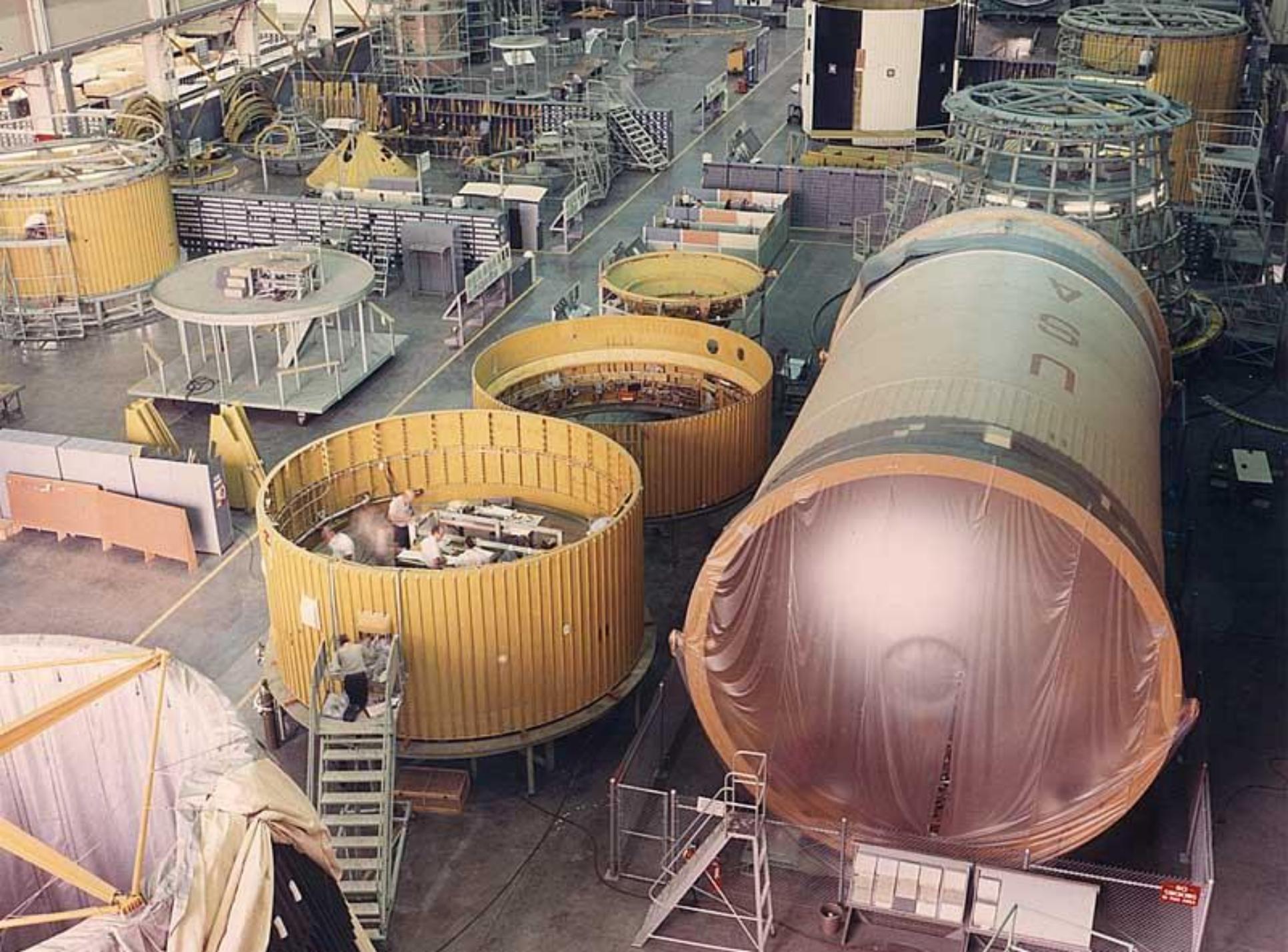
Gene Kranz



Barevné provedení Saturnu V







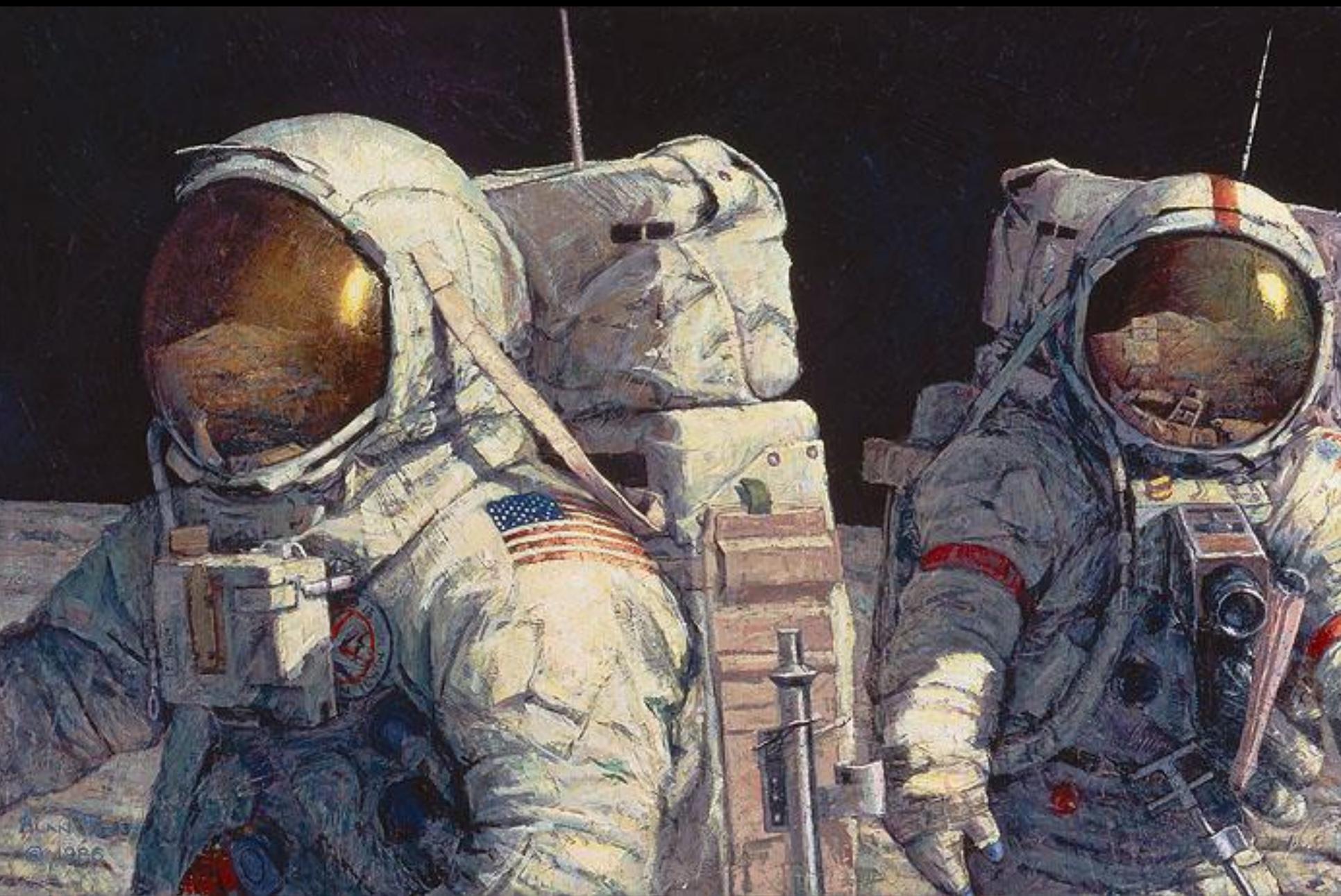
Ken Mattingly na startu?











ALAN ...
© 1986

Apollo 14 - Alan Shepard



Apollo 15 - David Scott



Apollo 16 – John Young



Apollo 17 – Eugene Cernan



Apollo 13 Lunar Surface EVA helmet.
Courtesy: Jim Lovell

The Apollo 13 extravehicular helmet, placed over the pressure suit, was the first one to have a red stripe running down the top of it. This stripe would help identify the commander in photos taken on the lunar surface. The gold reflective on the helmet acts like sunglasses. Like the material acts like sunglasses. Like the helmet, a radial ring provides a connection to this "ball-and-socket" that gives a wide field of view and eliminates the "near eye" that had been used in the Mercury and Gemini designs. Can you also see the thermal cover layer that provides additional protection?



Apollo 13 Lunar Surface EVA helmet.
Courtesy: Jim Lovell

Apollo 13 Lunar Surface EVA helmet.
Courtesy: Jim Lovell

BOULDER TIPS

FILLET SAMPLE - CRYSTALLINE OR TOUGH BRECCIA

7' X SUN STEREO AFTER FILLET
7' X SUN & CLOSE-UP AFTER CHIP (STEREO)

REF SOIL - STD PROCEDURES
START BOULDER (2.5M)

FLIGHT LINE STEREO
GET CHIP FROM EACH LAYER (OTHER SIDE IF CAN)
IF NO LAYERS, CHIP BOTH ENDS

BOULDER TIPS

SPLIT BOULDER (CRYSTALLINE)
1/2 OVERTURNABLE
7' X SUN STEREO BEFORE TOUCHING
3 MORE 7' STEREO'S, OS & LOC SHOTS

5M INCH
CLOSE-UP STEREO AFTER EACH CHIP
7' STEREO BEFORE, 7' AFTER SOILS

SPLIT L-W (OR ADJACENT BLOCKS)
WIDTH \leq HT OF SPLIT (45° SHLD)

REF
X 5M
SOIL
STEREO BEFORE

SHIPPED SOIL
FILL SESO - SKIM SAMPLE
COLLECT SCOOP SAMPLE UNDER SKIM

CLOSEOUT TA 10 STA 9 TA 8 CLOSEOUT

STA 11 EGRESS LOAD UP BY PRESS AIR

EVA 3
EVA 3

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 MALE.



SEEN ANY INTERESTING HILLS & VALLEYS?

