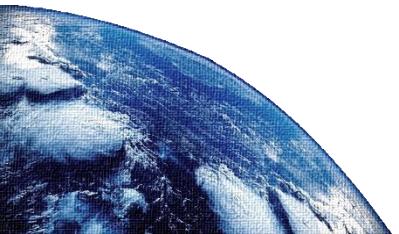
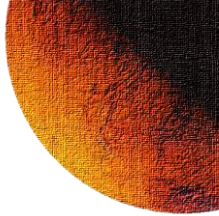


Sistemas Termicos Para Programas Humanos de la NASA

Zaida Hernandez
Ingeniera del Centro Espacial Johnson

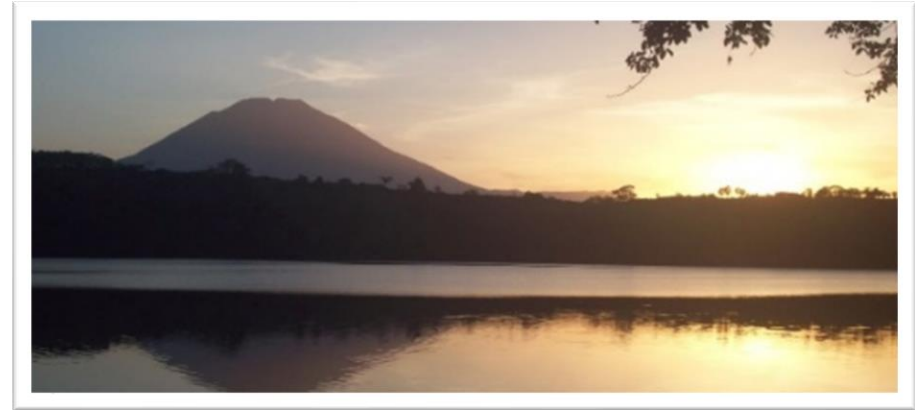




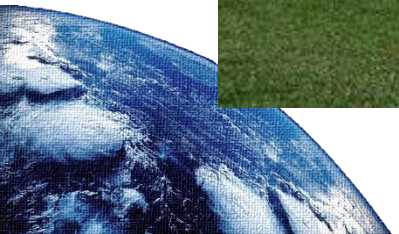
Sobre Mi



Houston, Texas

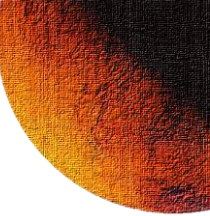


El Salvador, C.A.





Como llegue a la NASA



UNIVERSITY of **HOUSTON**

CULLEN COLLEGE of ENGINEERING

MECHANICAL ENGINEERING

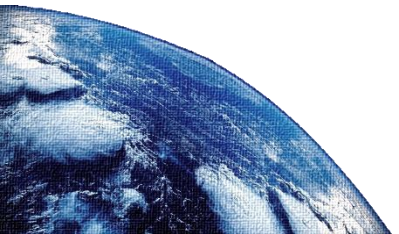
Licenciatura 2015

INDUSTRIAL ENGINEERING

Maestria 2017

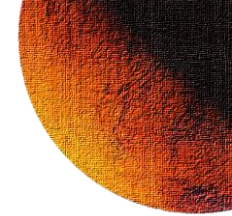
Materias favoritas en la escuela secundaria / escuela secundaria: Matemáticas, Ingeniería Gráfica (CAD), Periodismo

Materias favoritas en la universidad: Matemáticas fijas, diseño de vehículos espaciales, transferencia de calor





