

Kterak nás sežere čínský kosmický drak

Ing. Tomáš PŘIBYL

pribyl@technicalmuseum.cz

www.technicalmuseum.cz



**TECHNICKÉ
MUZEUM
V BRNĚ**

Ale nejdříve...

A photograph of a SpaceX Starship rocket on the launch pad. The rocket is tall and slender, with a black nose cone and a blue body. It is surrounded by a complex metal structure. In the background, there are several large, cylindrical storage tanks and a clear blue sky with some clouds. A dark SUV is visible in the bottom right corner.

Starship, nákladák ke hvězdám

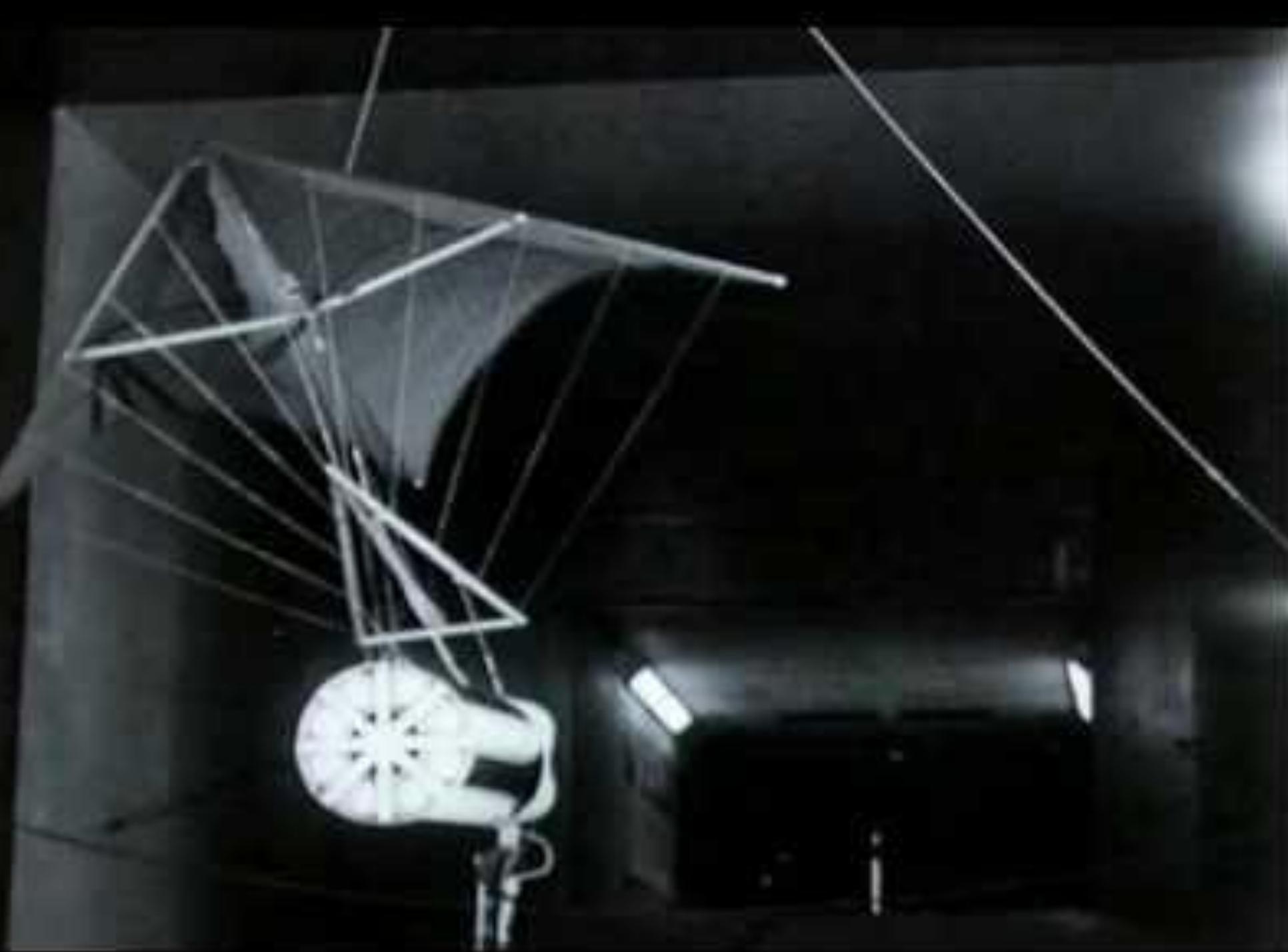
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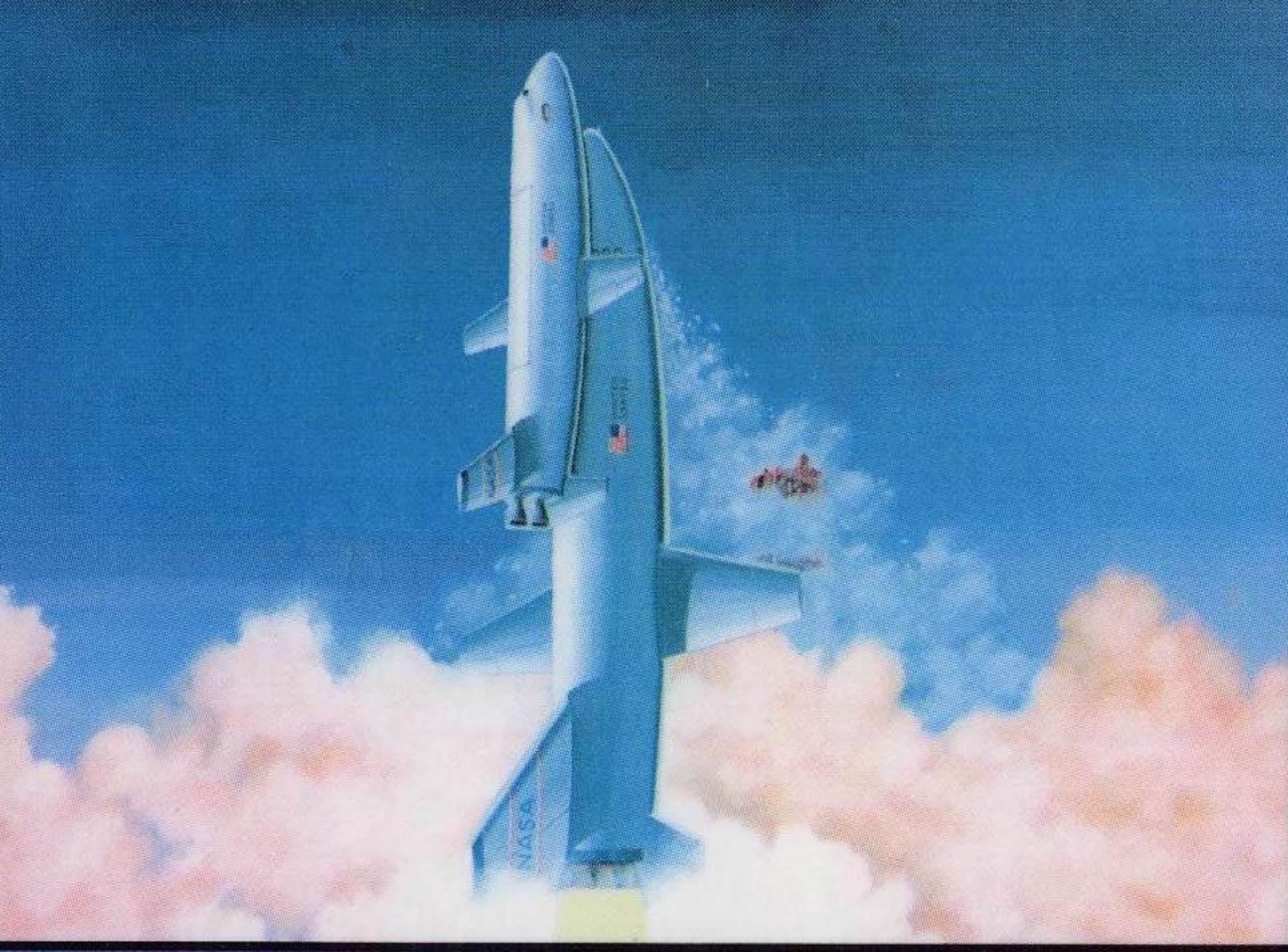




































CREW



TANKER



CARGO



LUNAR



DEEP SPACE

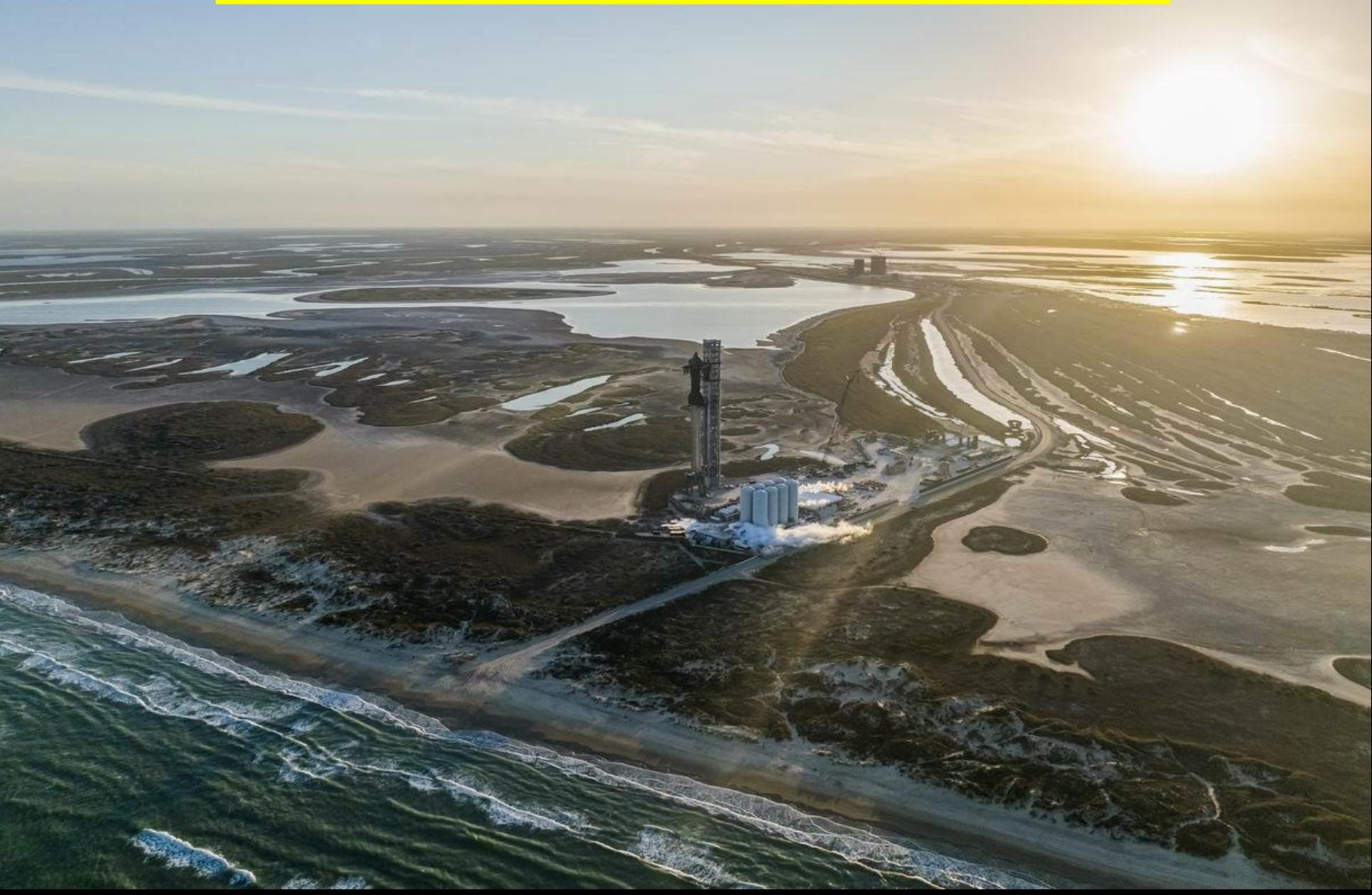
Návrat přímo na rampu



Znovupoužitelnost



Start každou hodinu



Tisíc vyrobených raket

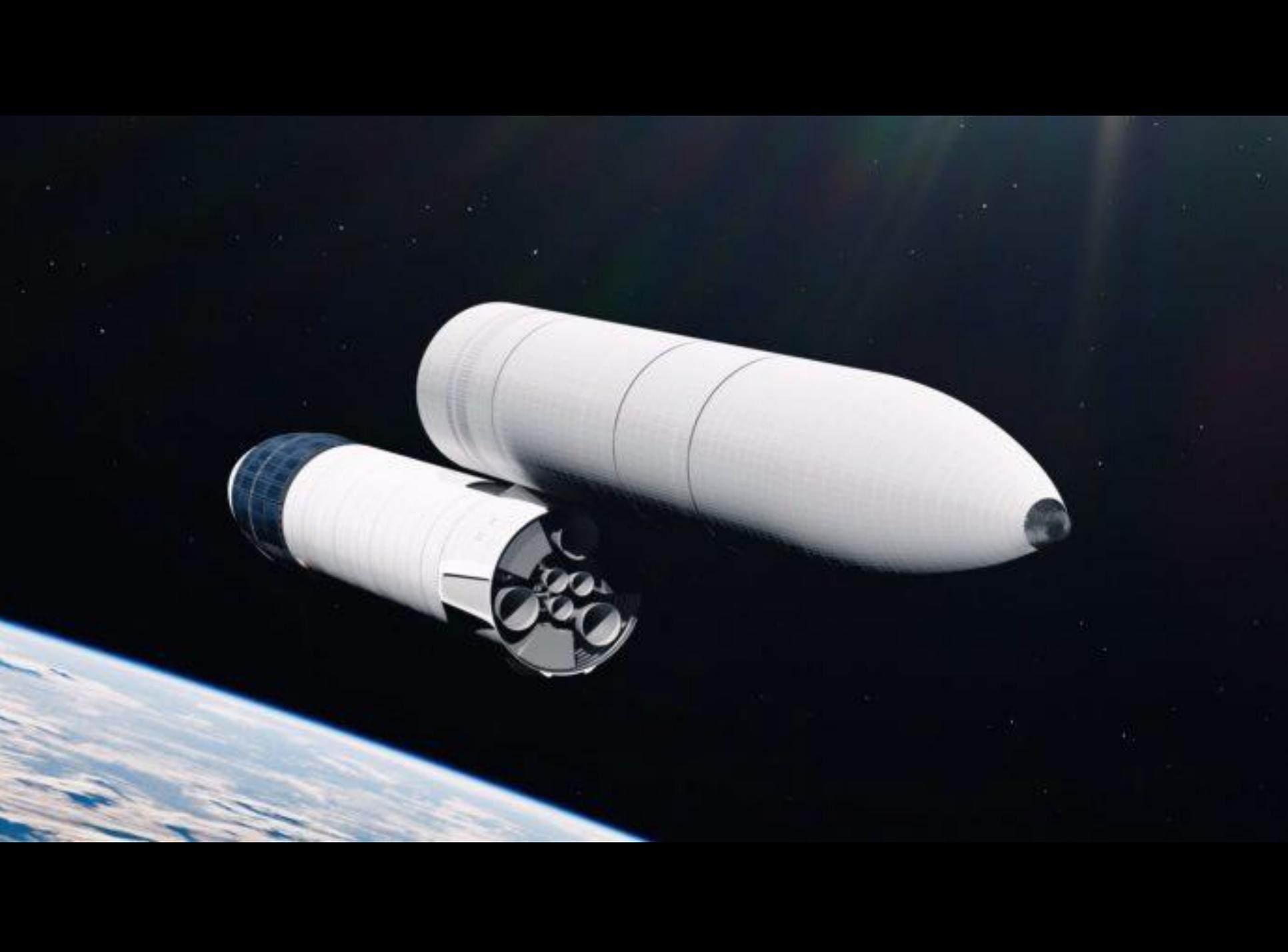


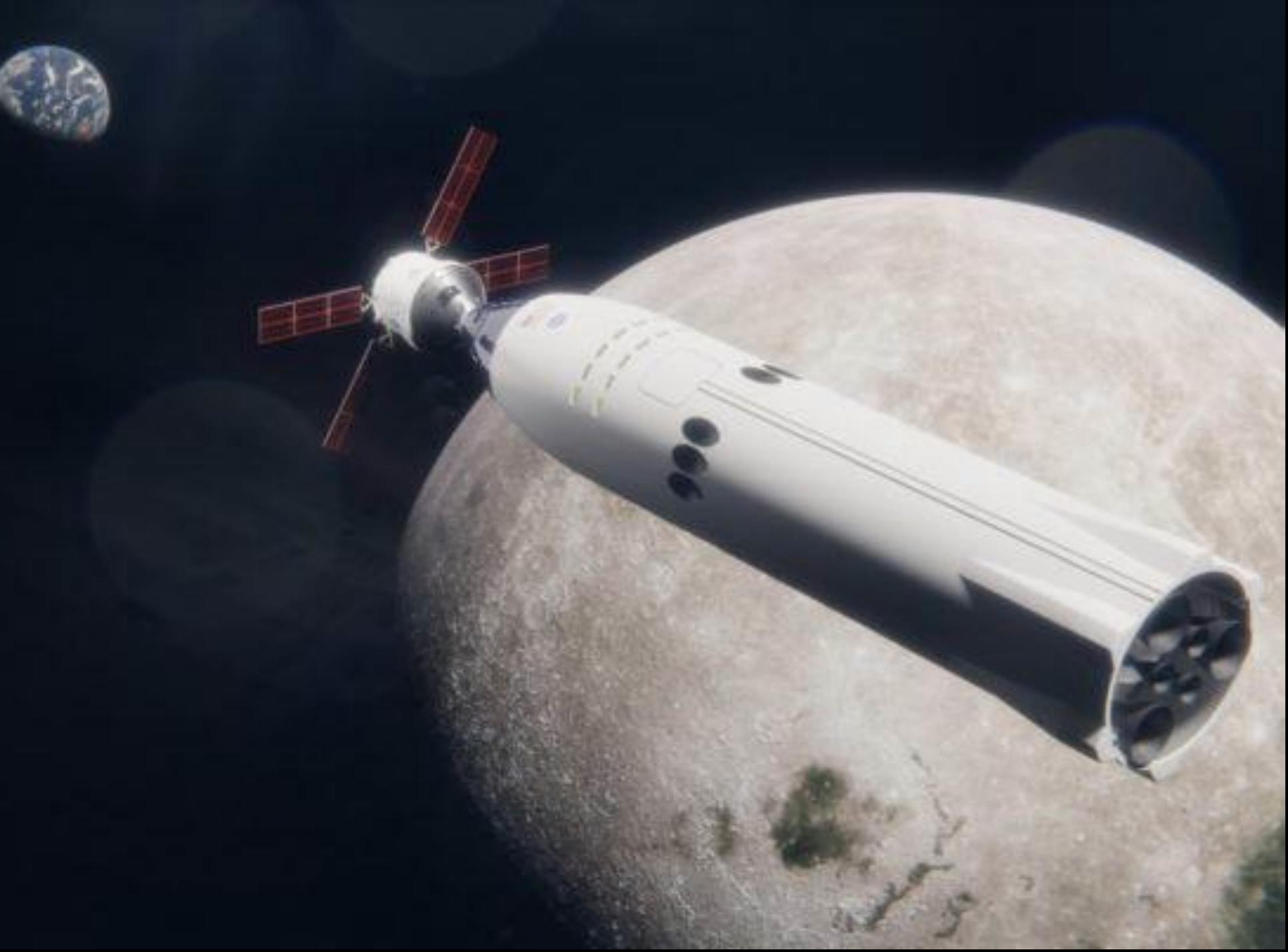
Tankování na oběžné dráze



Výroba paliva na Marsu (CH_4)

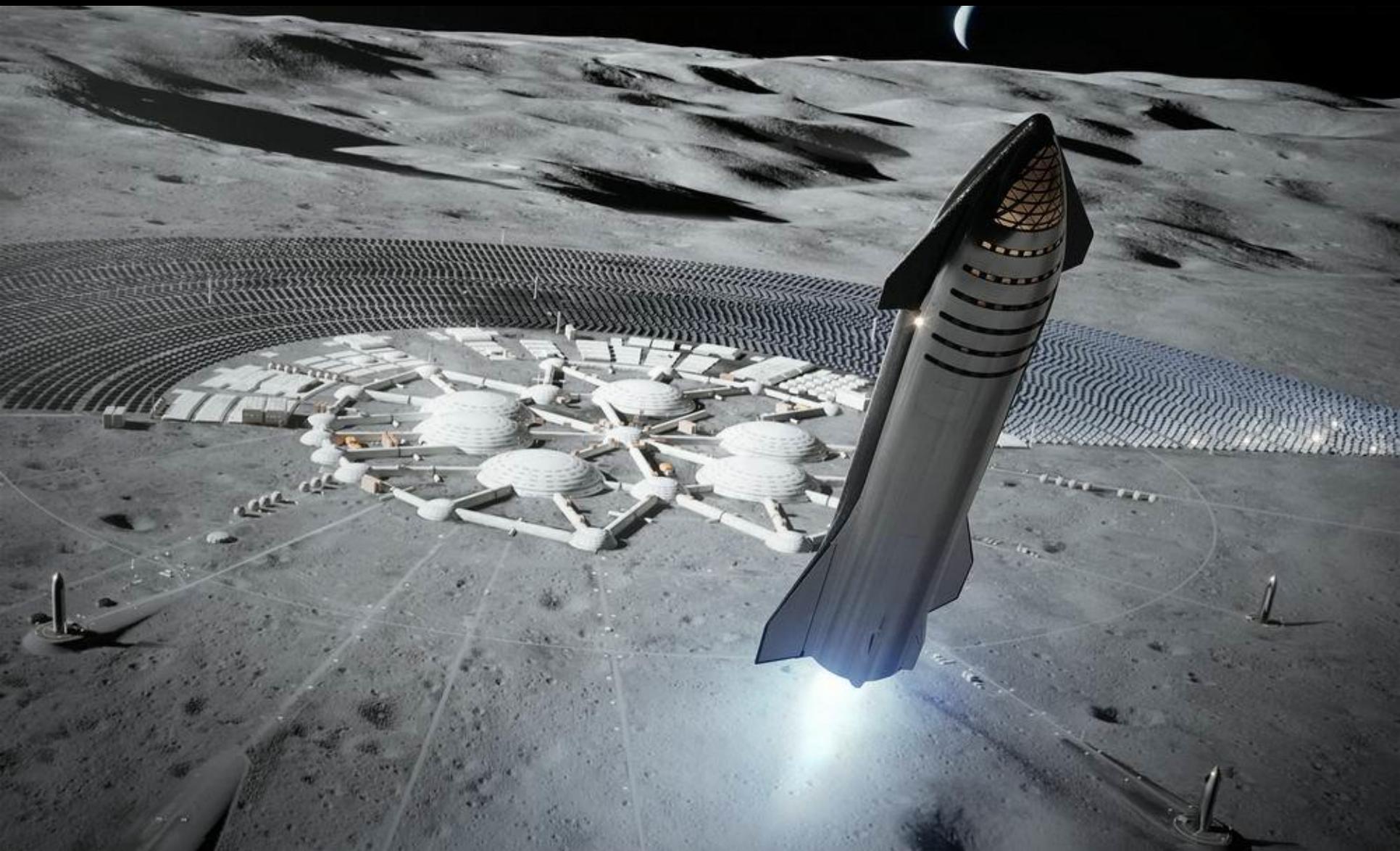


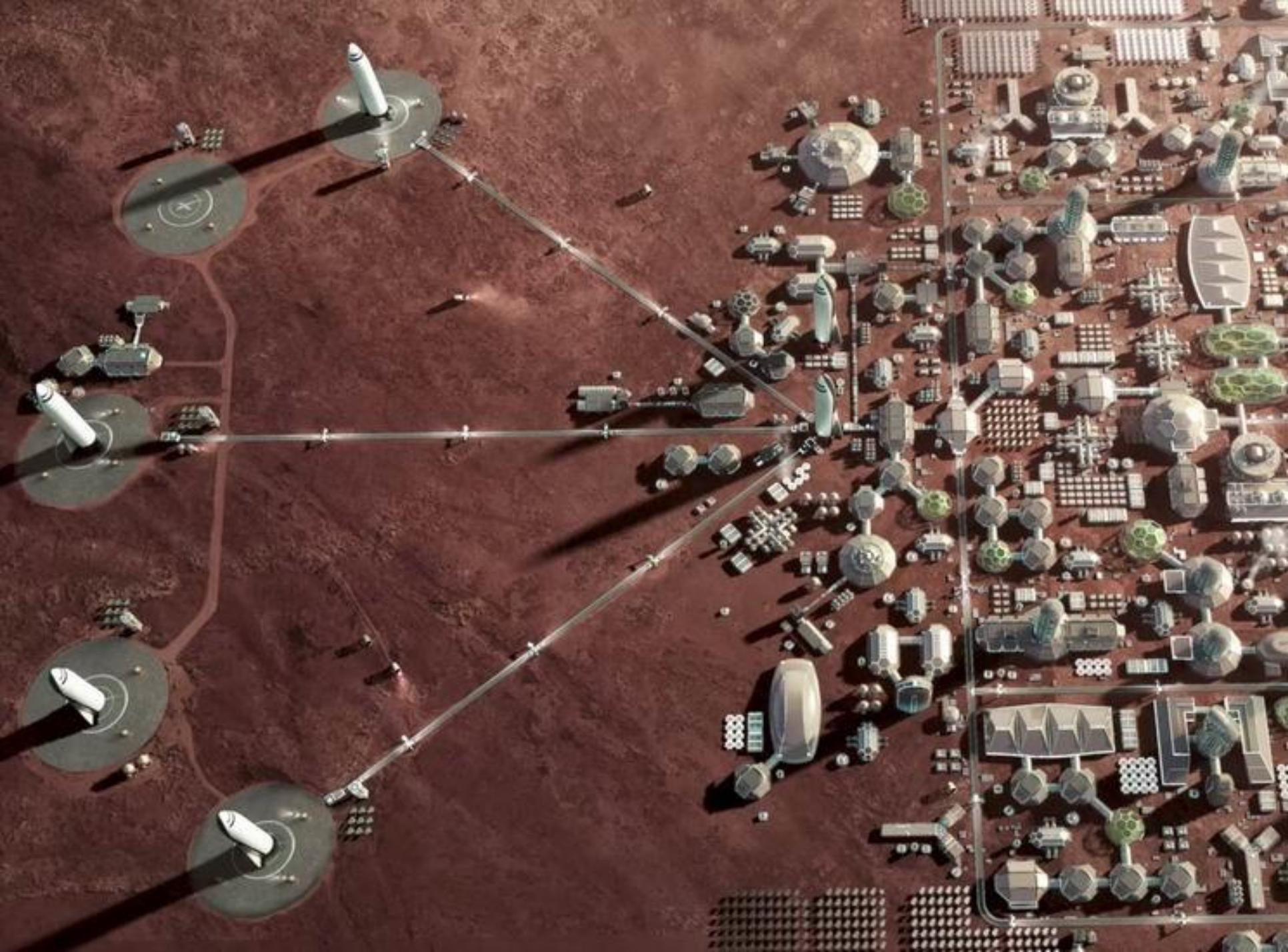


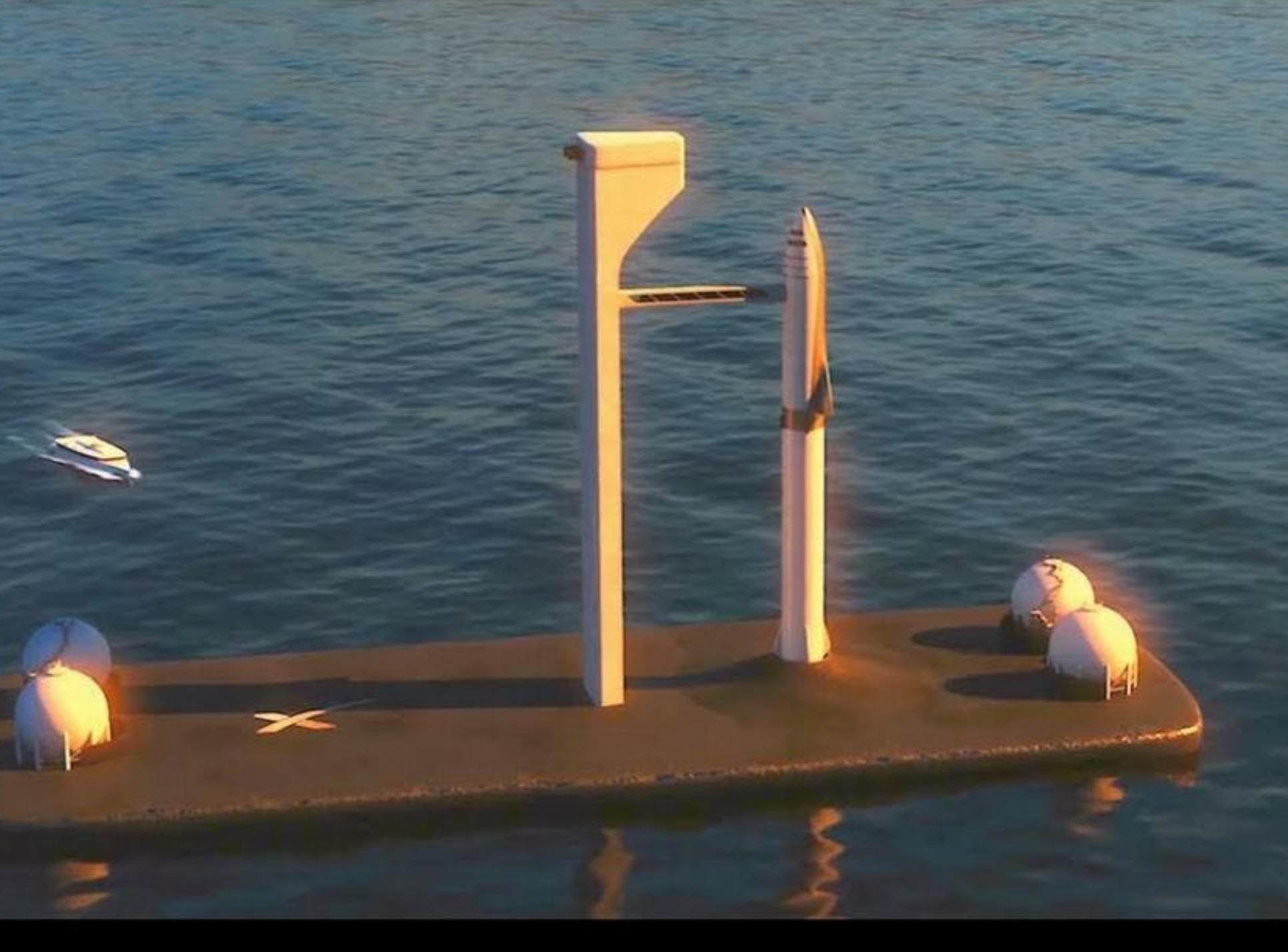












Sci-fi?















The Ring Watchers

@RINGWATCHERS
.gg/RINGWATCHERS

STARSHIP PRODUCTION

THE CORE TEAM: Ryer · Jax · RohanB17 · Sam/SN18 · Neuralink · Nick/Cham · McSlinPlay · MannsOfNaz · Quango · PKALeader · Mouser · Oskar Wróbel · Indstar · Brendan Lewis

October 17th 2023 | ❄️ Cryogenic Test | 🌀 Spin Prime | 🔥 Static Fire

○ Section not stacked. | 🌀 Dome not sleeved. | ● Transparency indicates uncertainty of assignment.



Ship 25
Launch Site
❄️ 5x
🌀 1x
🔥 1x

Ship 26
Test Stand B
❄️ 3x

Ship 28
Engine Install Stand
❄️ 2x

Ship 29
Rocket Garden
❄️ 3x

Ship 30
High Bay

Ship 31
High Bay

Ship 32
High Bay

Ship 33

Ship 34

Changes since September 26th 2023 are highlighted



The Ring Watchers

@RINGWATCHERS
.gg/RINGWATCHERS

BOOSTER PRODUCTION

THE CORE TEAM: Ryer · Jax · RohanB17 · Sam/SN18 · Neuralink · Nick/Cham · McSlinPlay · MannsOfNaz · Quango · PKALeader · Mouser · Oskar Wróbel · Indnstar · Brendan Lewis

October 17th 2023 | ✨ Cryogenic Test | 🌀 Spin Prime | 🔥 Static Fire

○ Section not stacked. | 🌀 Dome not sleeved. | ● Transparency indicates uncertainty of assignment.