TRVERSE
GEO

UNMENTED
AMPLE

CORE
AMPLE

URVEYOR

XEER
A TERM









Nerealizované plány

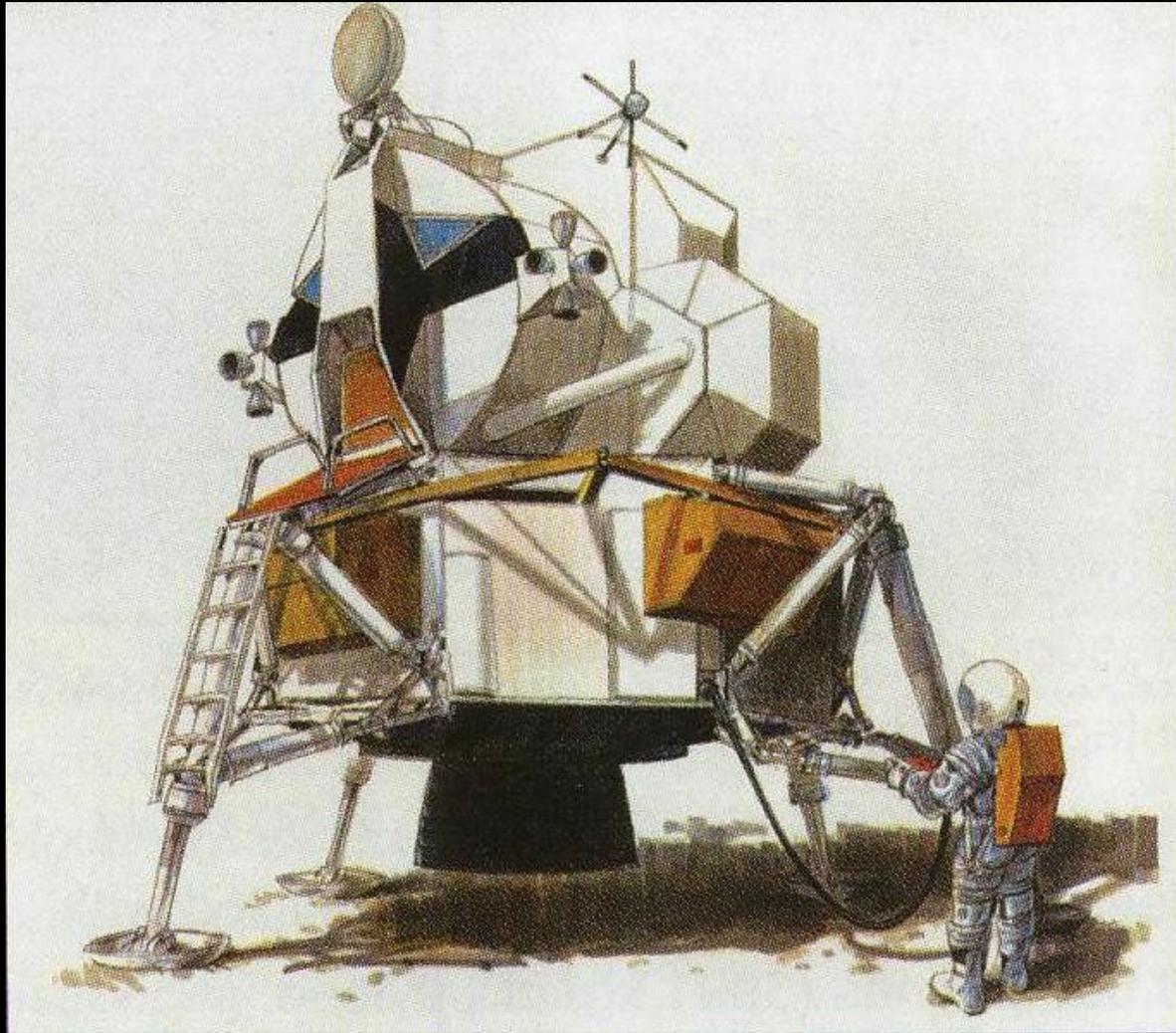


Block I - bezpilotní

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

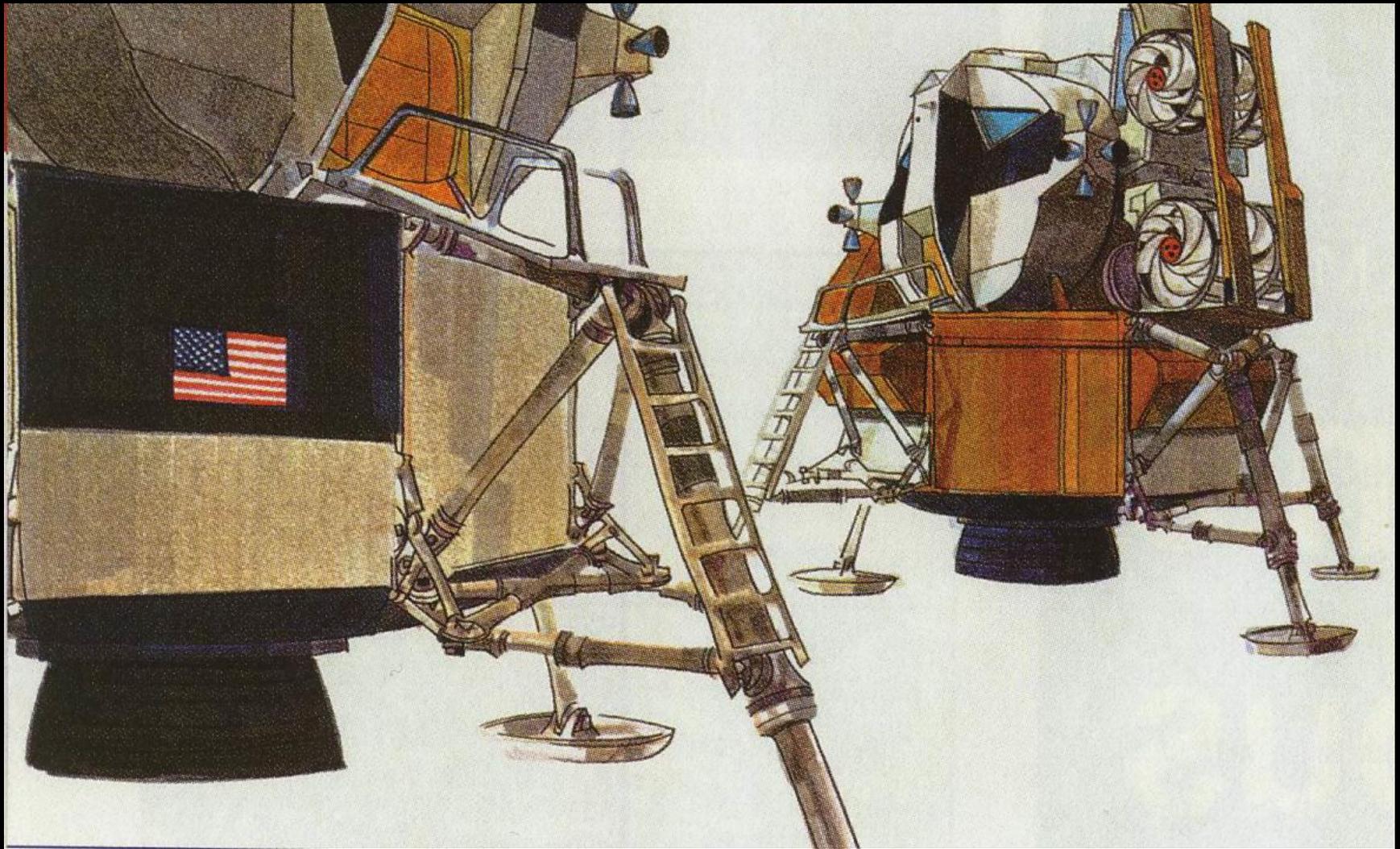
„Těžký“: 72 h samostatný, 450 kg „dolů“.

Augmented LM

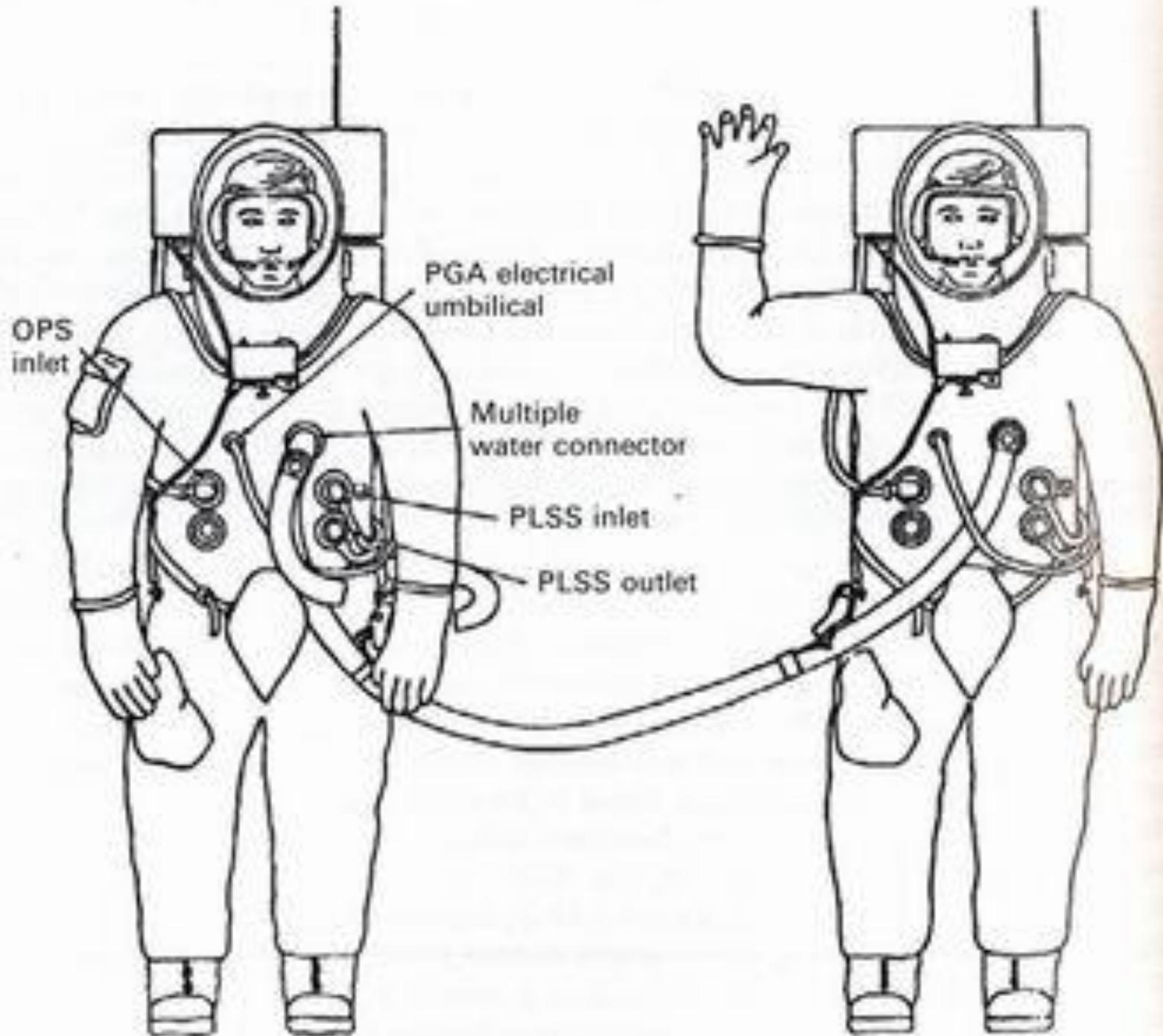


900 kg dolů (nebo 8 dní a 450 kg) .

