

WAY 4 SPACE

LUNE, LE HUITIÈME CONTINENT

Way4Space

Station T - 7 décembre 2022 - Université citoyenne de Thouars



THALES

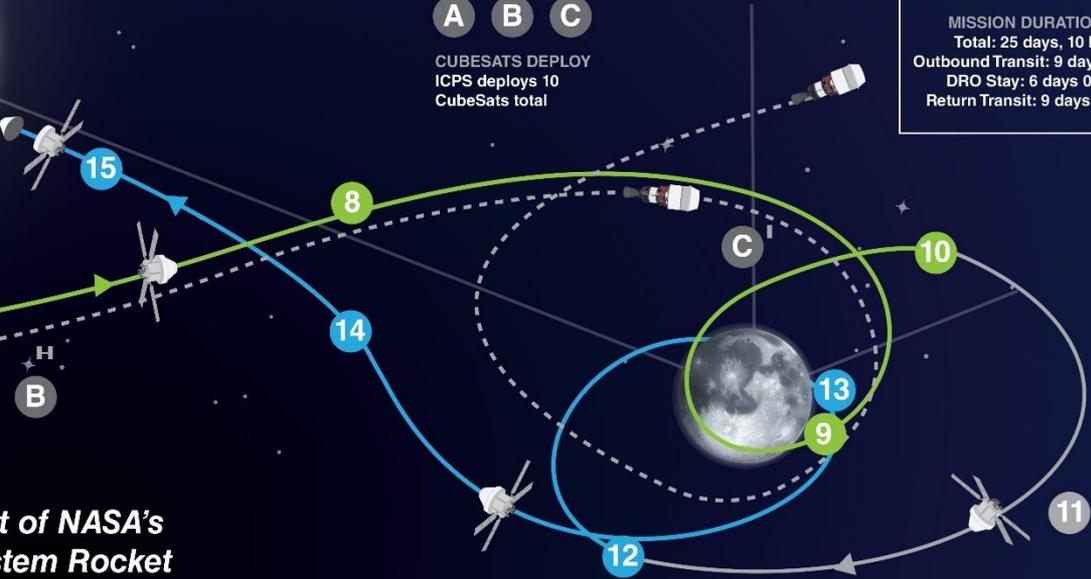




A B C

CUBESATS DEPLOY
ICPS deploys 10
CubeSats total

MISSION DURATIONS:
Total: 25 days, 10 hrs
Outbound Transit: 9 days 13 hrs
DRO Stay: 6 days 0 hrs
Return Transit: 9 days 19 hrs



ARTEMIS I

The First Uncrewed Integrated Flight Test of NASA's Orion Spacecraft and Space Launch System Rocket

1 LAUNCH (11/16/22)
SLS and Orion lift off from pad 39B at Kennedy Space Center.

2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM

3 CORE STAGE MAIN ENGINE CUT OFF
With separation.

4 PERIGEE RAISE MANEUVER

5 EARTH ORBIT
Systems check with solar panel adjustments.

6 TRANS LUNAR INJECTION (TLI) BURN
Maneuver lasts for approximately 20 minutes.

7 INTERIM CRYOGENIC PROPULSION STAGE (ICPS) SEPARATION AND DISPOSAL
ICPS commits Orion to moon at TLI.

8 OUTBOUND TRAJECTORY CORRECTION BURNS
As necessary adjust trajectory for lunar flyby to Distant Retrograde Orbit (DRO).

9 OUTBOUND POWERED FLYBY
105.5 miles from the Moon; targets DRO insertion.

10 LUNAR ORBIT INSERTION
Enter Distant Retrograde Orbit.

11 DISTANT RETROGRADE ORBIT
Perform a half revolution (6 day duration) in the orbit 43,730 miles from the surface of the Moon.

12 DRO DEPARTURE
Leave DRO and start return to Earth.

13 RETURN POWERED FLYBY
RPF burn prep and return coast to Earth initiated. Closest approach in middle of burn, 81 miles.

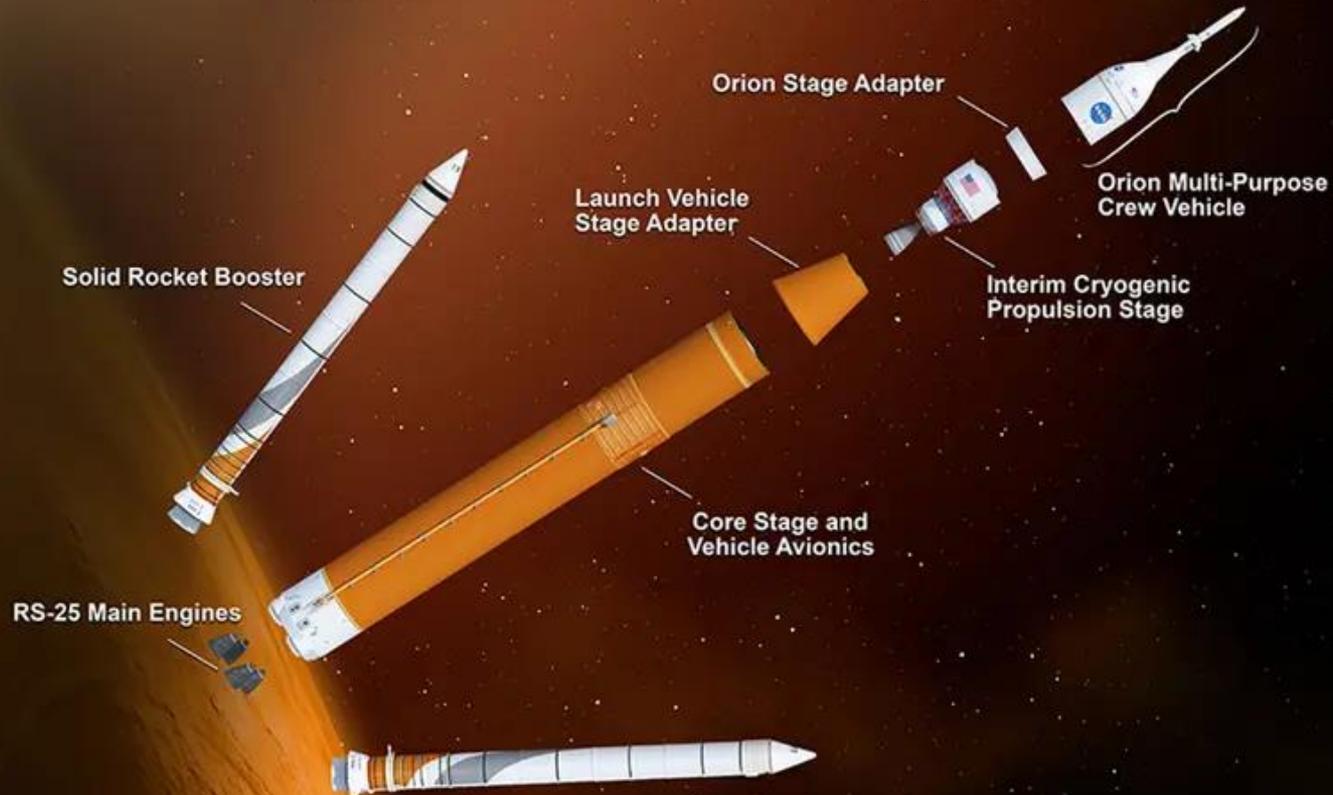
14 RETURN TRANSIT
Return Trajectory Correction burns as necessary to aim for Earth's atmosphere.