Experiencia en la NASA



Oficina de STEM
2009-2010



Grupo de Trajes Espaciales
2010-2011



Grupo Termico
2012



Grupo de Trajes Espaciales
2013



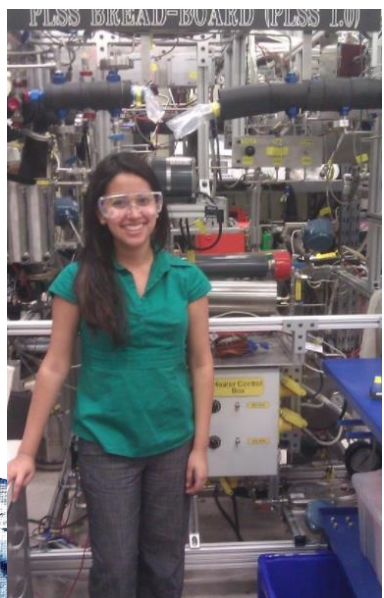
Grupo de Diseño Mecanico
2013



Sistemas Dinámicos
2014



Grupo Termico
2015, 2016
Tiempo Completo
2017





Ocupación Actual



- Gerente de subsistemas para Artemis - sistemas de protección térmica del módulo de servicio y sistema de aborto de lanzamiento
- Analista para escudo termico de nave especial Orion
- Ingeniera para vehiculo lunar para transporte de astronautas (LTV)
- Previamente - ingenieria de systema termicos para vehiculo rover que irá a la luna (VIPER)