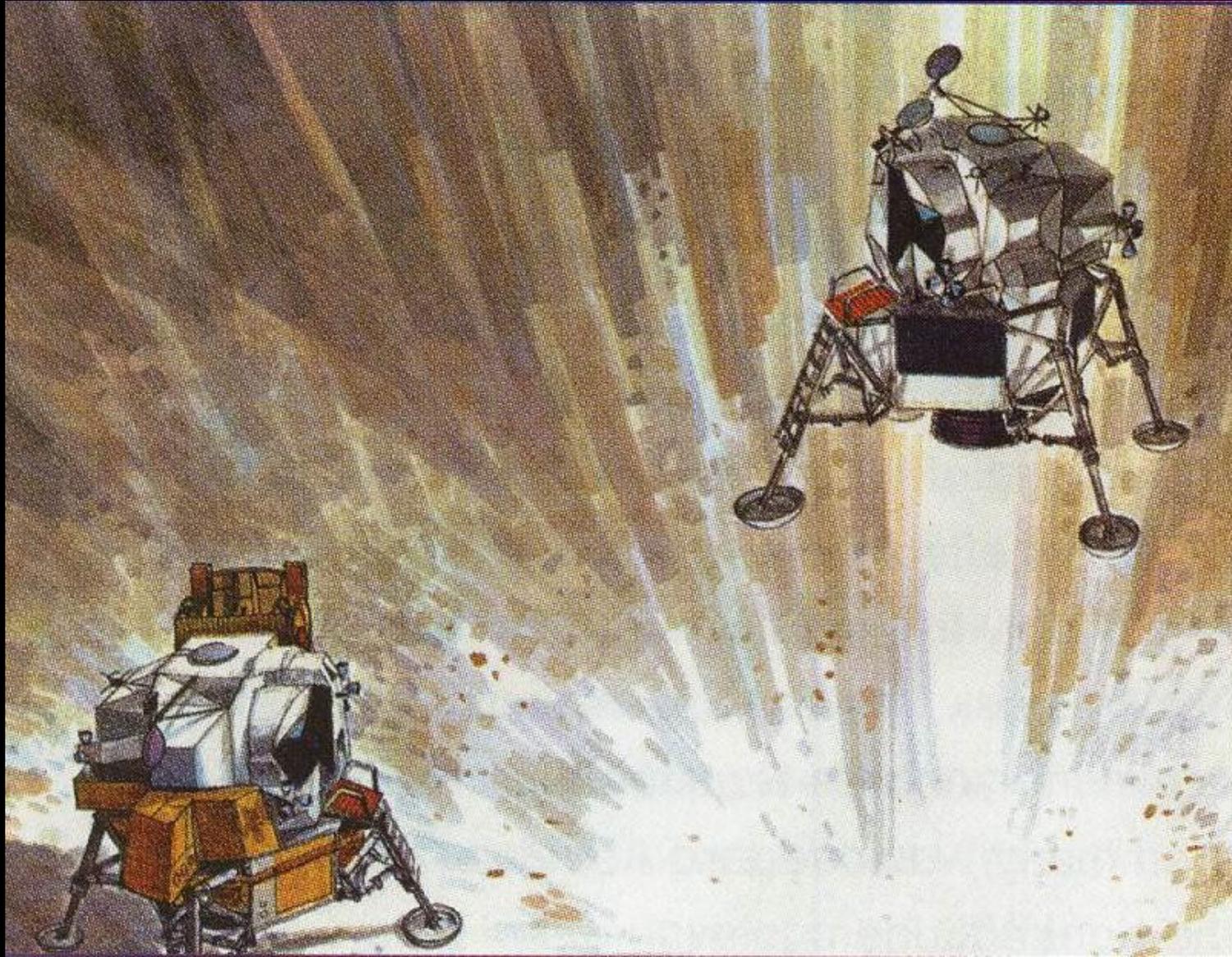
LM Taxi + LM Shelter



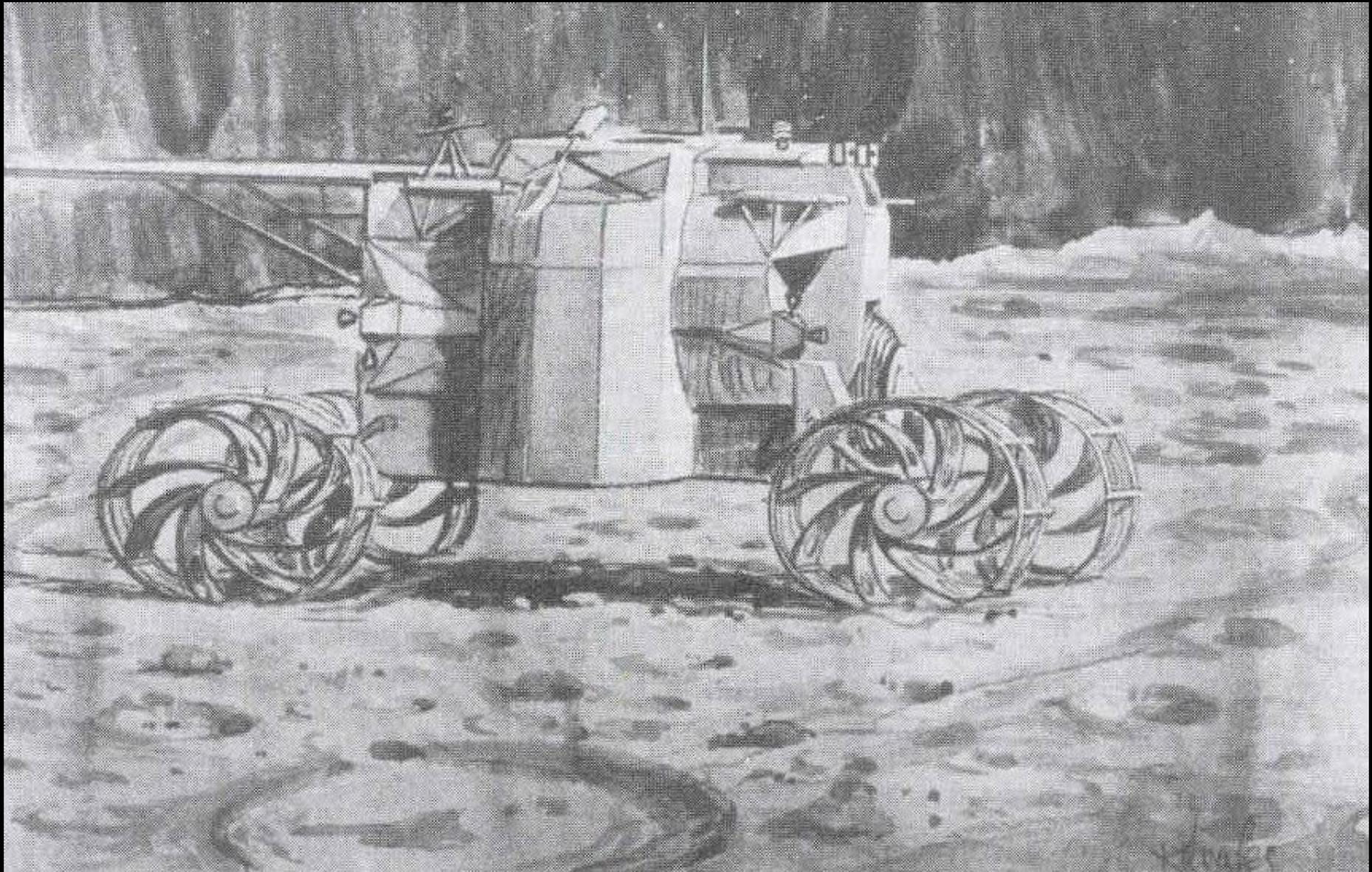
Taxi 14 dní, Shelter 60 dní

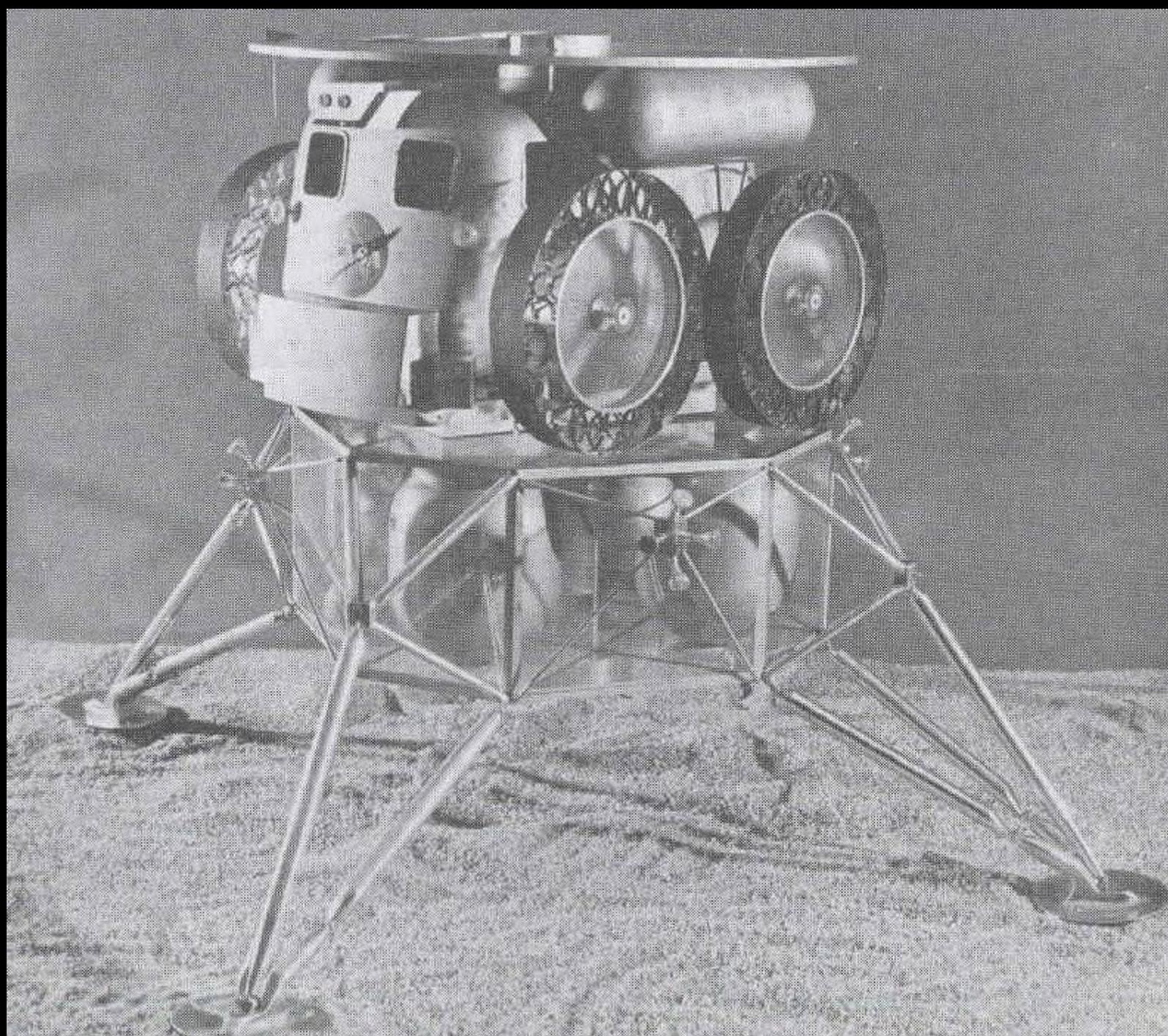


Duální start (Shelter + Taxi)

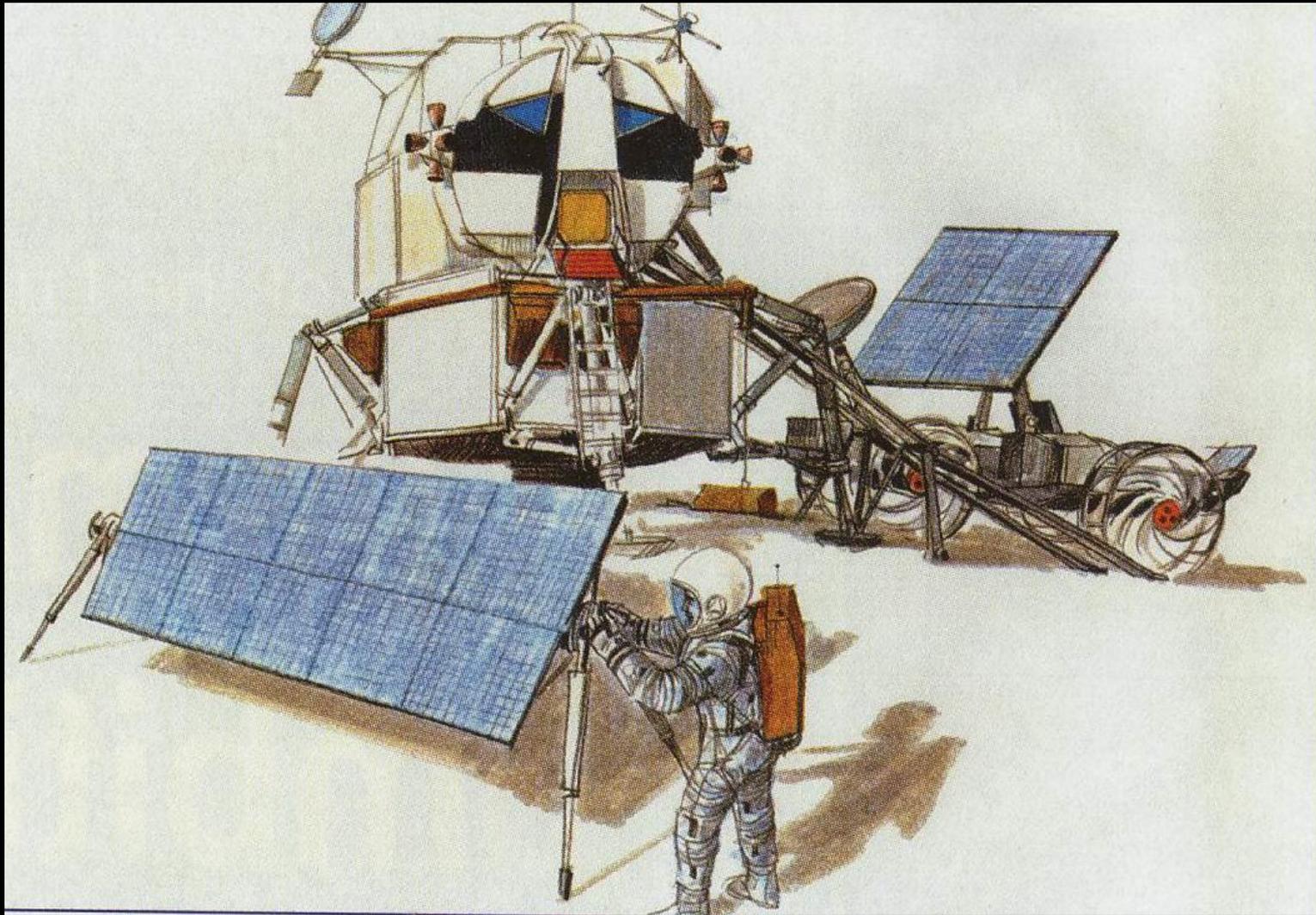


MoLab (Mobile Laboratory)