15 CREW MODULE SEPARATION FROM SERVICE MODULE

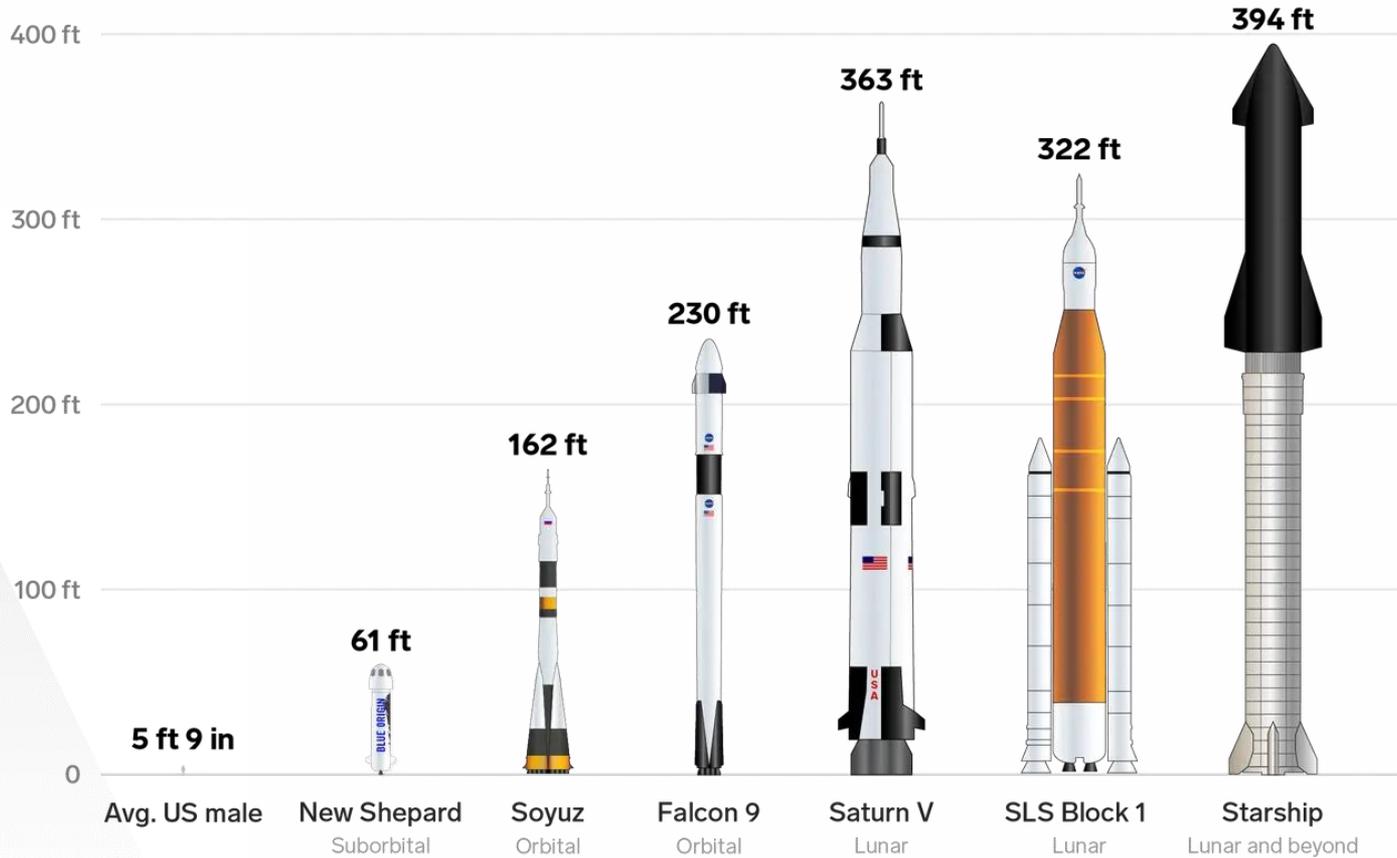
16 ENTRY INTERFACE
Enter Earth's atmosphere.

17 SPLASHDOWN (12/11/22)
Pacific Ocean landing within view of the U.S. Navy recovery ship.

Space Launch System - Block 1 Expanded View



Launch Systems for Human Spaceflight



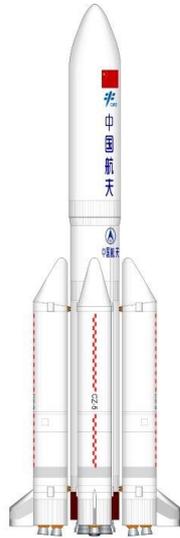
Heavy Launchers of the World



LVM 3



Angara A5



CZ-5B



Ariane 6



Vulcan



H-3



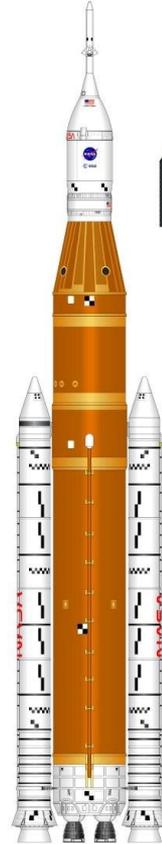
Delta IV Heavy



Falcon 9 Block 5



Falcon Heavy



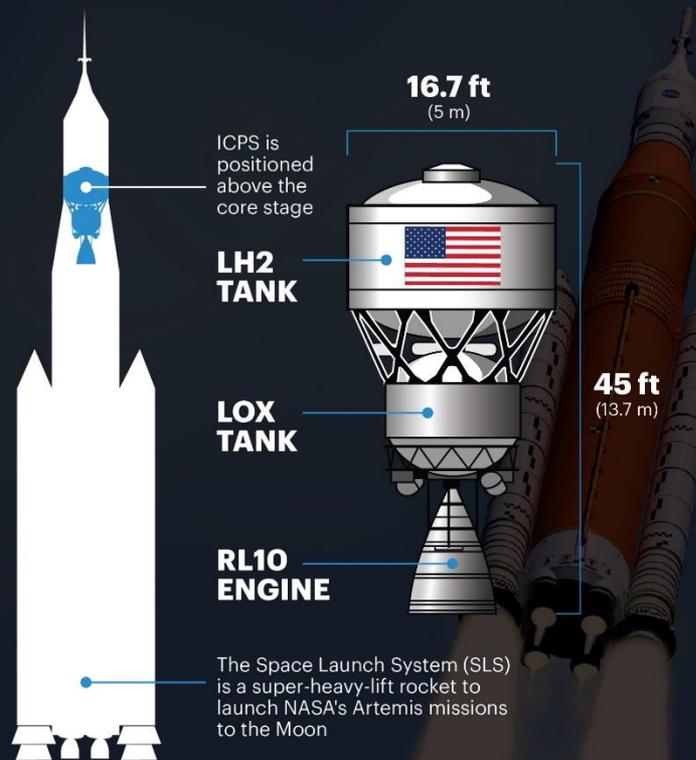
SLS Block 1



Starship/Superheavy

TO THE MOON!