NASA Exploration

Solar System

Deep Space

LEO

Discover
Explore
Develop

Cis-Lunar

Discover
Explore
Develop

Discover
Explore
Develop

Discover
Explore
Develop

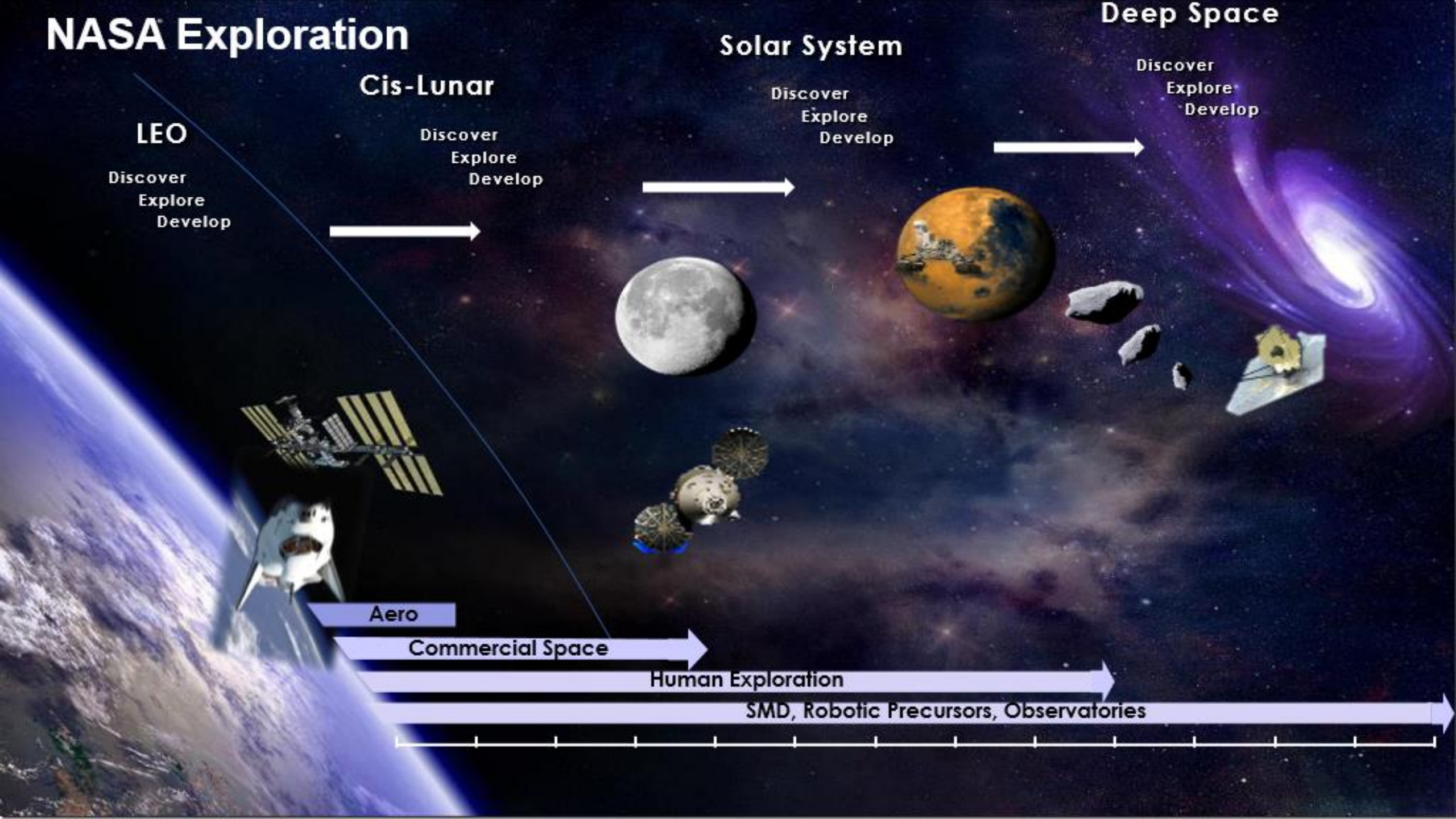


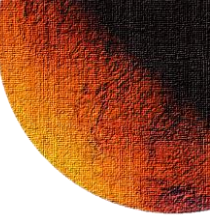
Aero

Commercial Space

Human Exploration

SMD, Robotic Precursors, Observatories

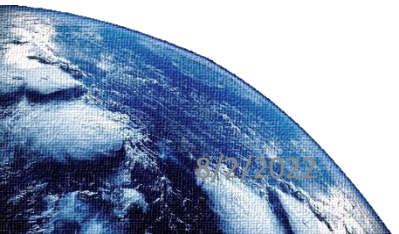




ARTEMIS

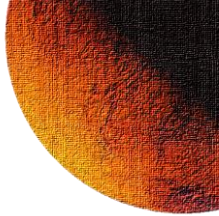
Hermana gemela de Apolo y diosa de la Luna en la mitología griega, Artemisa es la portadora de la antorcha que personifica nuestro camino hacia la Luna. Durante la próxima era de exploración humana, descubriremos ciencia y tecnología que salvarán vidas y cambiarán la Tierra a lo largo del camino.

El objetivo de la NASA es llevar a la primera mujer y primera persona de color a la Luna. Cuando los astronautas Artemis aterricen en la superficie lunar, darán un paso hacia el futuro, trayendo consigo a toda la humanidad.