Booster 9

OLM

✨ 3x
🌀 2x
🔥 2x

Booster 10

Mega Bay 1

✨ 4x

Booster 11

Mosley's

✨ 1x

Booster 12

Mega Bay 1

Booster 13

Mega Bay 1

Booster 14

Booster 15

Changes since September 26th 2023 are highlighted



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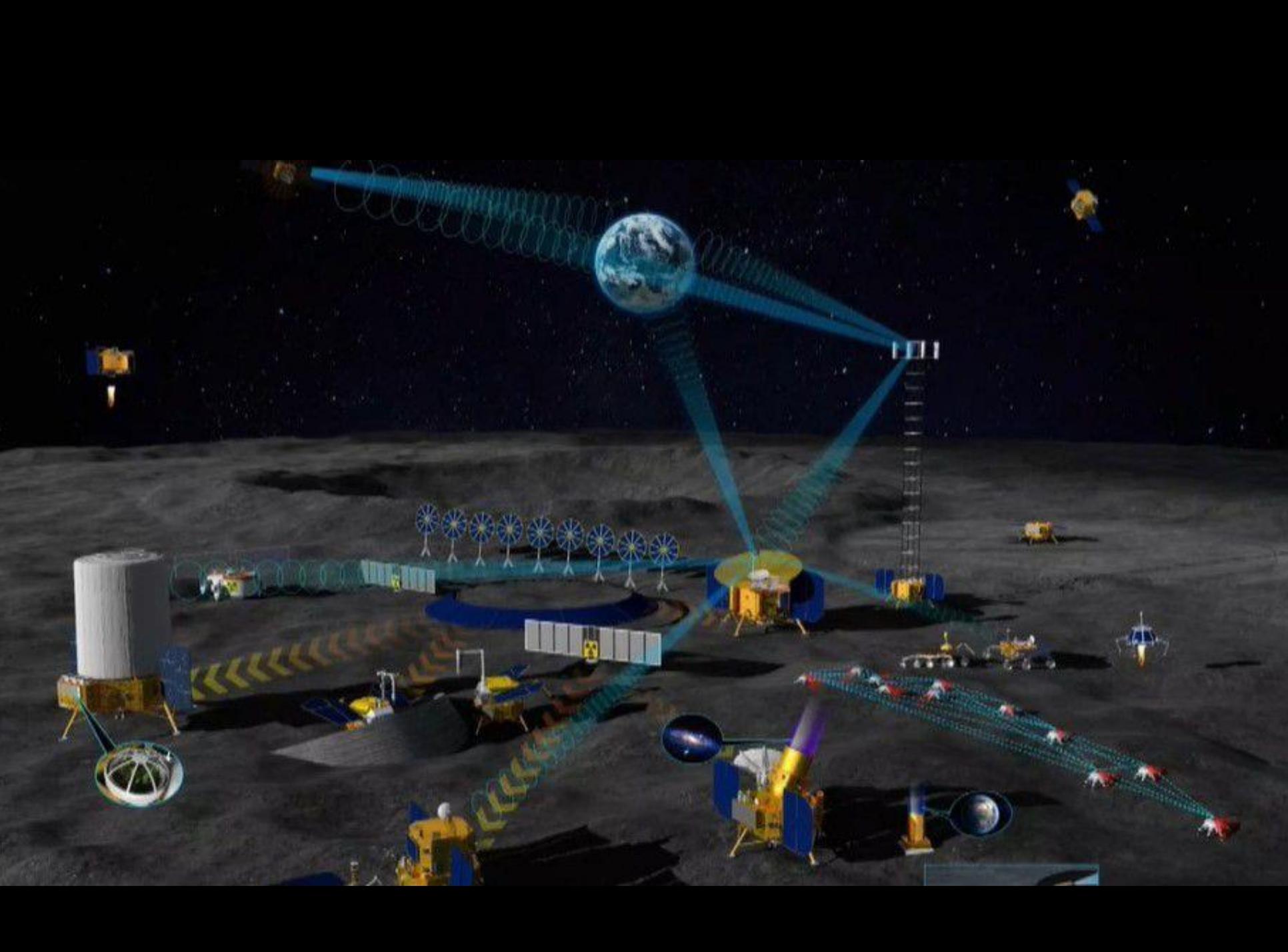


Wan Ho

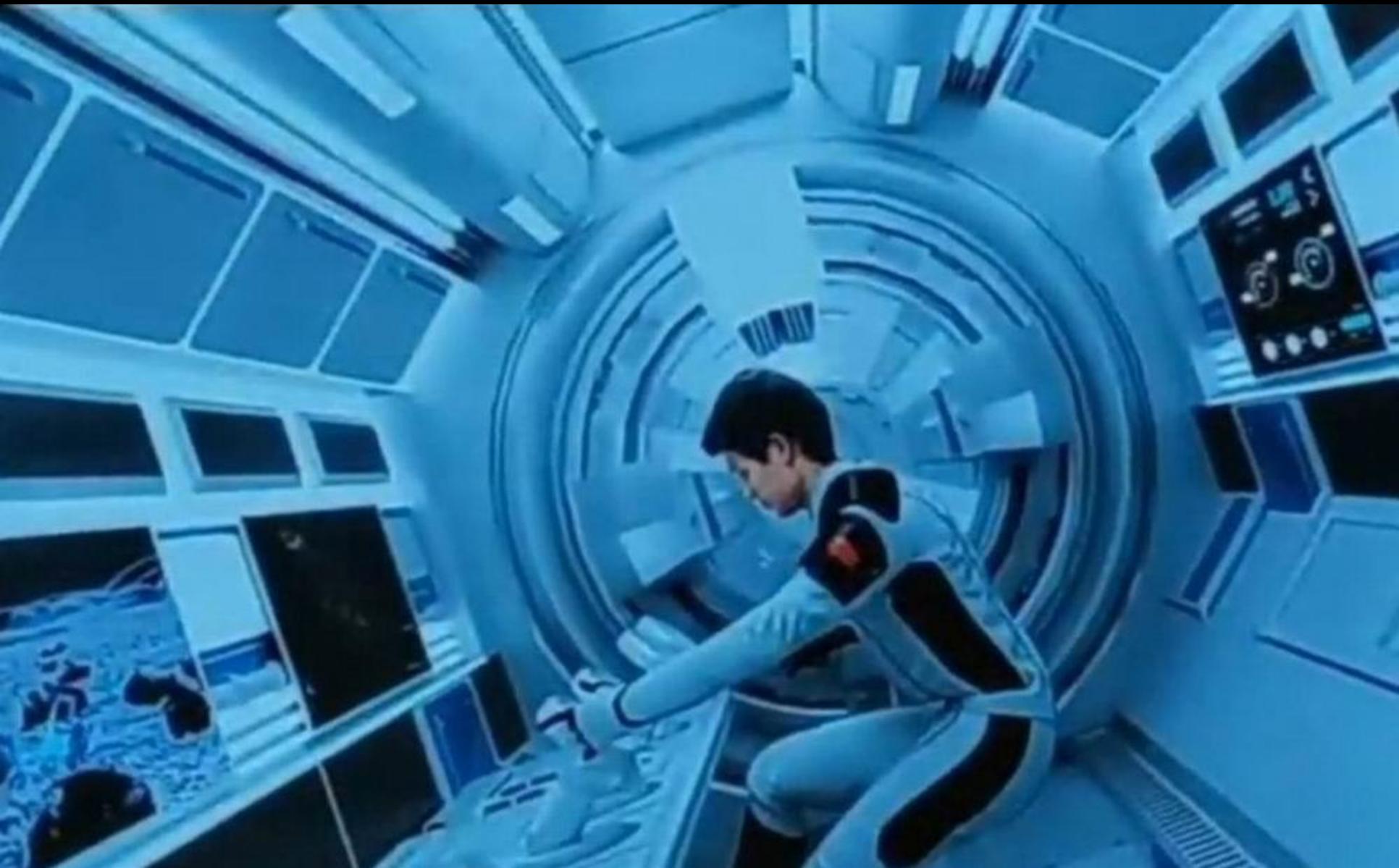












Zhuque 2 (Rumělkový pták)



Starship



Starship



Vulcan



Starship



Vulcan



New
Glenn



Starship



Vulcan



New
Glenn



Neutron



Terran R



Terran R



Sojuz 5



Terran R



Sojuz 5



ESA



Terran R



Sojuz 5



ESA



Čína







**Galactic
Energy**



iSpace



**Space
Pioneer**



Landspace



CAS Space



Expance

Galactic Energy



iSpace

星际荣耀 双曲线系列运载火箭



Landspace





朱雀

朱雀

朱雀

朱雀

LANDSPACE

LANDSPACE

LANDSPACE

LANDSPACE

LANDSPACE

朱雀
LANDSPACE
朱雀

Tianlong 1 (Nebeský drak)





Tianlong-2

Length: 35 m

Launch mass: 150 t

Maximum payload: 2 t

Propellant: Kerosene/Liquid oxygen

Launch date: April 2, 2023

Other products



Tianlong-3

Reusable liquid launch vehicle



Tianlong-3H

Reusable liquid launch vehicle



Tianlong-3M

Intercontinental human transportation system

CAS Space





中科宇航
CAS SPACE



力箭一号甲

干质量: 1.500km/SSO
湿重: 300km/LEO

力箭二号

2.2t(300km/SSO)

力箭三号

干质量: 7.4t(300km/SSO)
湿重: 6.1t(300km/SSO)

力箭三号重型

干质量: 13.8t(500km/SSO)
湿重: 10.5t(300km/SSO)

近太空可回收科学实验平台

0.1-0.8t

太空旅游飞行器

1.5-2t





ExPace



China Rocket Co.



Linkspace

New Line -1 新干线 一号

翎客航天首款小型运载火箭



全箭总长	20.1m
起飞重量	33t
最大直径	1.8m
轨道高度	250~550km
有效载荷	150~200kg
发射报价	< 3000万 (一次性)
	< 1500万 (重复使用)



OrienSpace

ORIENSPACE
东方空间

“引力”系列大中型运载火箭

东方空间面向航天发射市场全力打造的大中型系列化运载火箭品牌，整体定位于快速增长的各类大中型发射需求，具有运载能力大、响应速度快、捆绑构型多样、海陆兼容发射等技术特点，立志于打造为全球顶尖的运载火箭系列。

2023年达到商业化服务能力 → 2025年达到国内一流运载能力水平 → 2030年达到国际一流运载能力，实现载人空间探索



引力-1号 Gravity-1/TL-1



引力-2号

Gravity-05/TL-05



Gravity-2/TL-2



引力-3号 Gravity-3/TL-3

一米参照物比例模型 | 1.5m



原力-85

海平面推力 700t
真空推力 600t
推重比 270%
推量比 150
推结构 液氧煤油

核心技术

超净级煤油

国际领先大推力、超净级煤油工艺研发

大推力推力调节

825-1000大推力推力调节技术，实现推力大范围、性能连续调节

高可靠验证

液氧煤油、燃气发生器等关键技术验证，性能可靠验证，高可靠验证

高成本

低成本设计、低成本设计、低成本设计、低成本设计、低成本设计

Rocket Group

达尔文一号 小型液发运载火箭

构型	小型/基础型	中型/CBC构型
运载能力	150kg@SSO 270kg@LEO	1.2t@SSO 2t@LEO
载荷空间	直径1.8m 高2.6m	直径2.7m 高3.9m
火箭构型	2,25m基本型	2.25mCBC构型
全箭总长	24.1m	28.6m
整流罩直径	2.25m	3.35m
起飞质量	42.52t	115t
起飞推力	500kN	1500kN
一级	5台10吨级 液氧甲烷发动机	15台10吨级 液氧甲烷发动机
二级	单台10吨级 真空版液氧甲烷 发动机	单台10吨级 真空版液氧甲烷 发动机
首飞时间	2022年底	2024年

ROCKET II

Zhongke Aerospace



中科宇航
CAS SPACE



ZK-1A
2t/LEO



ZK-1B
2.5t/LEO



ZK-1
3.5t/LEO



ZK-2
4t/LEO



ZK-3
1.5t/LEO



ZK-4A
4t/LEO



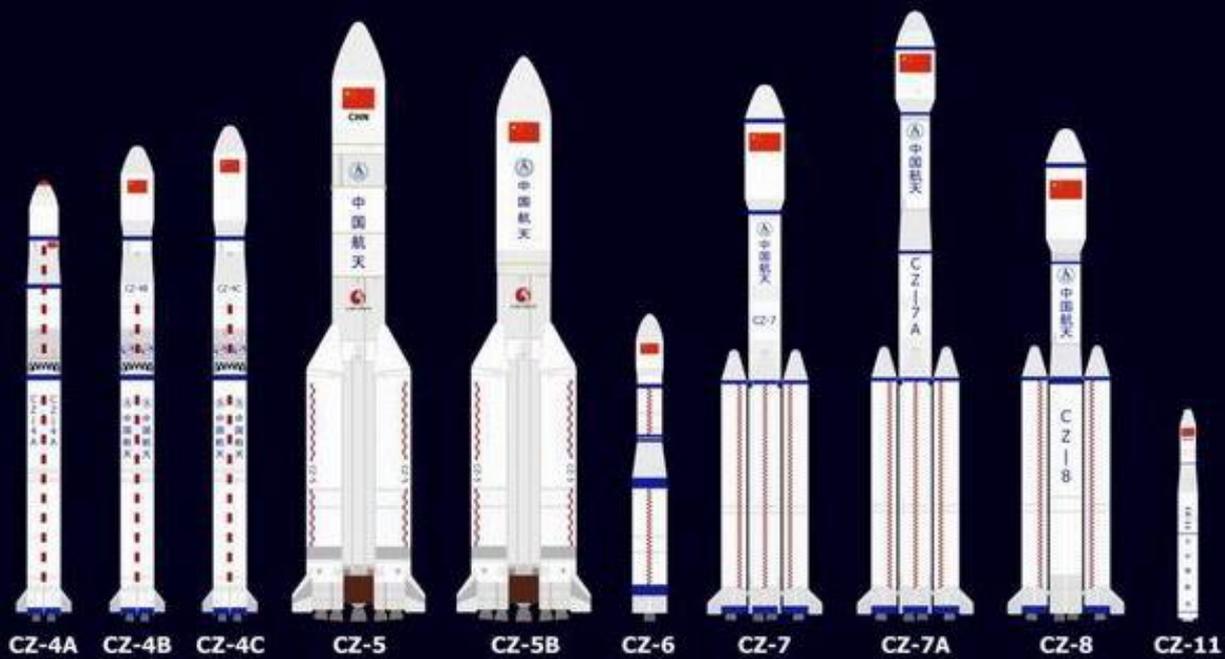
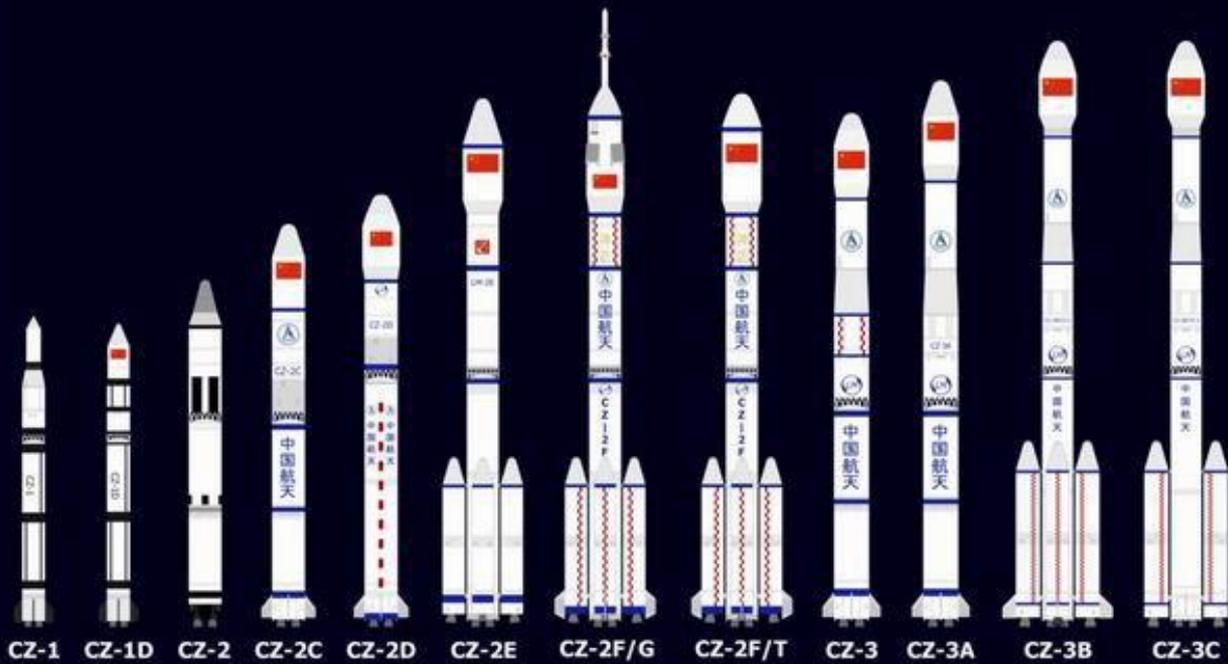
ZK-4
15t/LEO



ZK-5
1t/近太空探测

Deep Blue Aerospace





Nedostatek místa

















Džibutsko





Raketoplán „Made in China“



„Čínská vícenásobně
použitelná kosmická loď“



4. září 2020



6. září 2020



**Support
vehicles**



**Possible
space plane**



4. srpna 2022

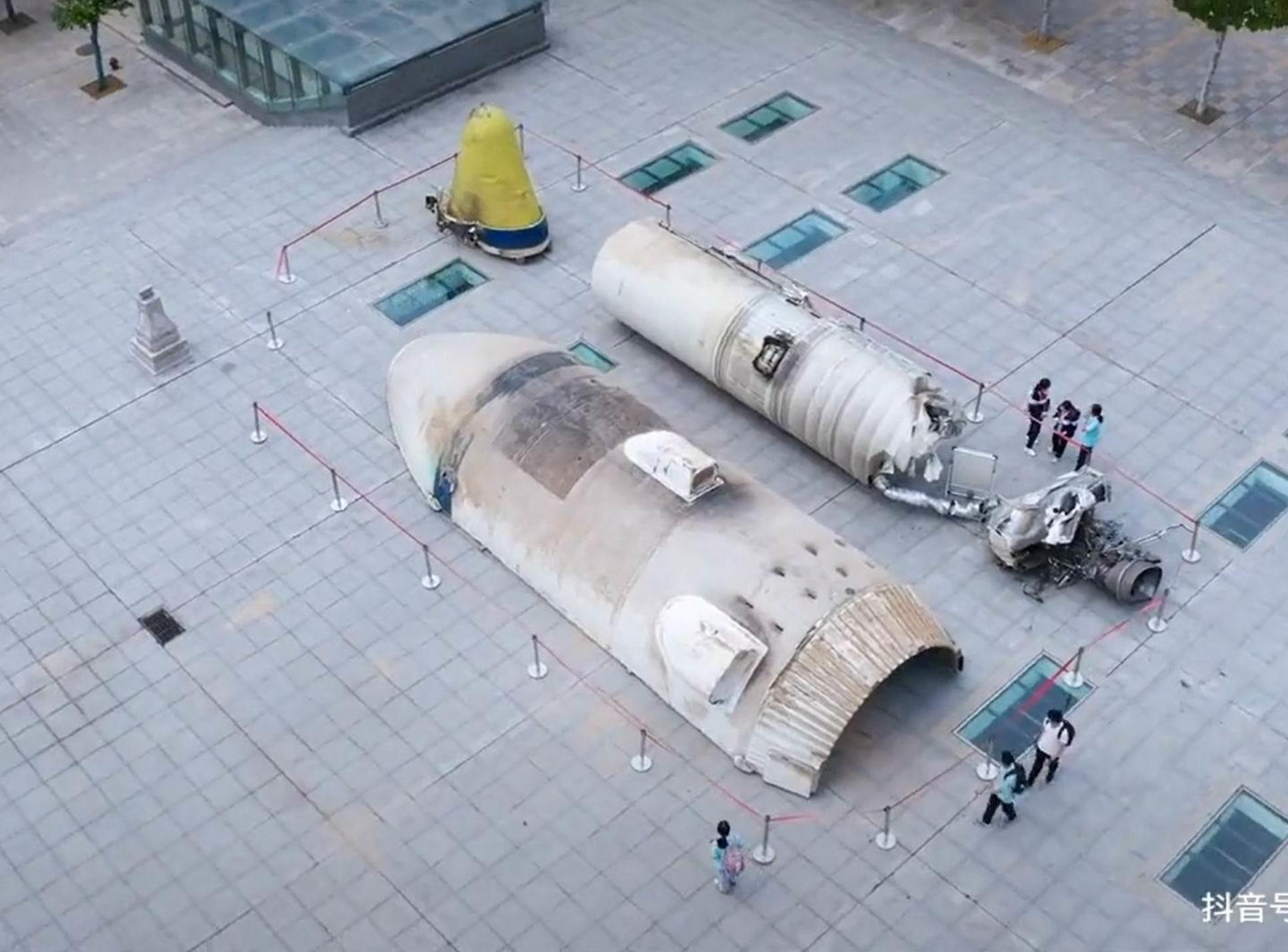


2022年8月5日我国发射的
某型号运载火箭助推器、整流罩残骸

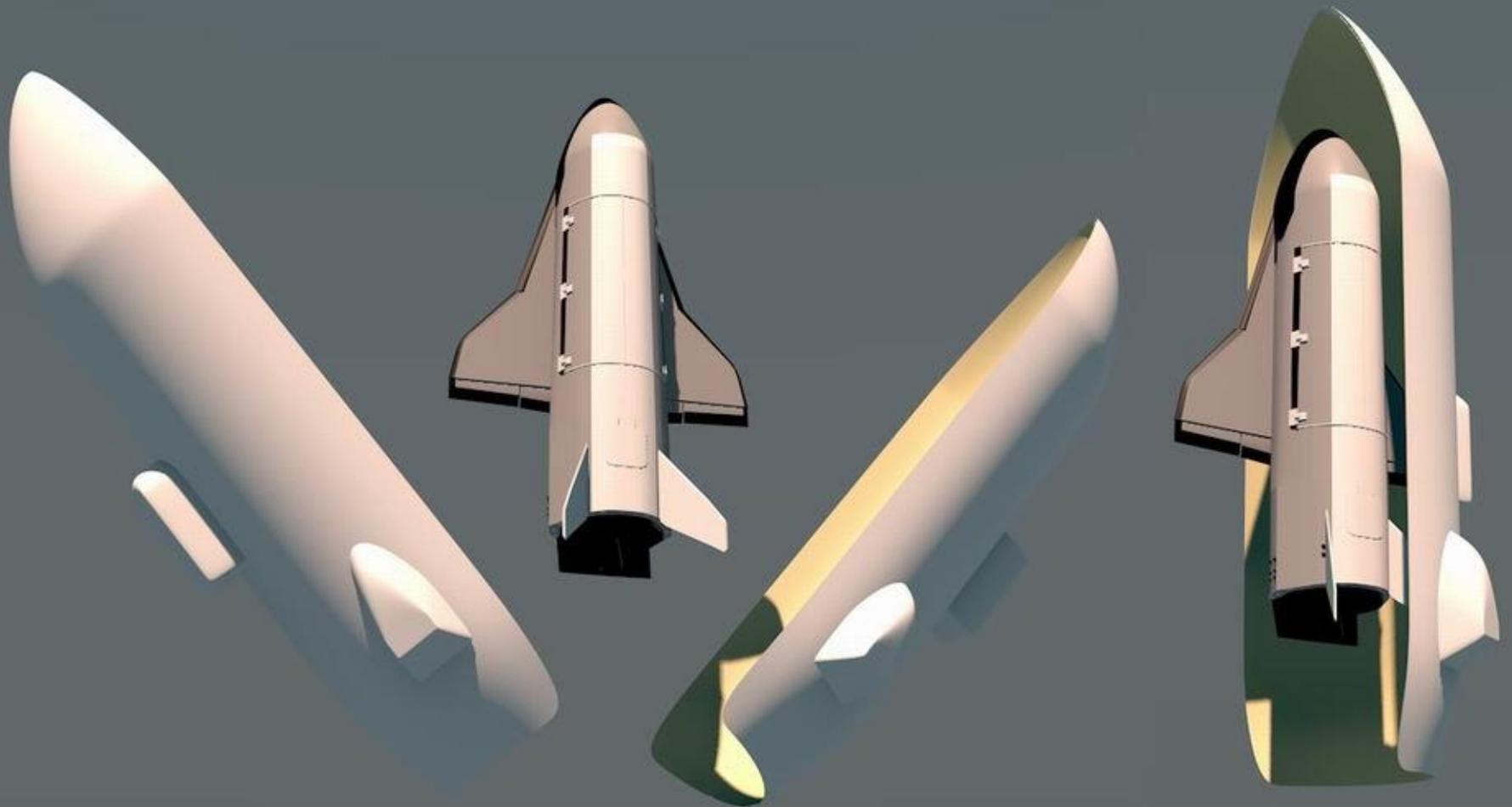
抖音

抖音号: hnsjydyzx



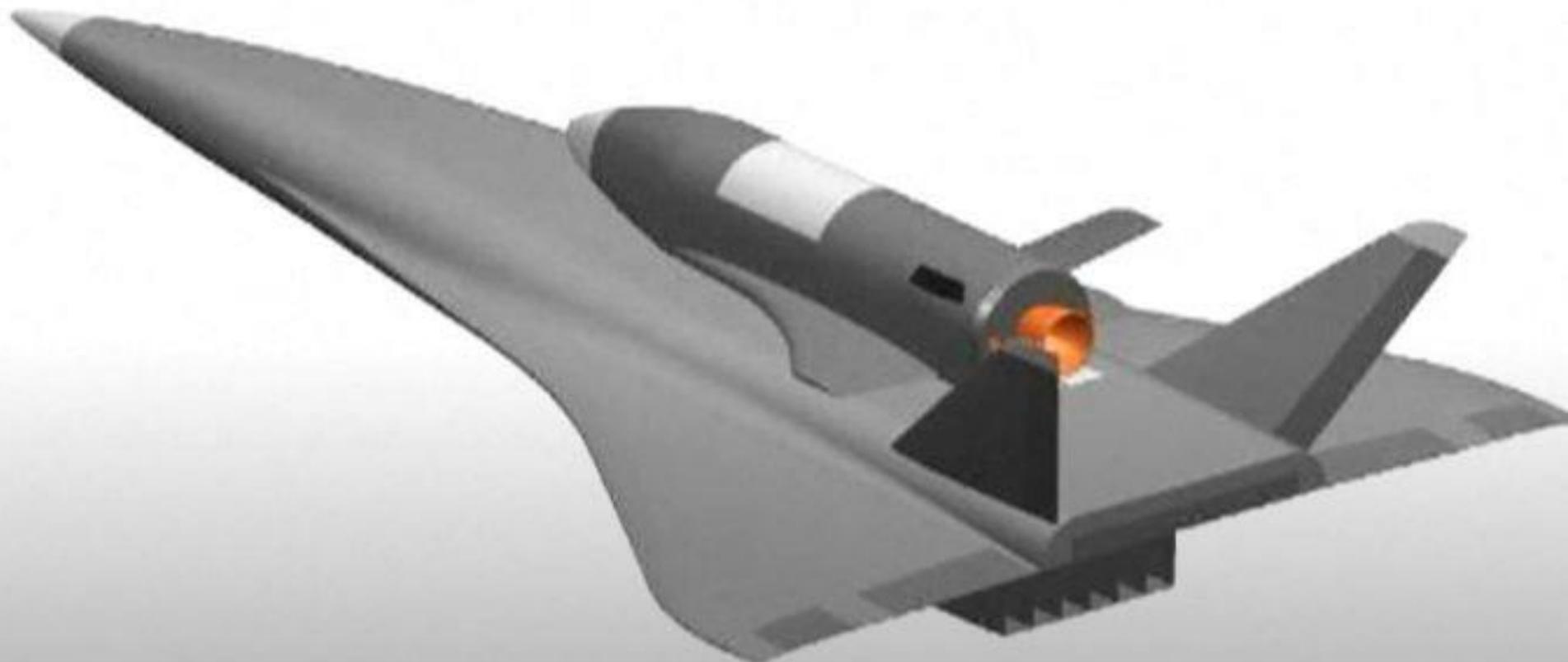


8. května 2023

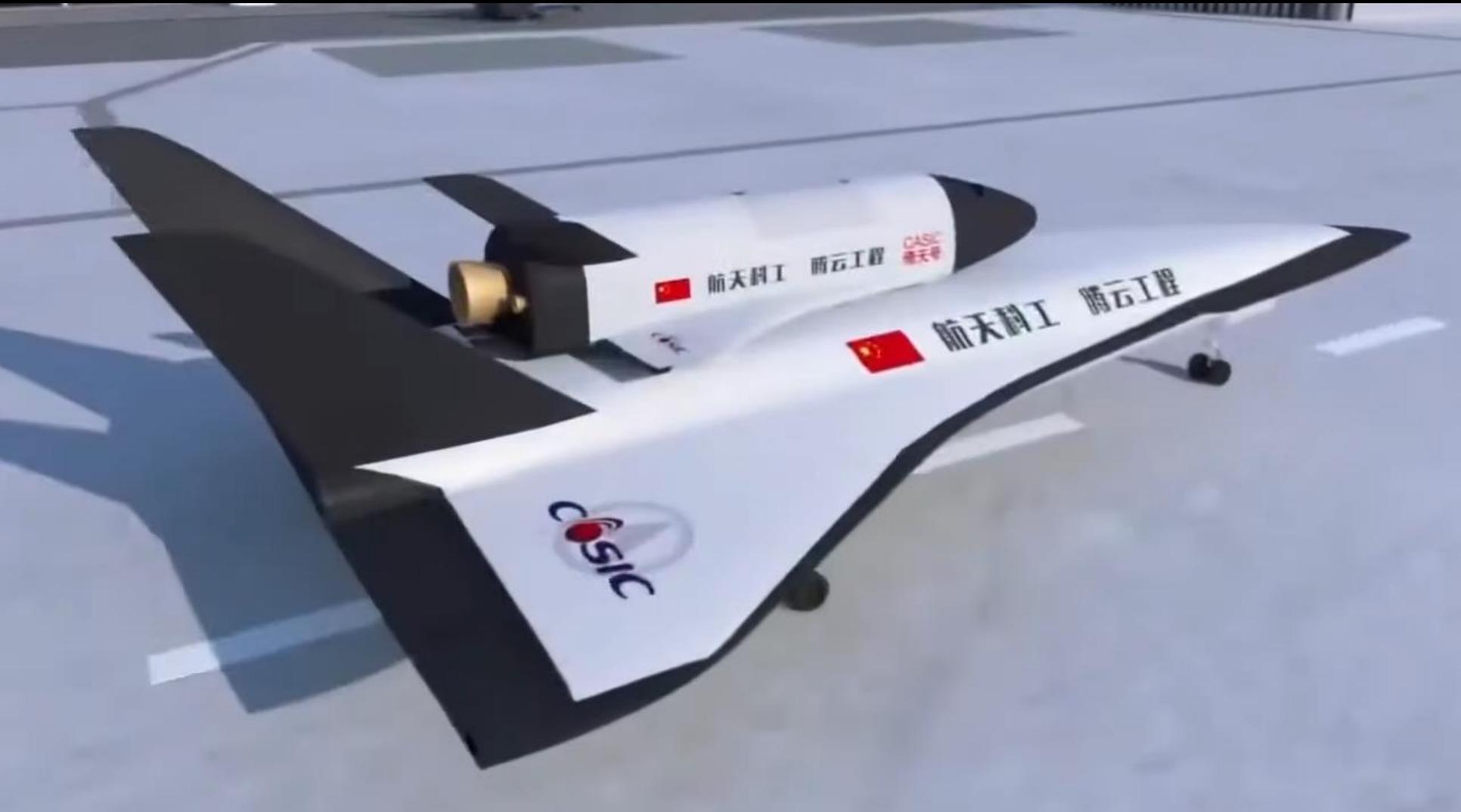


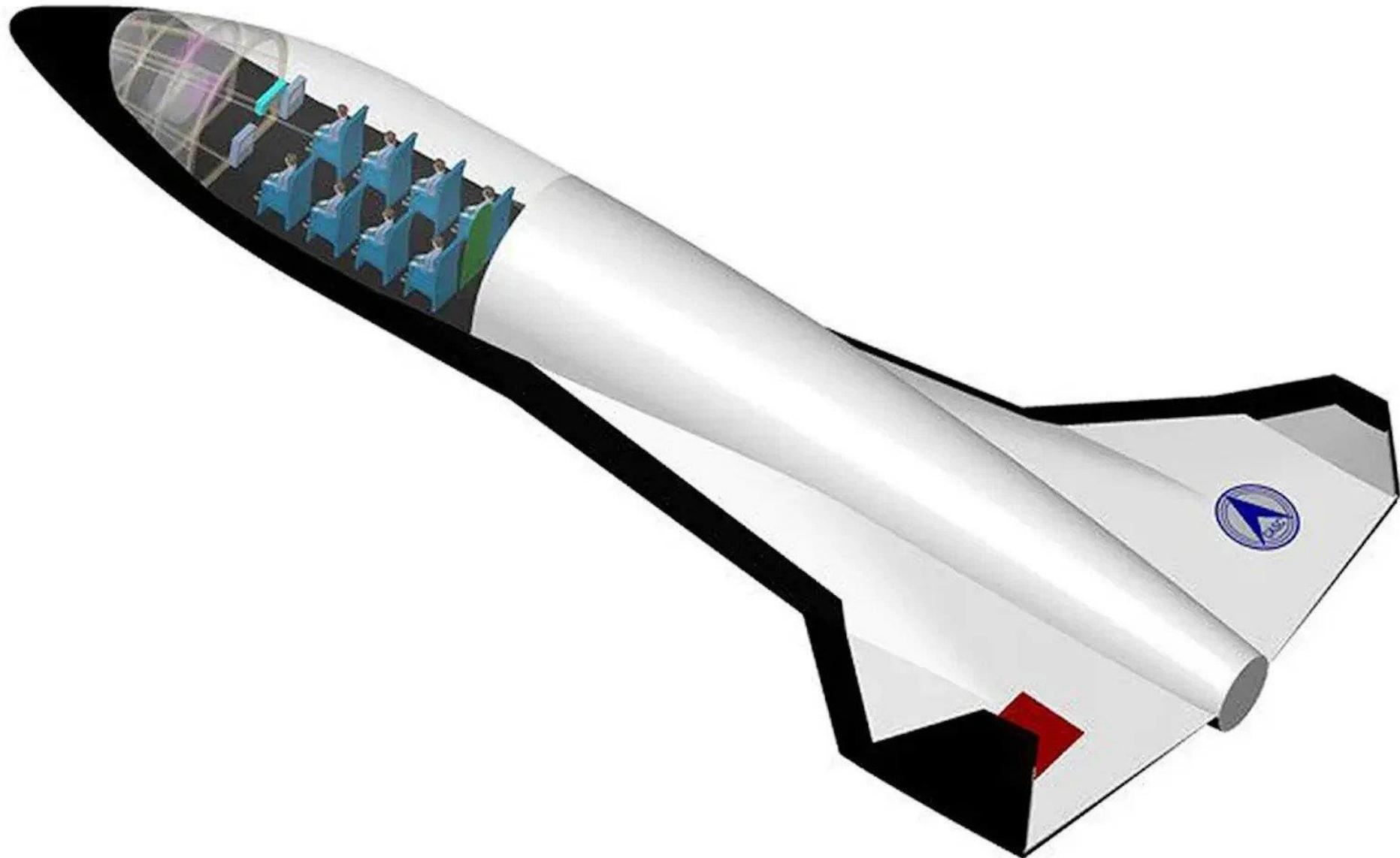
Shenlong (Božský drak)