ULA's ICPS is Powering America's Trip Back to the Moon



WHAT IS ICPS?

Interim Cryogenic Propulsion Stage (ICPS) is the upper stage of the SLS launch vehicle that will propel Orion to the Moon

DESIGN & OPERATIONS

- Modified version of the 5-meter Delta Cryogenic Second Stage (DCSS)
- The 5-meter DCSS has 24 flights with 100% mission success
- Features a stretched hydrogen tank and a second hydrazine bottle for additional attitude control propellant
- Electrical and mechanical interfaces customized for SLS and Orion
- Built by ULA in Decatur, Alabama, in partnership with Boeing
- ULA team is supporting SLS Launch Operations during ICPS processing

PERFORMANCE

- Produces 24,750 lbs (110.1 kilo-Newtons) of thrust
- Accelerates to more than 24,500 mph (39,422 kph) to escape Earth orbit

SUPPORT TO ARTEMIS

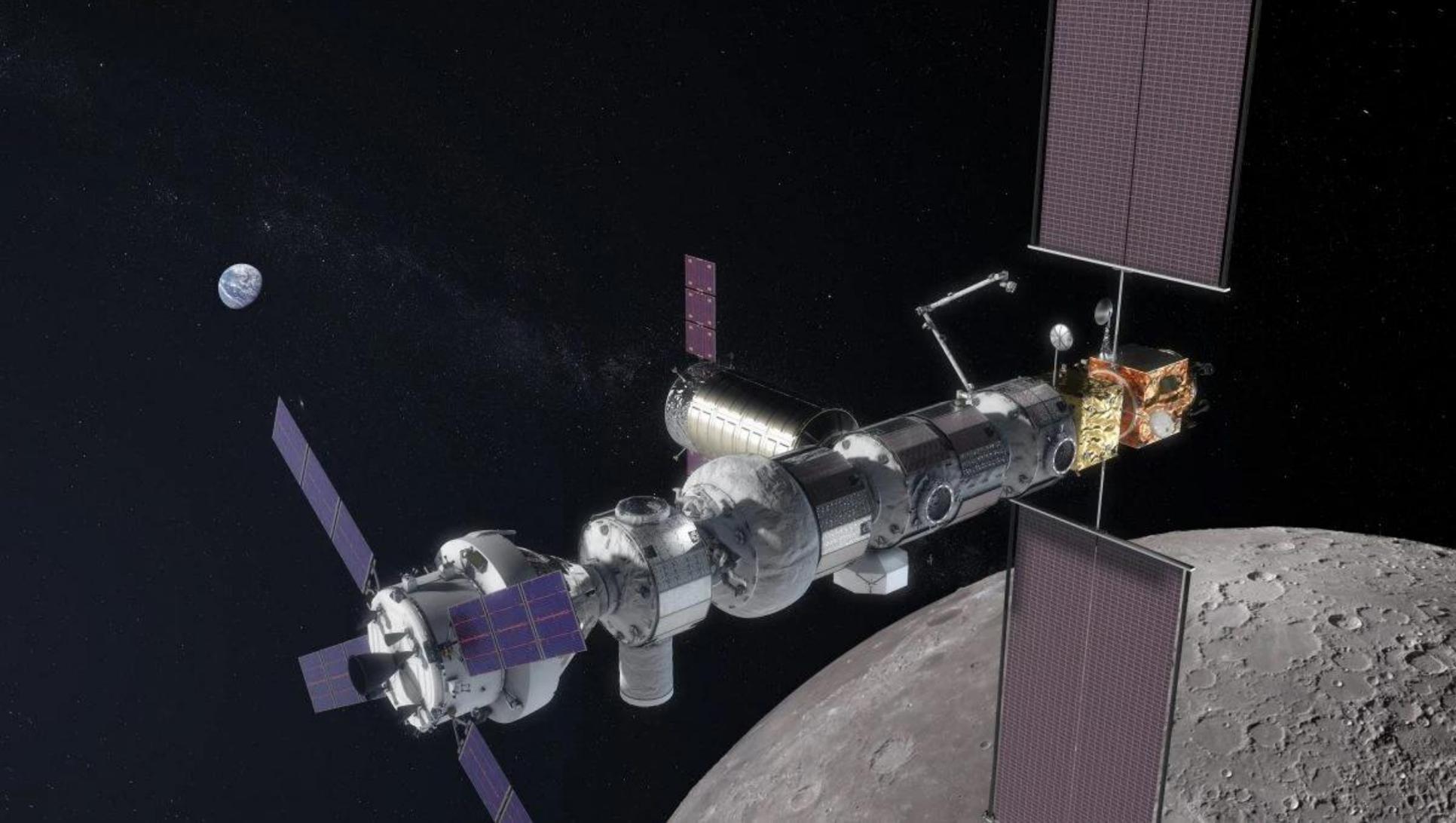
- ULA is providing hardware and engineering support for three ICPS stages on the first three Artemis missions
- ICPS for Artemis I will power a 26-42 day uncrewed test flight to validate the SLS rocket and Orion system prior to flying astronauts on the second Artemis mission