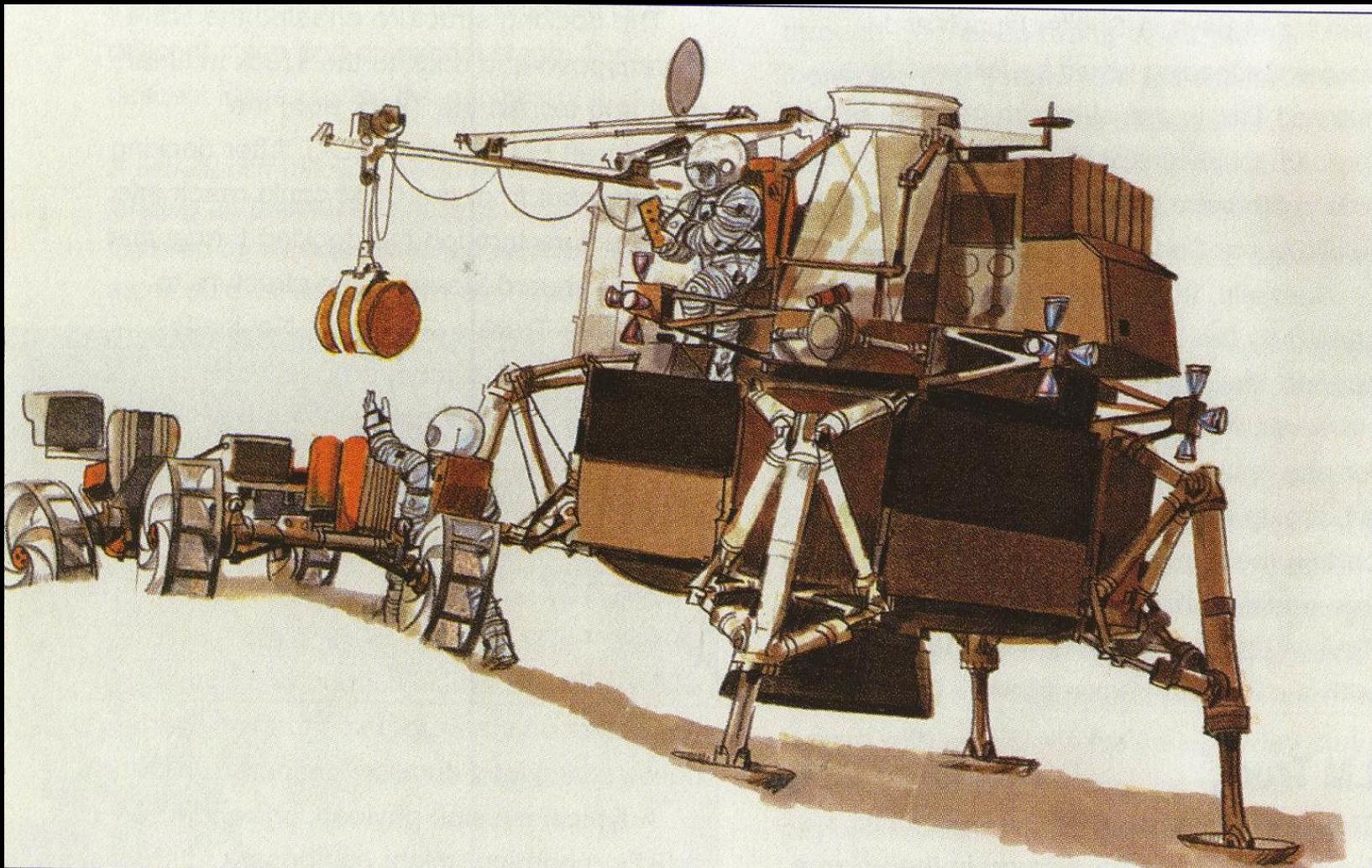


LM Payload Module

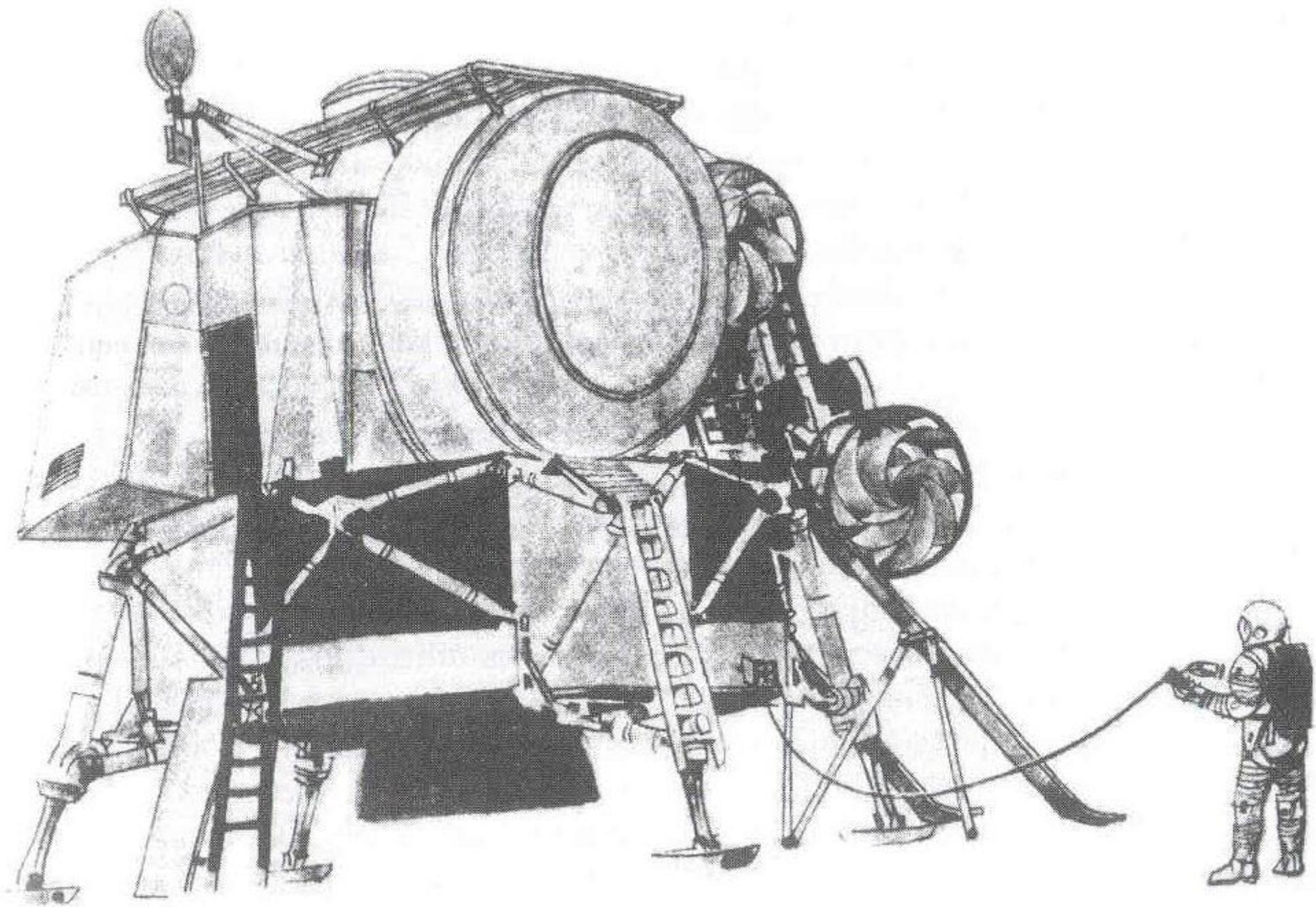


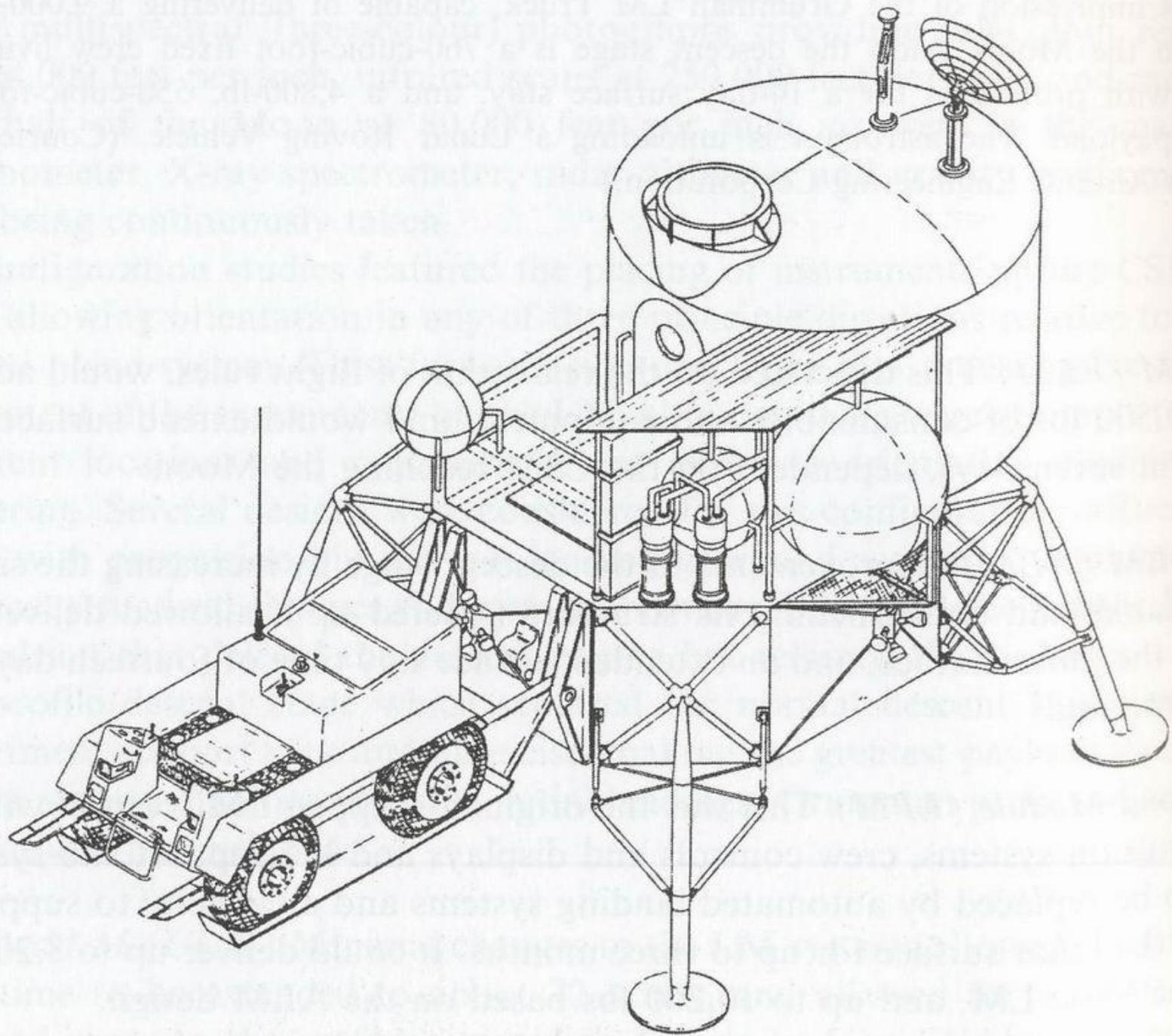
„Nákladní“ (bezpilotní, neobyvatelný).