Artemis



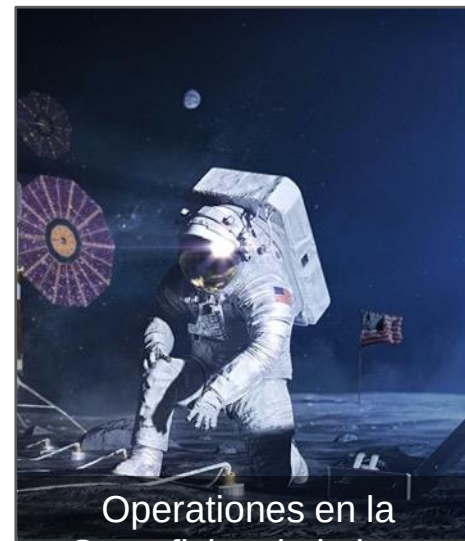
Cohete Espacial de Lanzamiento



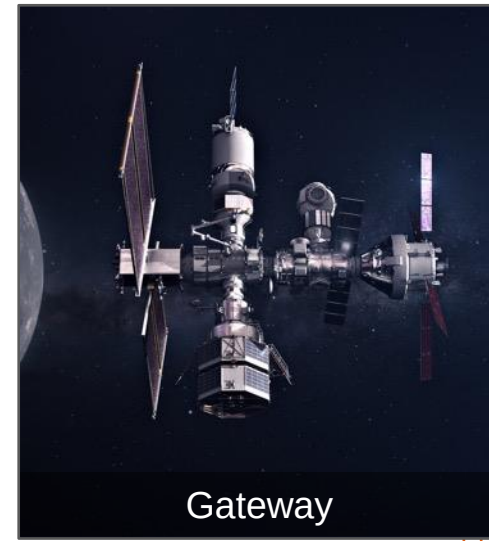
Nave Espacial Orion



Sistema de aterrizaje humano



Operaciones en la Superficies de la luna



Gateway



Sistemas terrestres de exploración



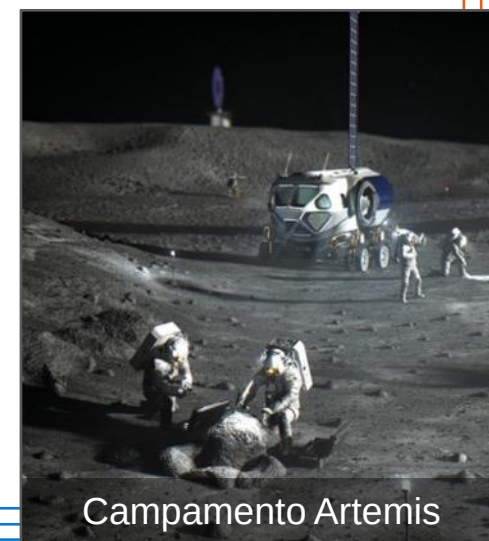
Comunicaciones espaciales y navegación



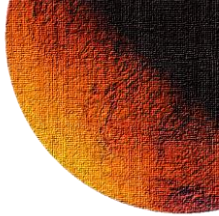
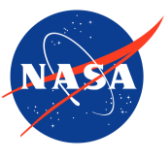
Movilidad de superficie



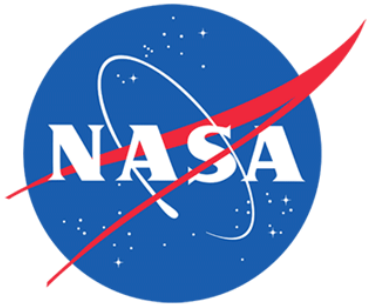
Trajes Espaciales



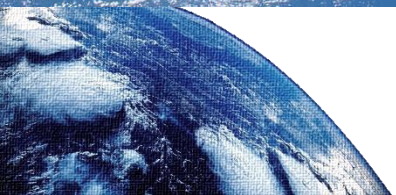
Campamento Artemis



Colaboraciones



POCKOCMOC



Artemis Phase 1: To the Lunar Surface by 2024

MARS 2020

ARTEMIS 1: FIRST HUMAN SPACECRAFT
TO THE MOON IN THE 21st CENTURY

ARTEMIS 2: FIRST HUMANS TO
THE MOON IN THE 21st CENTURY

FIRST HIGH POWER
SOLAR ELECTRIC
PROPULSION (SEP)
SYSTEM

FIRST PRESSURIZED
CREW MODULE
DELIVERED TO
GATEWAY

ARTEMIS 3: CREWED
MISSION TO GATEWAY
AND LUNAR SURFACE

Commercial Lunar Payload Services

- CLPS delivered science and technology payloads

Early South Pole Crater Rim Mission(s)

- First robotic landing on eventual human lunar return and ISRU site
- First ground truth of polar crater volatiles

Large-Scale Cargo Lander

- Increased capabilities for science
and technology payloads

Humans on the Moon - 21st Century

First crew leverages infrastructure
left behind by previous missions

LUNAR SOUTH POLE CRATER TARGET SITE

Artemis Base Camp

Comm, Nav, Power >>

Foundation Surface Habitat >>

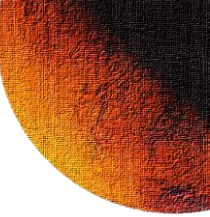
ISRU >>

Habitable Mobility Platform >>

Spacesuits >>

Lunar Terrain Vehicle >>

Artist's illustration of Artemis Base Camp



Artemis 1 será la primera prueba de vuelo integrada de la **nave espacial Orion** de la NASA y el lanzamiento de un cohete del Sistema de Lanzamiento Espacial (SLS) desde el Centro Espacial Kennedy.