Tengyun (Jezdec v oblacích)





Megakonstelace







GEEELY

时空道宇

中国航天科技集团

中国航天科技集团

中国航天科技集团

中国航天科技集团

中国航天科技集团

中国航天科技集团

中国航天科技集团

Geely Future Mobility Constellation
72 do 2025
druhá fáze 168

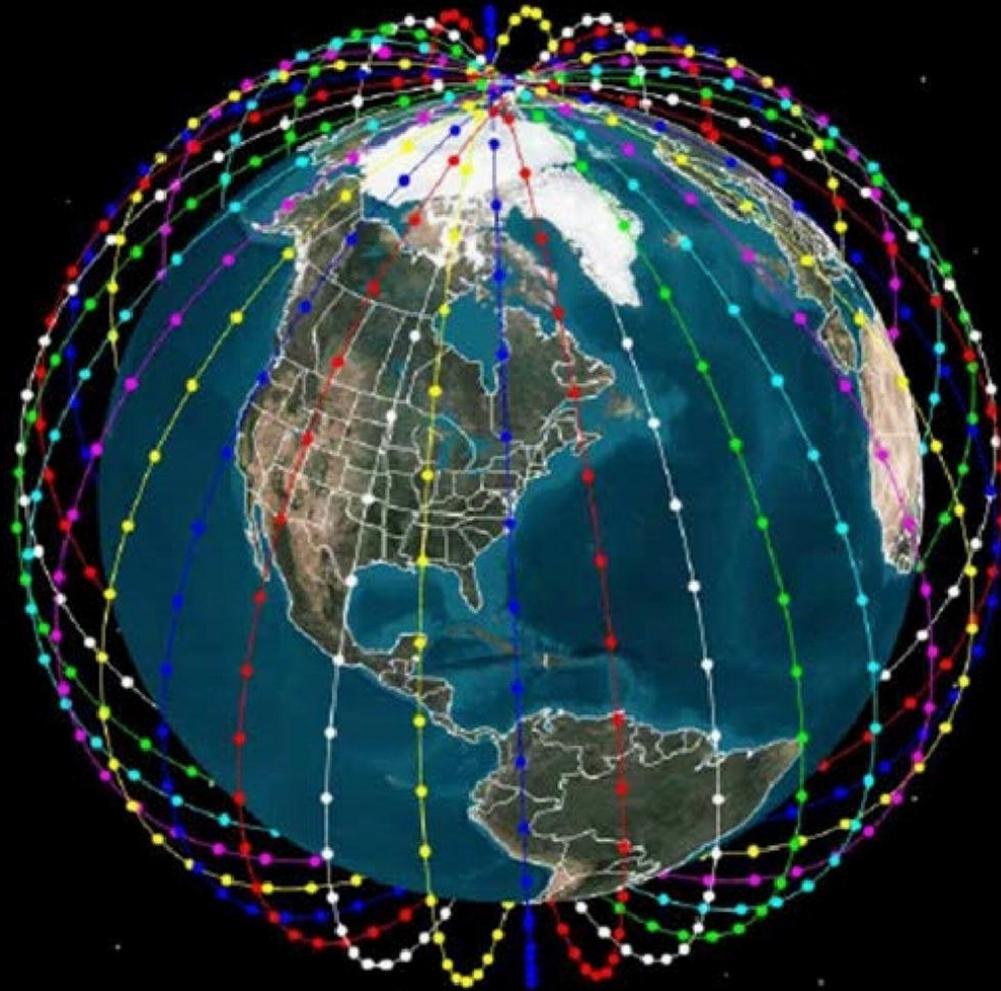


Geely Satellite Factory

(navigace, internet, komunikace V2X,
další služby...)

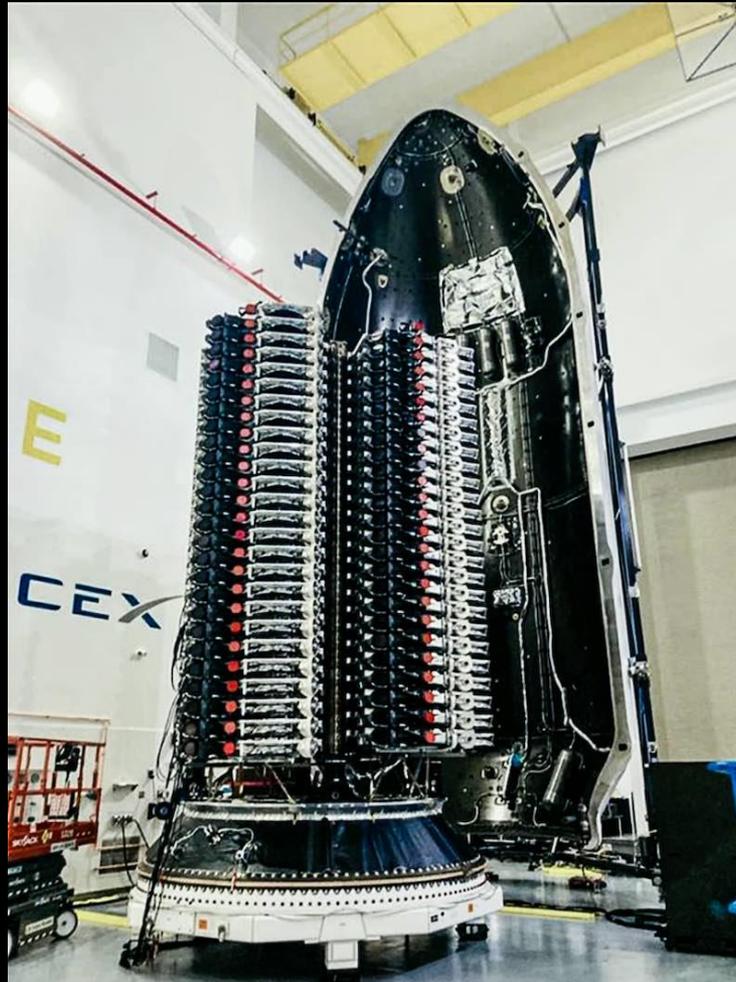


Guowang (národní síť)



12992 družic

G60 Starlink



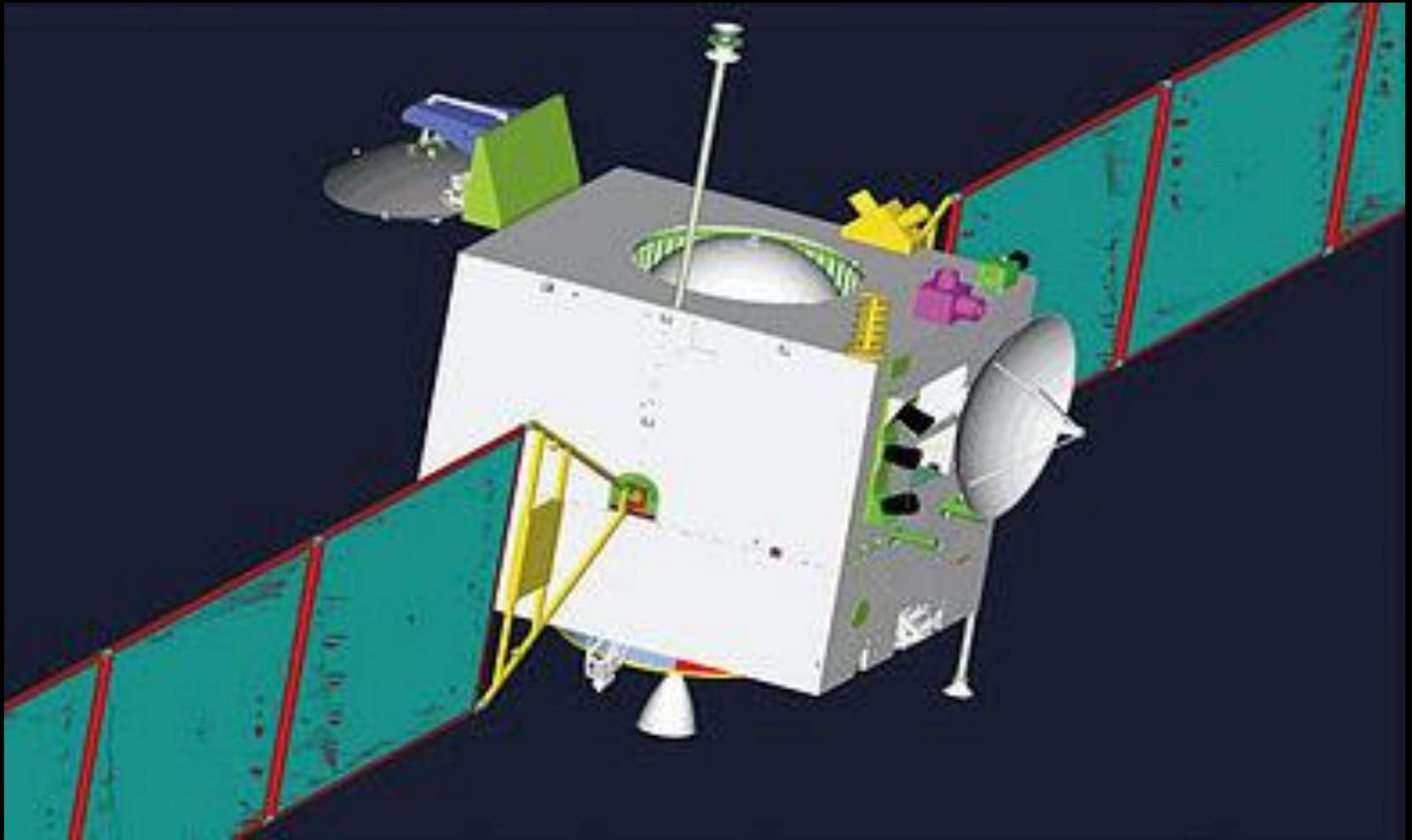
1296 družic

Lunární sondy



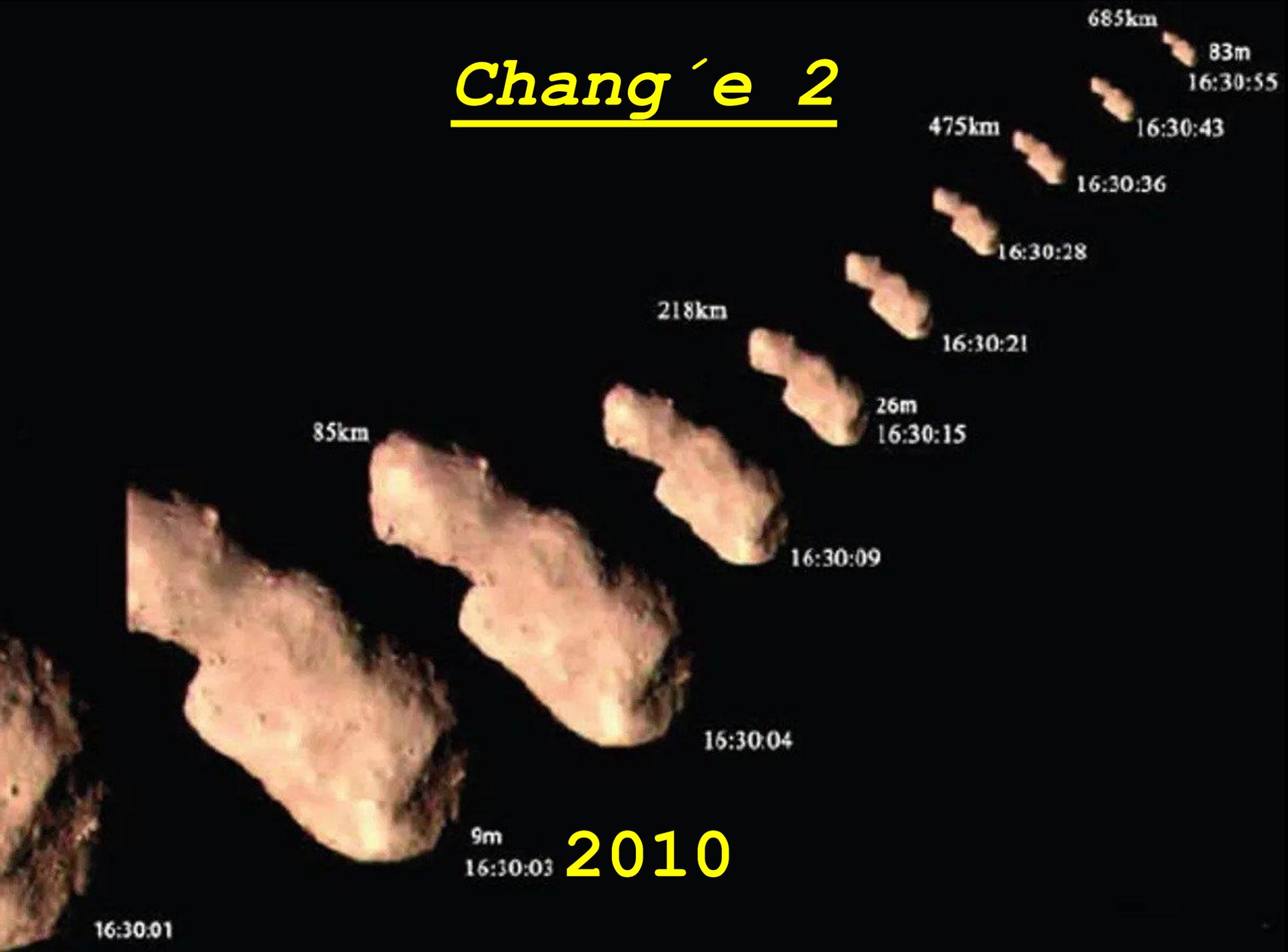
中国探月
CLEP

Chang'e 1



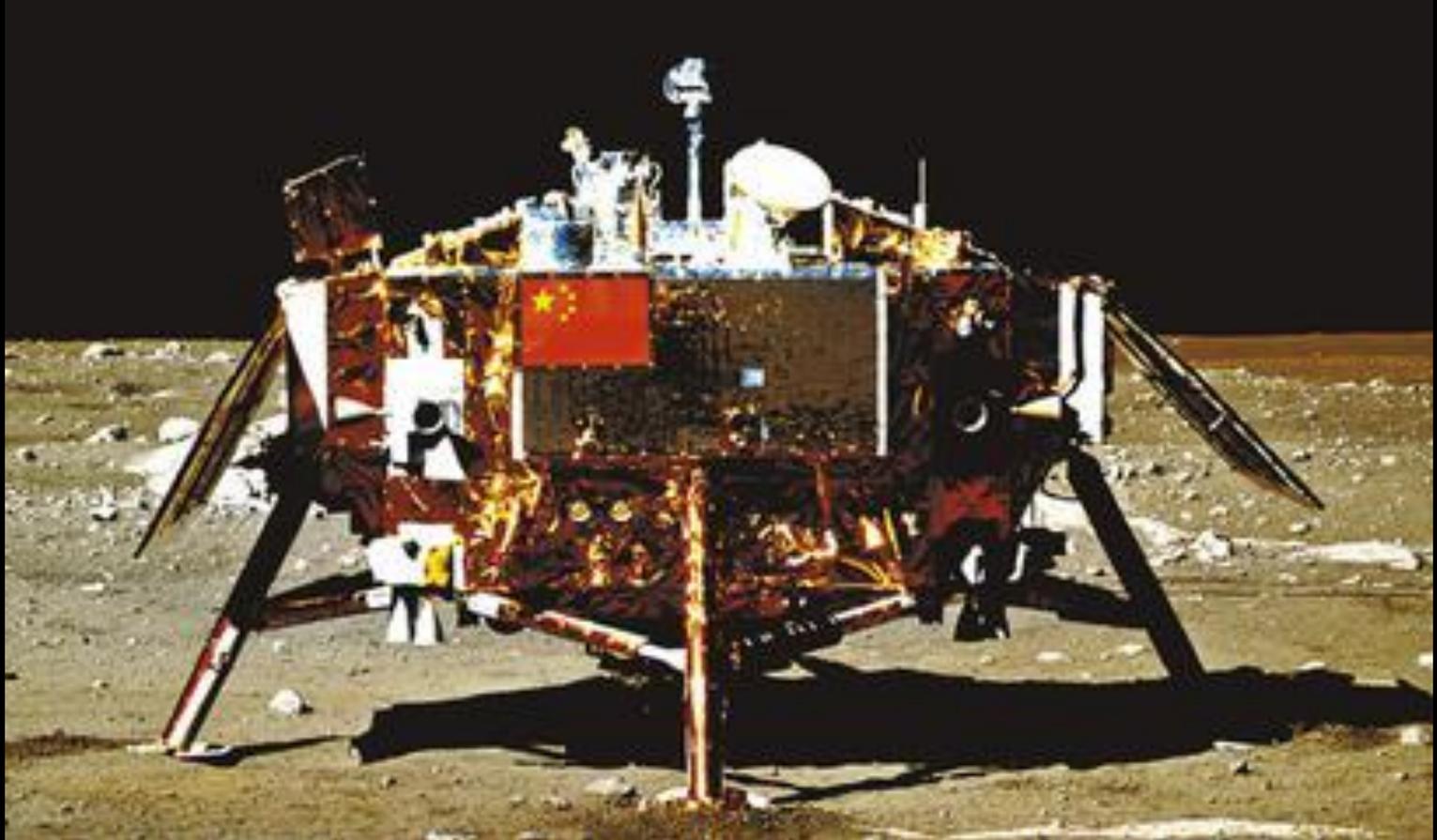
2007

Chang'e 2



2010

Chang'e 3



2013

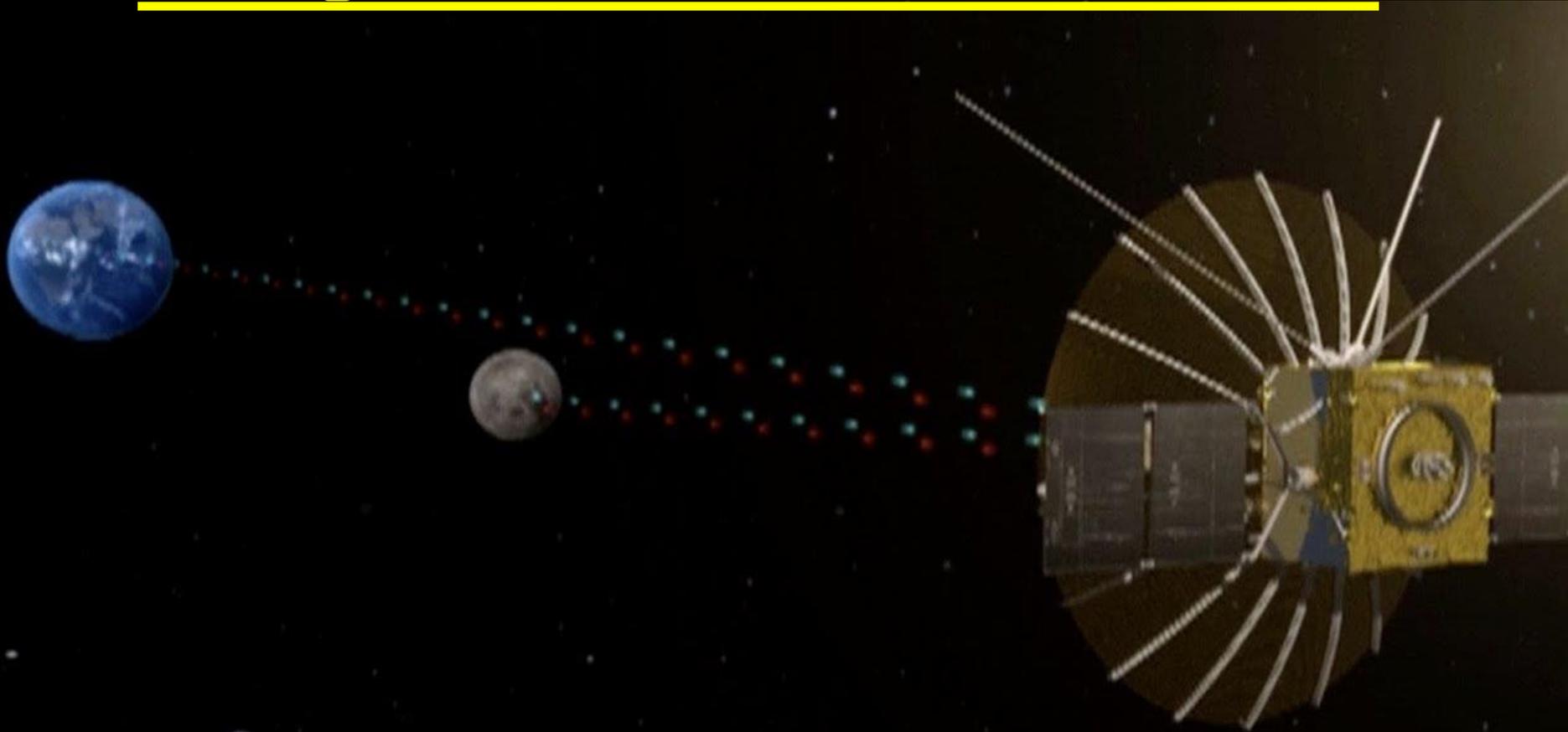
Chang'e 5-T1



2014

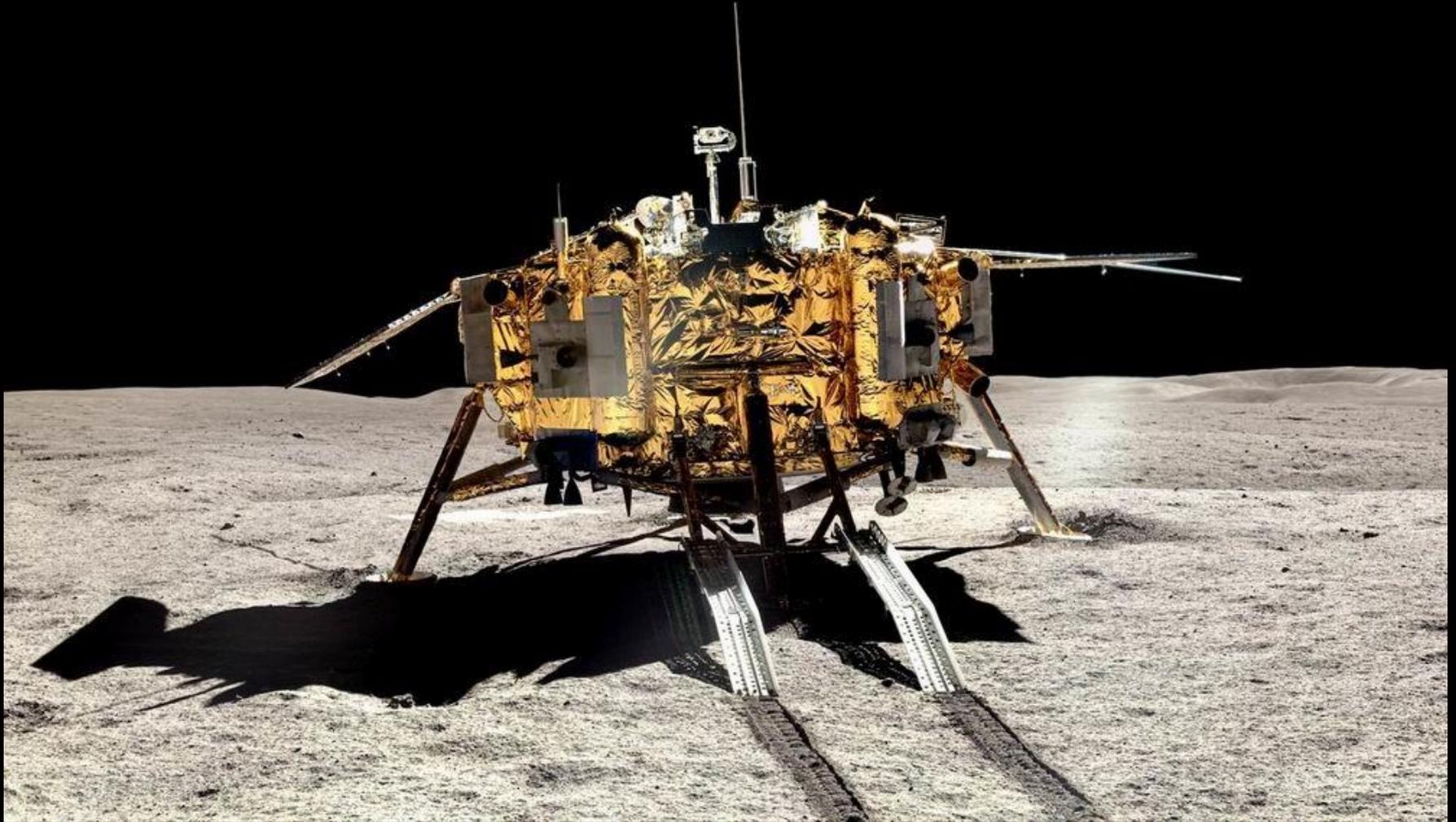


Queqiao 1 (Stračí most)



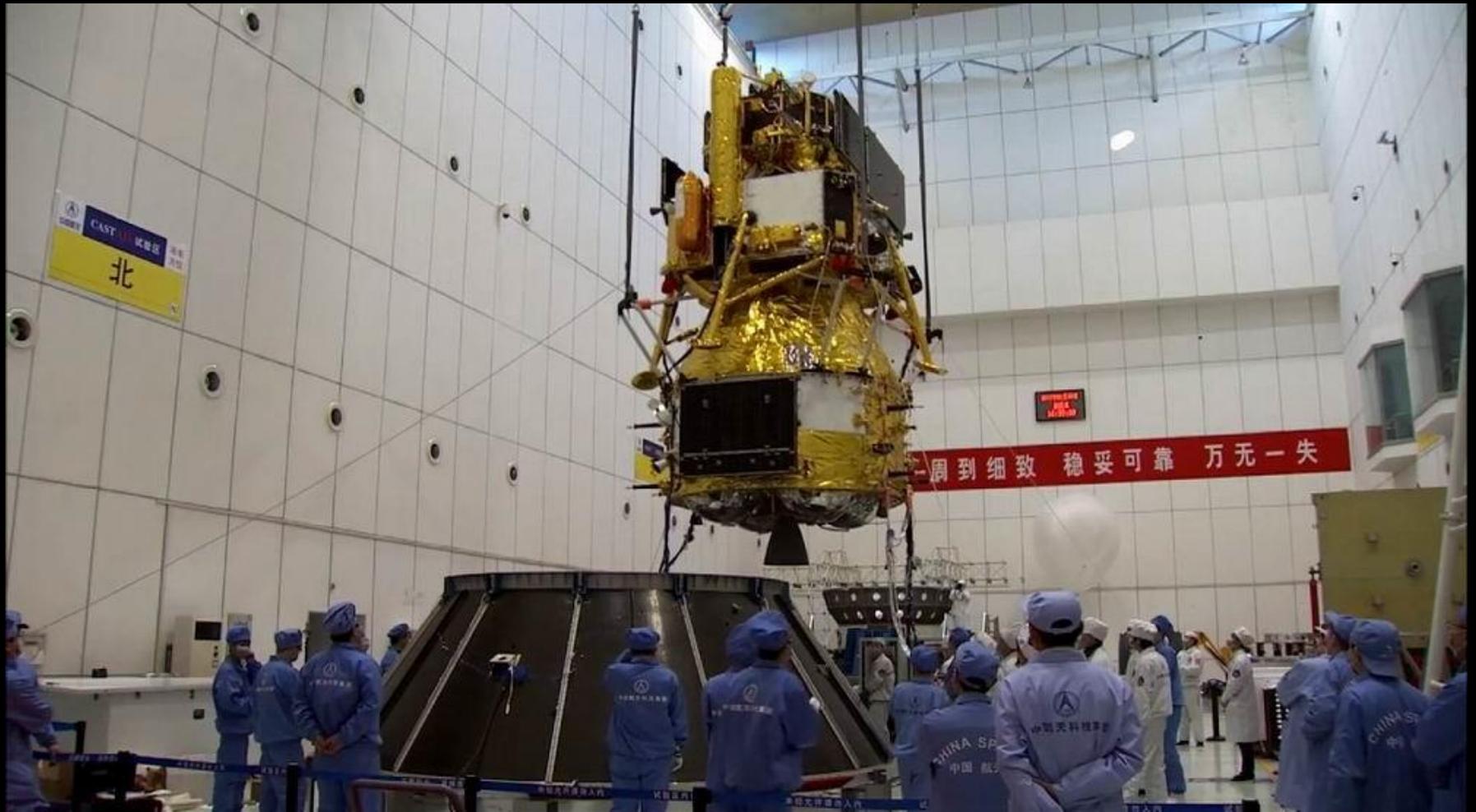
2018

Chang'e 4



2018

Chang'e 5

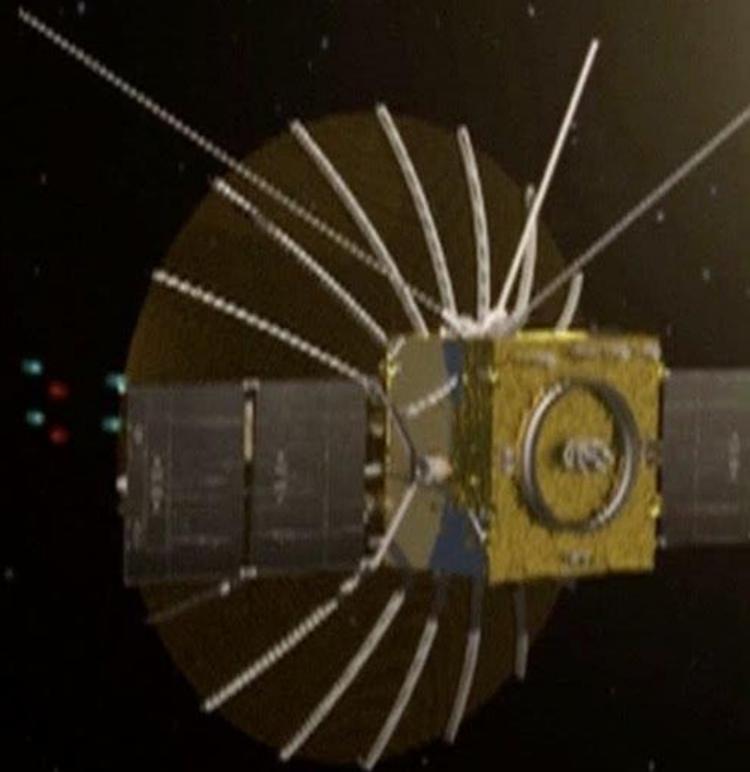


2020

1731 g



Queqiao 2



Březen 2024

Chang'e 6

Prospect of International Cooperation Opportunities



CE-6 International Cooperation

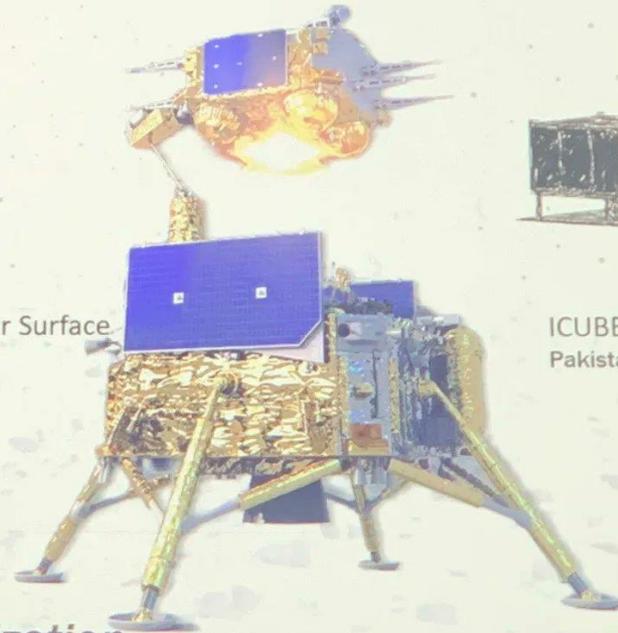
INstrument for landing-Roving laser
Retroreflector Investigations
Italy



Negative Ions on Lunar Surface
ESA/Sweden



Detection of Outgassing RadoN
France



ICUBE-Q Cubesat
Pakistan

Technical interfaces is under finalization.