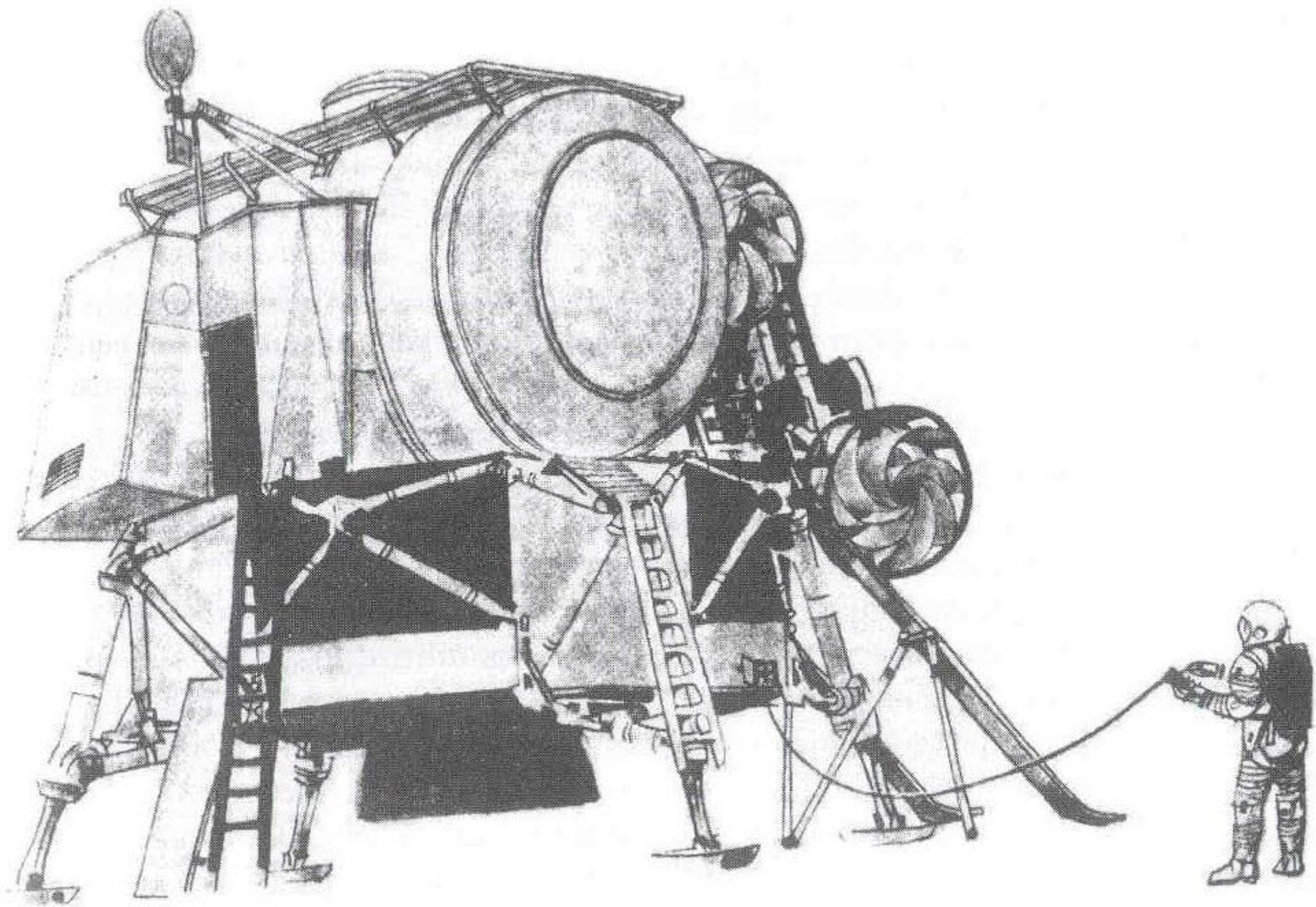
LM Truck



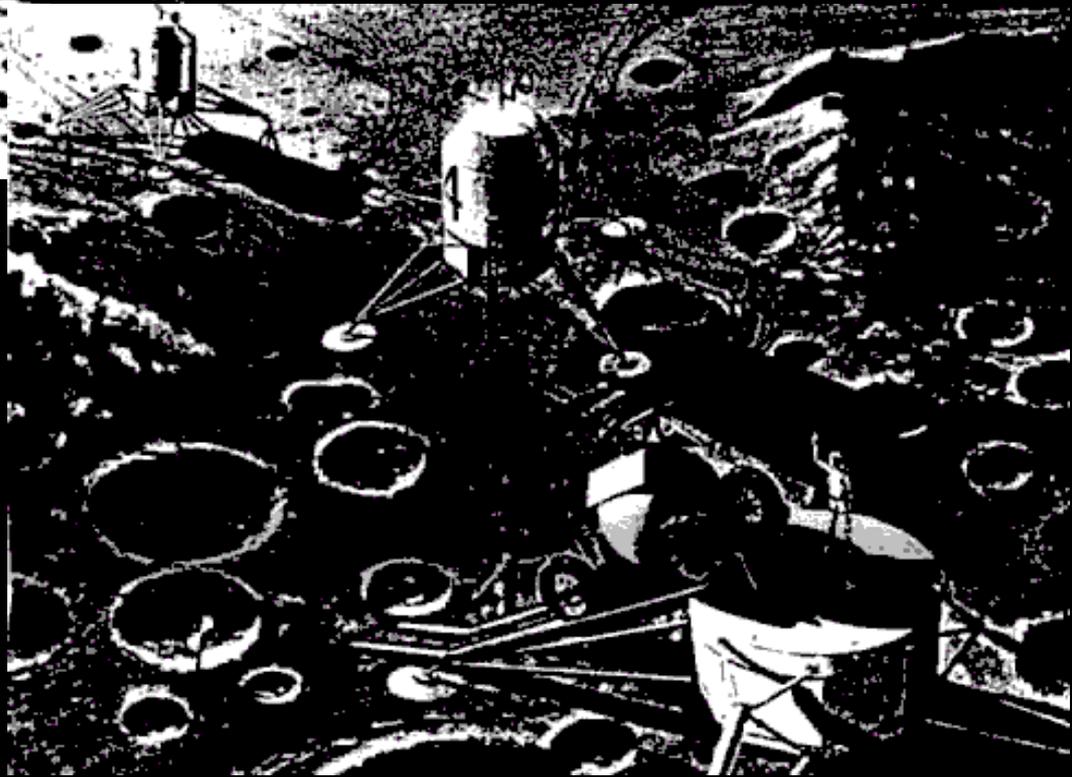
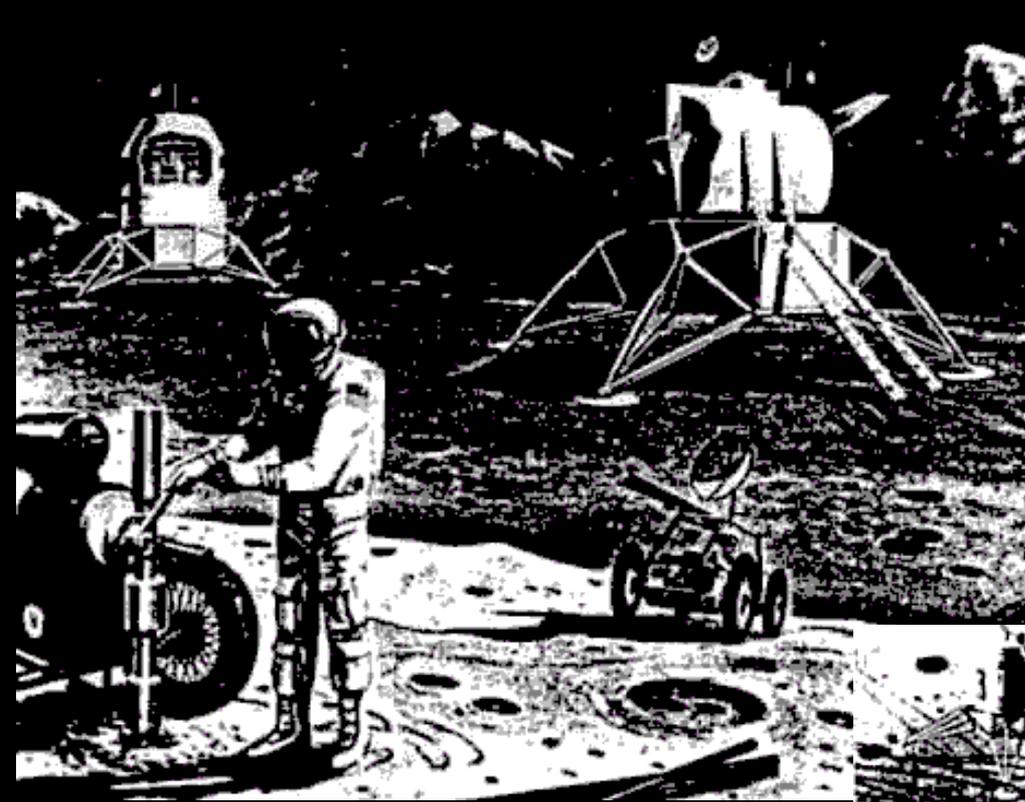
Nákladní plošina, nahoře stykovací.





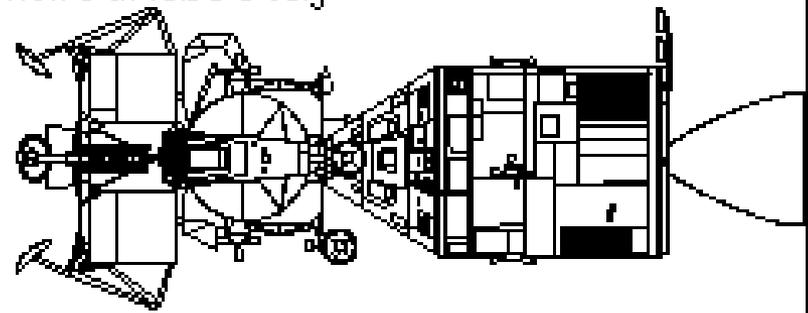


Celá základna

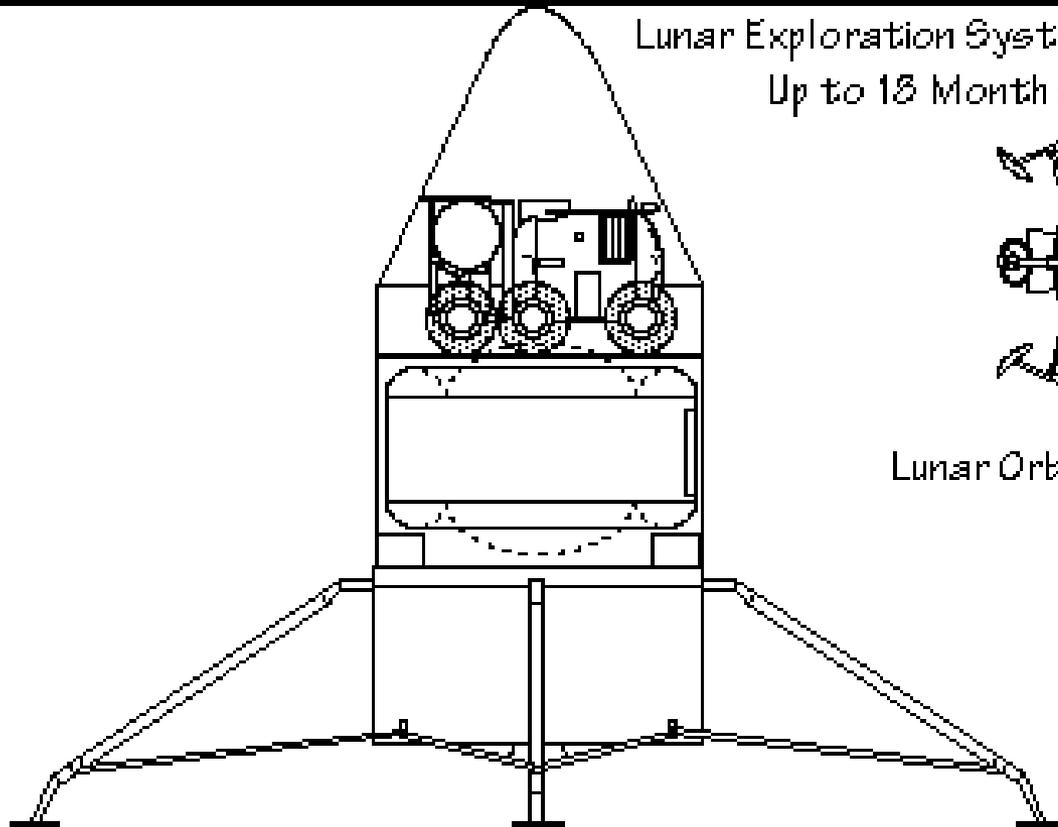


LESA (Lunar Exploration System for Apollo)