El viaje será sin tripulación y diseñado para llevar el sistema a sus límites.

Construir, lanzar, y volar el sistema inspira a nuestra nación y al mundo.

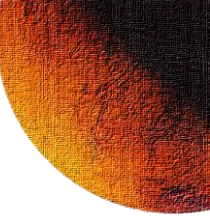




Prioridades de Artemis 1

Una prueba de vuelo que permitirá a la NASA llevar a la tripulación a la luna y regresar en Artemis II

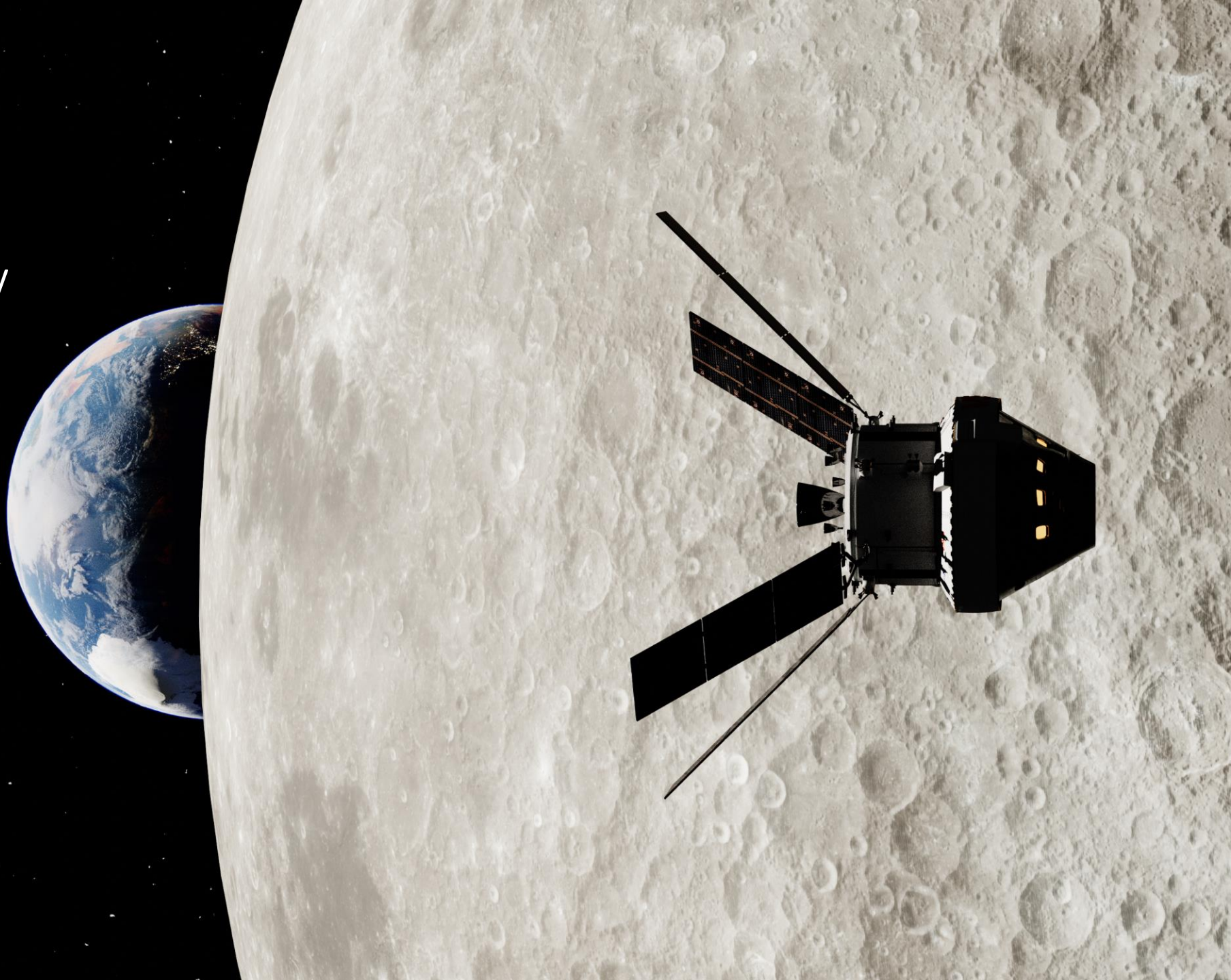
1. Demuestre el escudo térmico Orion en condiciones de reentrada lunar
2. Operar sistemas en el entorno de vuelo
3. Recuperar nave espacial
4. Completar los objetivos restantes. Realizar una misión residual en ausencia de fallas del sistema