Květen 2024



Chang'e 7

China's Lunar Exploration Program

CE-7 Mission Brief

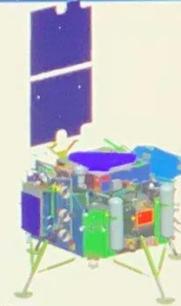


Objective

to conduct detailed investigation (landing, roving, flying-over) of resources and environment near lunar south pole

Composition

- An orbiter, a lander, a rover and a hopper
- Queqiao-2 relay satellite



Launch schedule

- CE-7 Probe: to be launched in about 2026, by CZ-5 rocket in the WSL
- Queqiao-2: to be launched in about 2024

Landing area

above 85° S



10

2026



„Létající detektor“



Chang'e 8

China's Lunar Exploration Program

CE-8 Mission Brief

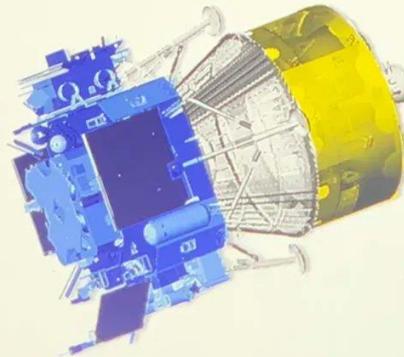
Composition

A propulsion module, a lander, a rover and a hopper



Objective

- To manifest the feasibility of lunar resource utilization
- To build the basic model of Lunar Research Station



Launch schedule

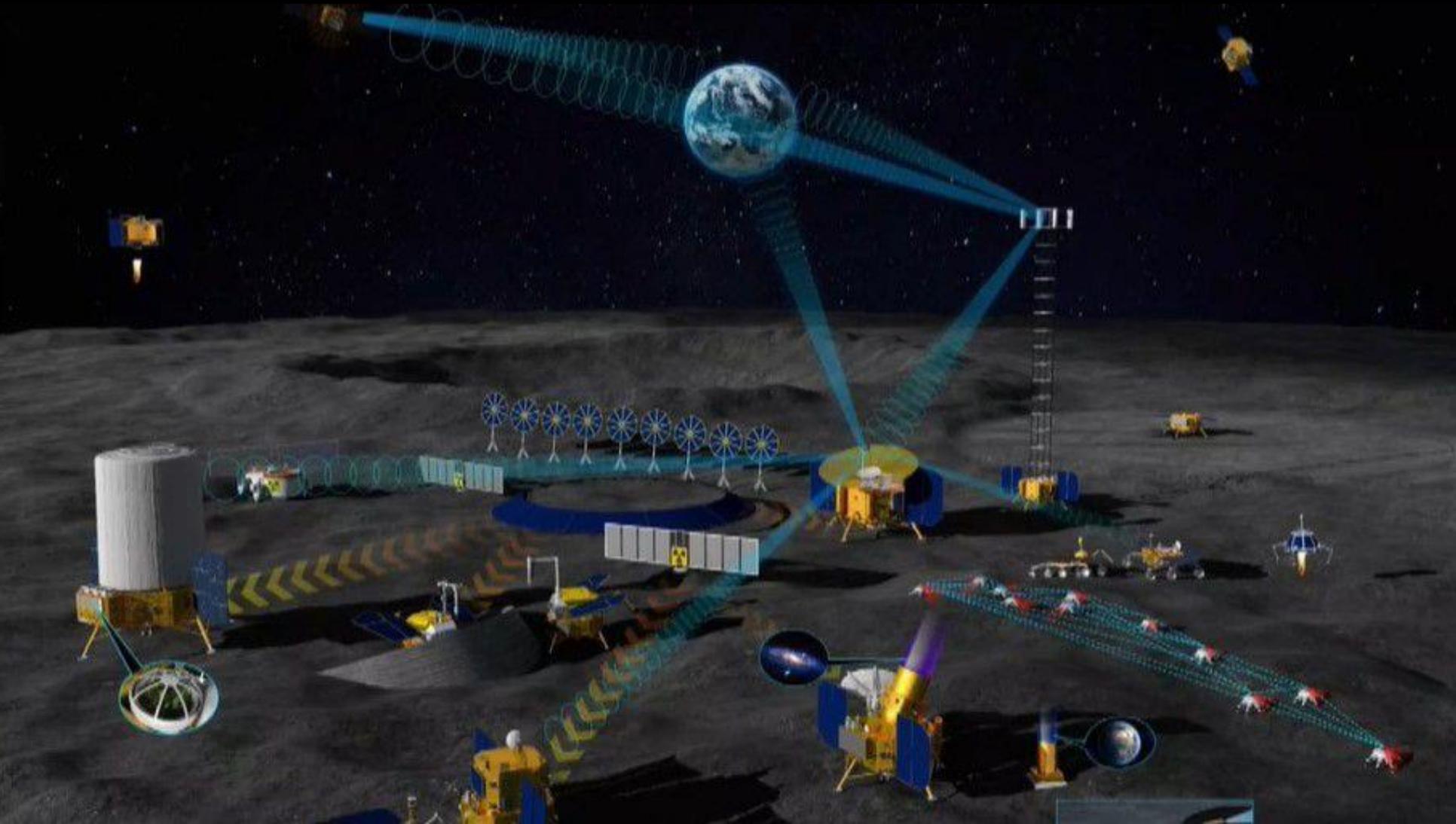
To be launched before 2030, by CZ-5 rocket in the WSLs

11

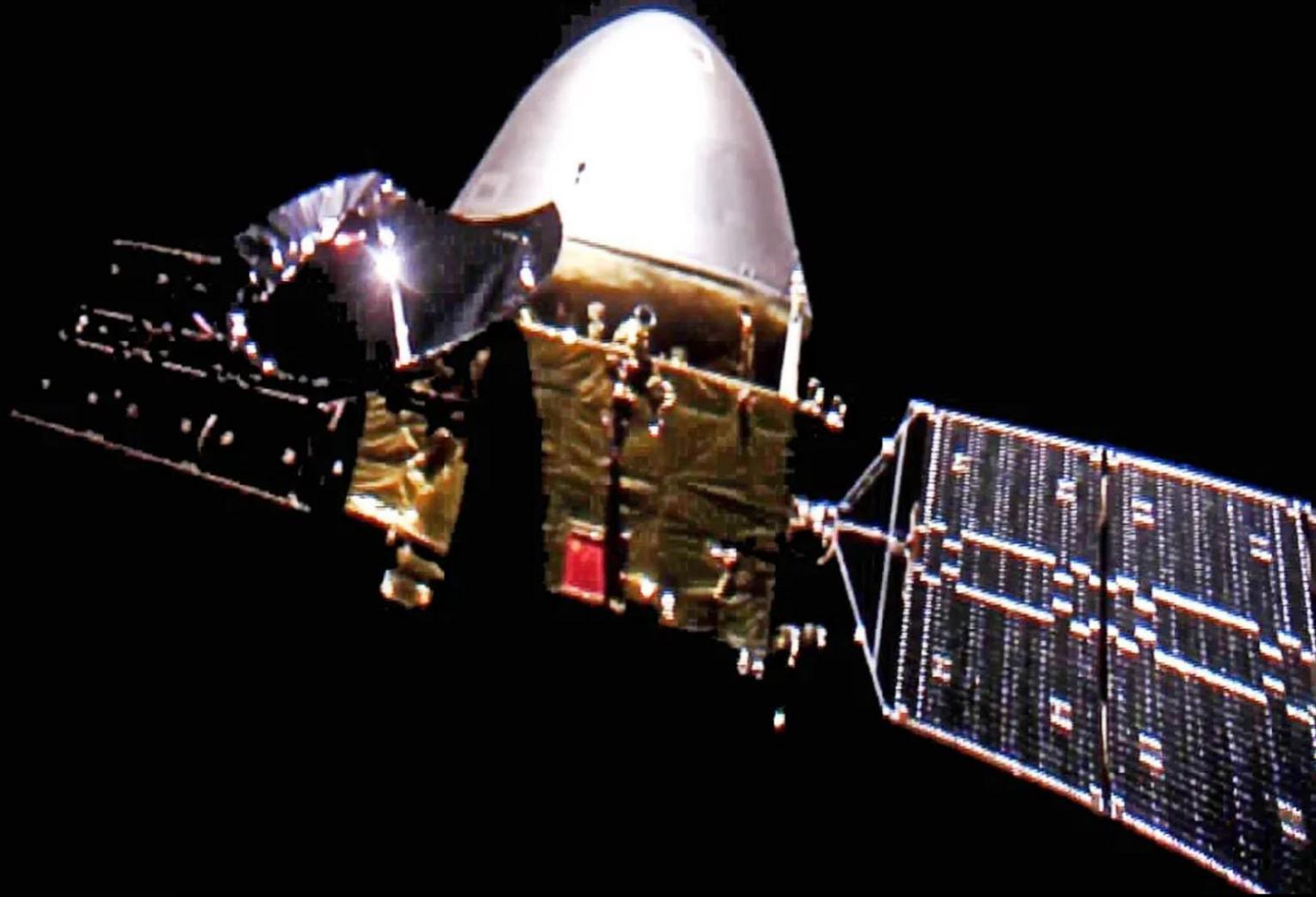
2028

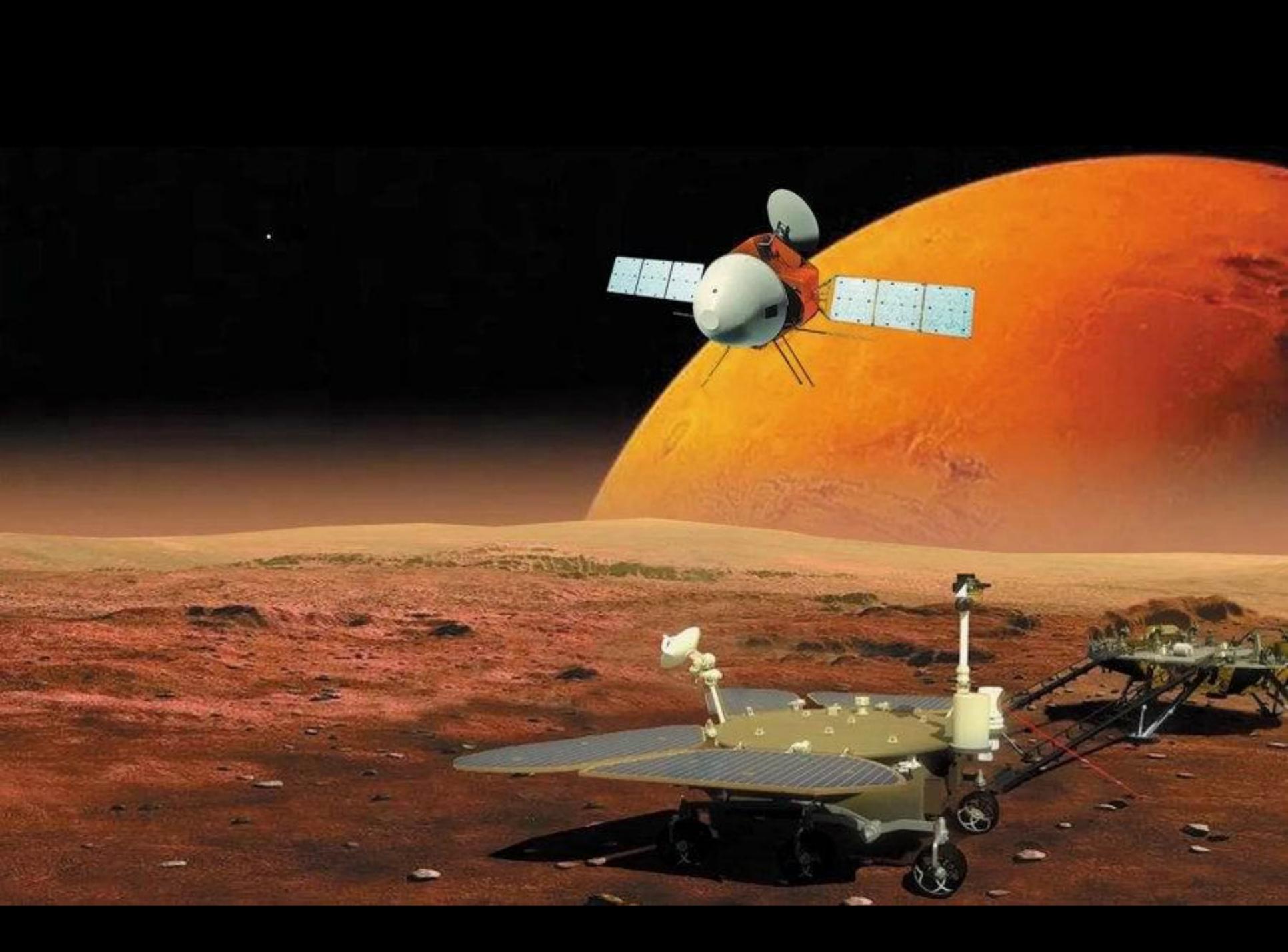


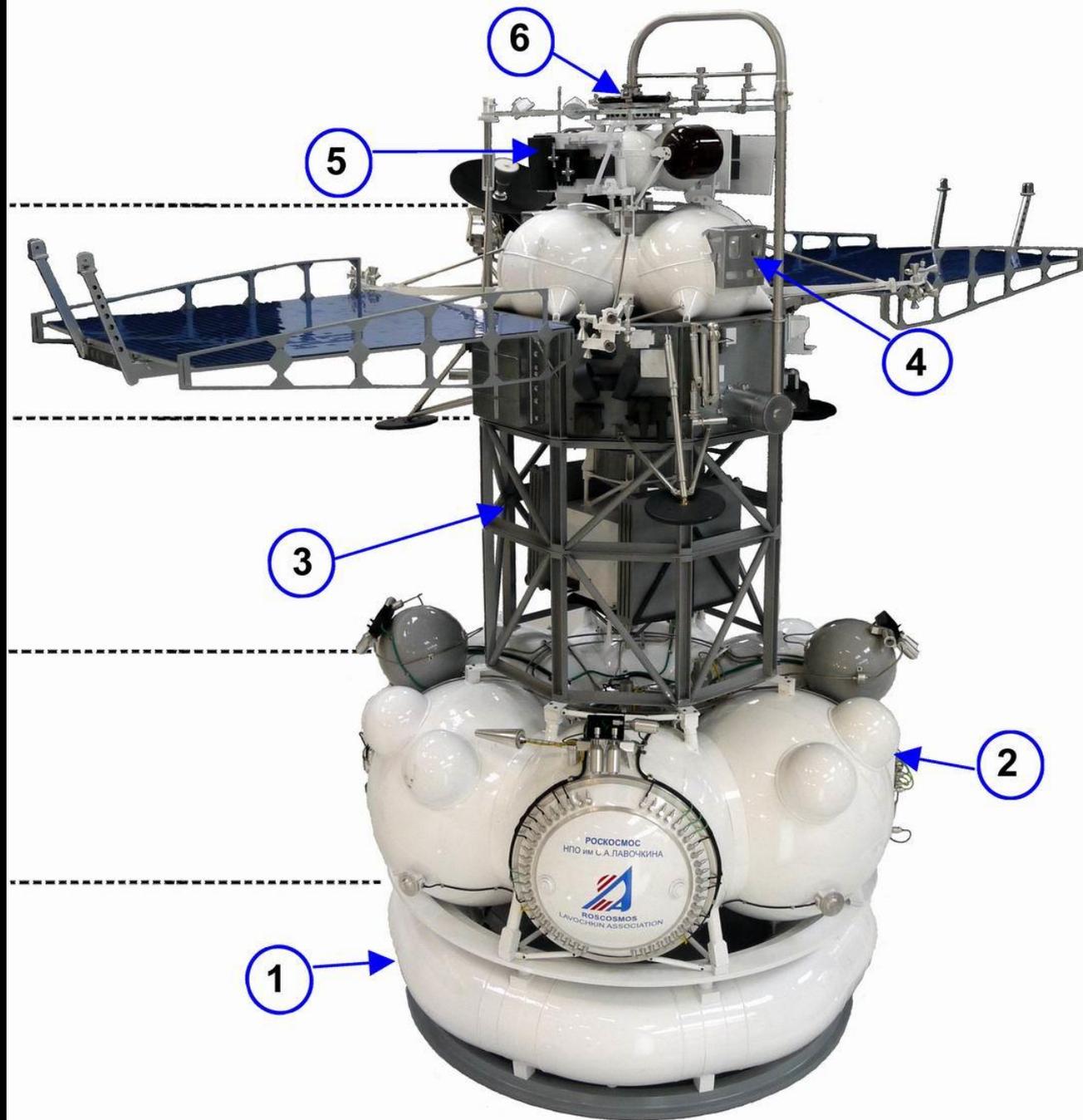
International Lunar Research Station



Mars



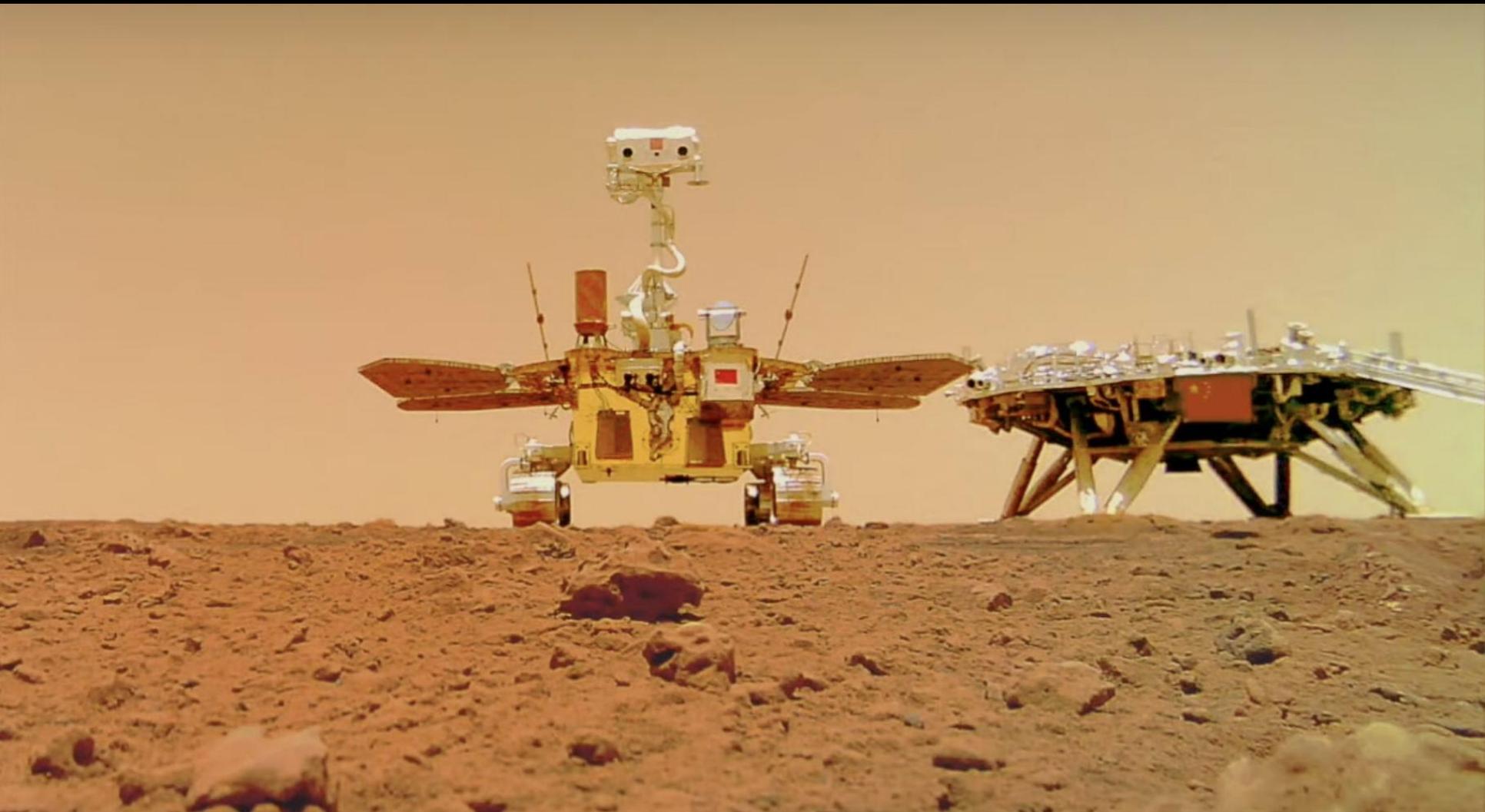




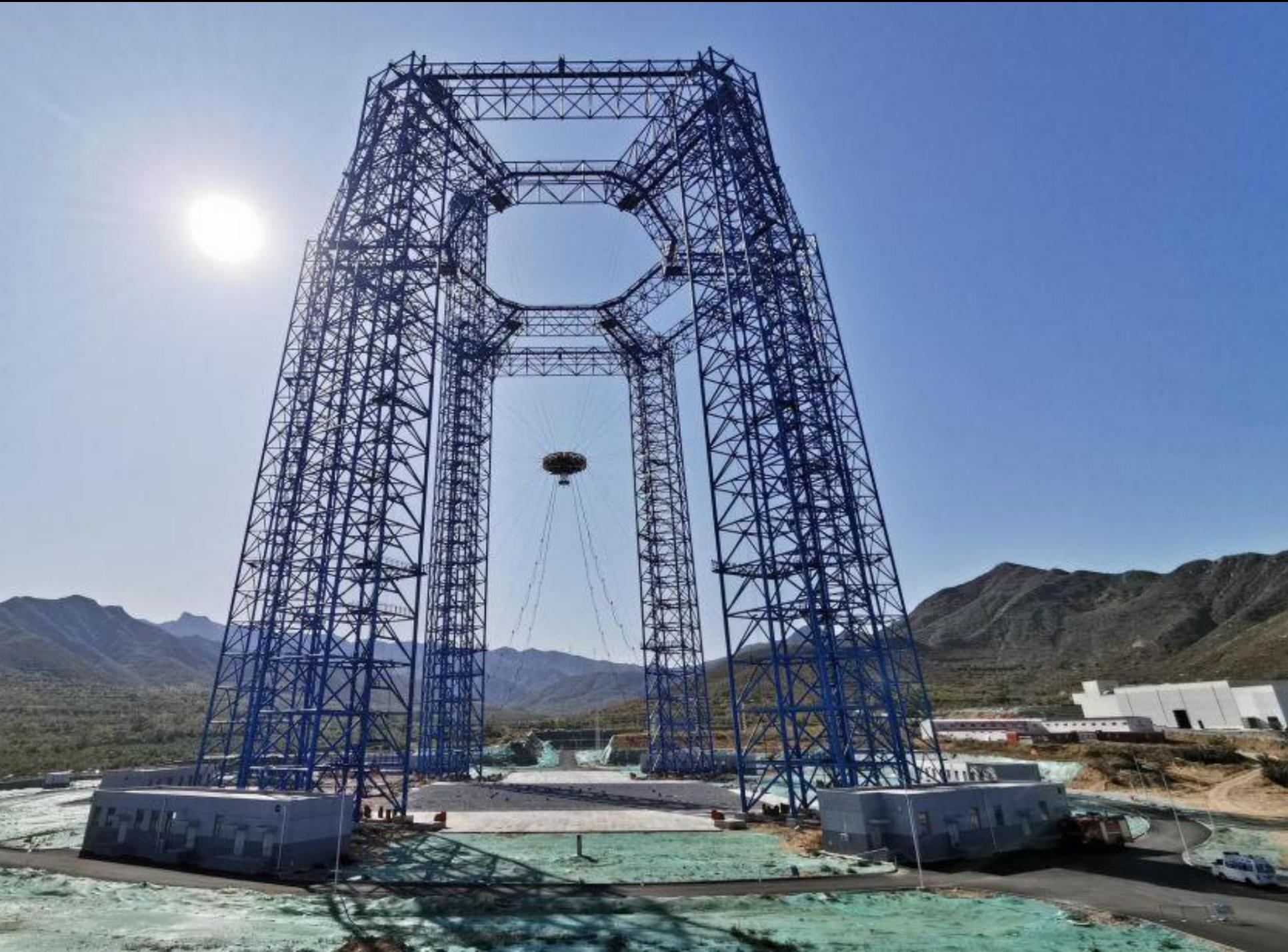
© M. Carroll



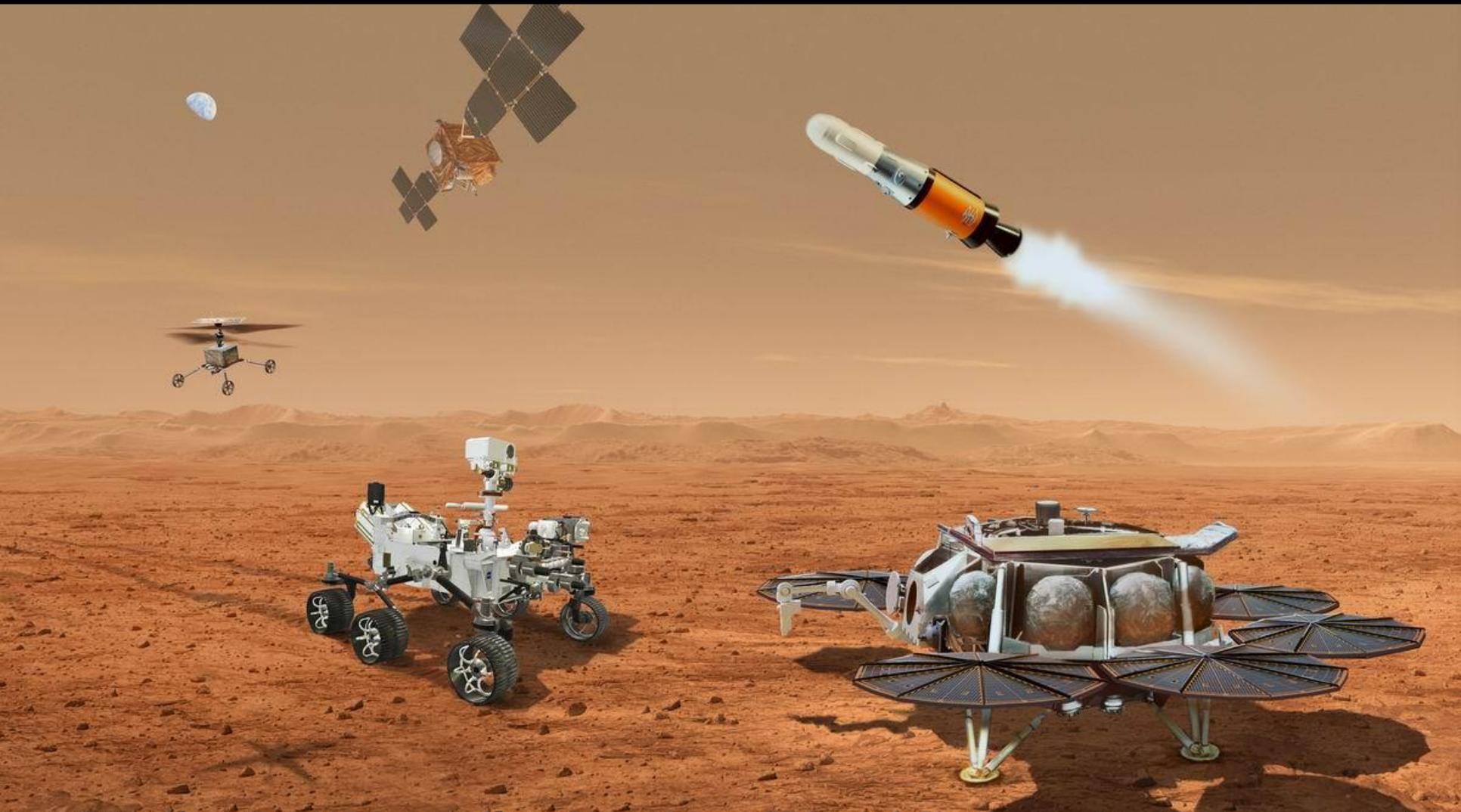
Tianwen 1 (Nebeské otázky)







Mars Sample Return



Listopad 2028 (CZ-3B)

Prosinec 2028 (CZ-5)

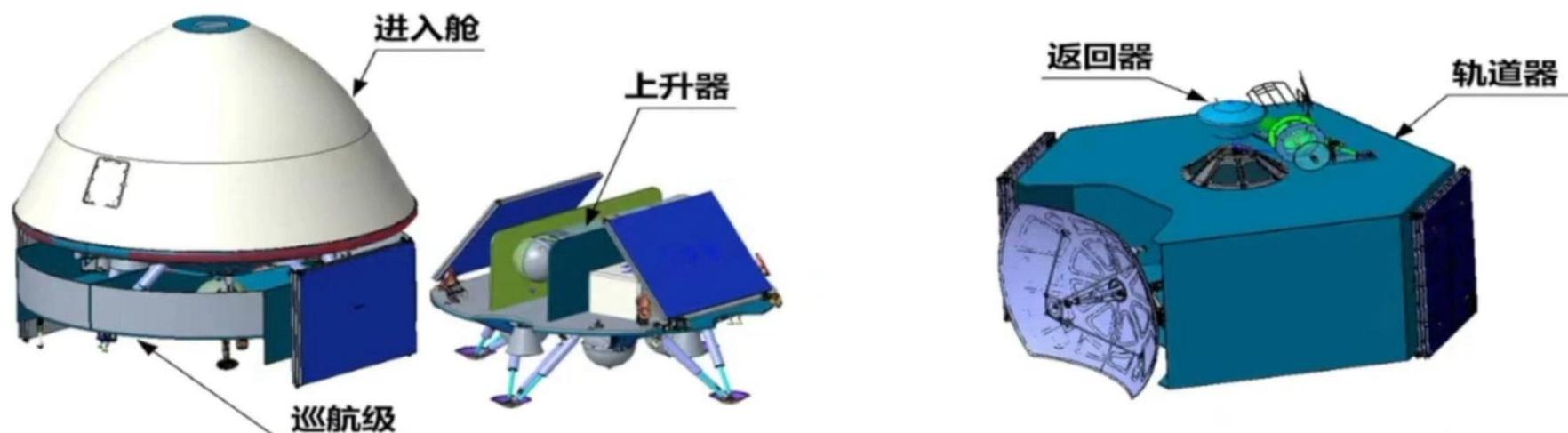


探测器系统组成

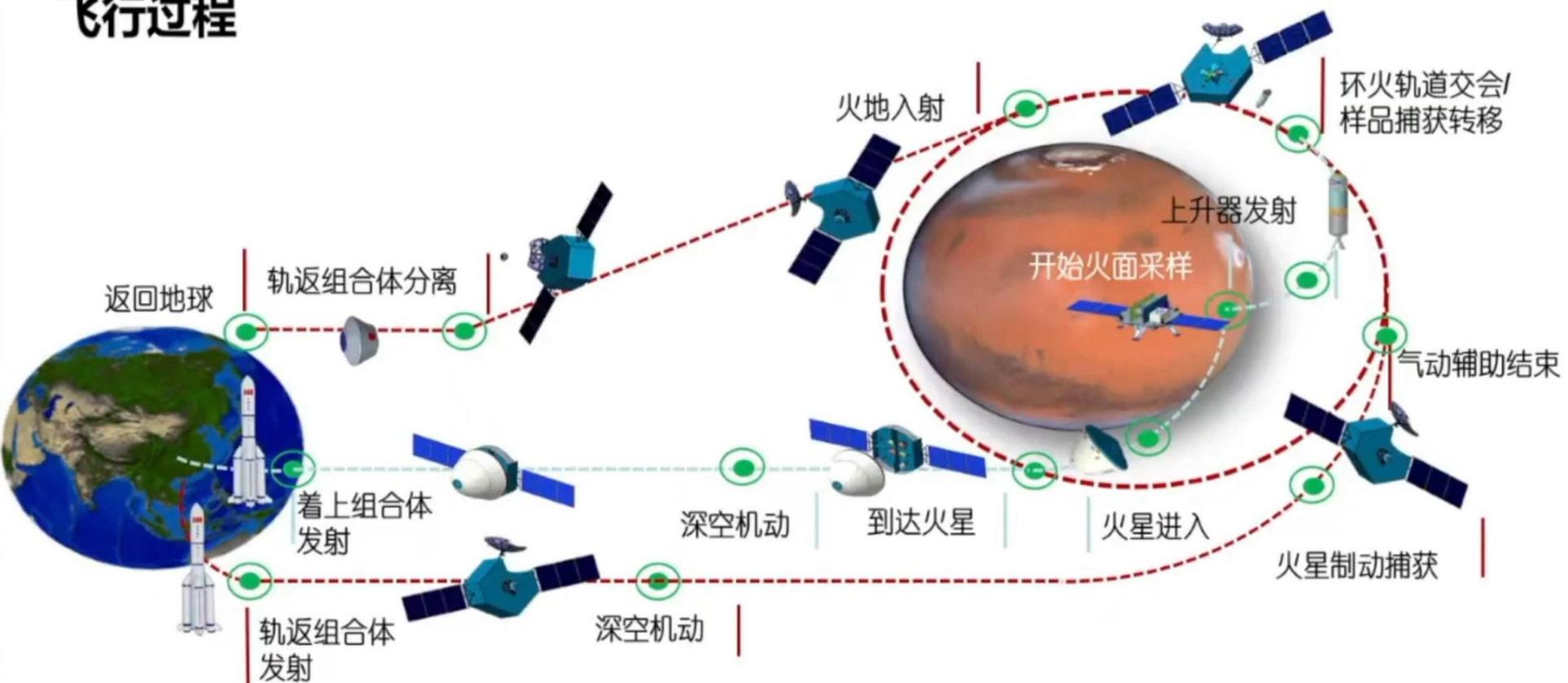
探测器由轨返组合体和着上组合体组成。

轨返组合体包括轨道器和返回器；

着上组合体包括着陆器和上升器，着陆器包括巡航级和进入舱。



飞行过程



Červenec 2031

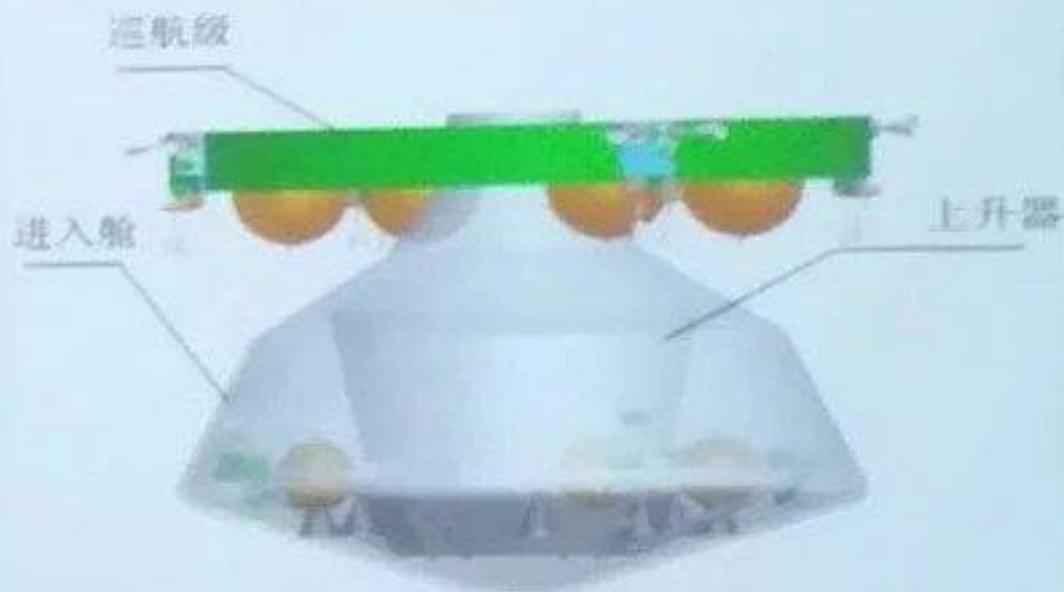


走向航天强国

C, 2028年前后火星取样返回 (CZ-9B火箭, 或CZ-5+CZ-3BG2)