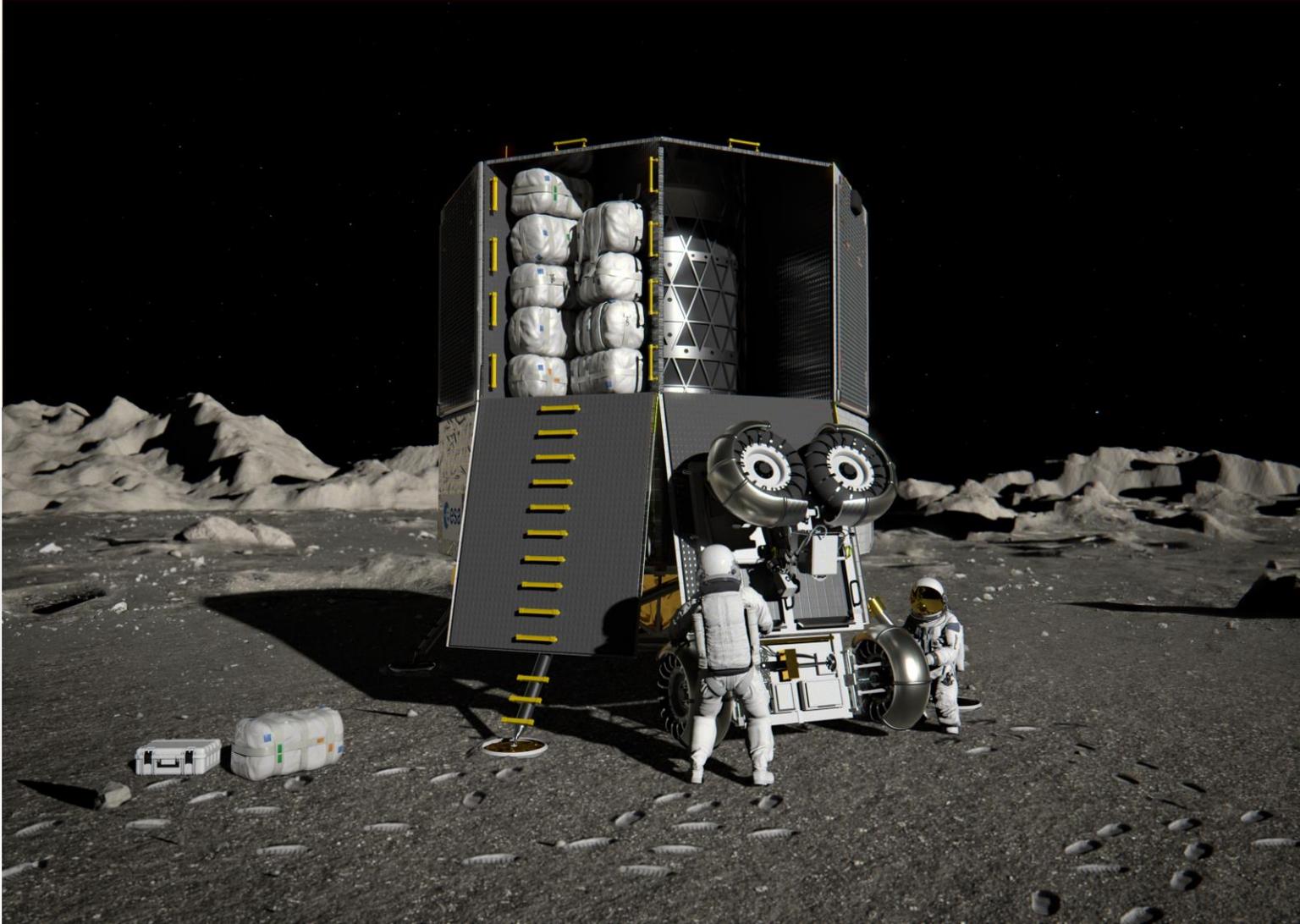
Background image courtesy of NASA





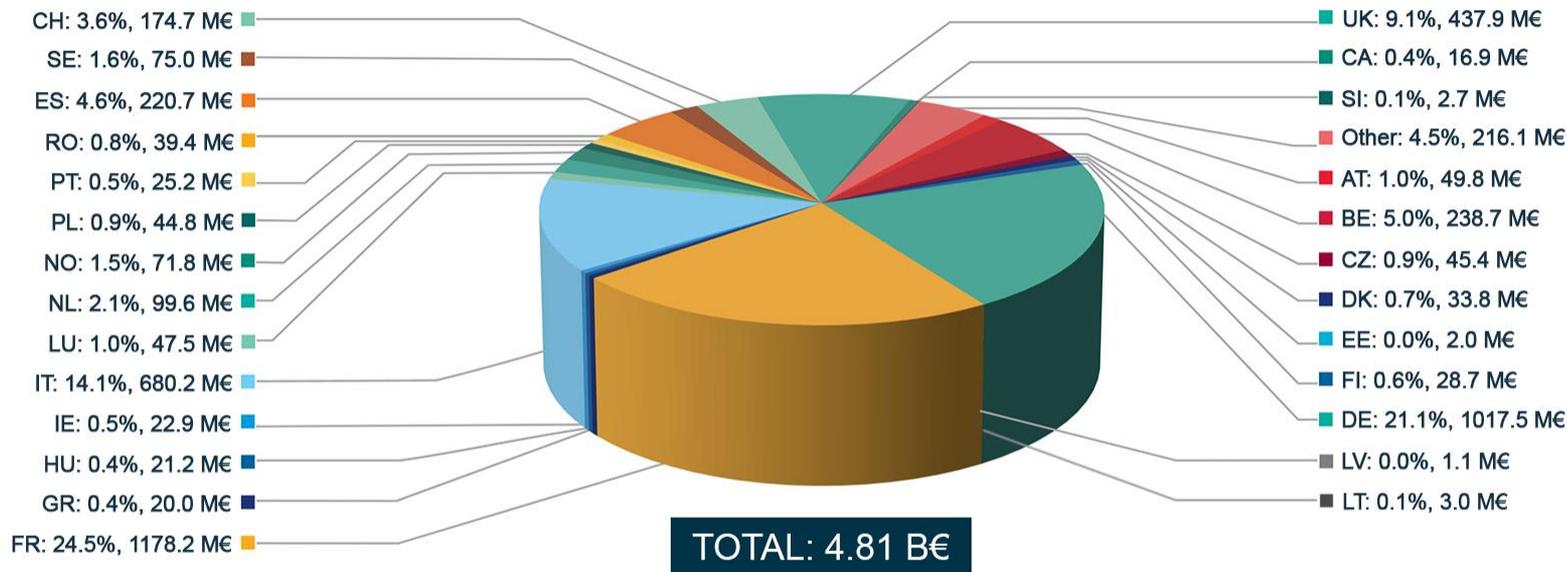






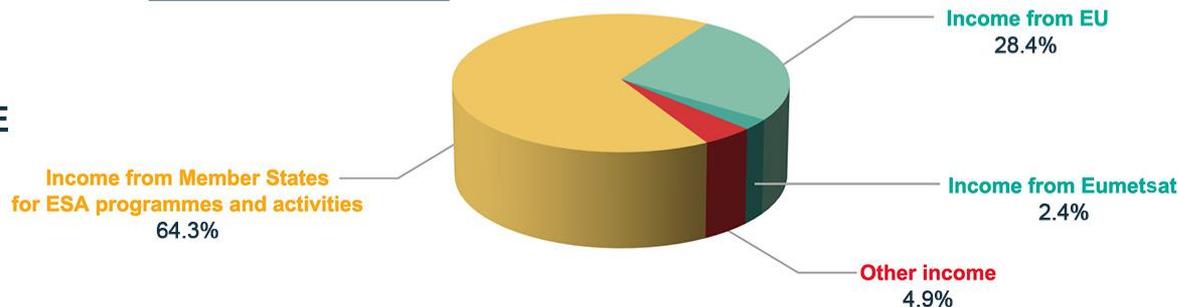
BUDGET 2022

ESA Activities and Programmes



BUDGET 2022 BY FUNDING SOURCE

TOTAL: 7.15 B€





La promotion 2022 des astronautes de l'ESA comprend cinq astronautes de carrière, 11 astronautes réservistes et un astronaute porteur de handicap physique.