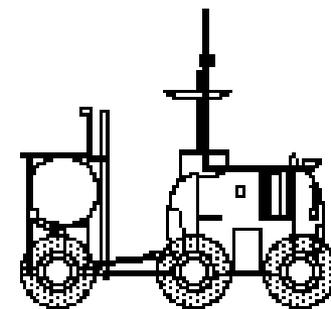
Lunar Exploration System for Apollo - LESA
Up to 18 Month Surface Stay

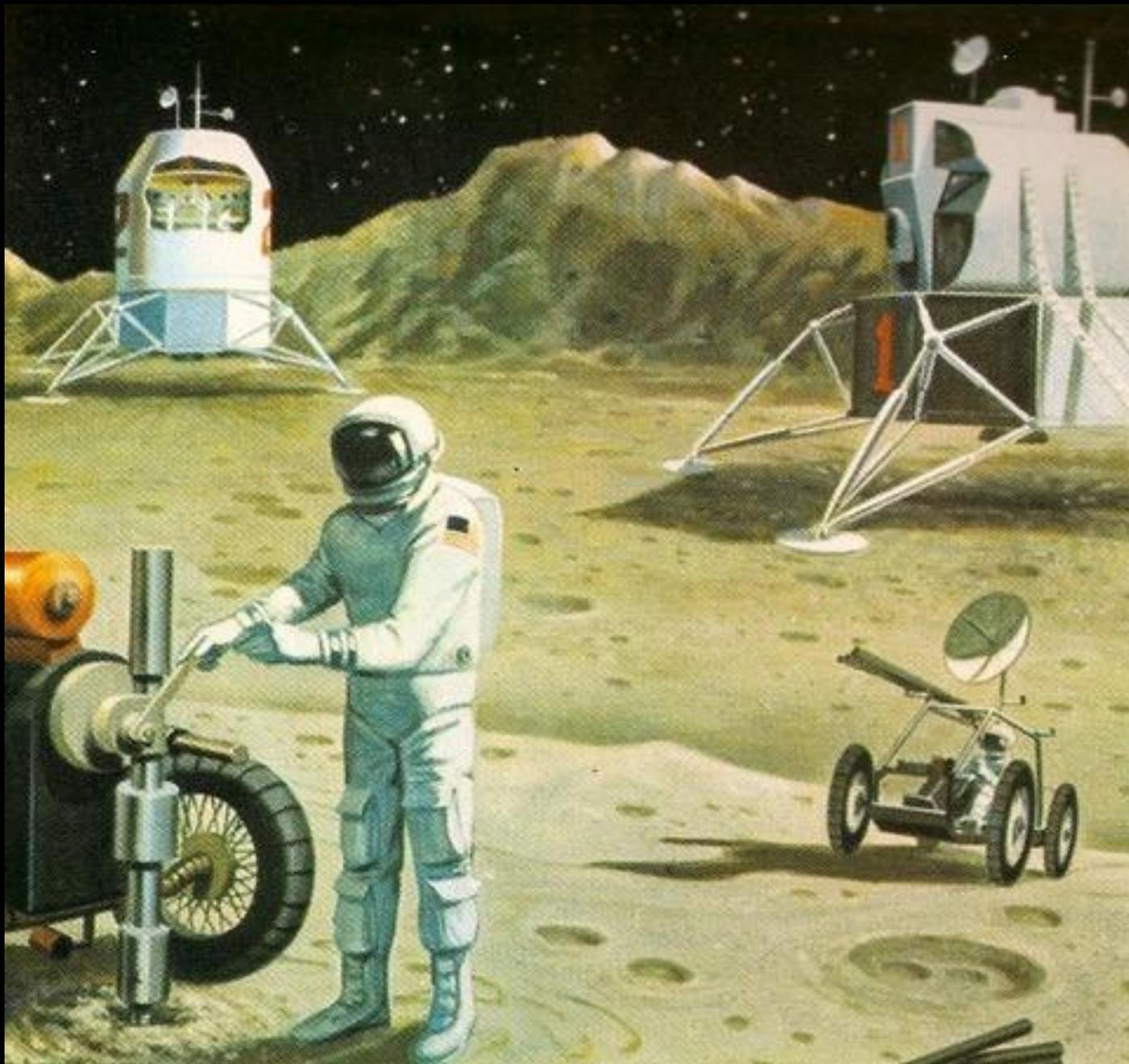


Lunar Orbit Configuration - LEM Taxi - CSM



Lunar Landing Vehicle with LESA 6 Man Lunar Laboratory and Mobile Lunar Laboratory

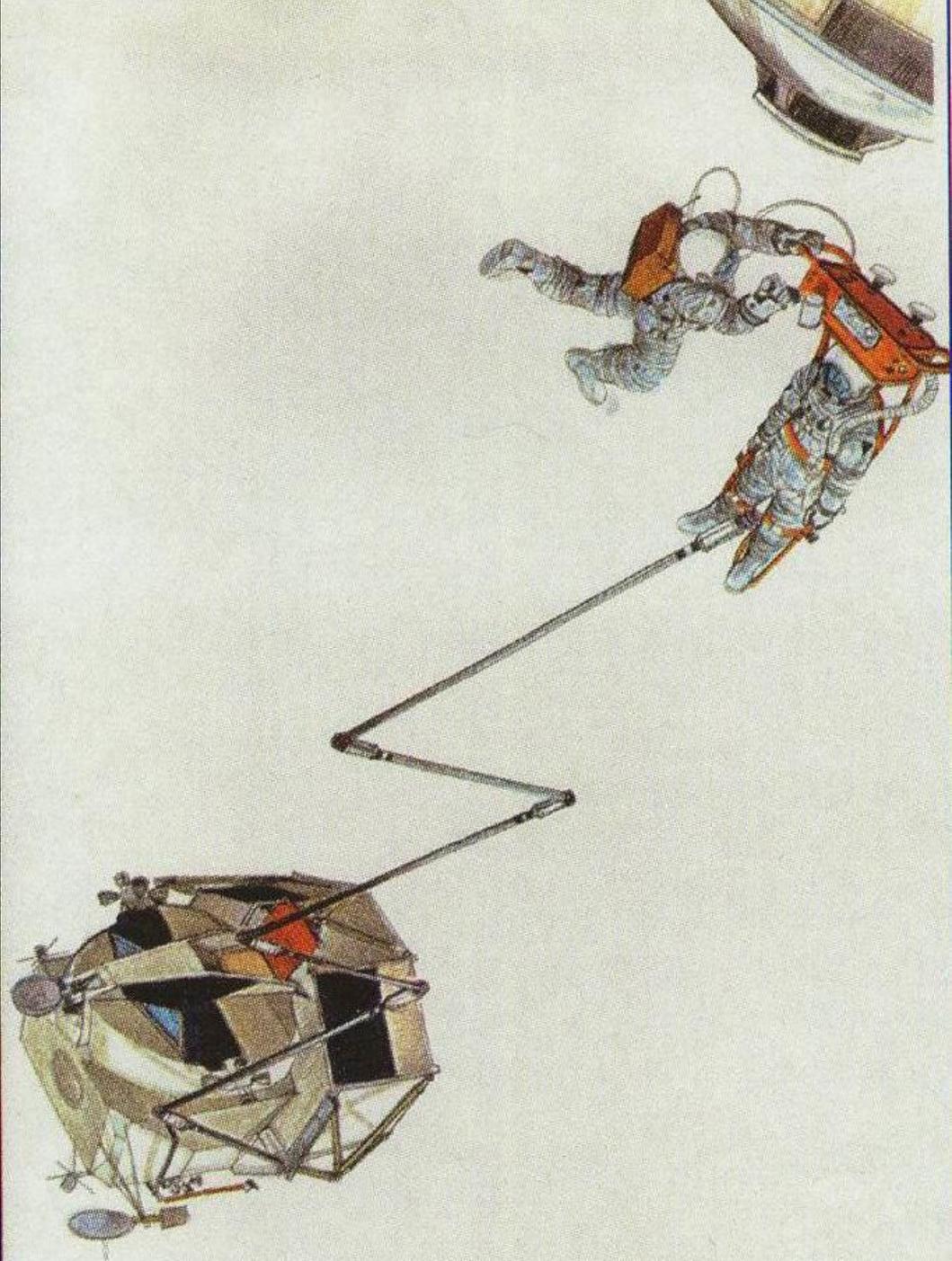


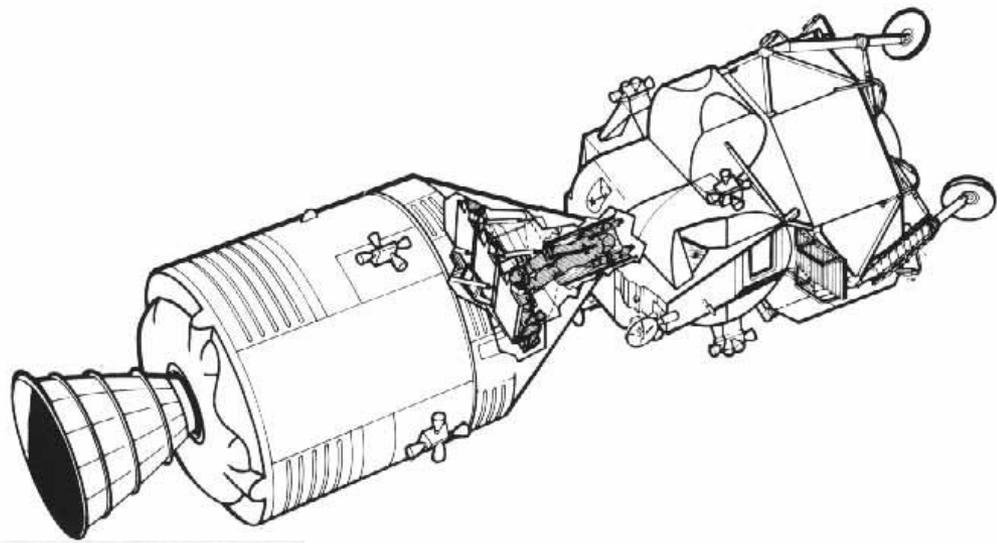


14 dní na Měsíci?