轨道返回组合体

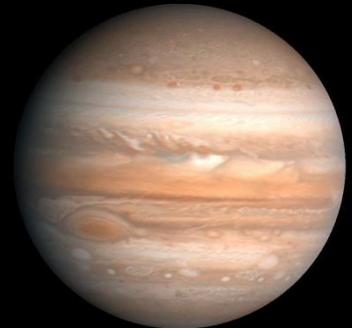


着陆上升组合体

d, 2030年木星4环绕探测 (CZ-5火箭)

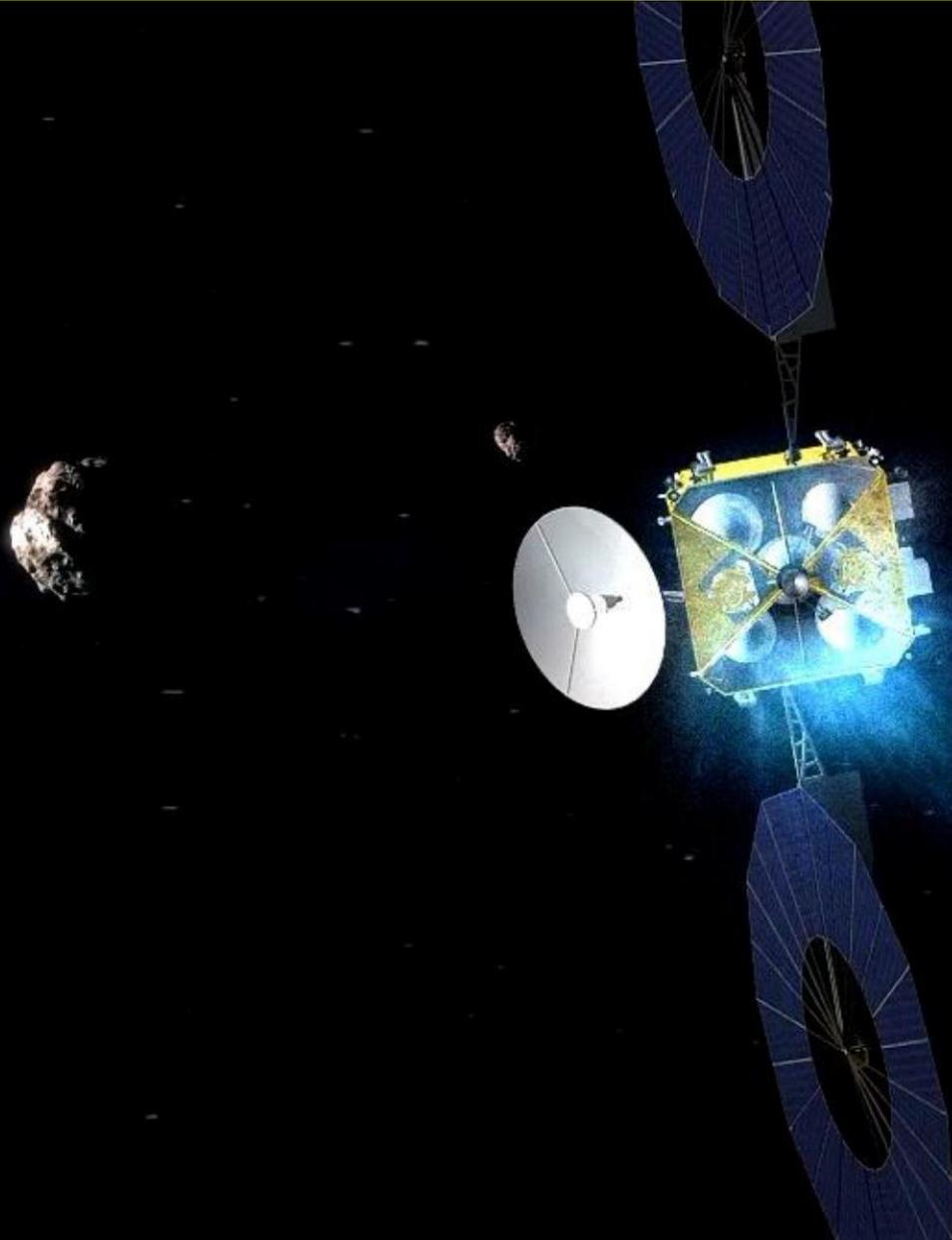
E, 2049年前后力争探测太阳系边缘 (距太阳150AU, 即100AU的日地边界, 或光行13.83小时的距离)

Planetární sondy



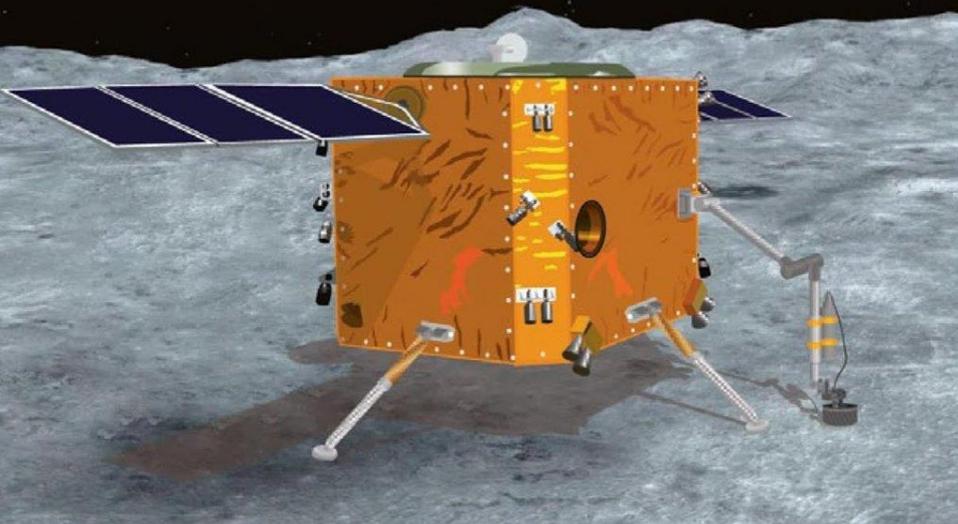
**Venuše (2024), vzorky z asteroidů
(2025) a Jupiter (2028)**

Zhenghe alias Tianwen 2 (2025)

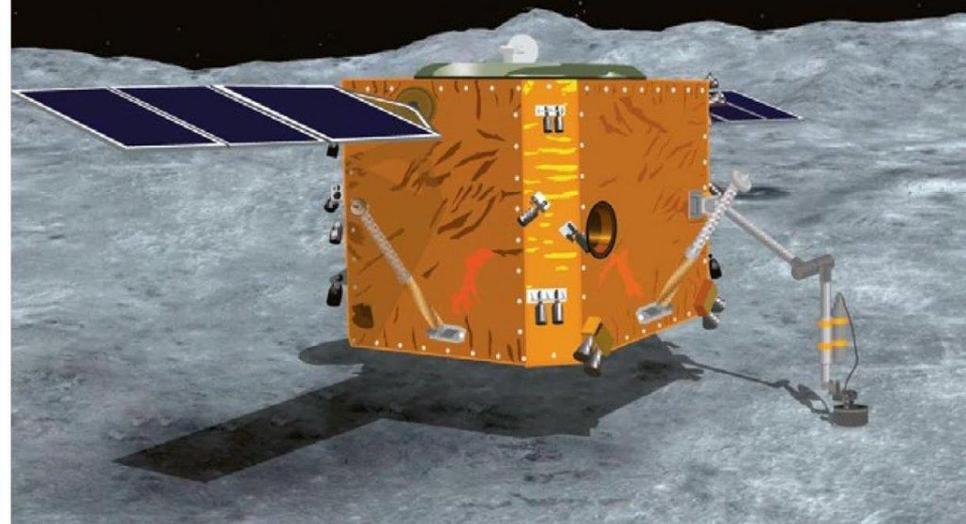


Asteroid 2016 HO3 (469219 Kamo'oailewa)

Anchor-and-attach architecture



Touch-and-go architecture



200 až 1000 g tři roky po startu

Aktivní asteroid 311P/PanSTARRS

Active Asteroid P/2013 P5 • Hubble Space Telescope • WFC3/UVIS

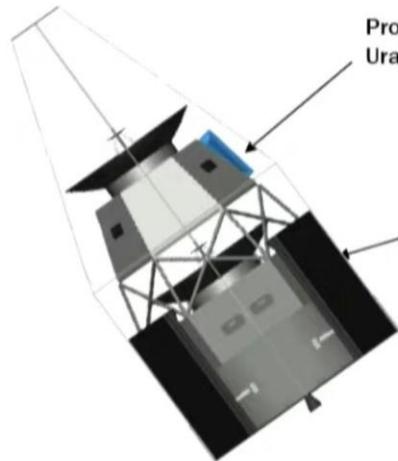


Tianwen 4 (Dan Ge)

Planetary Exploration of China



TW-4 Mission Brief



Probe for Uranus flyby

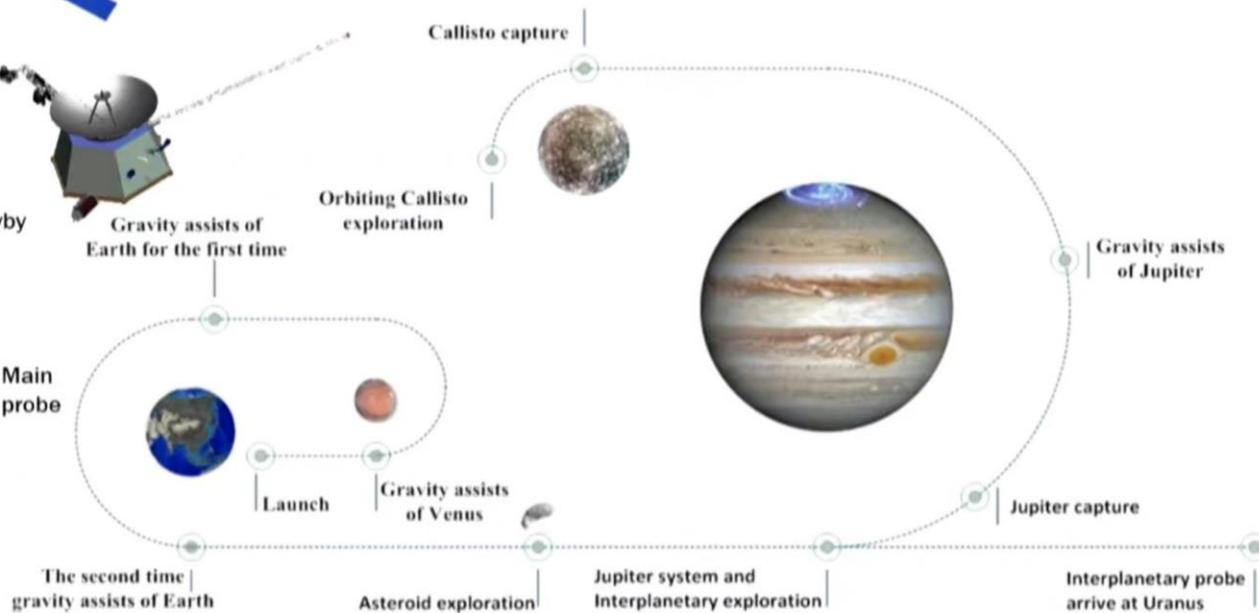
Main probe

Objective

Jovian system and interplanetary exploration

Launch schedule

To be launched in about 2030 by CZ-5 rocket in WSLs



Kosmická loď



Blízkozemní vs. lunární



(a) 14t spacecraft



(b) 20t spacecraft

24. června 2016

Víceúčelová zmenšená návratová
kapsle kosmické lodi





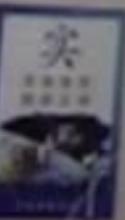
5. května 2020

*Testovací exemplář budoucí
pilotované kosmické lodi*





8000 km



2 dny 19 hodin 49 minut









一、概述

(二) 正在开发的载人飞船

美国

俄罗斯

中国

商业乘员计划 (CCDev)

星座计划

PPTS

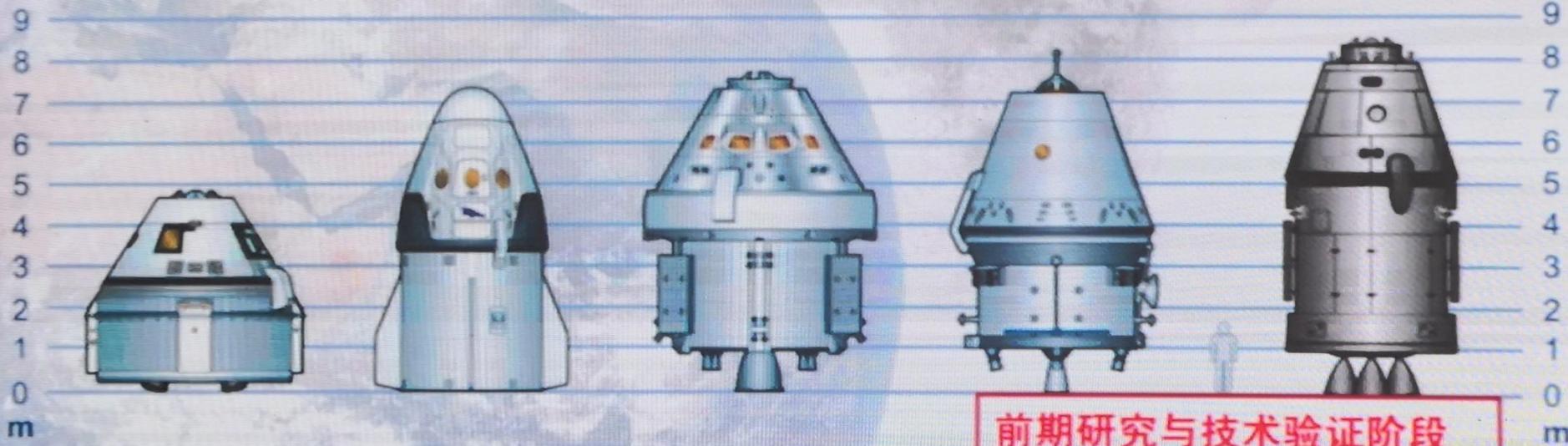
CST-100
(星际航线)

Dragon V2
(龙飞船)

Orion
(猎户座)

PTK-NP
(联邦号)

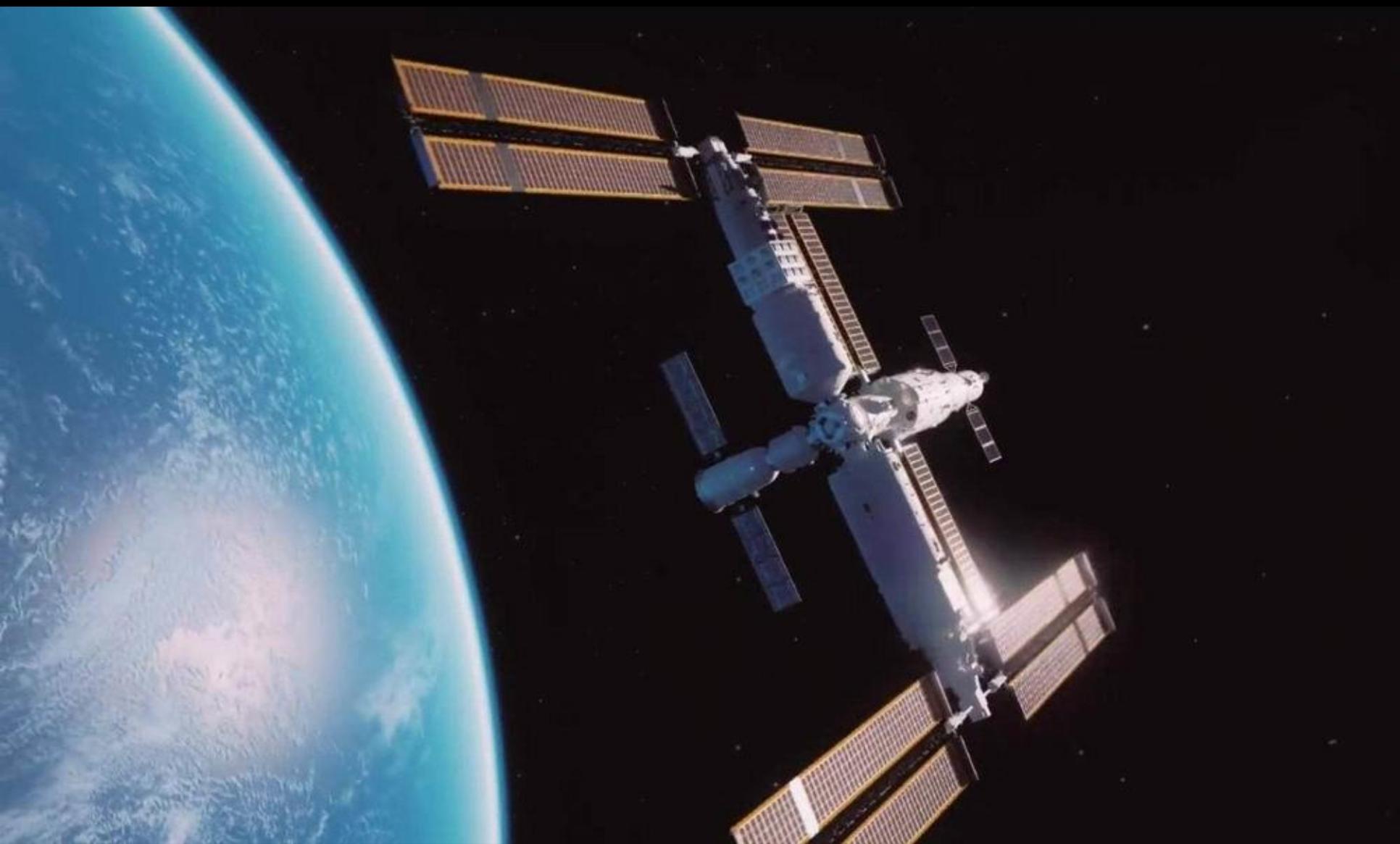
新一代
载人飞船



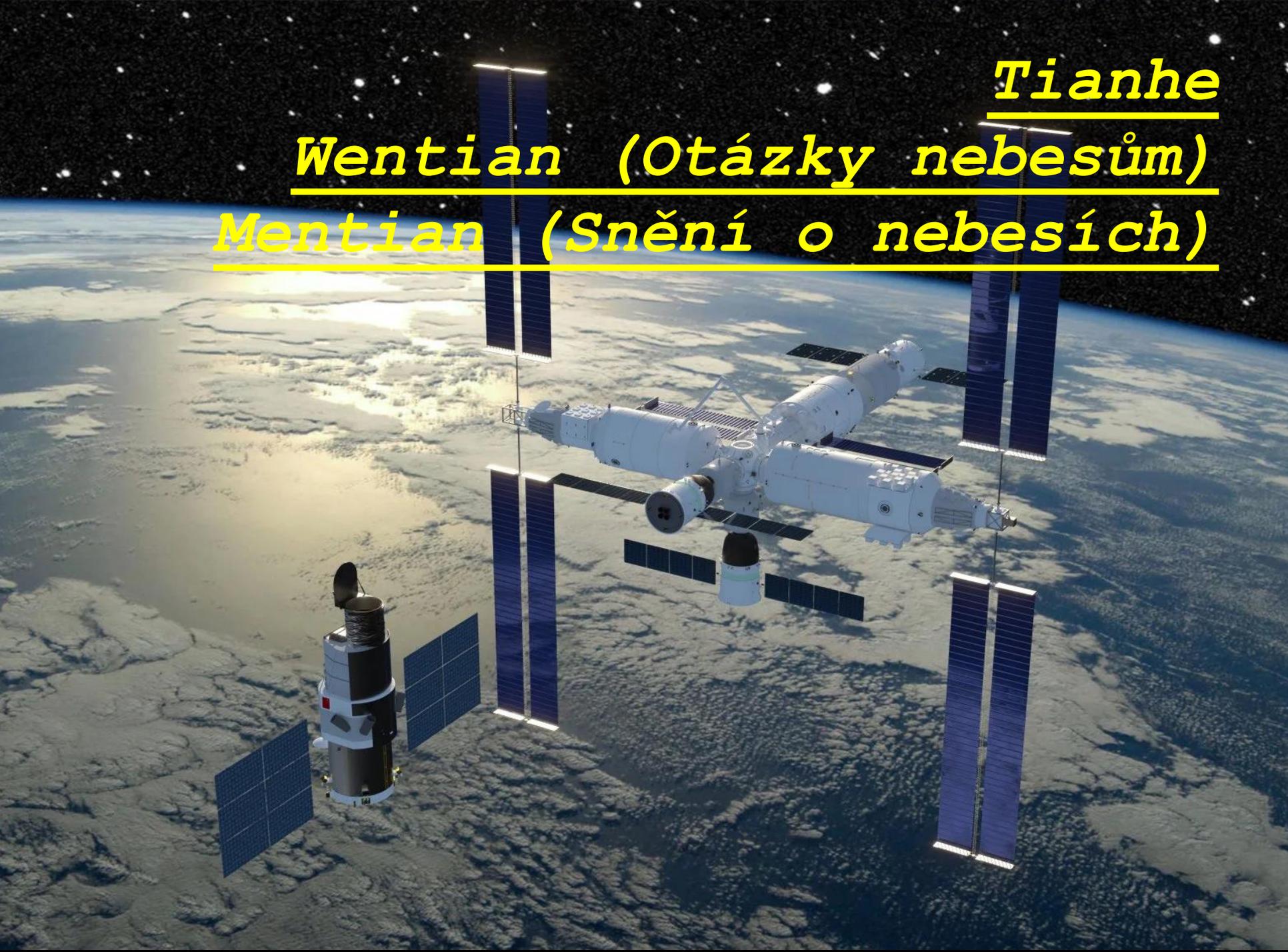
2024 k orbitální stanici?



Tiangong (Palác v nebesích)

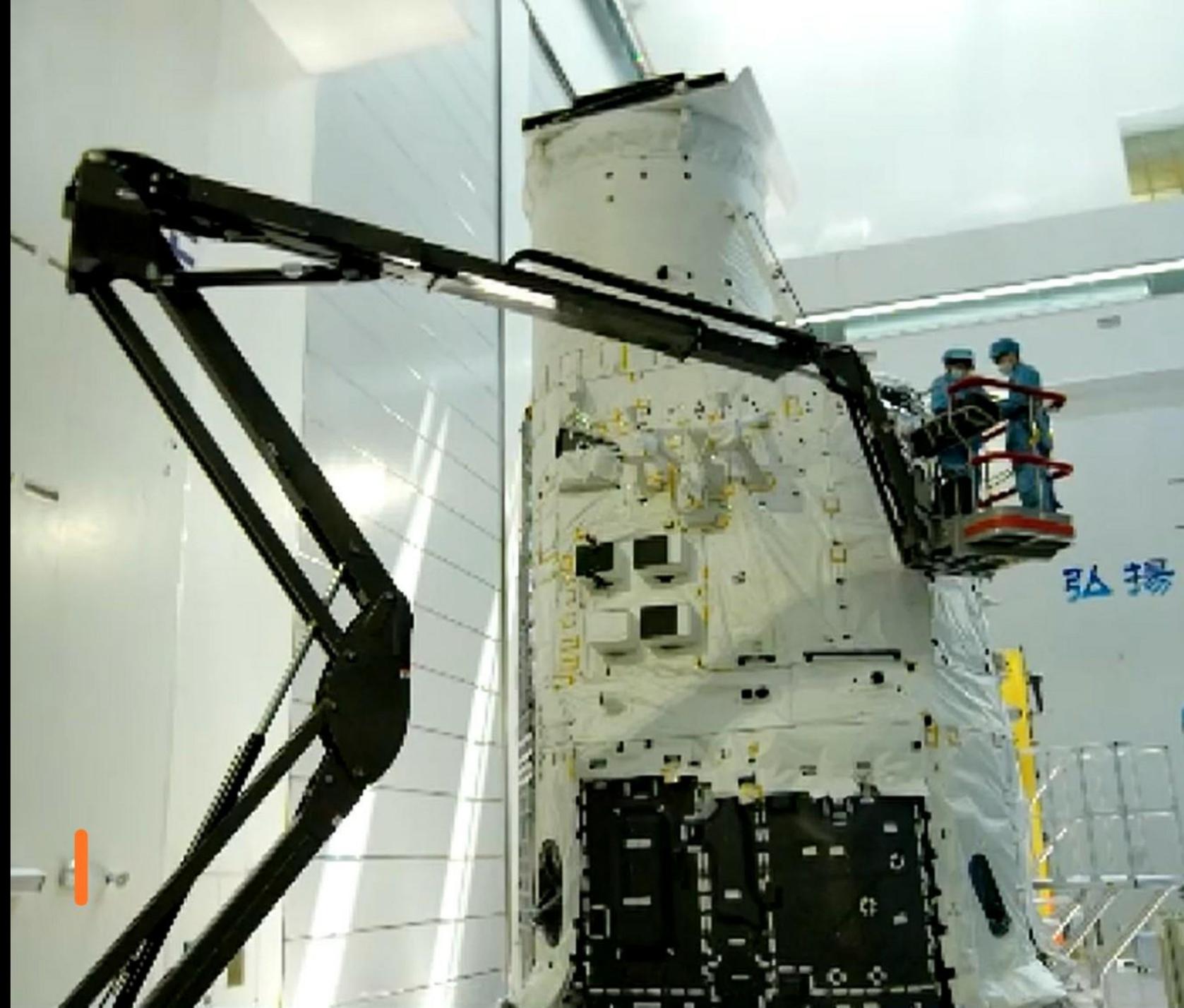


Tianhe
Wentian (Otázky nebesům)
Mentian (Snění o nebesích)

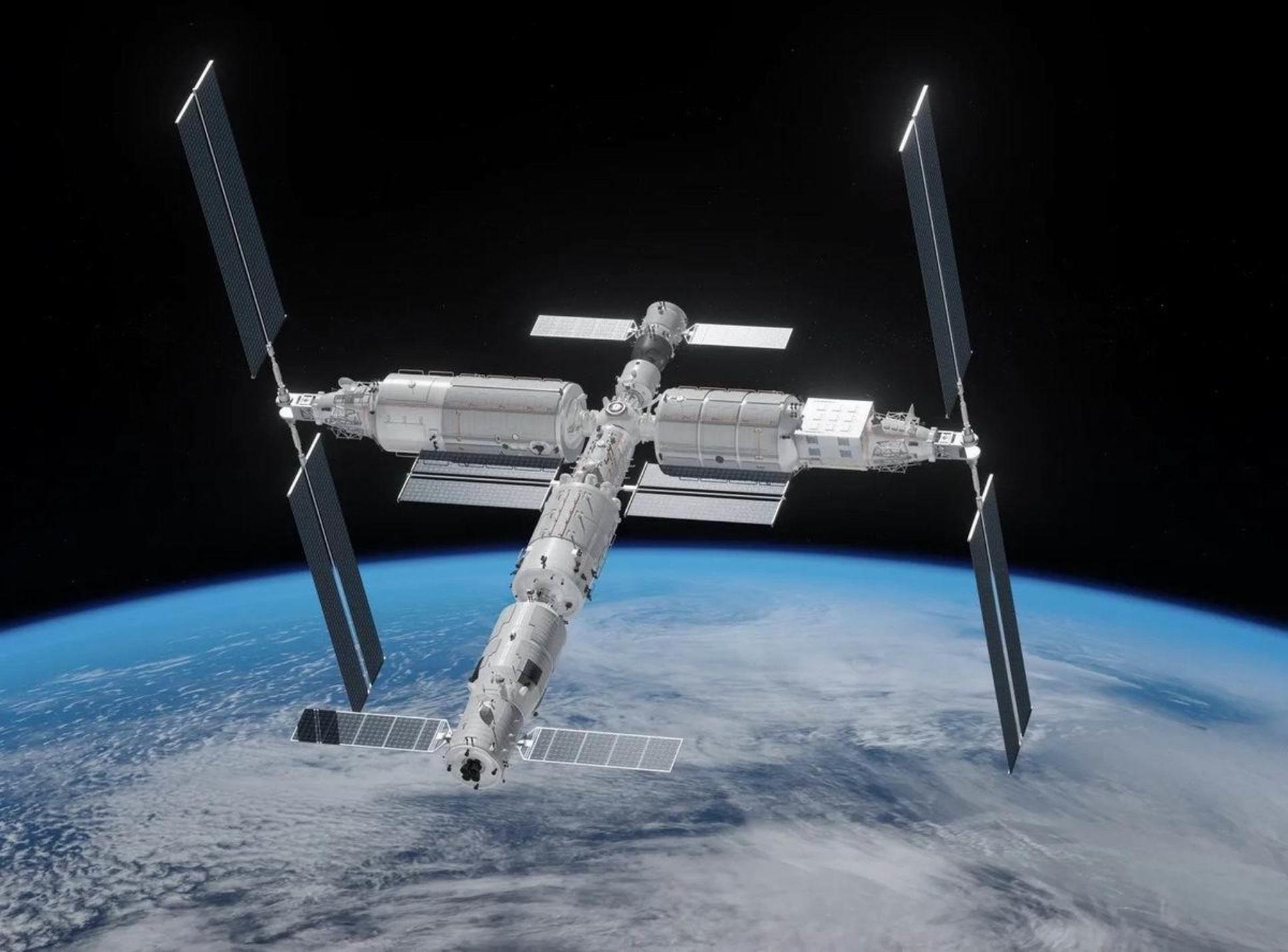


Xuntian (Putování po nebesích)