LES ACCORDS ARTEMIS

PRINCIPES DE COOPÉRATION POUR L'EXPLORATION
ET L'UTILISATION CIVILES
À DES FINS PACIFIQUES DE LA LUNE, DE MARS, DES
COMÈTES ET DES ASTÉROÏDES



PARAGRAPHE 10 – RESSOURCES SPATIALES - LES ACCORDS ARTEMIS

1. Les signataires notent que l'utilisation de ressources spatiales peut profiter à l'humanité en offrant un soutien essentiel pour la réalisation d'activités sûres et durables.

2. Les signataires rappellent que l'extraction et l'utilisation de ressources spatiales, y compris tout prélèvement sur ou sous la surface de la Lune, de Mars, de comètes ou d'astéroïdes, sont censés être effectuées conformément au Traité sur l'espace extra-atmosphérique et en vue d'appuyer des activités spatiales sûres et durables. Les signataires affirment que l'extraction de ressources spatiales ne constitue pas en soi une appropriation nationale aux termes de l'article II du Traité sur l'espace extra-atmosphérique et que les contrats et les autres instruments juridiques liés aux ressources spatiales sont censés concorder avec ce traité.

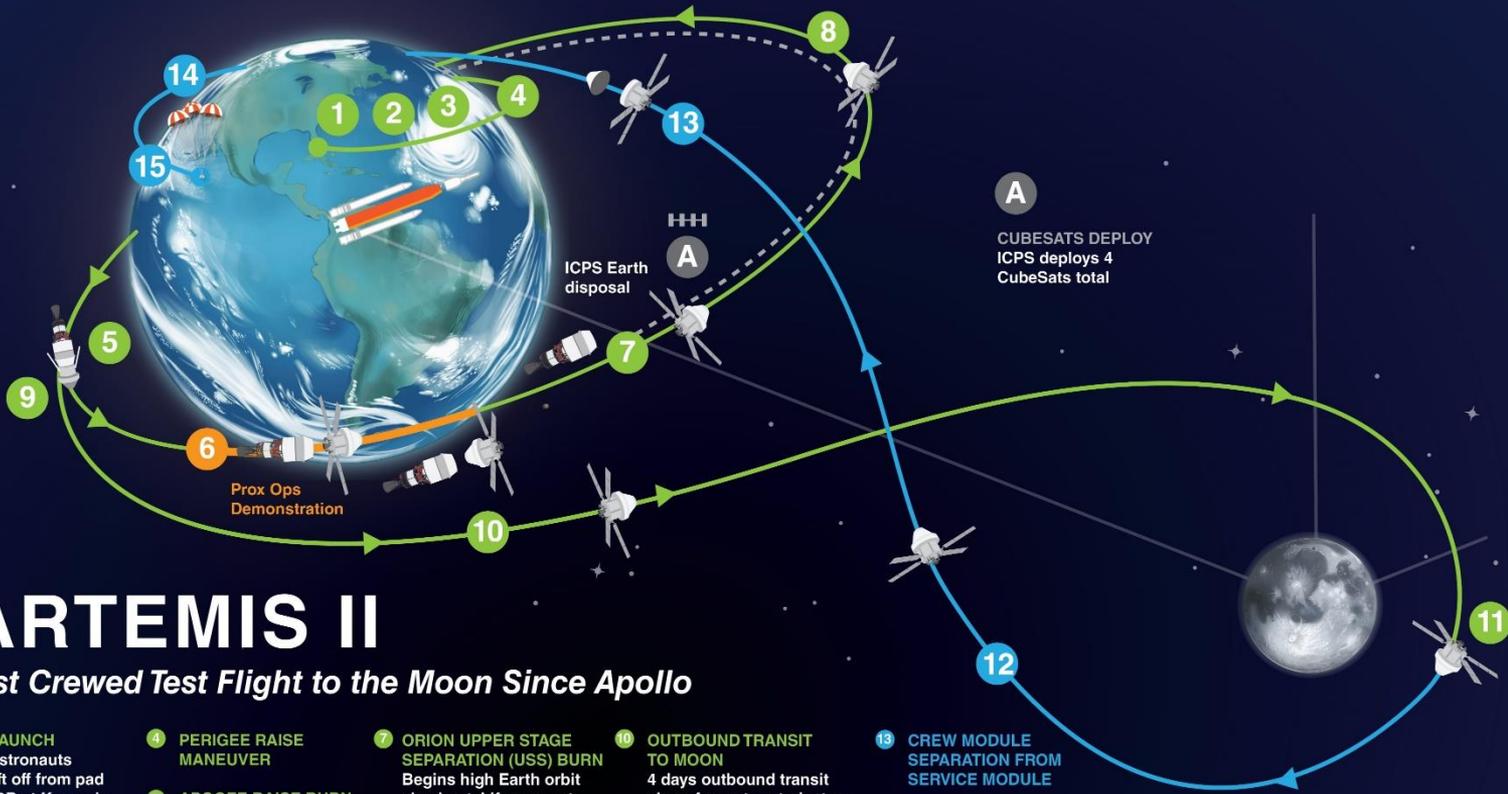


PARAGRAPHE 10 – RESSOURCES SPATIALES - LES ACCORDS ARTEMIS

3. Les signataires s'engagent à informer le Secrétaire général des Nations Unies, le public et la communauté scientifique internationale de leurs activités d'extraction de ressources spatiales, conformément au Traité sur l'espace extra-atmosphérique.

4. Les signataires entendent utiliser l'expérience acquise dans le cadre des accords Artémis pour contribuer aux efforts multilatéraux visant à développer davantage les pratiques et les règles internationales applicables à l'extraction et à l'utilisation des ressources spatiales, notamment au moyen d'efforts soutenus au COPUOS.





A

CUBESATS DEPLOY
ICPS deploys 4
CubeSats total

ARTEMIS II

First Crewed Test Flight to the Moon Since Apollo

- 1 LAUNCH**
Astronauts lift off from pad 39B at Kennedy Space Center.
- 2 JETTISON SOLID ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 PERIGEE RAISE MANEUVER**
- 5 APOGEE RAISE BURN TO HIGH EARTH ORBIT**
Begin 24 hour checkout of spacecraft.
- 6 ORION SEPARATION FROM INTERIM CRYOGENIC PROPULSION STAGE (ICPS) FOLLOWED BY PROX OPS DEMO**
Plus manual handling qualities assessment for up to 2 hours.
- 7 ORION UPPER STAGE SEPARATION (USS) BURN**
Begins high Earth orbit checkout. Life support, exercise, and habitation equipment evaluations.
- 8 PERIGEE RAISE BURN**
- 9 TRANS-LUNAR INJECTION (TLI) BY ORION'S MAIN ENGINE**
Lunar free return trajectory initiated with European service module.
- 10 OUTBOUND TRANSIT TO MOON**
4 days outbound transit along free return trajectory.
- 11 LUNAR FLYBY**
5,630 nmi (mean) lunar farside altitude.
- 12 TRANS-EARTH RETURN**
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere; travel time approximately 4 days.

- 13 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 14 ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 15 SPLASHDOWN**
Ship recovers astronauts and capsule.