Este es el cohete más poderoso jamás
construido por la NASA - Sistema de
Lanzamiento Espacial



La nave espacial
proporcionará un viaje
seguro más allá de la luna y
de regreso.



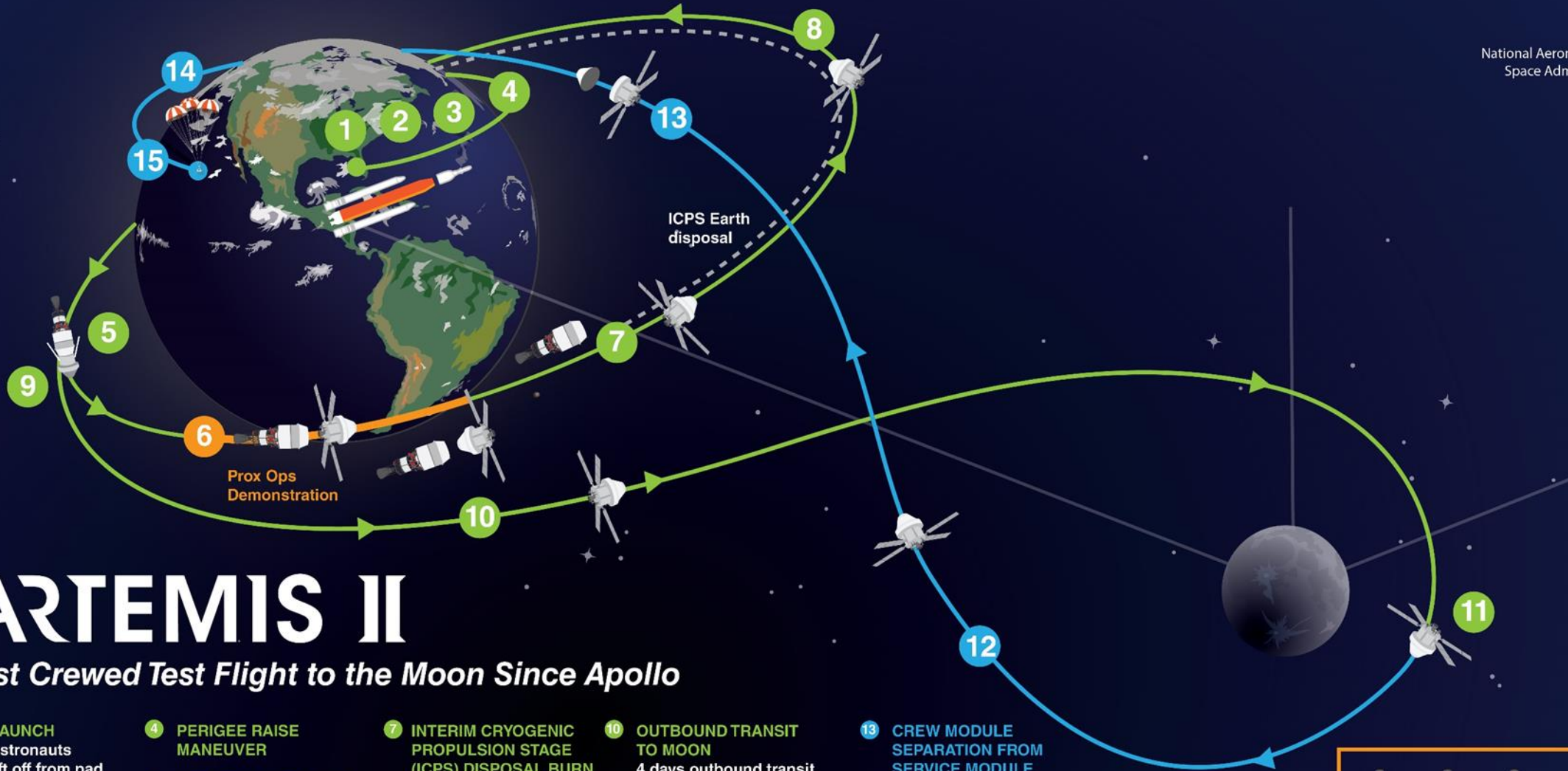
A B C D E
CUBESATS DEPLOY
ICPS deploys 13
CubeSats total