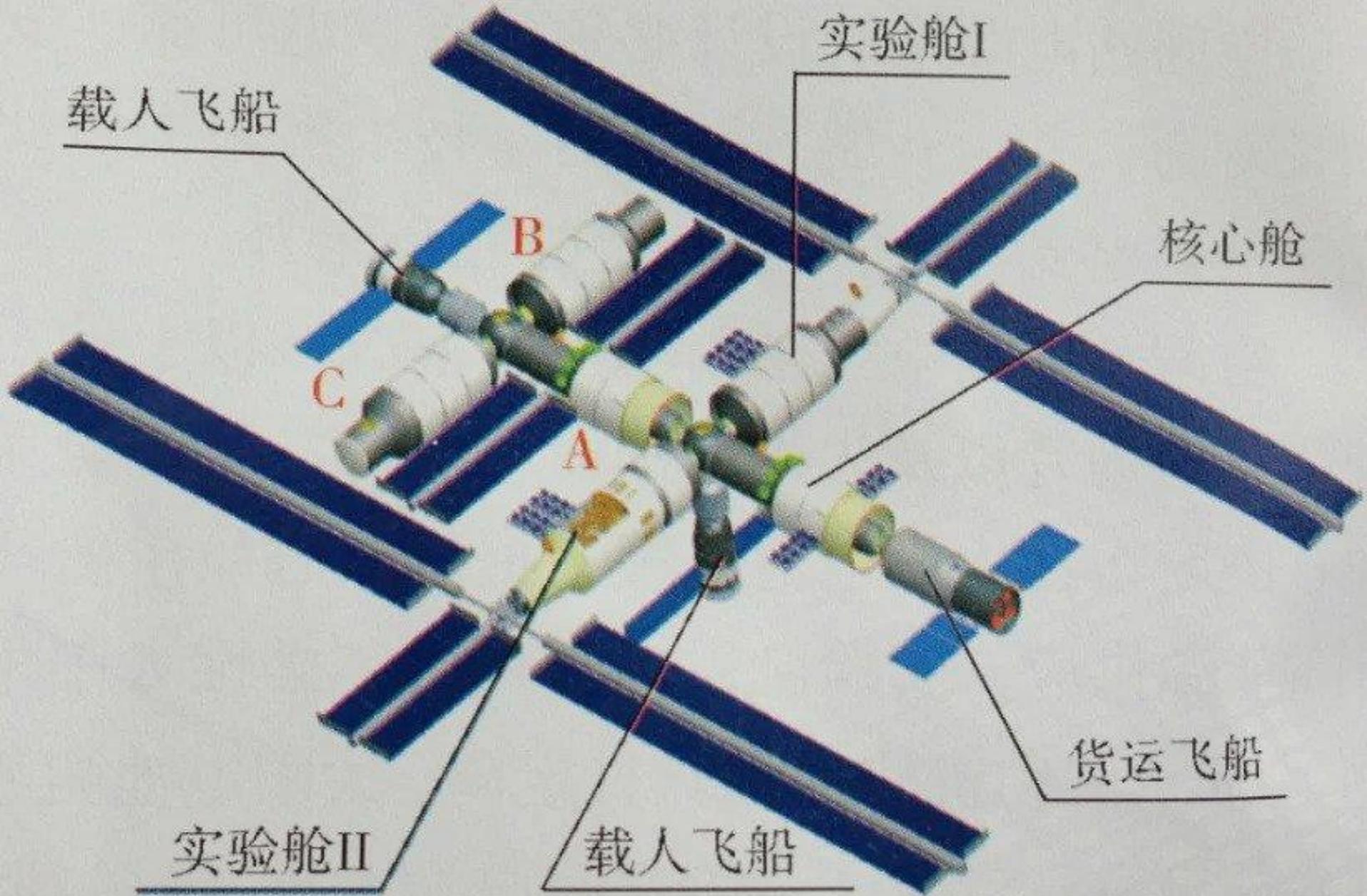


图 2 空间站最大扩展构型

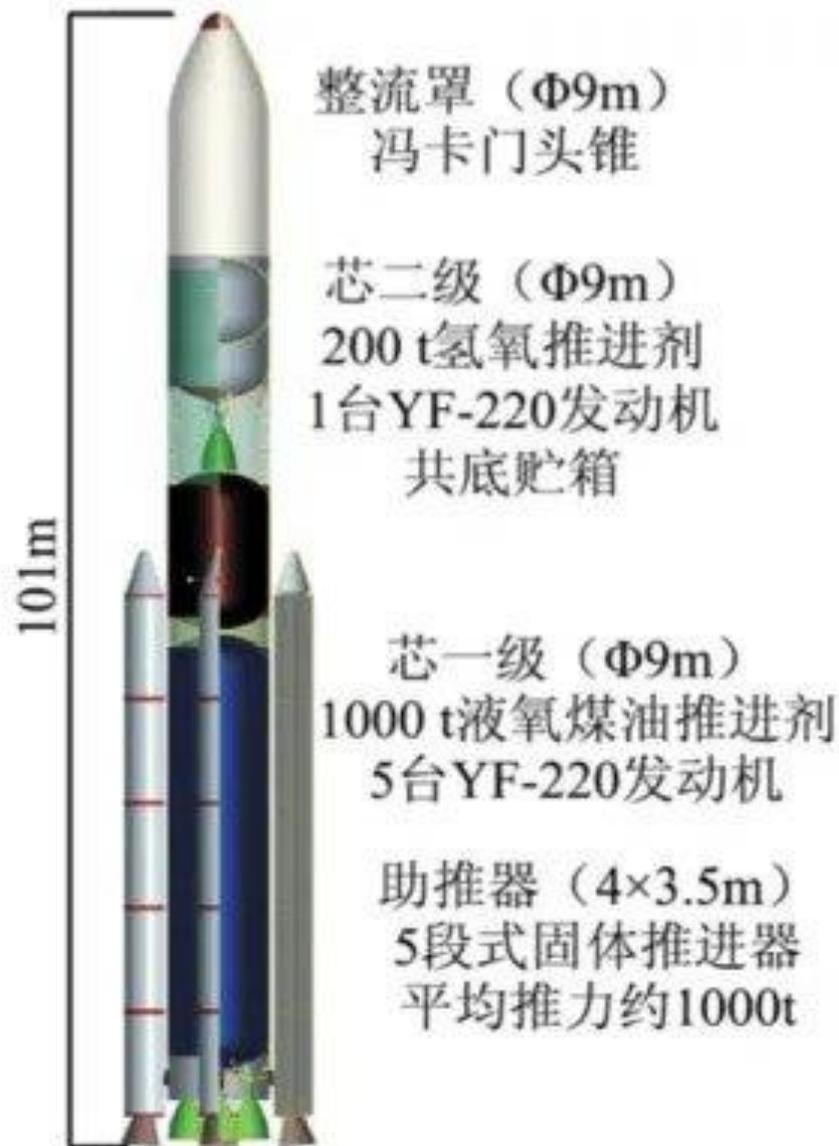
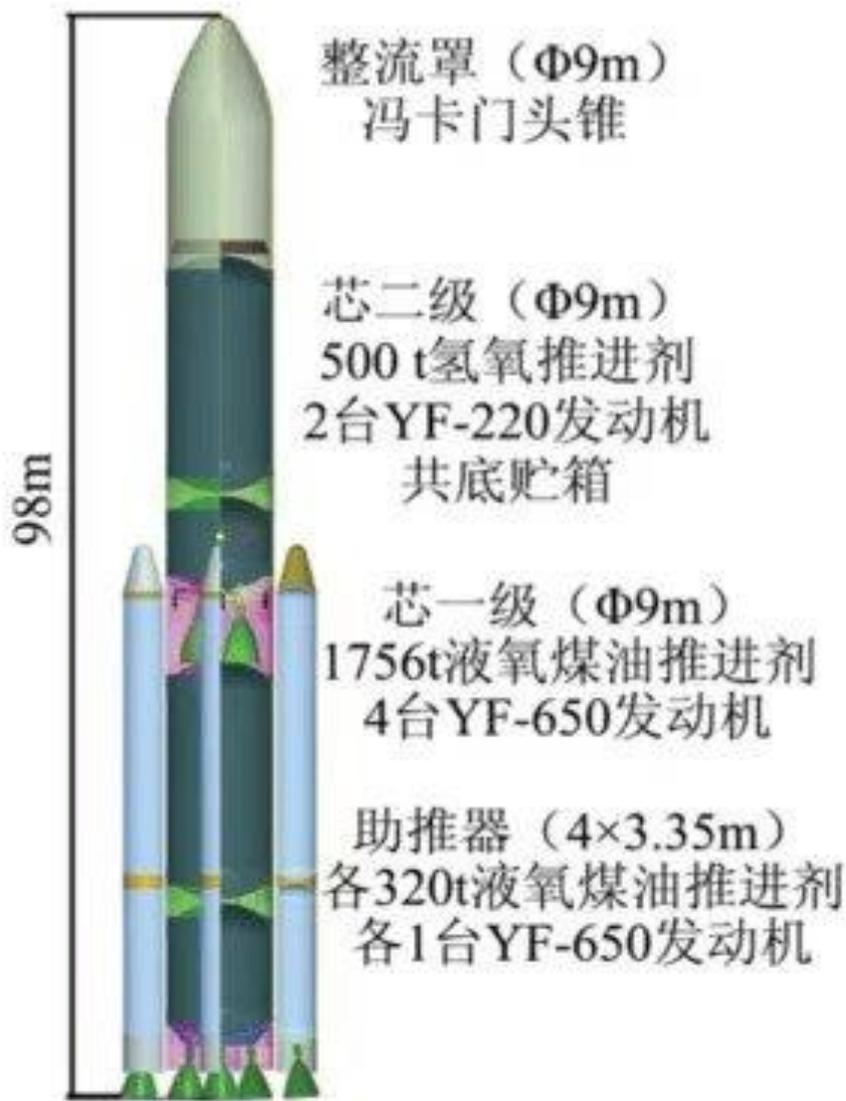
Sluneční elektrárna



Pozemní přijímací ověřovací stanice



CZ-9



9: v tradičním čínském učení feng-šuej jde o číslo nejvyšší vznešenosti vyhrazené toliko císaři.



2021

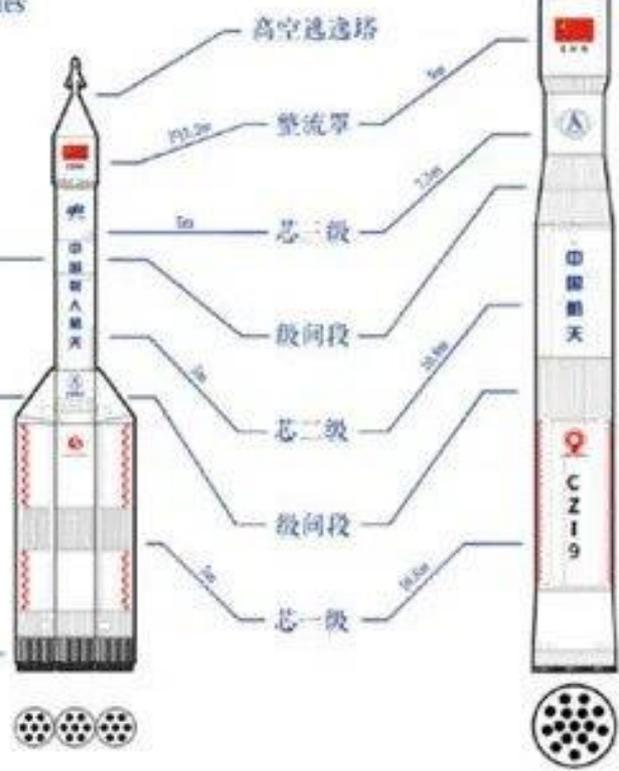
中国新一代重型运载火箭家族

China's new generation of heavy launch vehicle families

制图: 海上风Wind
Copyright: You/youYuanli Min

新一代载人运载火箭 (921运载火箭)

三级: 3*YF-75D
二级: 2*YF-100M
一级: 21*YF-100K
(CBC构型, 3*7+21)
运力: LEO 70t
TLI 25t
预计首飞: 2025



长征九号运载火箭

1*120t HO
4*120t HO
16*YF-135
LEO 150t(二级构型)
TLI 53t
2030



Verze 2022



3 stupně, 108 m výška, 10 m průměr,
150 t (50 t TLI nebo 35 t TMI)



2.11 重型运载火箭工程

工程简介

- 2033年前后实现长征九号两发试验箭飞行验证;
- 开展一子级海上定点返回试验, 构建重型运载火箭能力体系;
- 突破两级完全重复使用关键技术。

长征九号重型运载火箭参数

- 总长度: 114 m
- 起飞质量: 4400 t
- 起飞推力: 6100 t
- 箭体直径: 10.6 m
- 运载能力: 近地轨道不小于150 t, 地月转移轨道不小于50 t