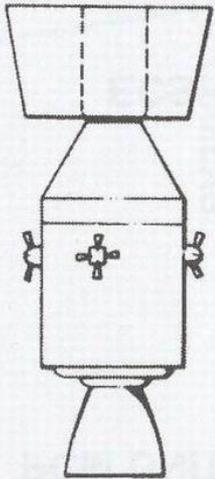


Záchranný LM

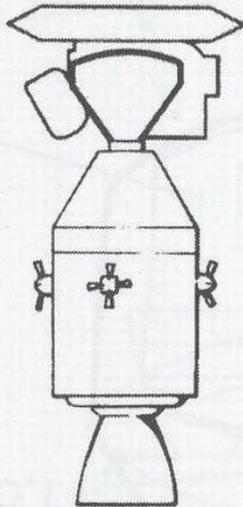




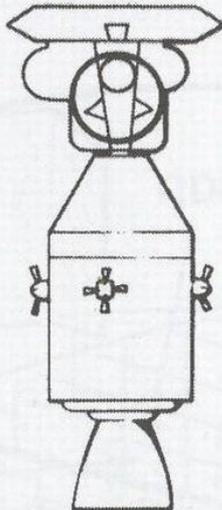
EARLY LABORATORY



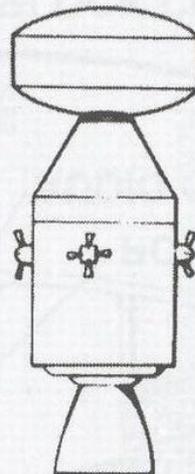
EXTENDED
APOLLO
SYSTEM
UTILISATION
STUDY



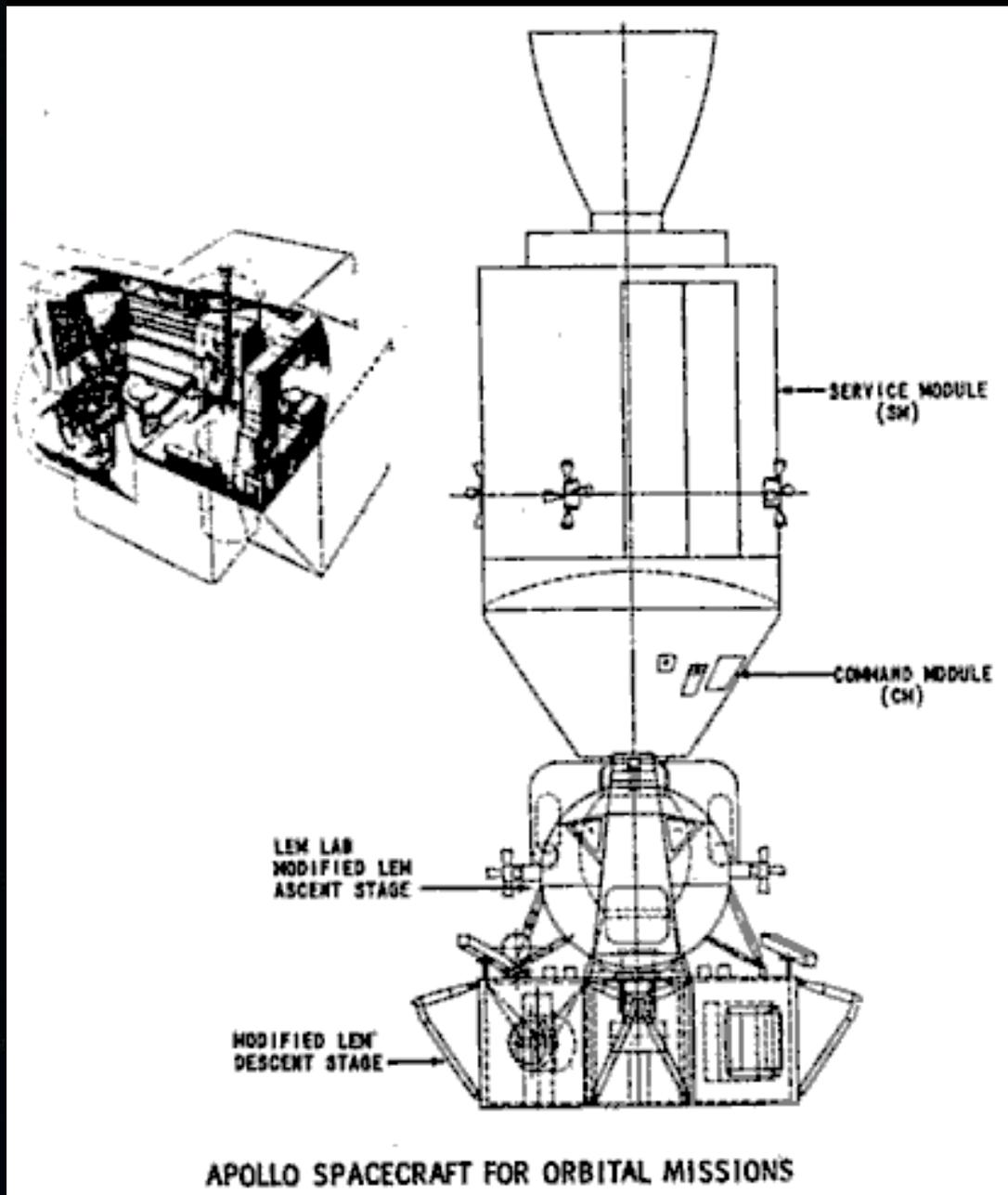
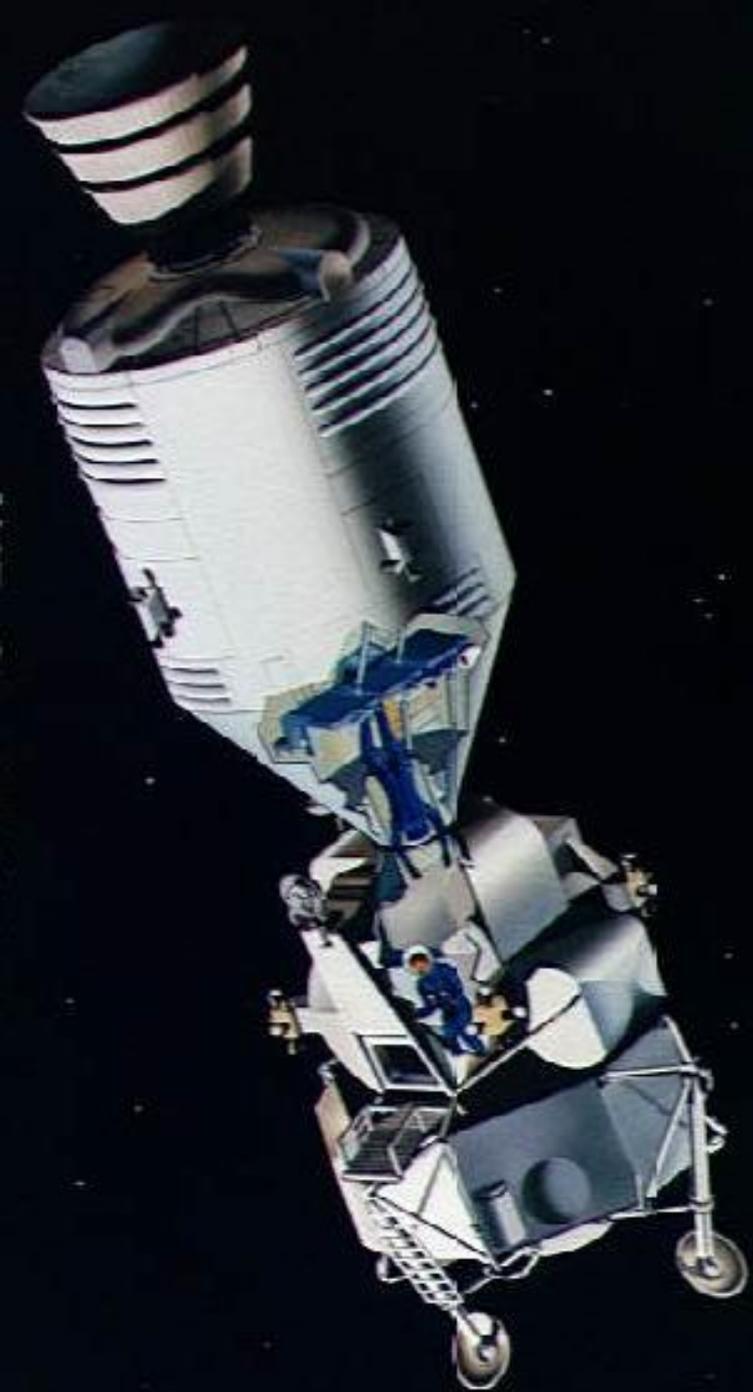
COMMAND
MODULE
LAB
(COMLAB)



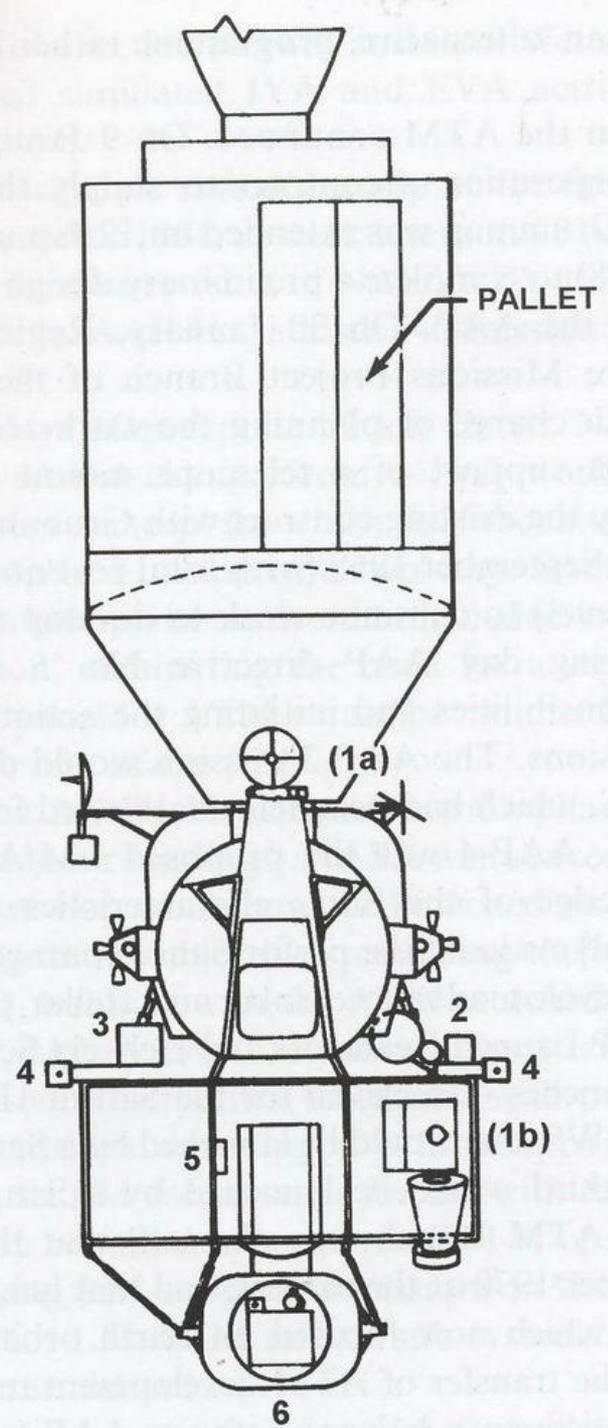
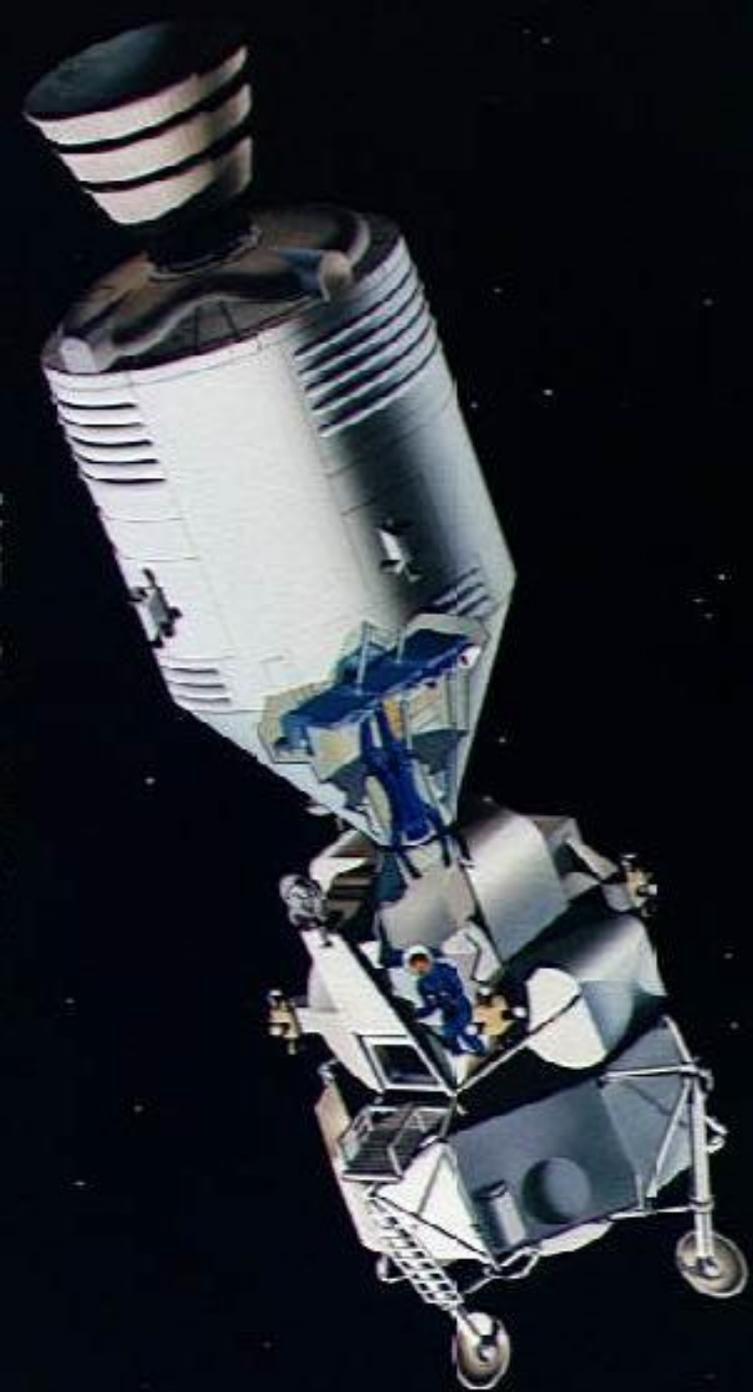
LEM LAB