PROXIMITY OPERATIONS DEMONSTRATION SEQUENCE	
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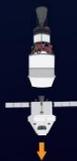
ARTEMIS II

PROXIMITY OPERATIONS DEMONSTRATION SEQUENCE



1

PRE-SEPARATION



2

SEPARATION / DRIFT



3

180° PITCH
MANEUVER



4

NULL SEPARATION
 ΔV



5

COARSE HQ



6

APPROACH



7

HQ 10m EVAL #1



8

BACK AWAY



9

STATIONKEEP



10

IPCS MANEUVER



11

APPROACH #2



12

HQ 15m EVAL #2



13

MULTI-AXIS TEST



14

MANUAL BACK-OUT



15

TURN TO ATT BURN



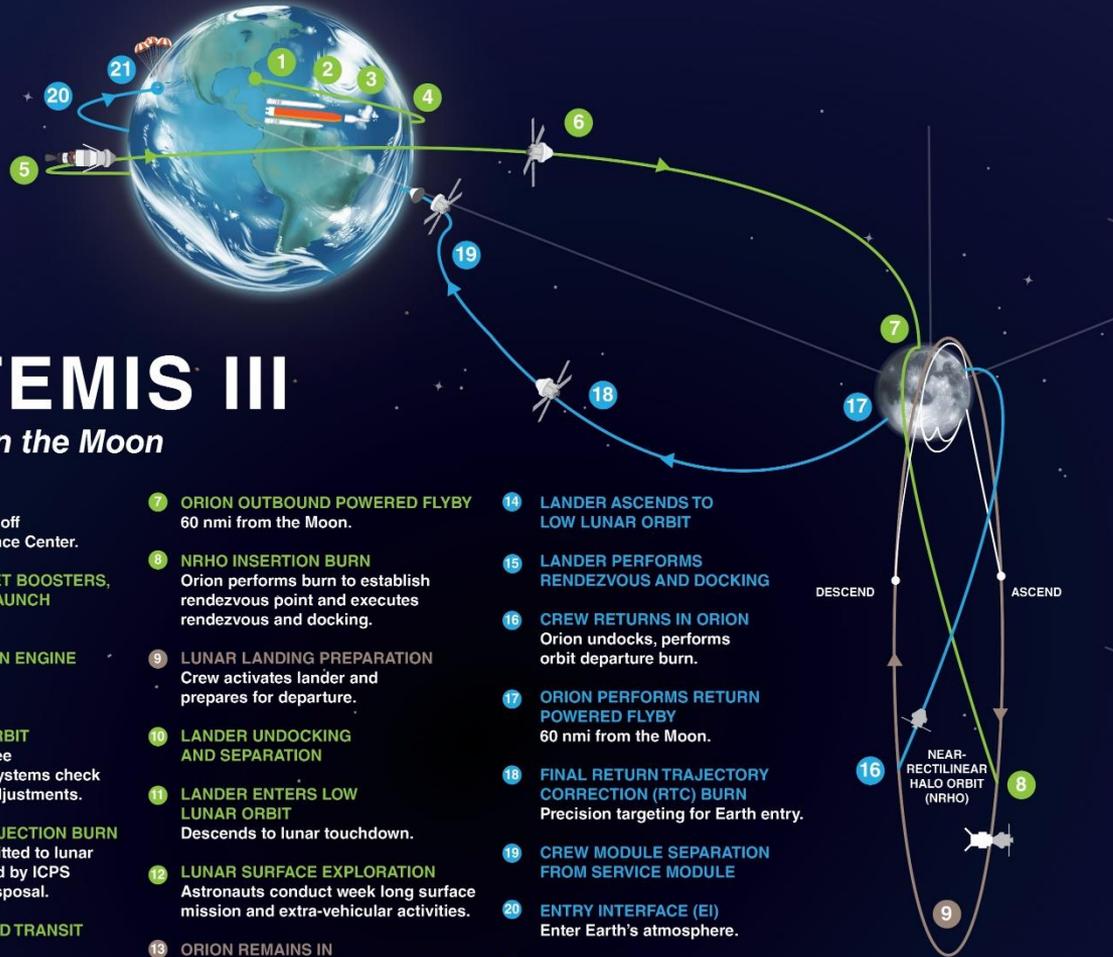
16

AUX DEPARTURE



17

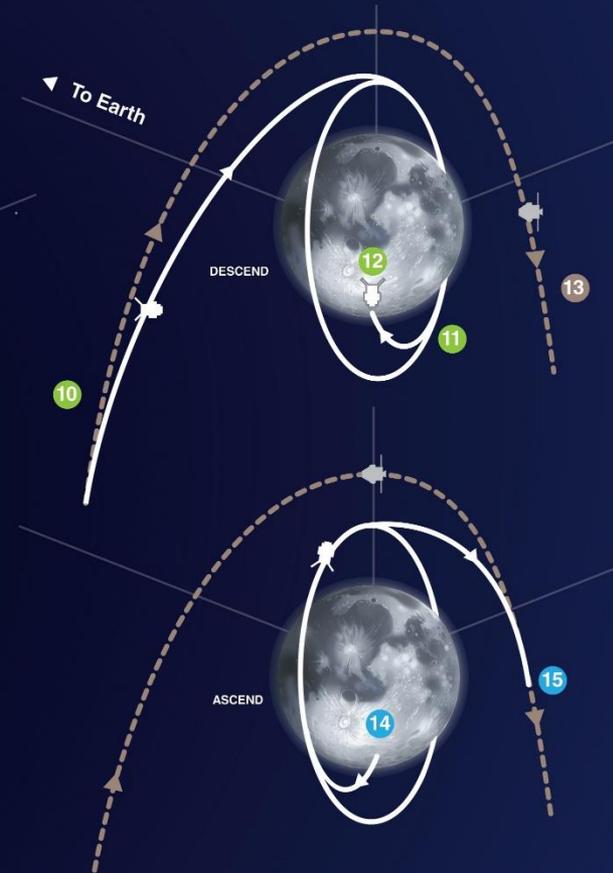
LONG RANGE FTO



ARTEMIS III

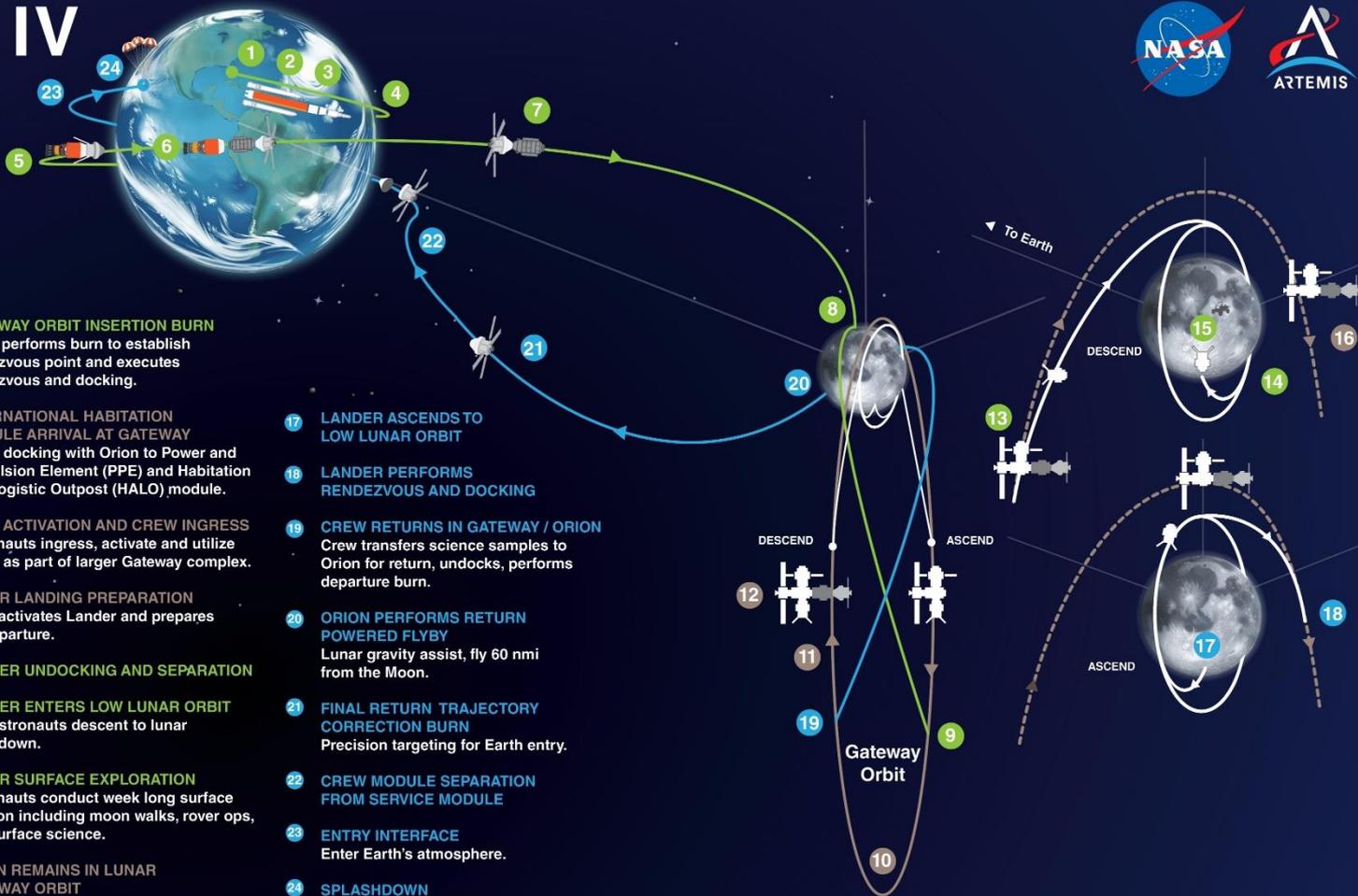
Landing on the Moon

- 1 LAUNCH**
SLS and Orion lift off from Kennedy Space Center.
- 2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 ENTER EARTH ORBIT**
Perform the perigee raise maneuver. Systems check and solar panel adjustments.
- 5 TRANS LUNAR INJECTION BURN**
Astronauts committed to lunar trajectory, followed by ICPS separation and disposal.
- 6 ORION OUTBOUND TRANSIT TO MOON**
Requires several outbound trajectory burns.
- 7 ORION OUTBOUND POWERED FLYBY**
60 nmi from the Moon.
- 8 NRHO INSERTION BURN**
Orion performs burn to establish rendezvous point and executes rendezvous and docking.
- 9 LUNAR LANDING PREPARATION**
Crew activates lander and prepares for departure.
- 10 LANDER UNDOCKING AND SEPARATION**
- 11 LANDER ENTERS LOW LUNAR ORBIT**
Descends to lunar touchdown.
- 12 LUNAR SURFACE EXPLORATION**
Astronauts conduct week long surface mission and extra-vehicular activities.
- 13 ORION REMAINS IN NRHO ORBIT**
During lunar surface mission.
- 14 LANDER ASCENDS TO LOW LUNAR ORBIT**
- 15 LANDER PERFORMS RENDEZVOUS AND DOCKING**
- 16 CREW RETURNS IN ORION**
Orion undocks, performs orbit departure burn.
- 17 ORION PERFORMS RETURN POWERED FLYBY**
60 nmi from the Moon.
- 18 FINAL RETURN TRAJECTORY CORRECTION (RTC) BURN**
Precision targeting for Earth entry.
- 19 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 20 ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 21 SPLASHDOWN**