基本型（长征九号）

两级串联构型

两级完全重复使用构型



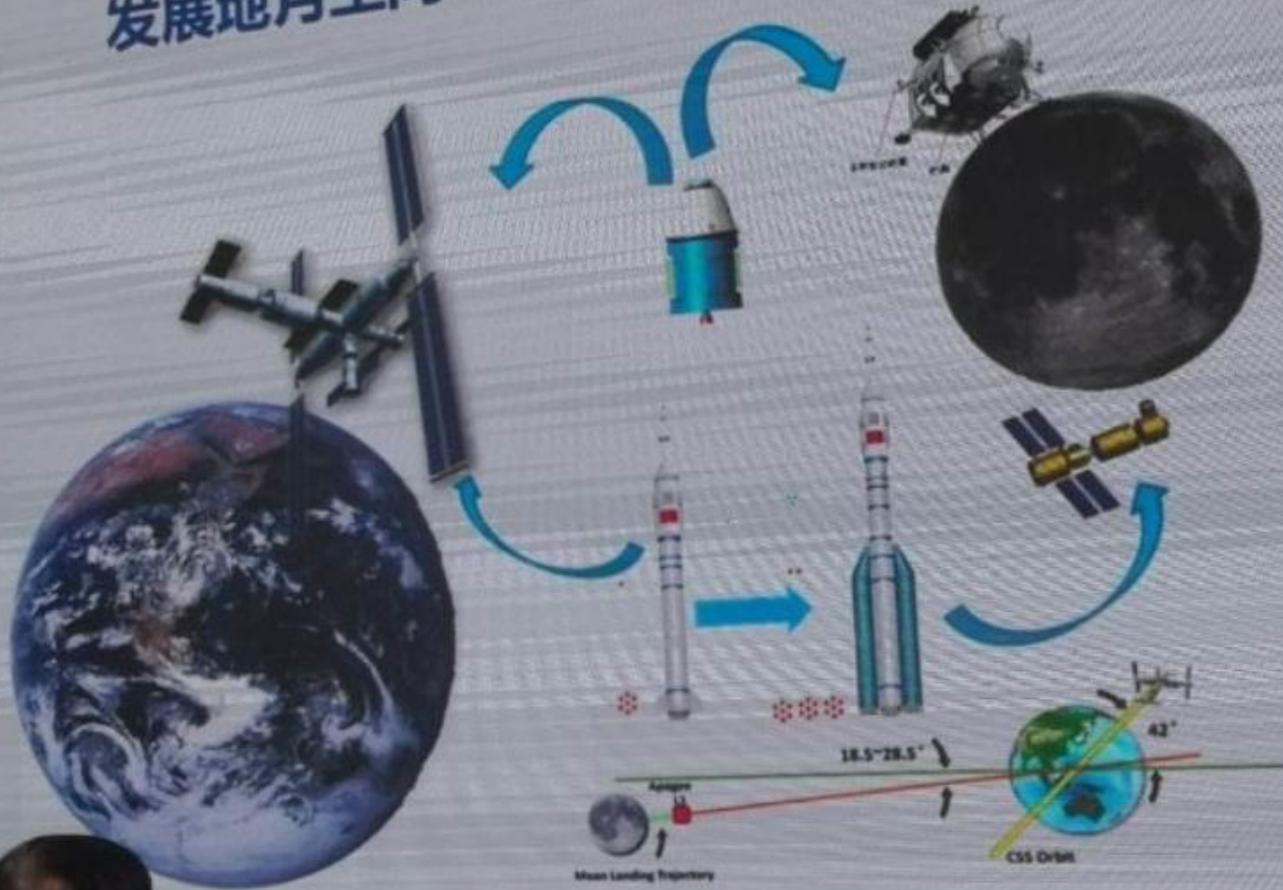
Vzhůru na Měsíc



CZ-5DY (Dengyue) alias CZ-10



发展地月空间：统筹空间站与月球



天(国际)学术大会
SPACE CONFERENCE

2018年10月23-24日
中国·西安



新一

安全警示灯亮时
请勿靠近试验区域

在6根立柱内安装承载350吨的拉杆

2026



2027



2028

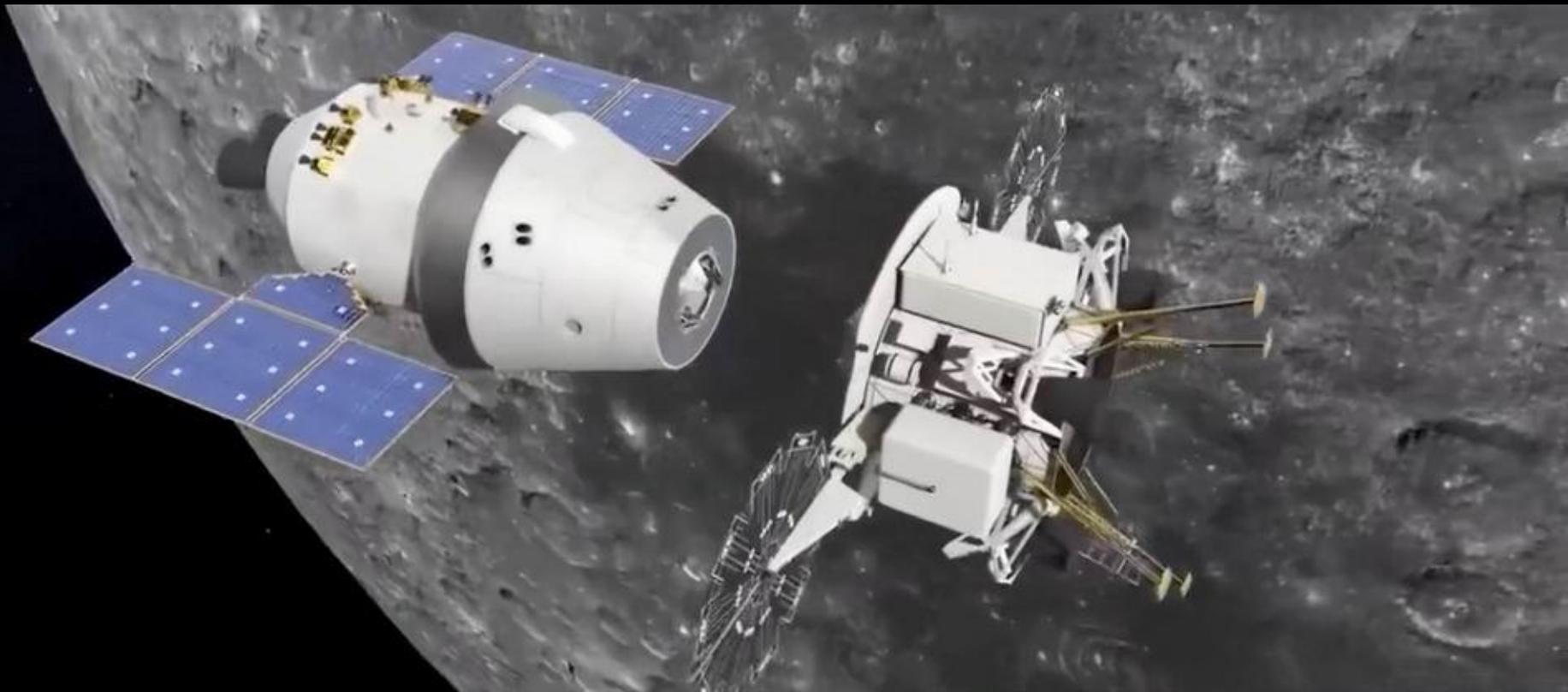


✓ 新一代载人飞船

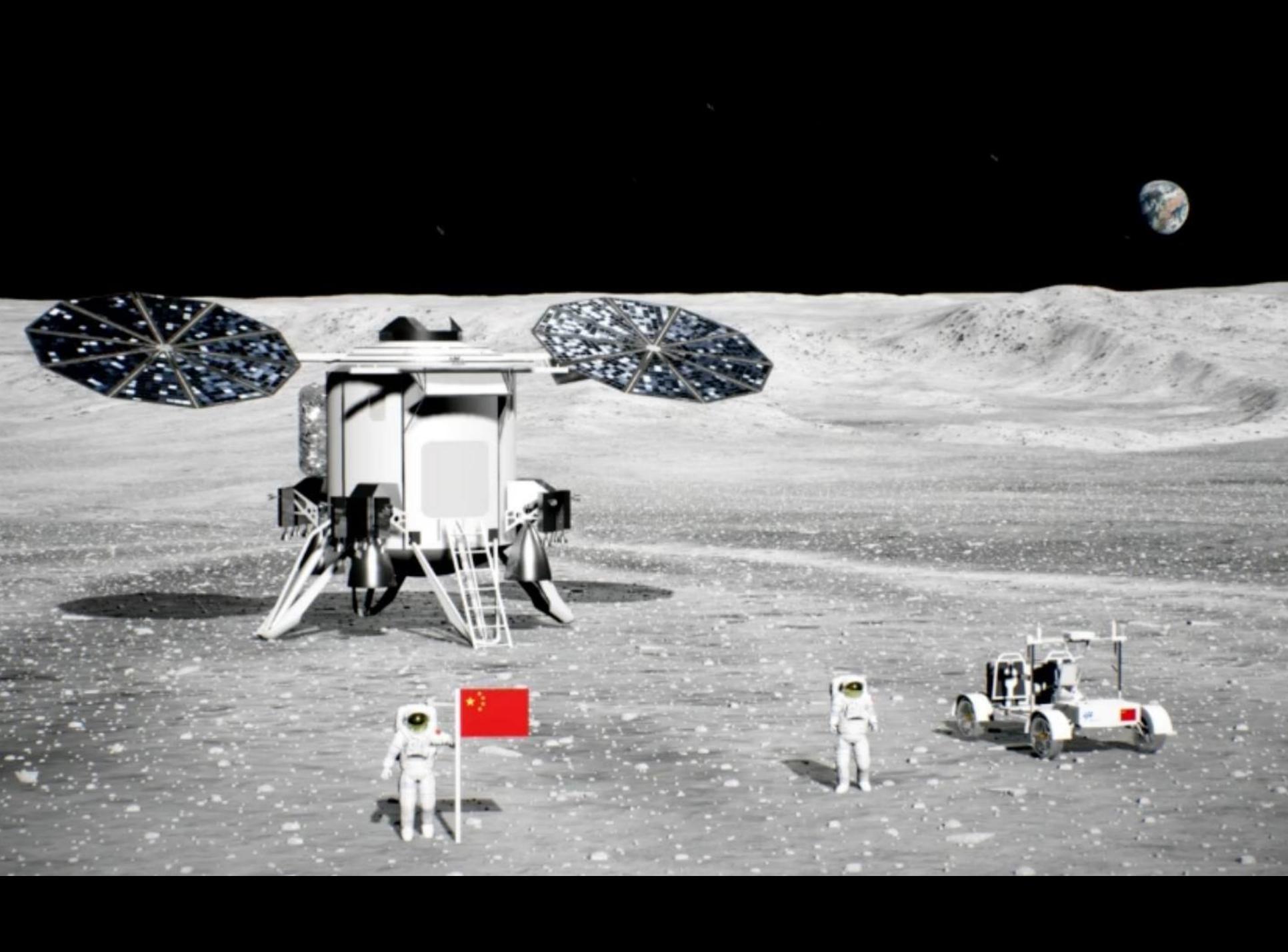
✓ 月面着陆器



2029

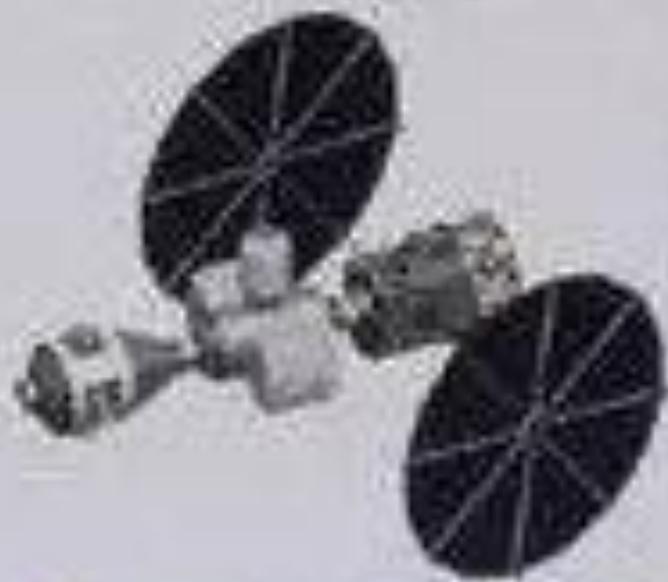




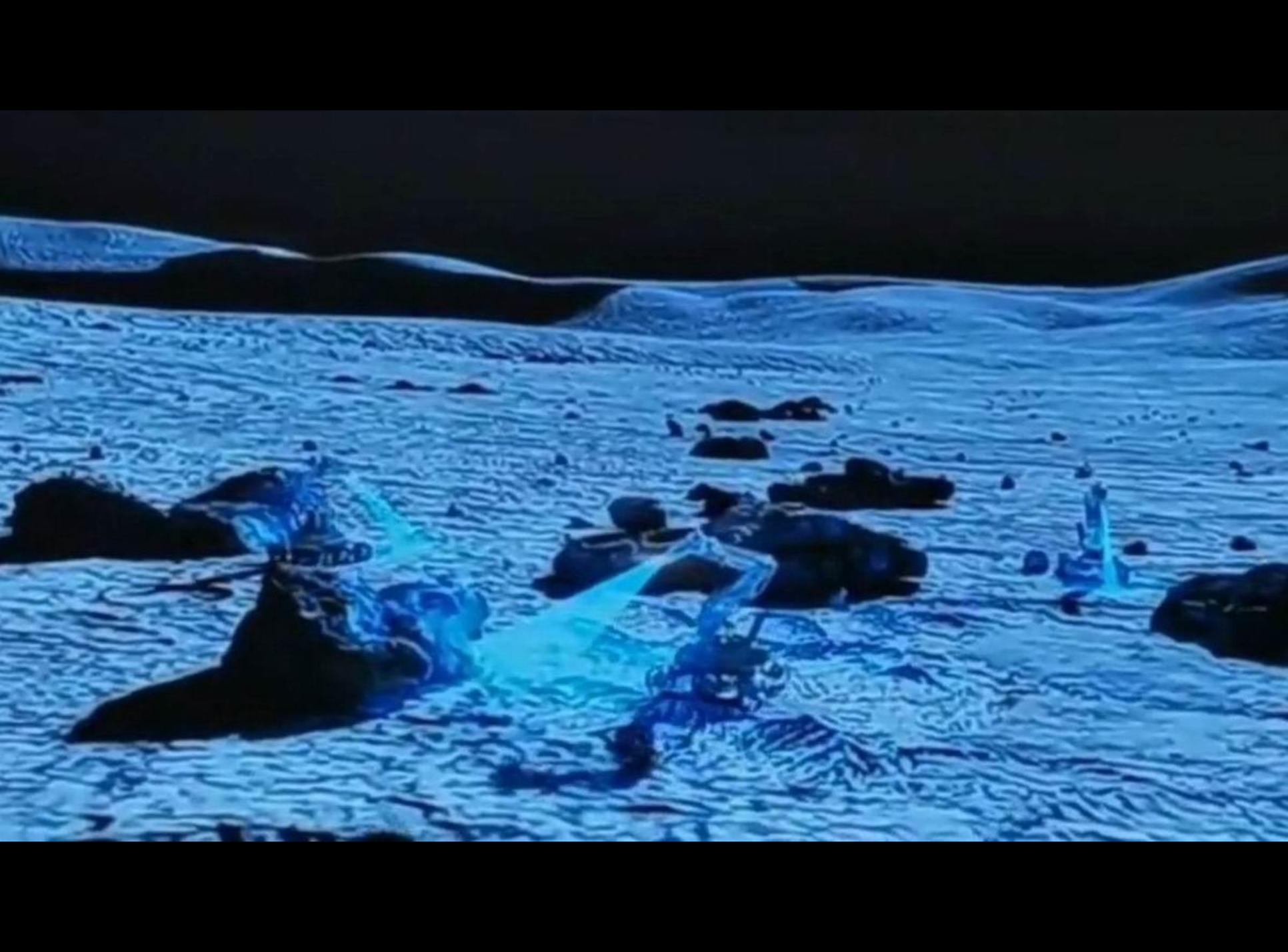


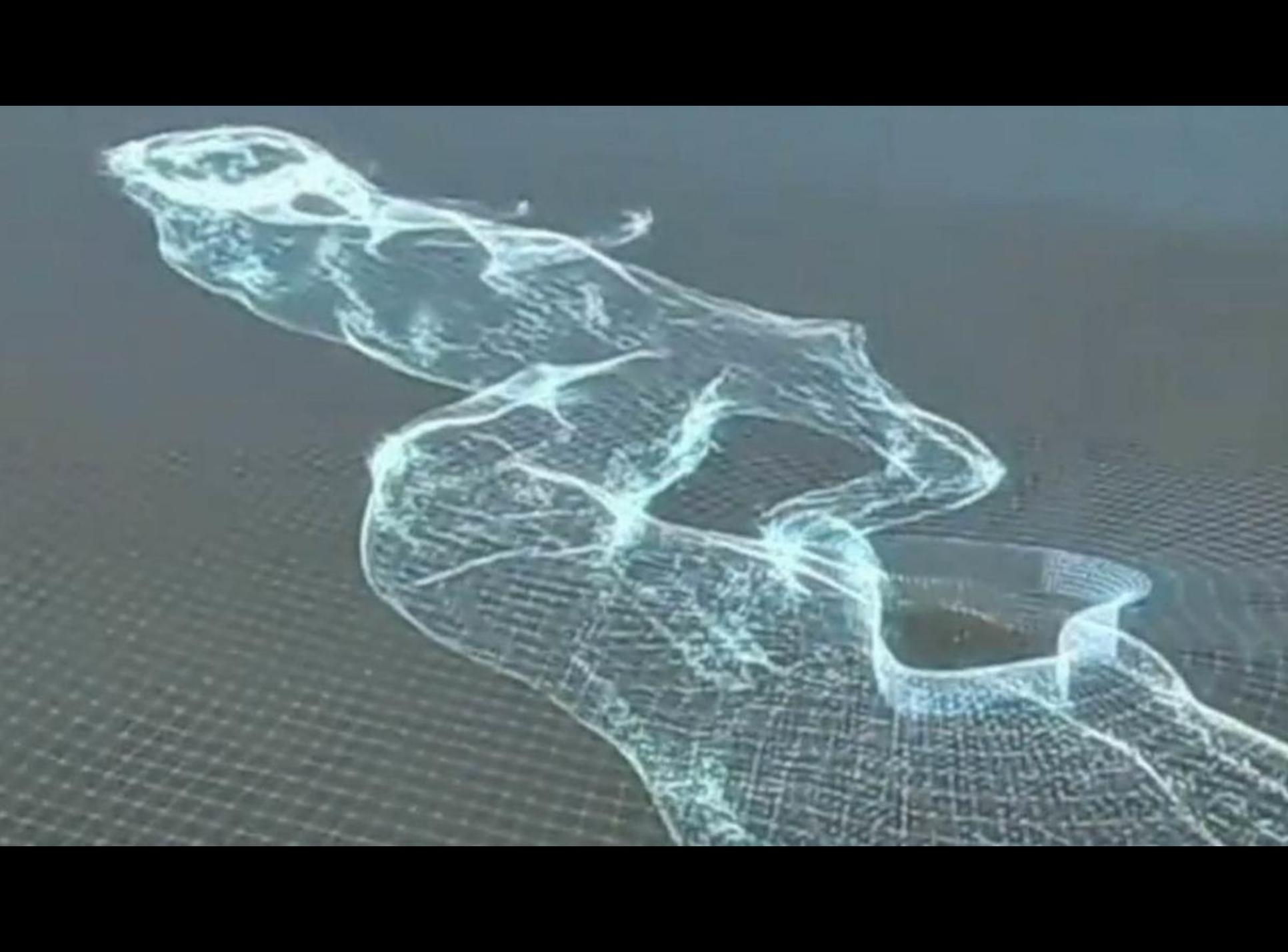
? 月球轨道空间站

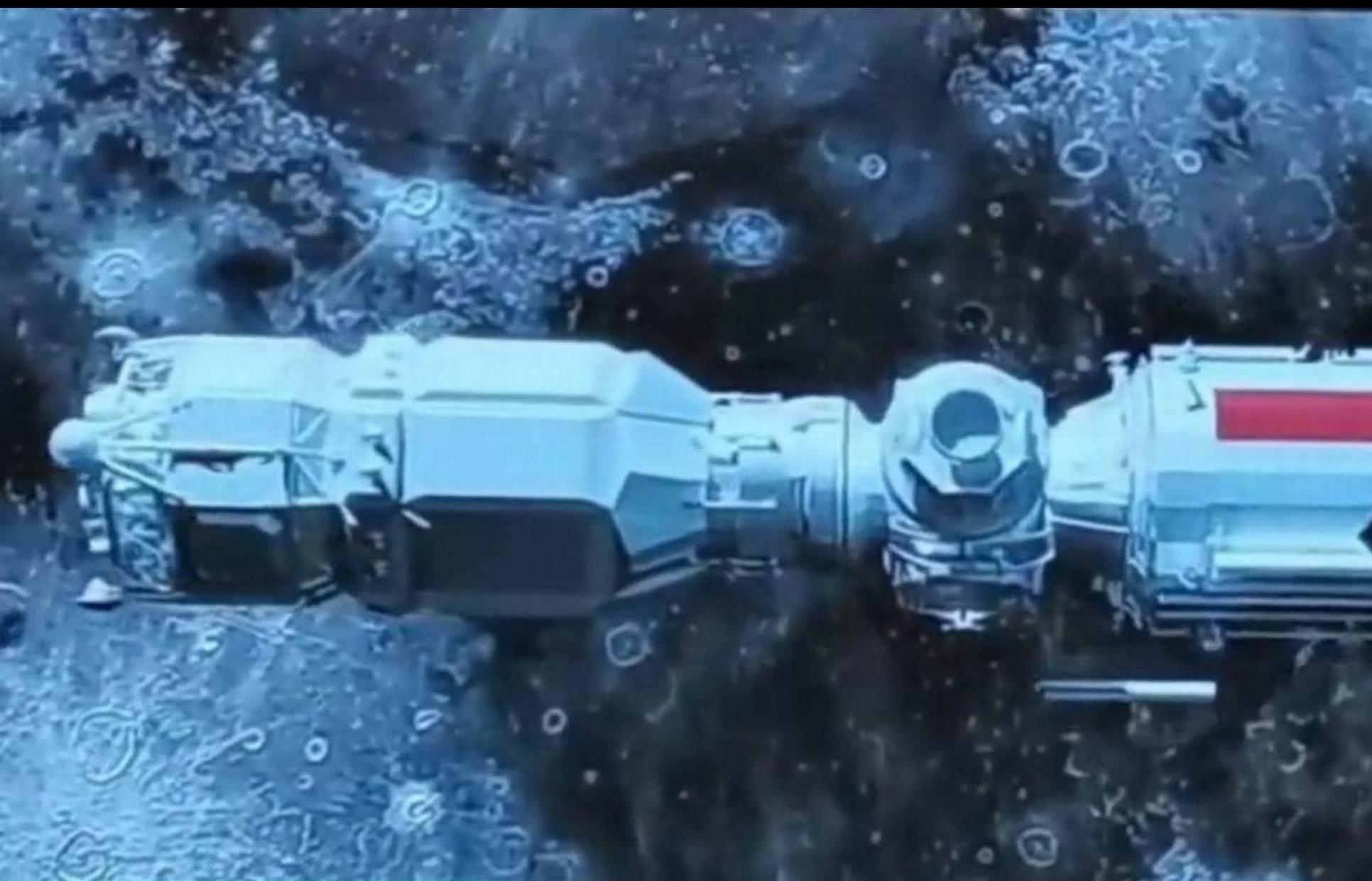
? 载人月面移动实验室

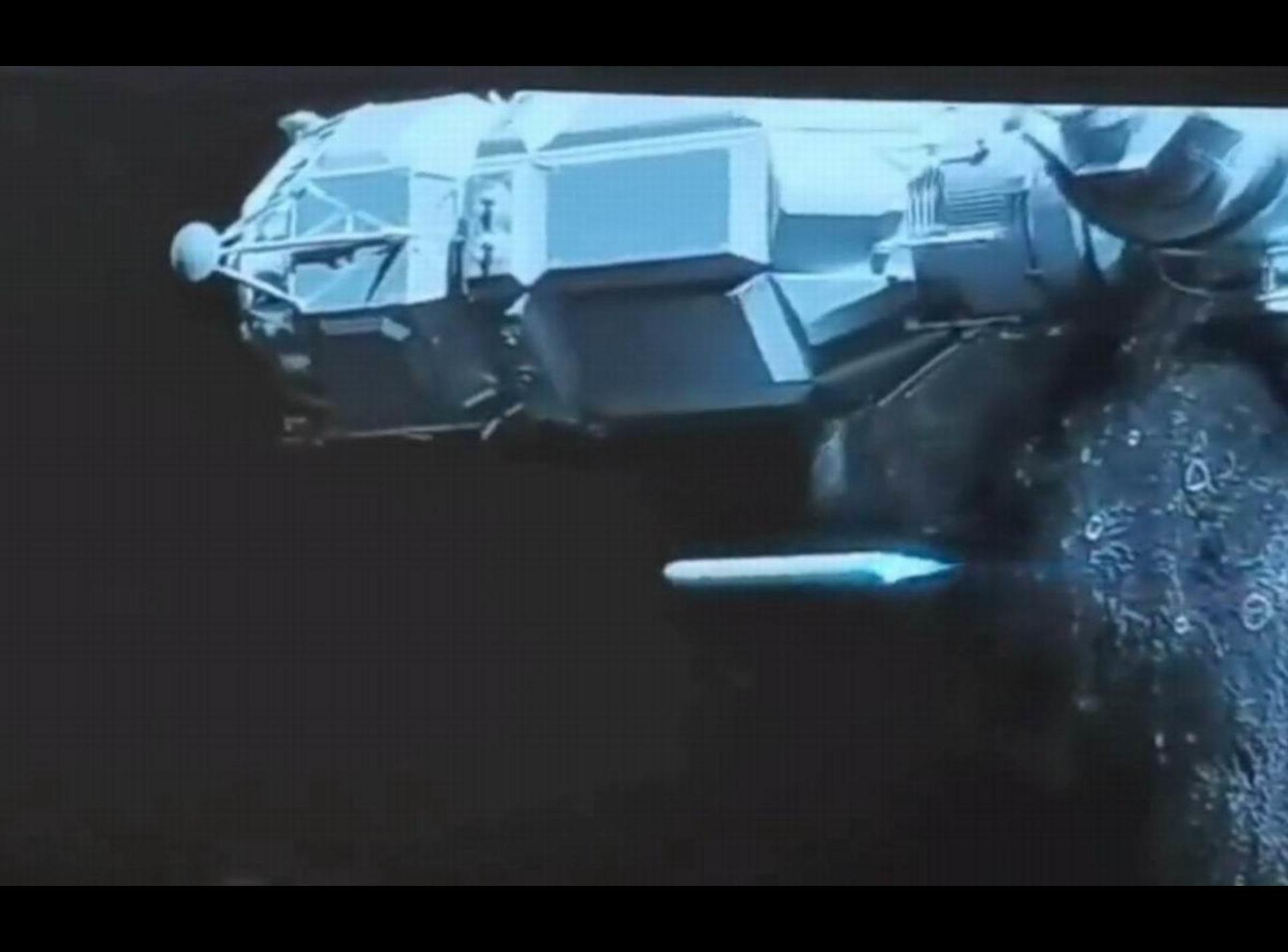


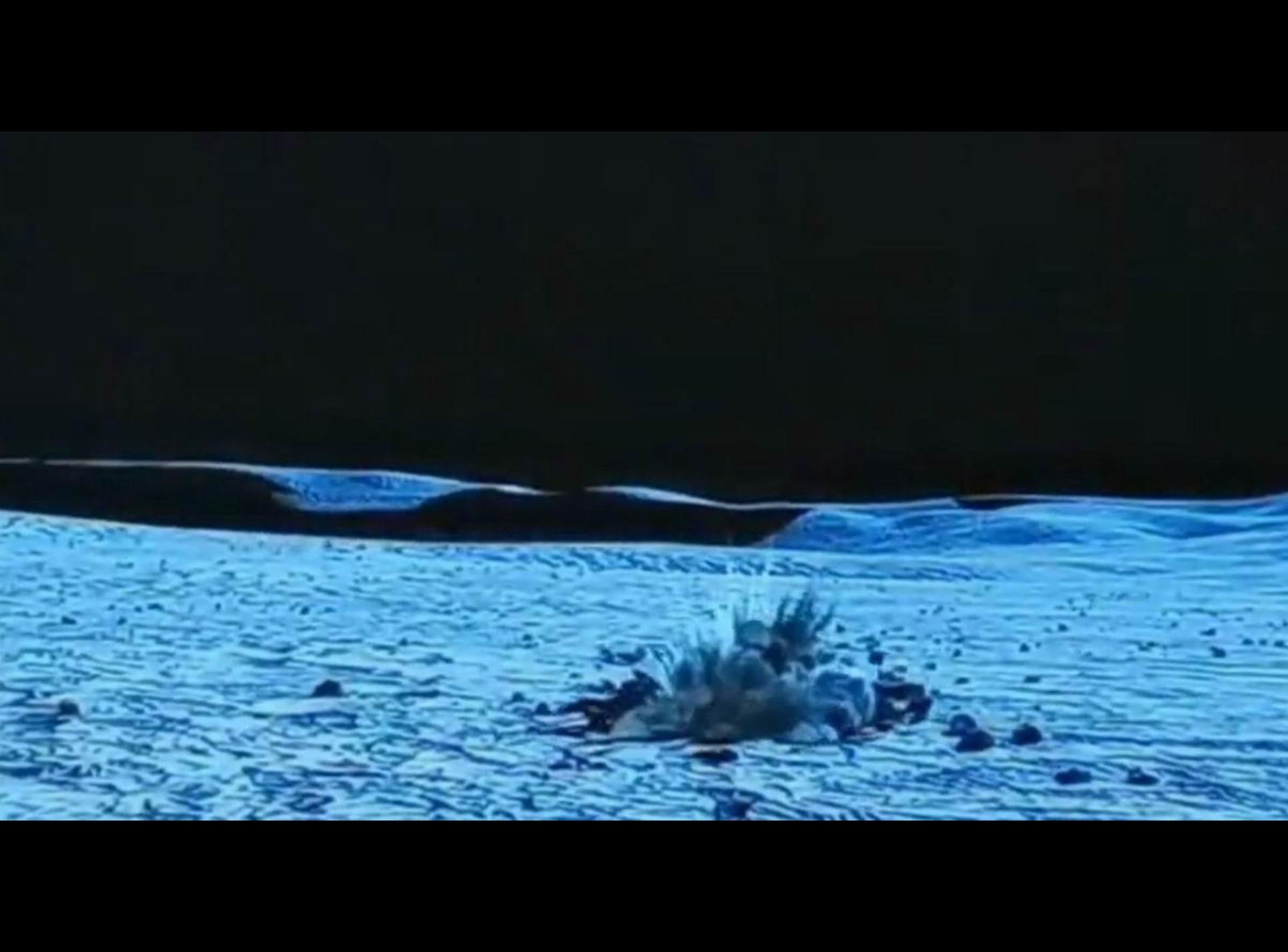






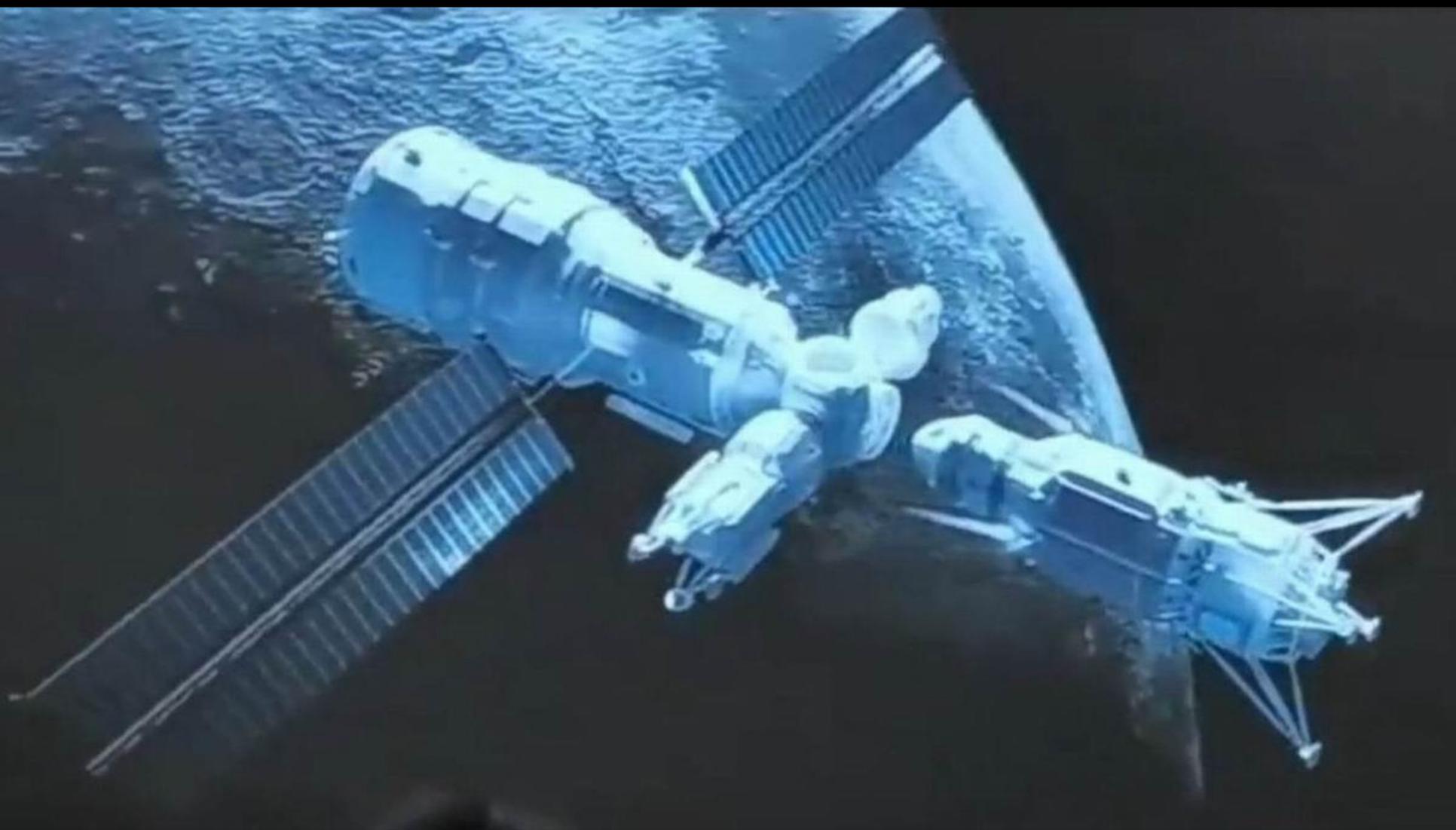


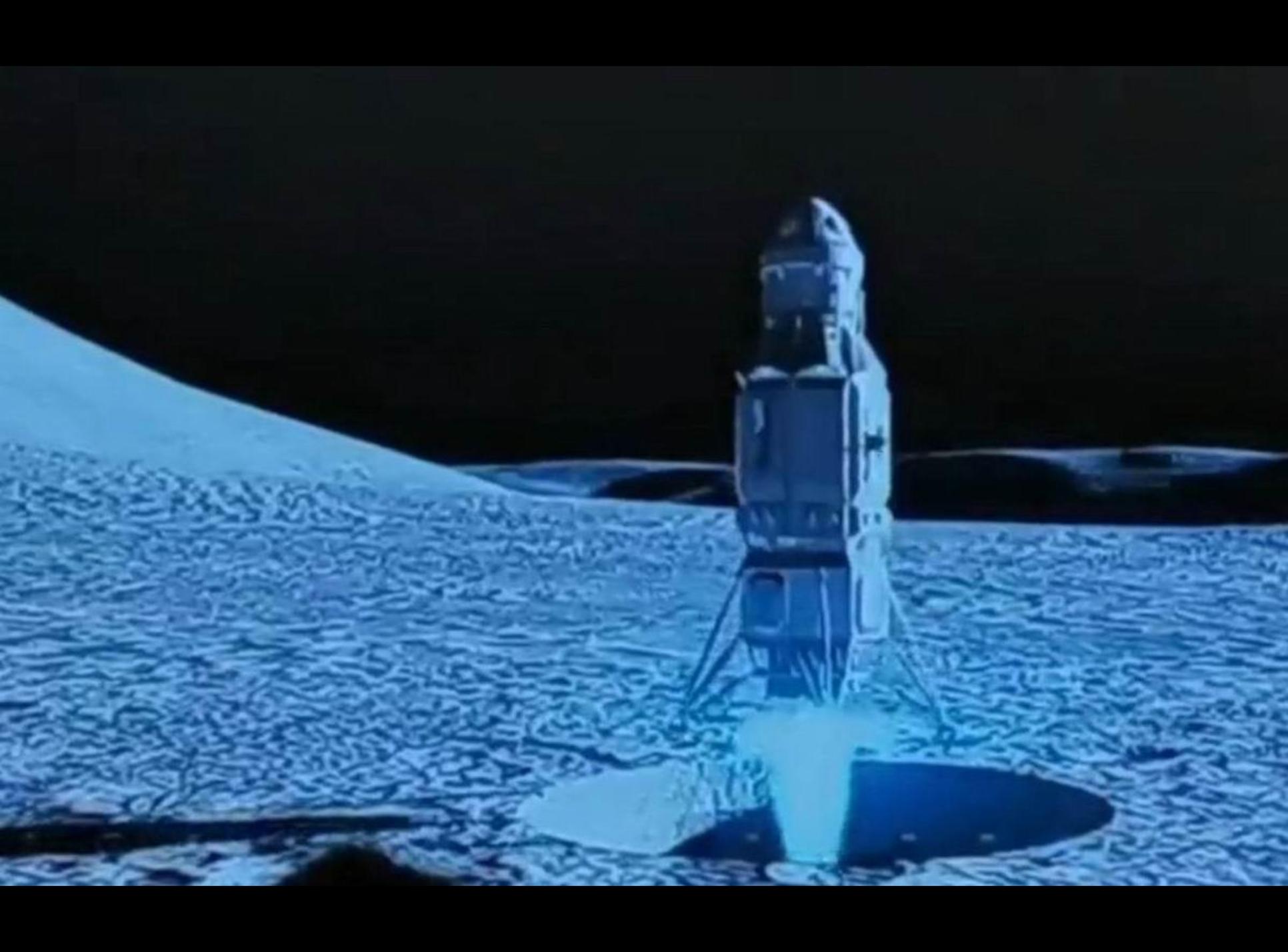




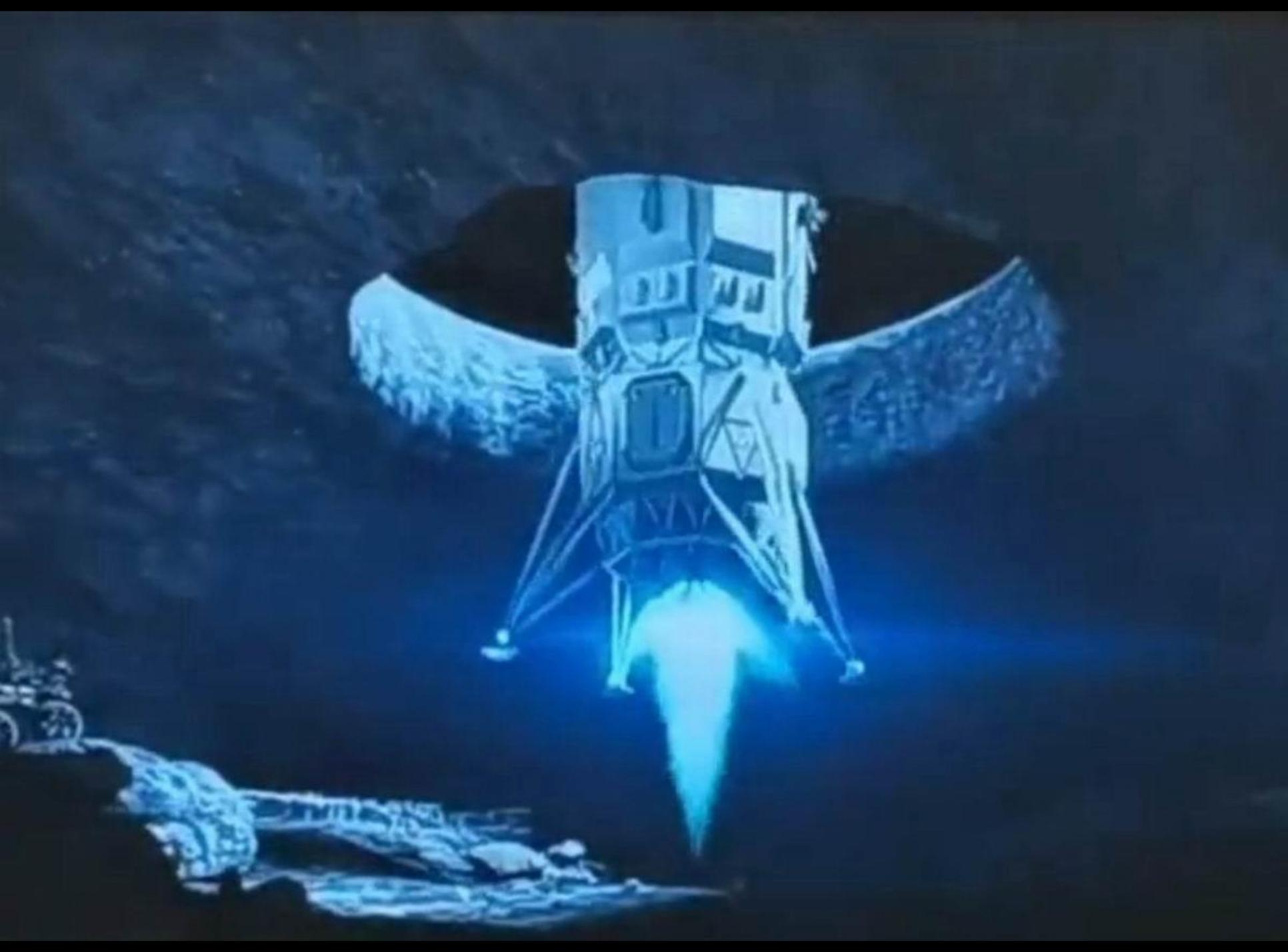


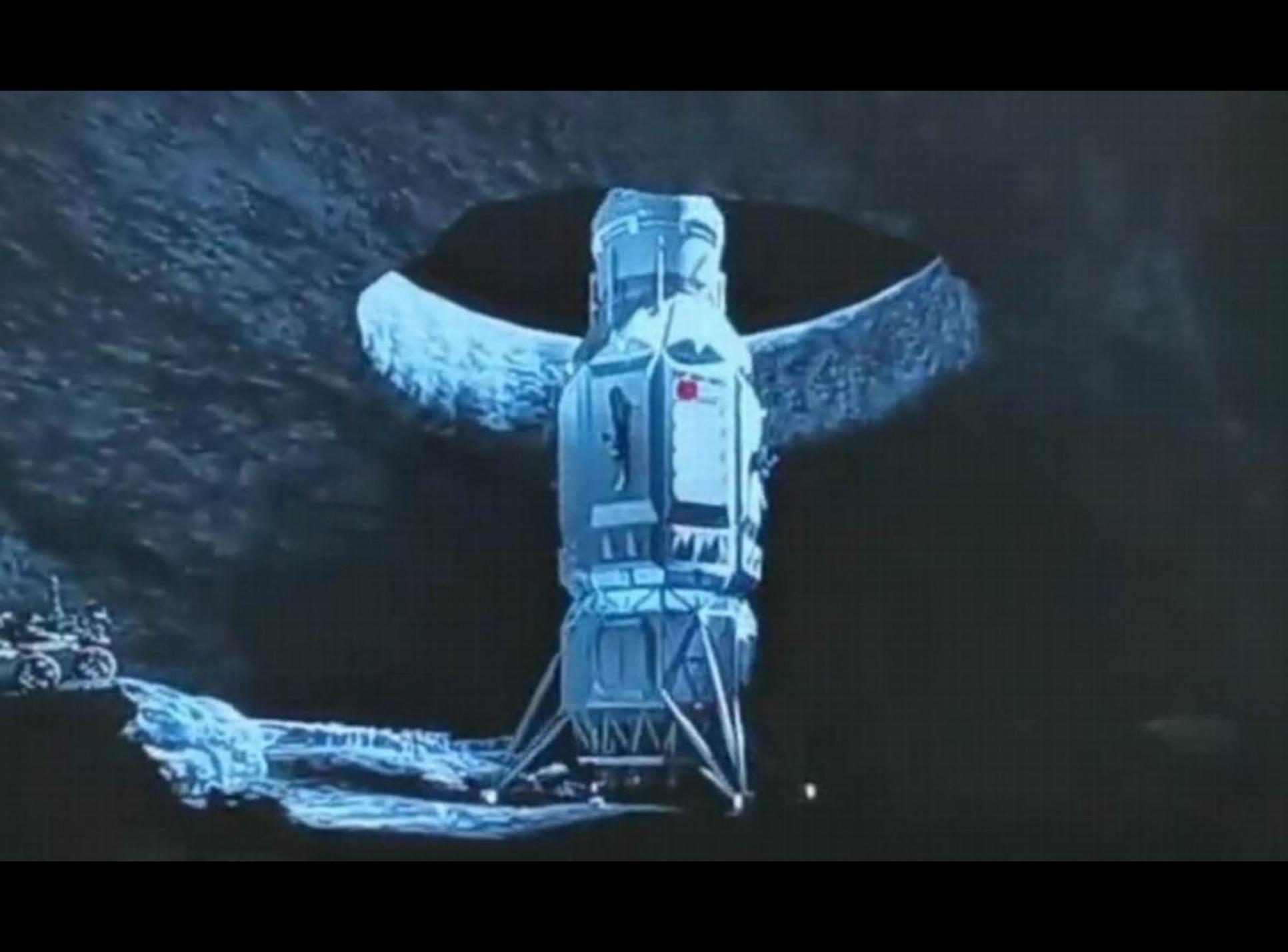


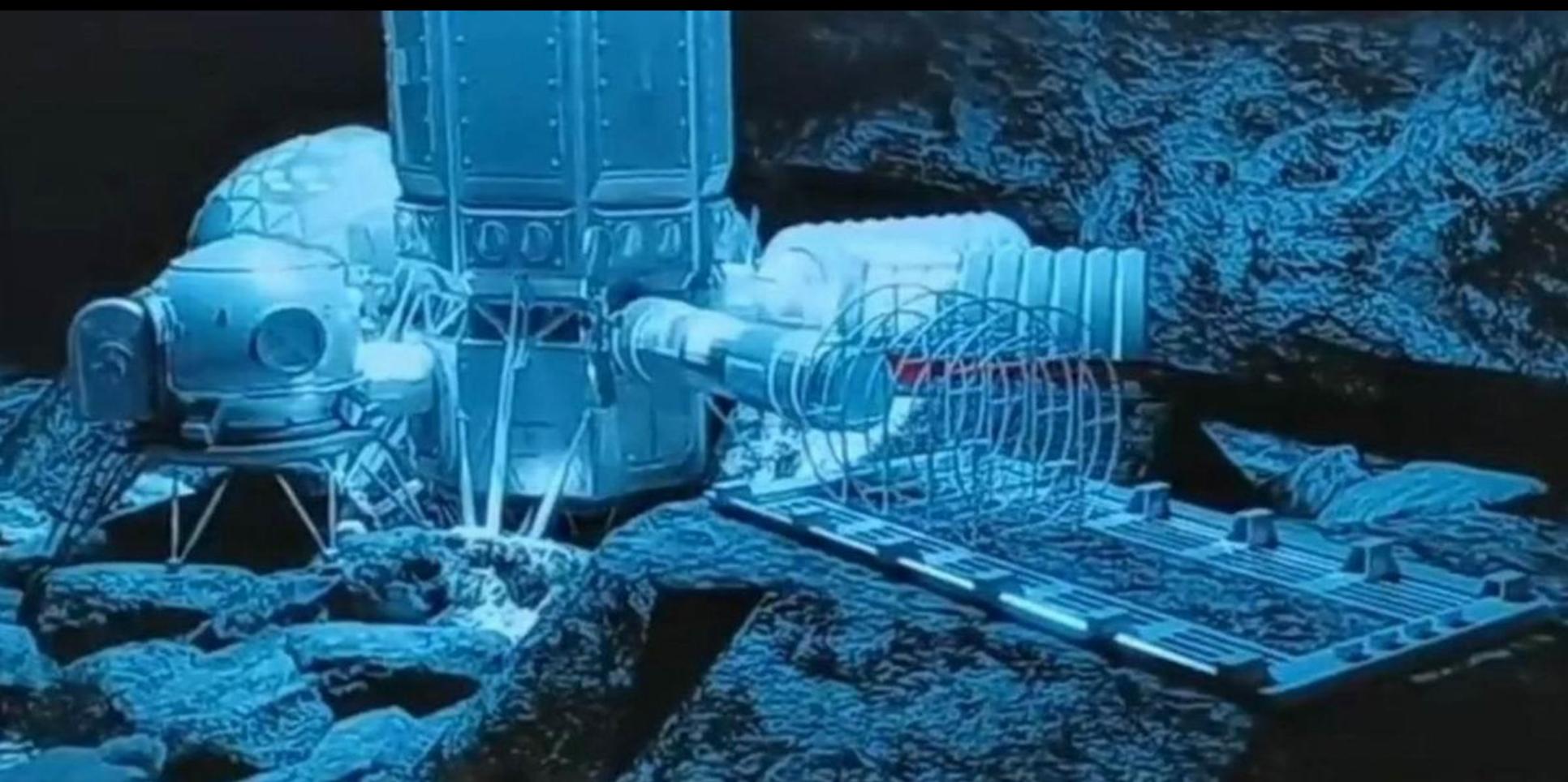


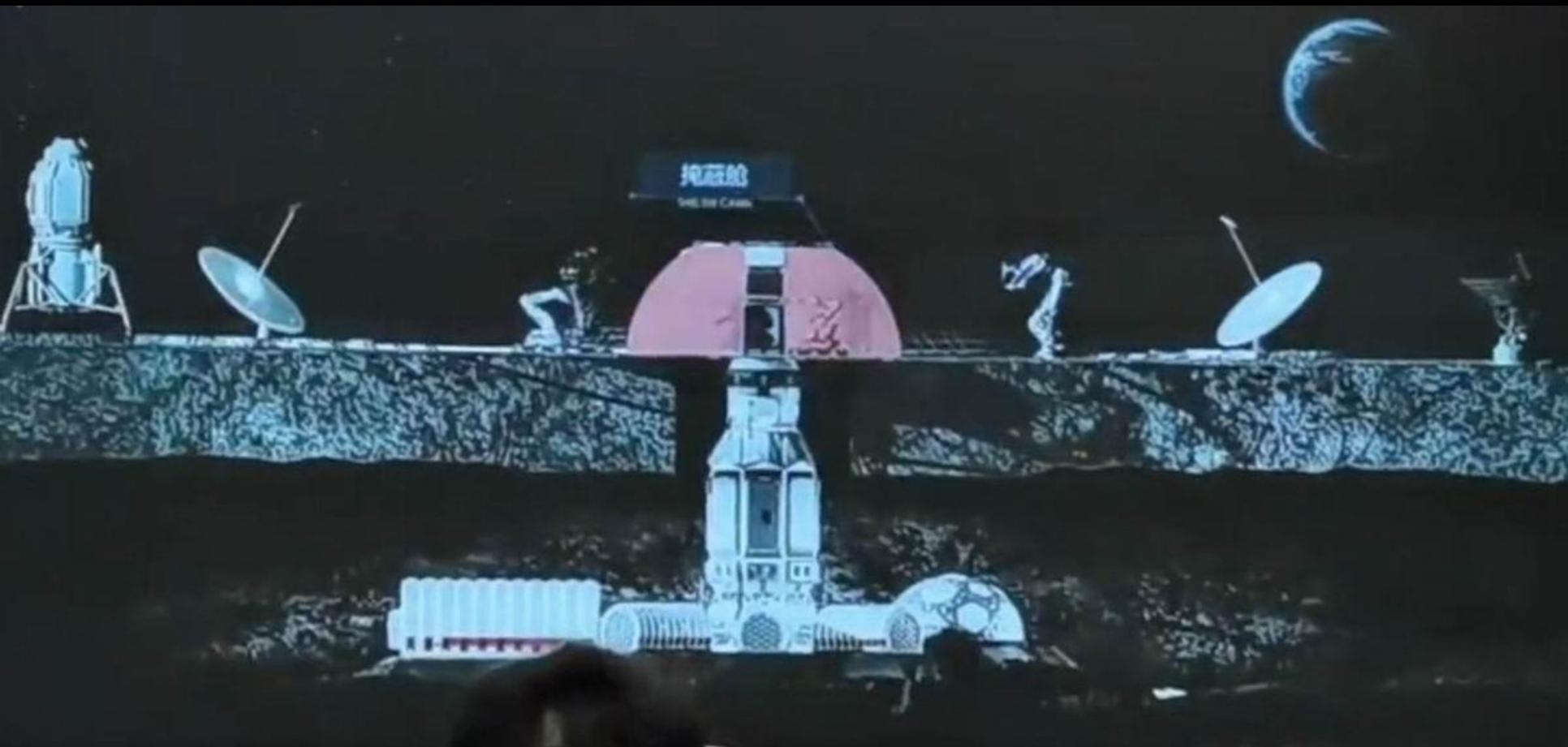


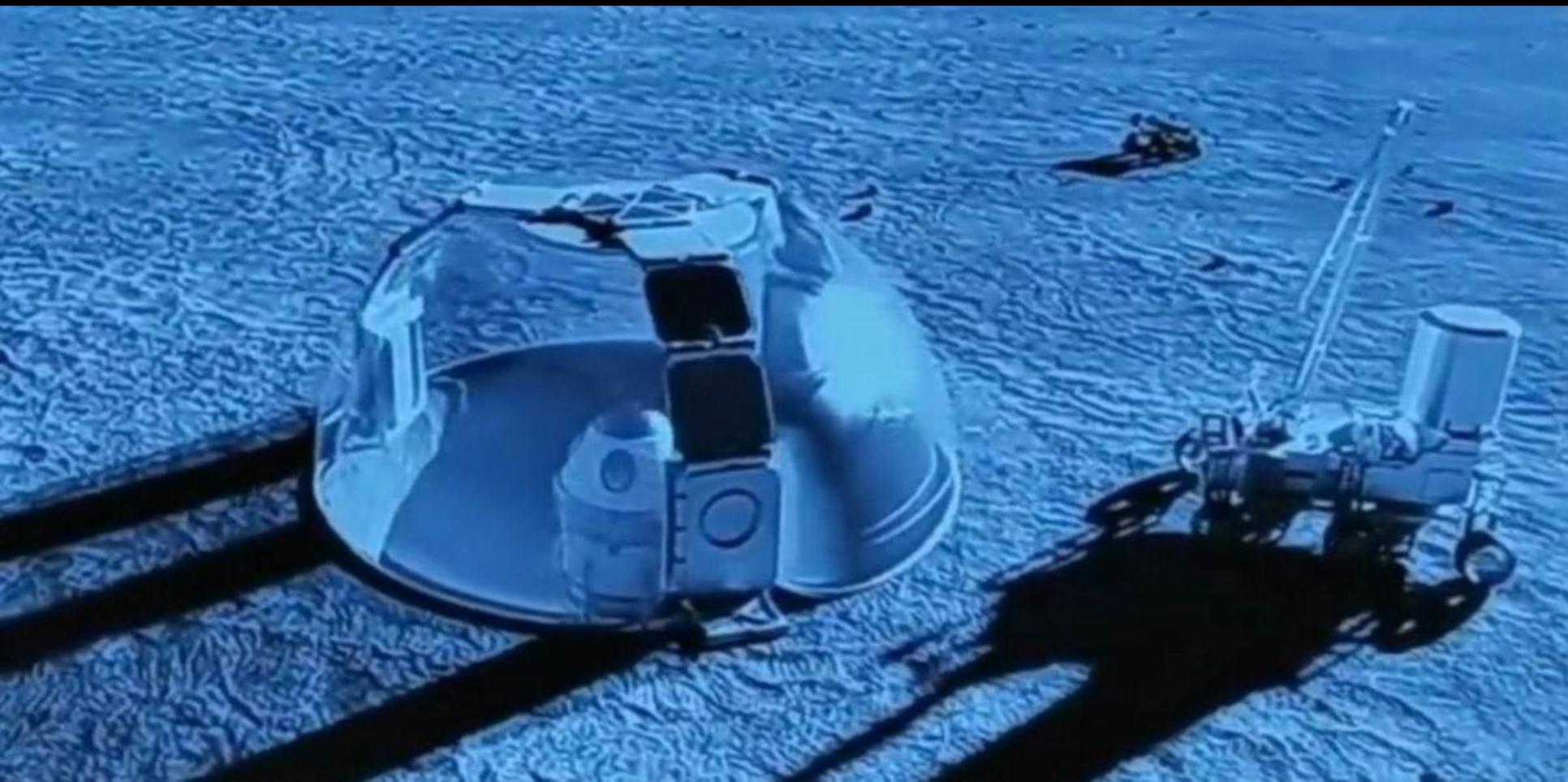


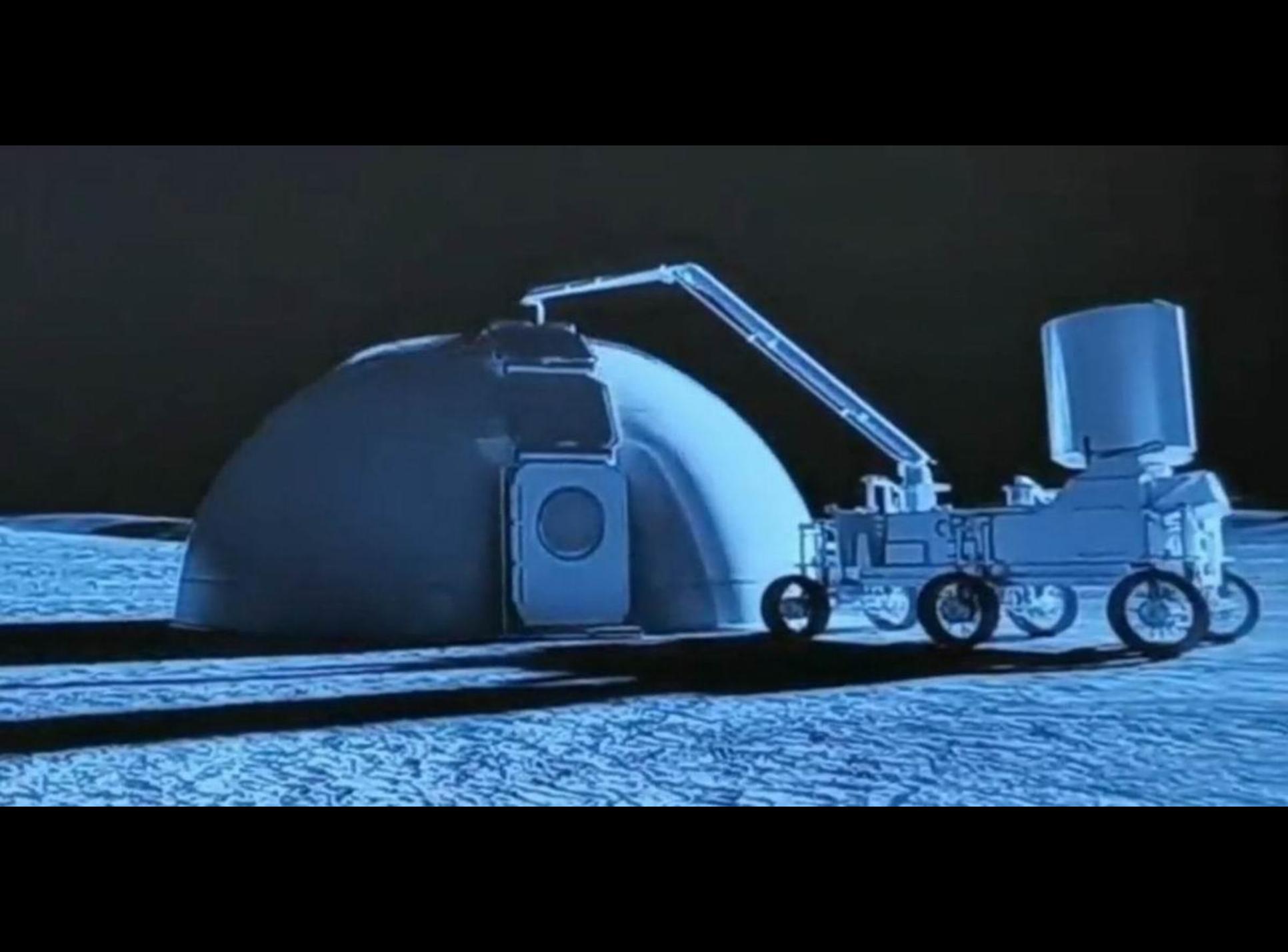