MISSION DURATIONS:
Total: 26–42 days
Outbound Transit: 8–14 days
DRO Stay: 6–19 days
Return Transit: 9–19 days

ARTEMIS I

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

- 1 **LAUNCH**
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**
The ICPS has committed Orion to TLI.
- 8 **OUTBOUND TRAJECTORY CORRECTION (OTC) BURNS**
As necessary adjust trajectory for lunar flyby to Distant Retrograde Orbit (DRO).
- 9 **OUTBOUND POWERED FLYBY (OPF)**
60 nmi from the Moon; targets DRO insertion.
- 10 **LUNAR ORBIT INSERTION**
Enter Distant Retrograde Orbit.
- 11 **DISTANT RETROGRADE ORBIT**
Perform half or one and a half revolutions in the orbit period 38,000 nmi from the surface of the Moon.
- 12 **DRO DEPARTURE**
Leave DRO and start return to Earth.
- 13 **RETURN POWERED FLYBY (RPF)**
RPF burn prep and return coast to Earth initiated.
- 14 **RETURN TRANSIT**
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere.
- 15 **CREW MODULE SEPARATION FROM SERVICE MODULE**
- 16 **ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 17 **SPLASHDOWN**
Pacific Ocean landing within view of the U.S. Navy recovery ship.