Ship recovers astronauts and capsule



ARTEMIS IV

International Habitation Module delivery to Gateway followed by Crewed Lunar Landing



1 LAUNCH

SLS with I-HAB co-manifested payload and Orion with 4 crew members lift-off from Kennedy Space Center.

2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM

3 CORE STAGE MAIN ENGINE CUT OFF

With separation.

4 ENTER EARTH ORBIT

Exploration Upper Stage (EUS) performs circularization of Low Earth Orbit. Systems check and solar panel adjustments.

5 TRANS LUNAR INJECTION BURN

EUS commits astronauts in Orion and I-HAB to lunar trajectory.

6 ORION TUGS I-HAB TO MOON

Orion separation from Universal Stage Adapter (USA), ejection of USA, Orion docking with I-HAB for extraction from EUS/ Payload Adapter Fitting (PAF) followed by Orion tug of I-HAB to Gateway Orbit and EUS disposal.

7 ORION OUTBOUND TRANSIT TO MOON

Requires several outbound trajectory burns.

8 ORION OUTBOUND POWERED FLYBY

60 nmi from the Moon.

9 GATEWAY ORBIT INSERTION BURN

Orion performs burn to establish rendezvous point and executes rendezvous and docking.

10 INTERNATIONAL HABITATION MODULE ARRIVAL AT GATEWAY

I-HAB docking with Orion to Power and Propulsion Element (PPE) and Habitation and Logistic Outpost (HALO) module.

11 I-HAB ACTIVATION AND CREW INGRESS

Astronauts ingress, activate and utilize I-HAB as part of larger Gateway complex.

12 LUNAR LANDING PREPARATION

Crew activates Lander and prepares for departure.

13 LANDER UNDOCKING AND SEPARATION

14 LANDER ENTERS LOW LUNAR ORBIT

Two astronauts descent to lunar touchdown.

15 LUNAR SURFACE EXPLORATION

Astronauts conduct week long surface mission including moon walks, rover ops, and surface science.

16 ORION REMAINS IN LUNAR GATEWAY ORBIT

Other two astronauts tend to Gateway during lunar surface mission.

17 LANDER ASCENDS TO LOW LUNAR ORBIT

18 LANDER PERFORMS RENDEZVOUS AND DOCKING

19 CREW RETURNS IN GATEWAY / ORION

Crew transfers science samples to Orion for return, undocks, performs departure burn.

20 ORION PERFORMS RETURN POWERED FLYBY

Lunar gravity assist, fly 60 nmi from the Moon.