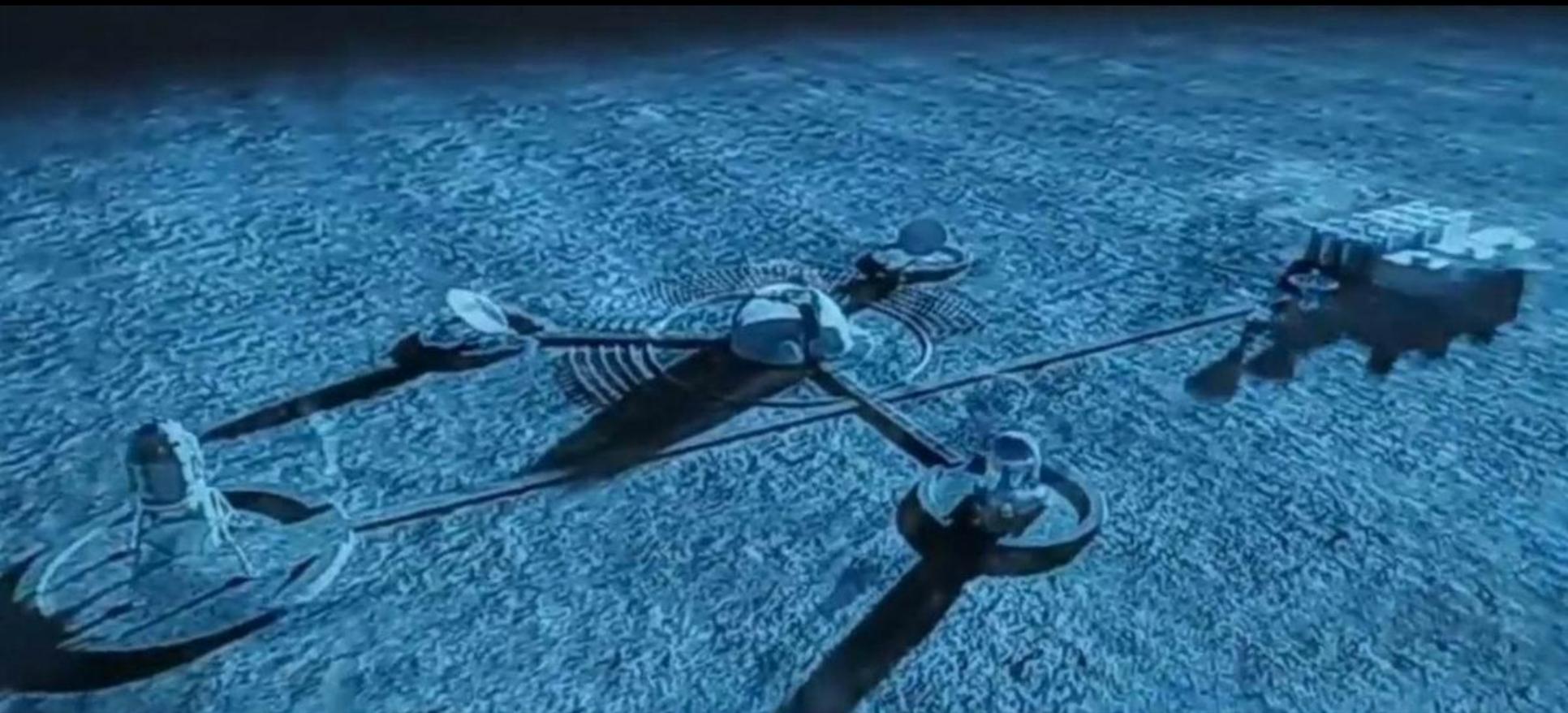


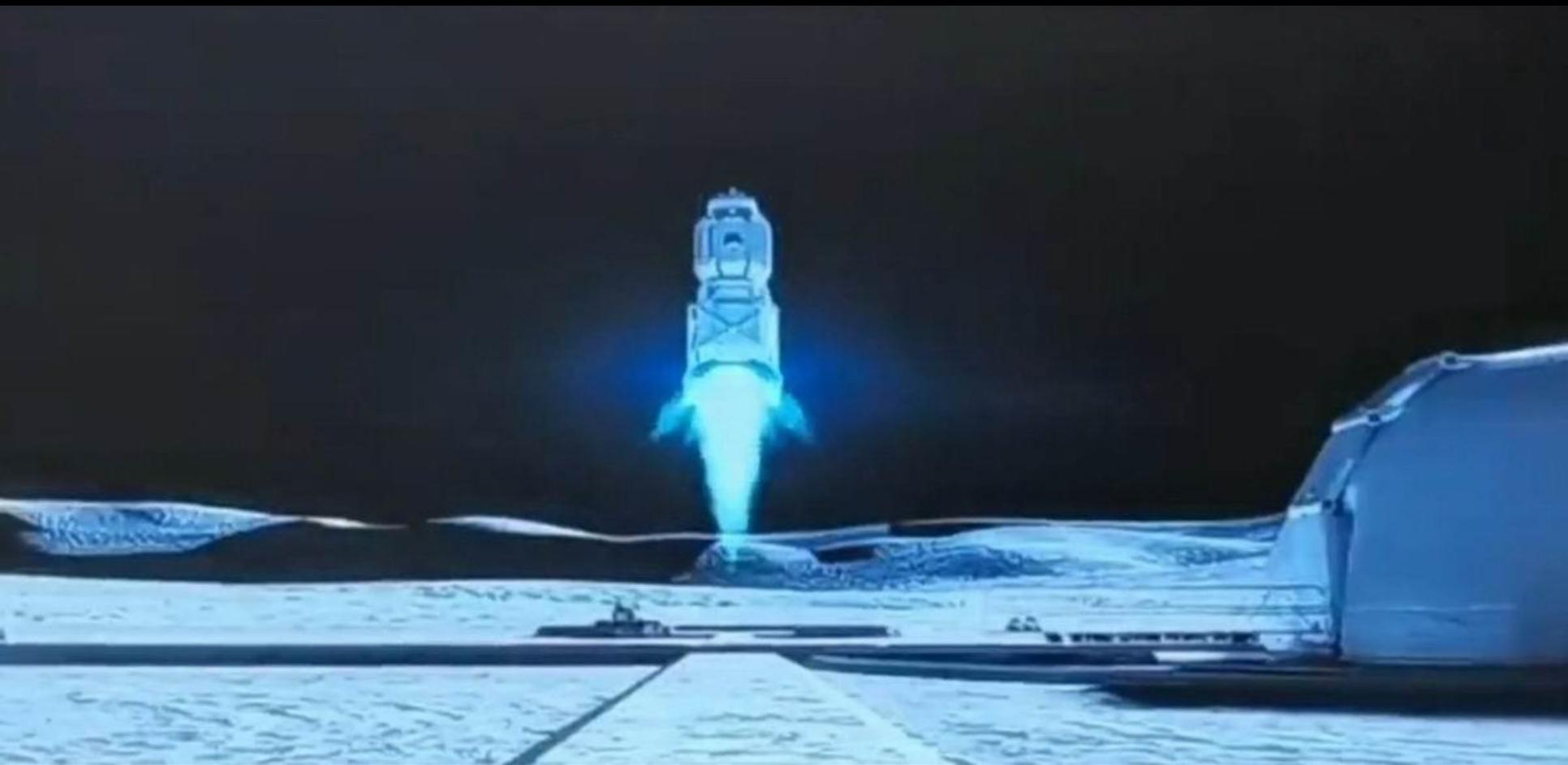




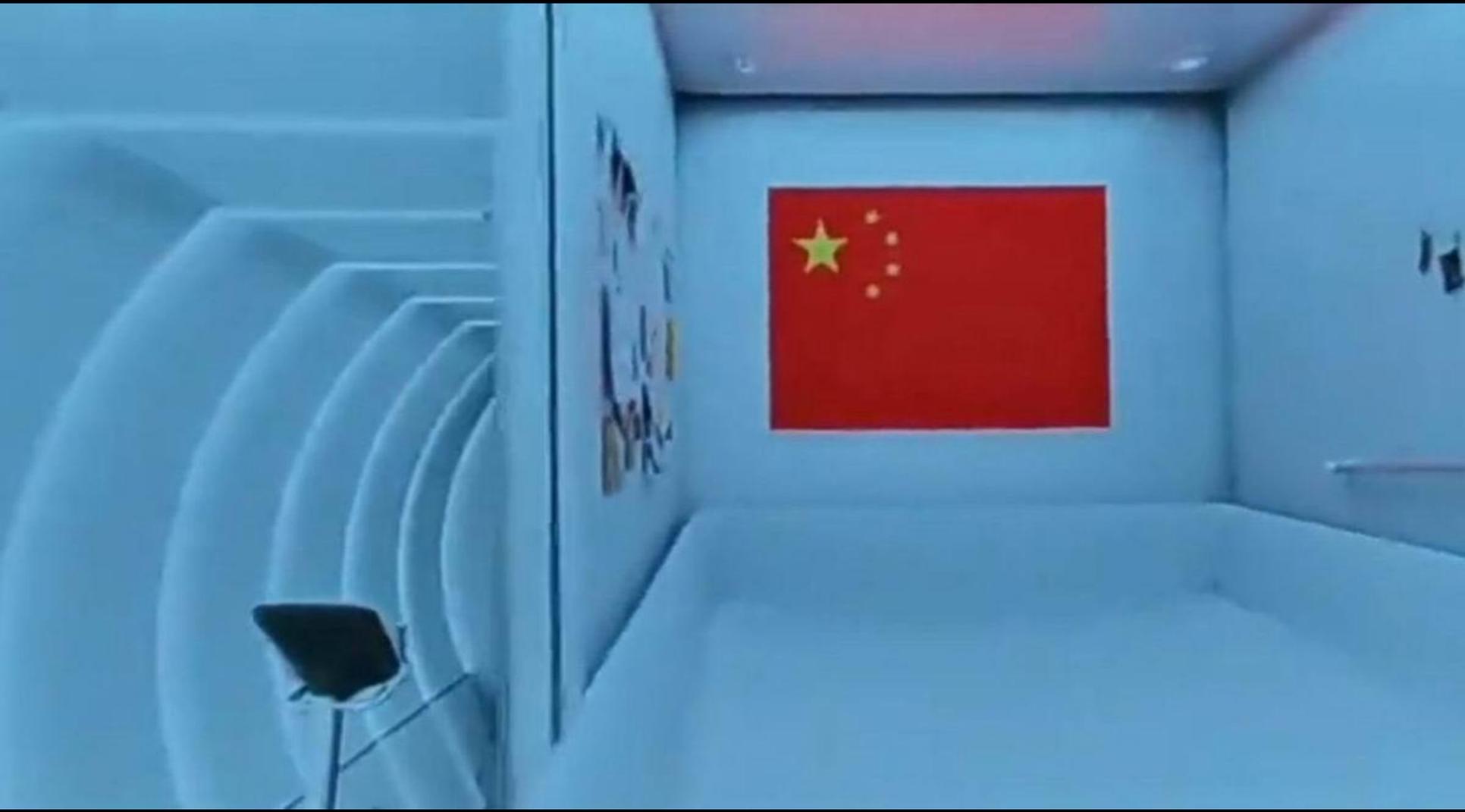












月表环境:

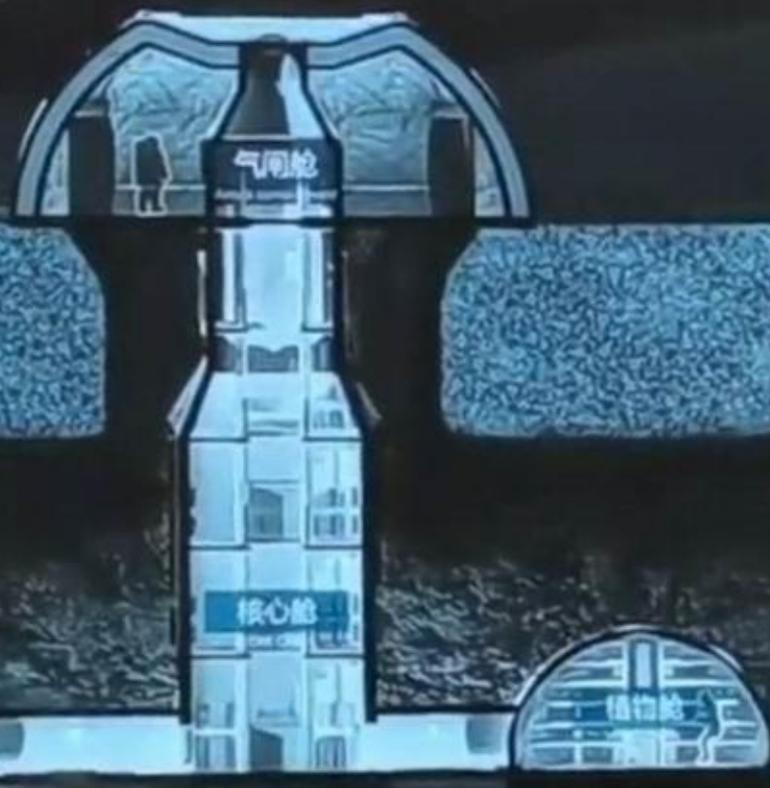
月昼: 117°C, 月夜: -173°C
强辐射、微粒子撞击、真空

熔岩管环境:

月昼: 17°C
月夜: -43°C真空

科研站内部环境:

稳定温度24-26°C
加压 (可呼吸气体)



1. 主要舱室面积

工作舱 10.5m, 10.5m, 10.5m, 1050.54m², 10507.0m³
 生活舱 10.5m, 10.5m, 10.5m, 1050.54m², 10507.0m³
 物资舱 10.5m, 10.5m, 10.5m, 1050.54m², 10507.0m³
 空气舱 10.5m, 10.5m, 10.5m, 1050.54m², 10507.0m³

2. 居住量

人员供气量: 300kg/人/日
 二氧消耗量: 10kg/人/日

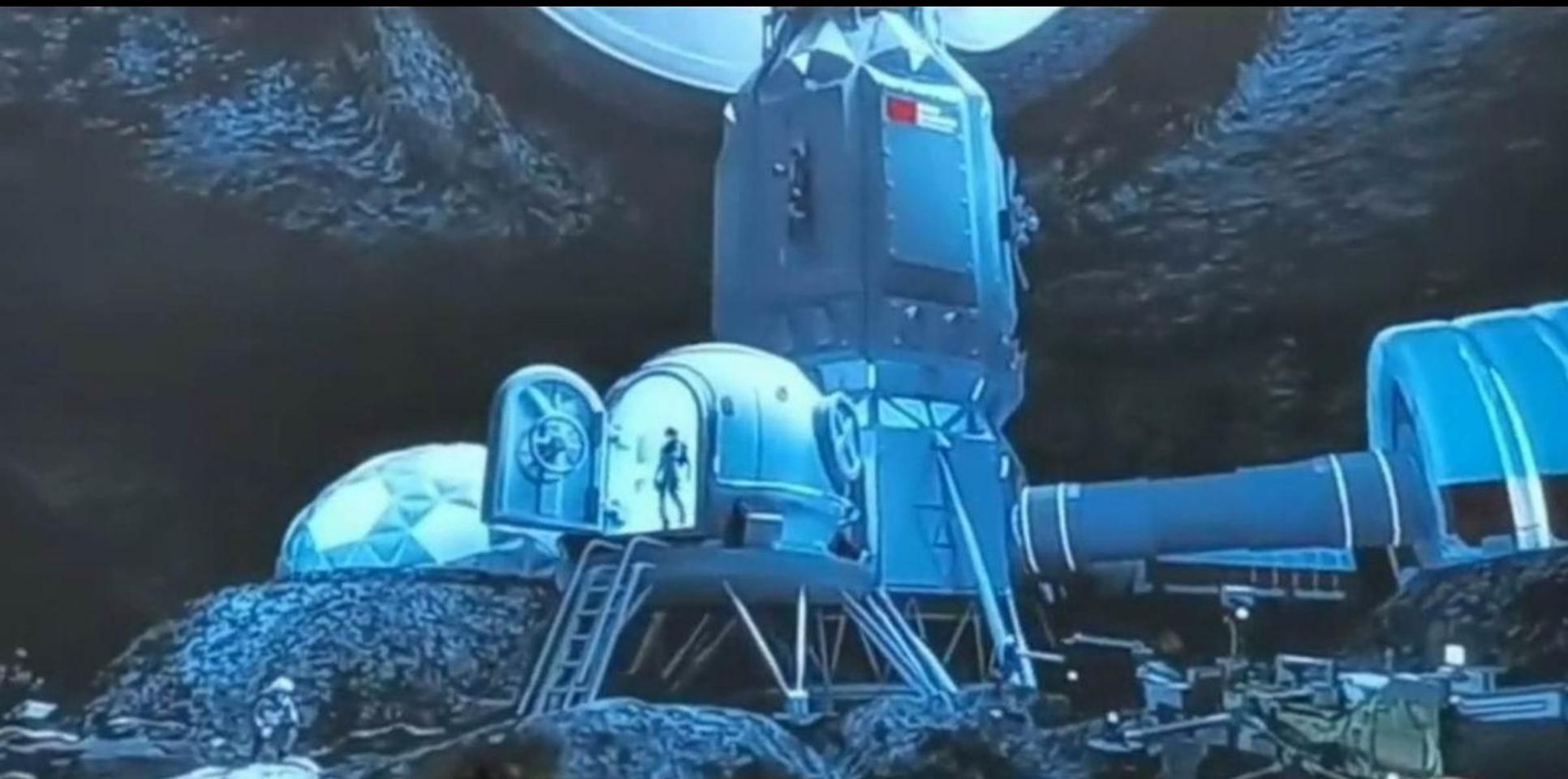
3. 功率量

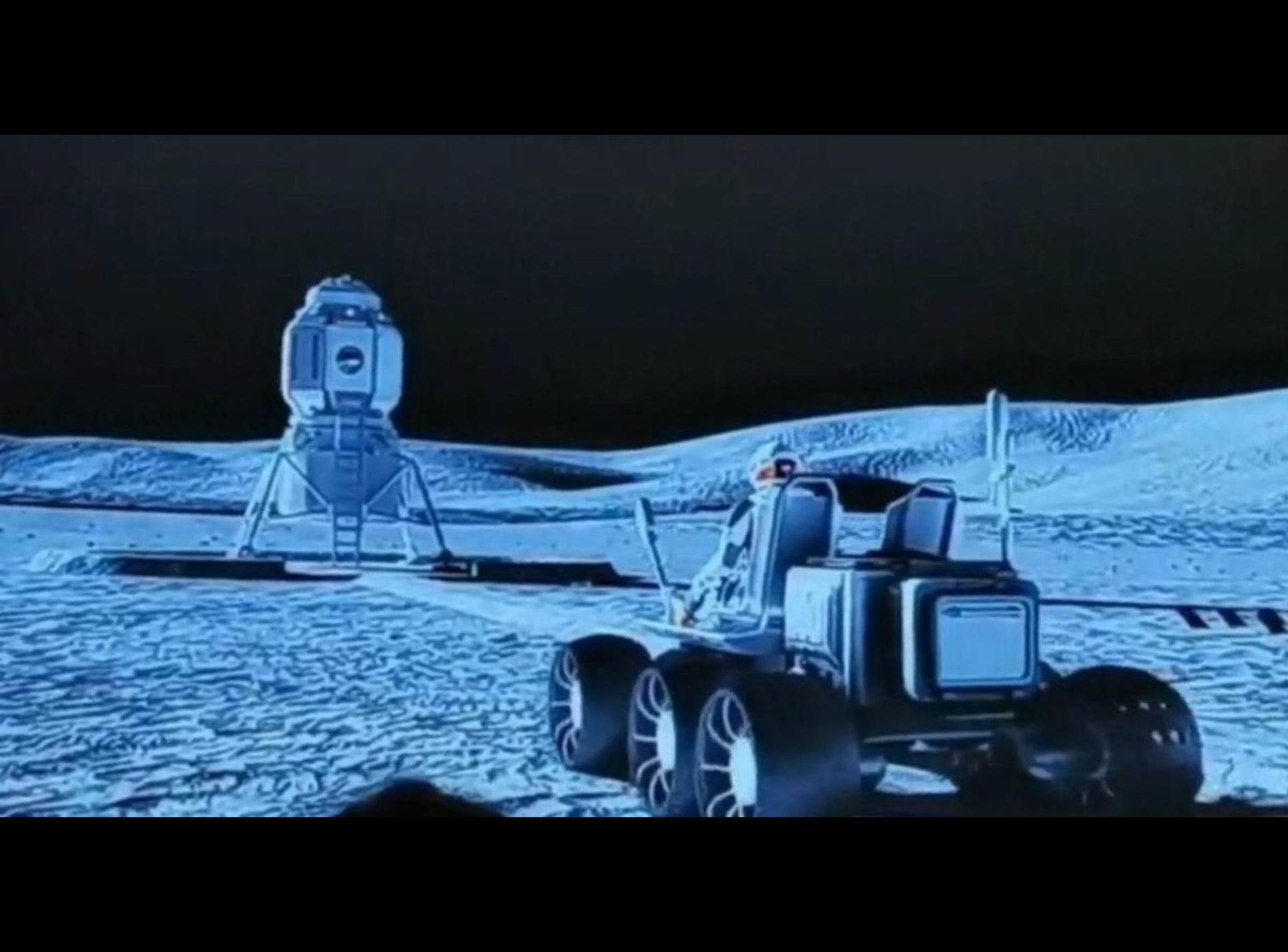
2.5kW/人/日, 即每日消耗24kWh电能/人/日

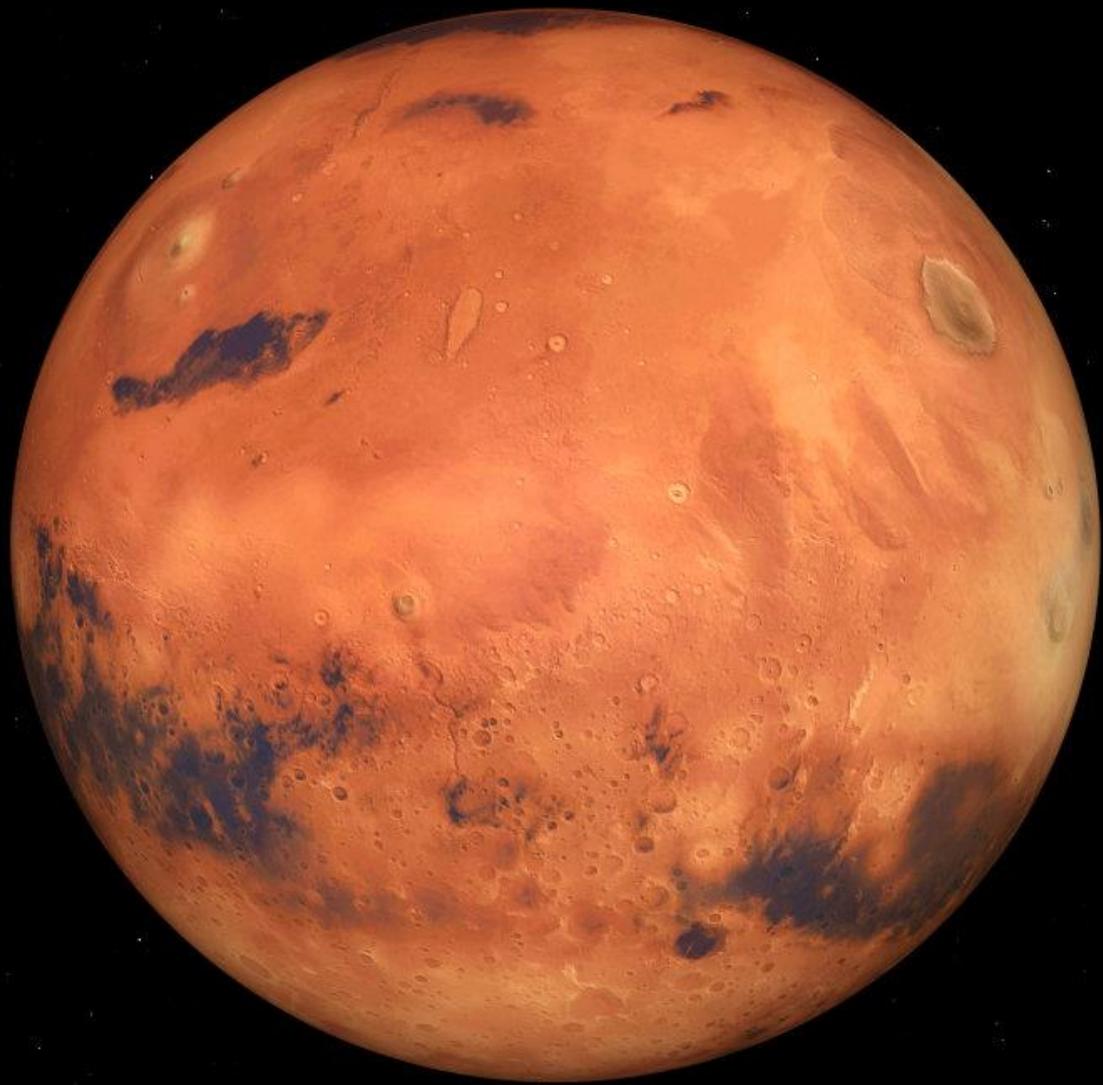
4. 舱内温度控制范围

工作舱 18°C-22°C, 办公室18°C-22°C, 18°C-22°C
 生活舱 18°C-22°C, 18°C-22°C, 18°C-22°C
 物资舱 18°C-22°C, 18°C-22°C, 18°C-22°C
 (舱内温度控制范围: 18°C-22°C, 18°C-22°C, 18°C-22°C)
 主要舱室温度控制: 18°C-22°C, 18°C-22°C

4—26°C稳定环境温度下的加压驻人空间







Děkuji za pozornost!

Ing. Tomáš PŘIBYL

pribyl@technicalmuseum.cz

www.technicalmuseum.cz