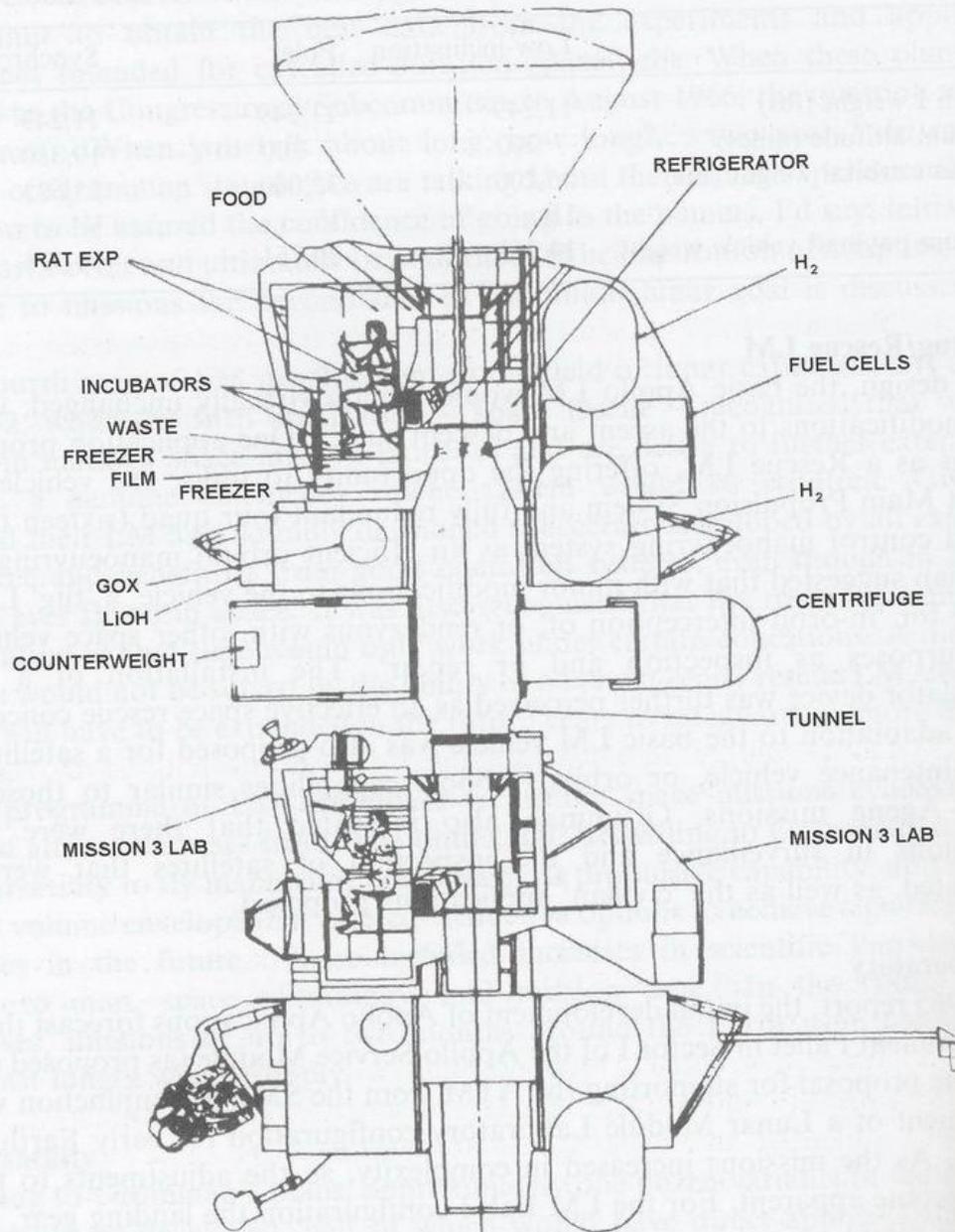
NEW LAB
MODULE



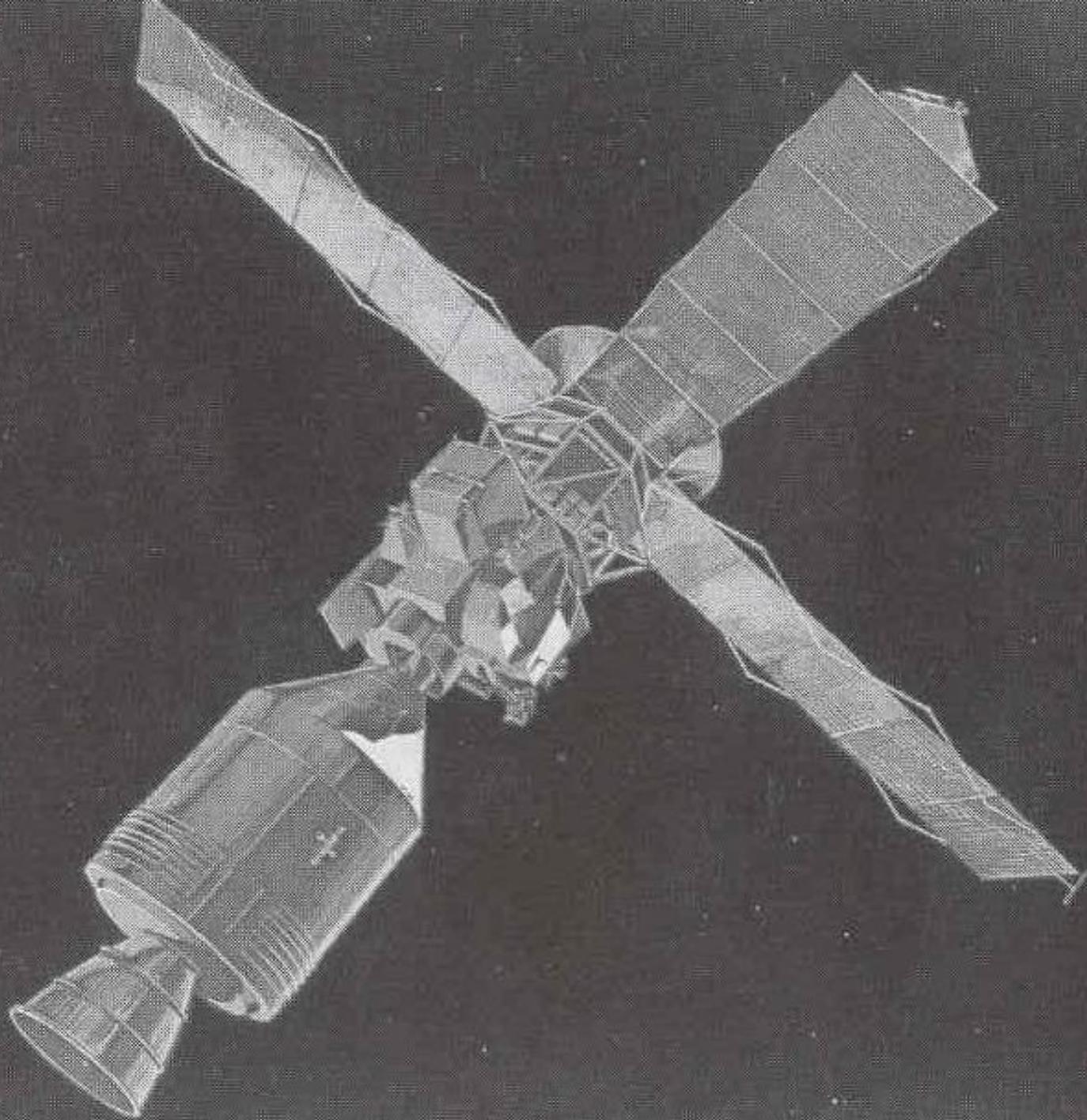
APOLLO SPACECRAFT FOR ORBITAL MISSIONS

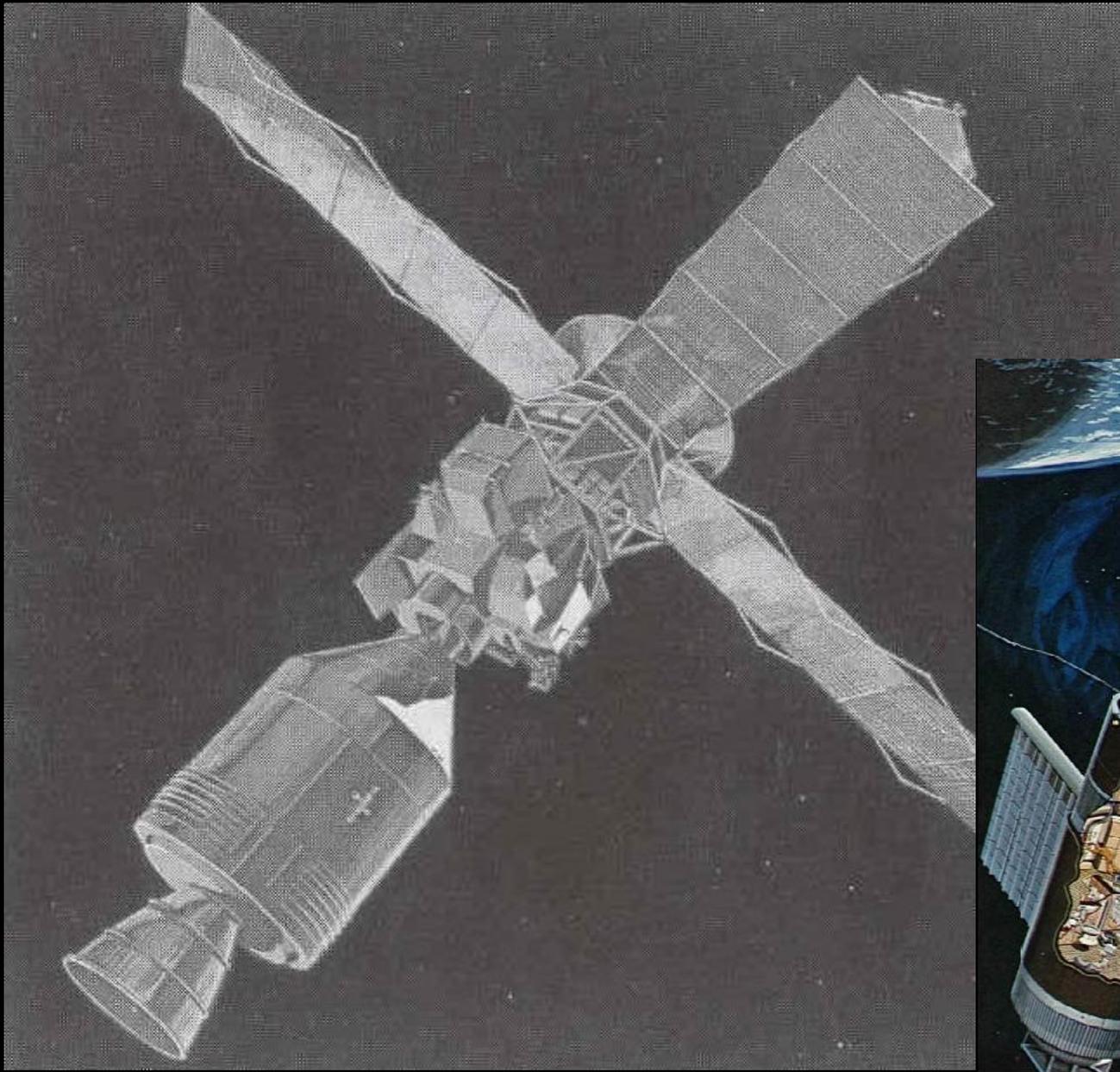


INBOARD PROFILE



VIEW LOOKING OUTBOARD
RIGHT-HAND SIDE







Děkujeme za pozornost!

Tomáš a Michal Příbylovi

tomas.pribyl@seznam.cz