21 FINAL RETURN TRAJECTORY CORRECTION BURN

Precision targeting for Earth entry.

22 CREW MODULE SEPARATION FROM SERVICE MODULE

23 ENTRY INTERFACE

Enter Earth's atmosphere.

24 SPLASHDOWN

Astronaut crew, science sample and capsule recovery by ship.

ARTEMIS V

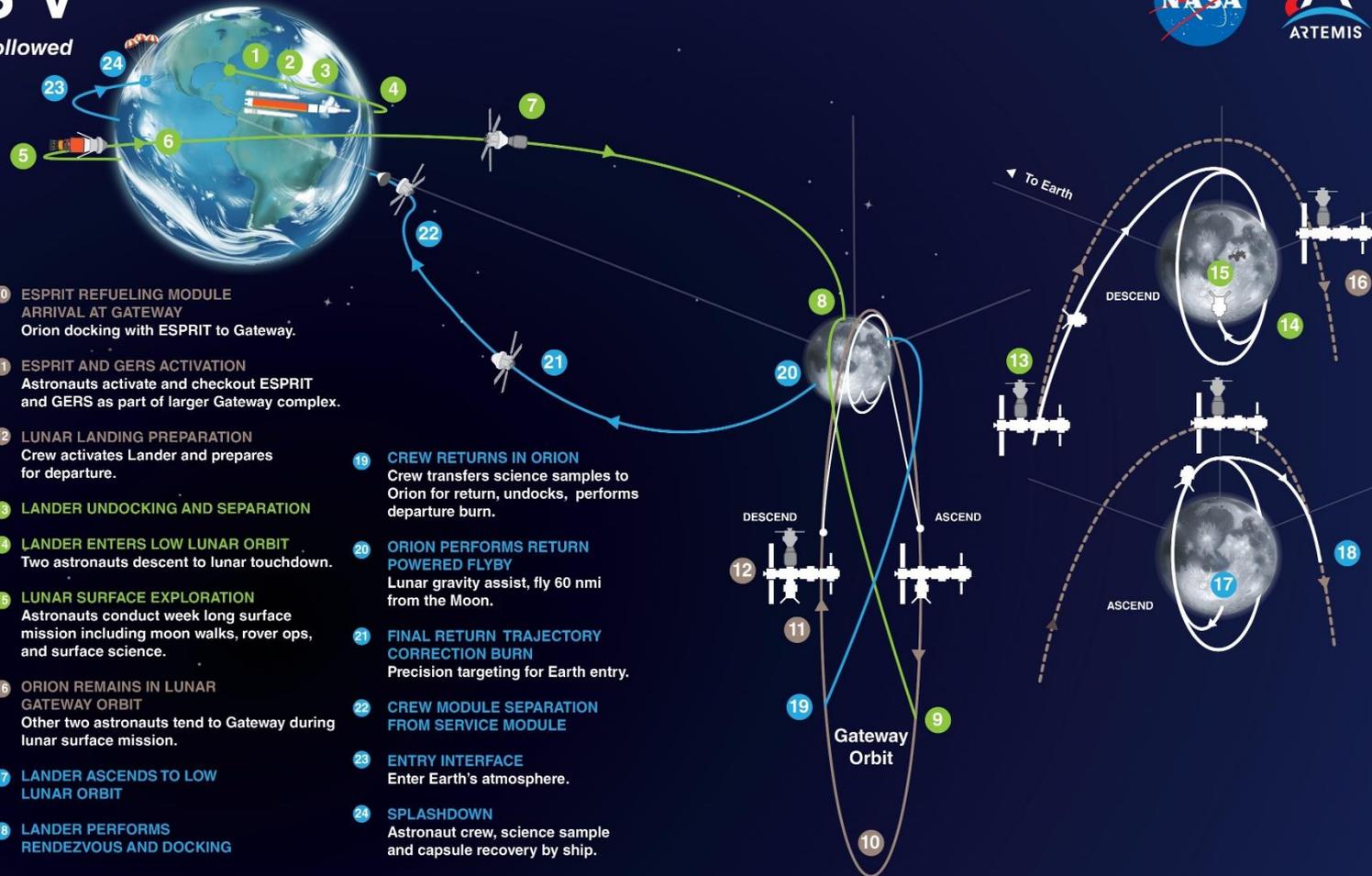
ESPRIT delivery to Gateway followed by Crewed Lunar Landing



- 1 LAUNCH**
SLS with ESPRIT payload and crewed Orion lift-off from Kennedy Space Center.
- 2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 ENTER EARTH ORBIT**
Exploration Upper Stage performs circularization of Low Earth Orbit. Systems check and solar panel adjustments.
- 5 TRANS LUNAR INJECTION BURN**
Exploration Upper Stage commits Astronauts in Orion and ESPRIT to lunar trajectory.
- 6 ORION TUGS ESPRIT TO MOON**
Orion separation from USA, docking with ESPRIT and extraction from USA followed by Orion tug of ESPRIT to Gateway orbit and EUS disposal.
- 7 ORION OUTBOUND TRANSIT TO MOON**
Perform periodic outbound trajectory correction maneuvers.
- 8 ORION OUTBOUND POWERED FLYBY**
Lunar gravity assist, fly 60 nmi from the Moon.
- 9 GATEWAY ORBIT INSERTION BURN**
Orion performs burn to establish rendezvous point and executes rendezvous.

- 10 ESPRIT REFUELING MODULE ARRIVAL AT GATEWAY**
Orion docking with ESPRIT to Gateway.
- 11 ESPRIT AND GERS ACTIVATION**
Astronauts activate and checkout ESPRIT and GERS as part of larger Gateway complex.
- 12 LUNAR LANDING PREPARATION**
Crew activates Lander and prepares for departure.
- 13 LANDER UNDOCKING AND SEPARATION**
- 14 LANDER ENTERS LOW LUNAR ORBIT**
Two astronauts descent to lunar touchdown.
- 15 LUNAR SURFACE EXPLORATION**
Astronauts conduct week long surface mission including moon walks, rover ops, and surface science.
- 16 ORION REMAINS IN LUNAR GATEWAY ORBIT**
Other two astronauts tend to Gateway during lunar surface mission.
- 17 LANDER ASCENDS TO LOW LUNAR ORBIT**
- 18 LANDER PERFORMS RENDEZVOUS AND DOCKING**

- 19 CREW RETURNS IN ORION**
Crew transfers science samples to Orion for return, undocks, performs departure burn.
- 20 ORION PERFORMS RETURN POWERED FLYBY**
Lunar gravity assist, fly 60 nmi from the Moon.
- 21 FINAL RETURN TRAJECTORY CORRECTION BURN**
Precision targeting for Earth entry.
- 22 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 23 ENTRY INTERFACE**
Enter Earth's atmosphere.
- 24 SPLASHDOWN**
Astronaut crew, science sample and capsule recovery by ship.



SOURCES :

**ESA, NASA, GIUSEPPE DE CHIARA
(TELESPAZIO), ...**