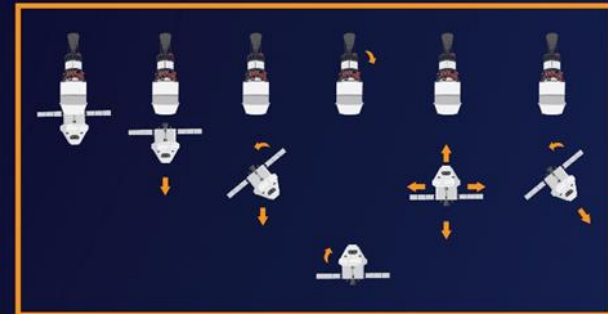


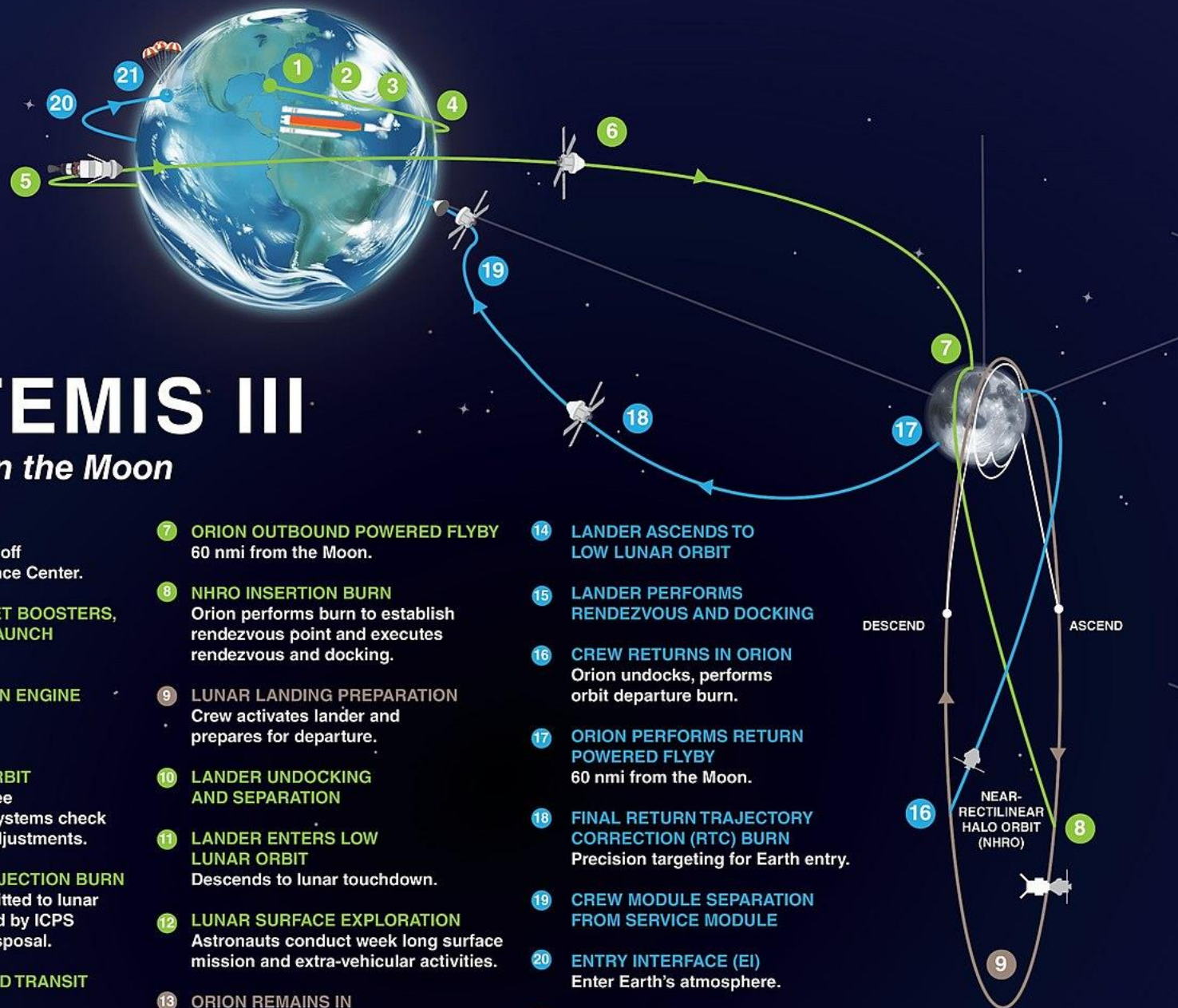
ARTEMIS II

First Crewed Test Flight to the Moon Since Apollo

- 1 LAUNCH**
Astronauts lift off from pad 39B at Kennedy Space Center.
- 2 JETTISON 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 42 hour checkout of spacecraft.
- 6 PROX OPS DEMONSTRATION**
Orion proximity operations demonstration and manual handling qualities assessment for up to 2 hours.
- 7 INTERIM CRYOGENIC PROPULSION STAGE (ICPS) DISPOSAL BURN**
- 8 HIGH EARTH ORBIT CHECKOUT**
Life support, exercise, and habitation equipment evaluations.
- 9 TRANS-LUNAR INJECTION (TLI) BY ORION'S MAIN ENGINE**
- 10 OUTBOUND TRANSIT TO MOON**
4 days outbound transit along free return trajectory.
- 11 LUNAR FLYBY**
4,000 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**
Astronaut and capsule recovery by U.S. Navy ship.

PROXIMITY OPERATIONS DEMONSTRATION SEQUENCE

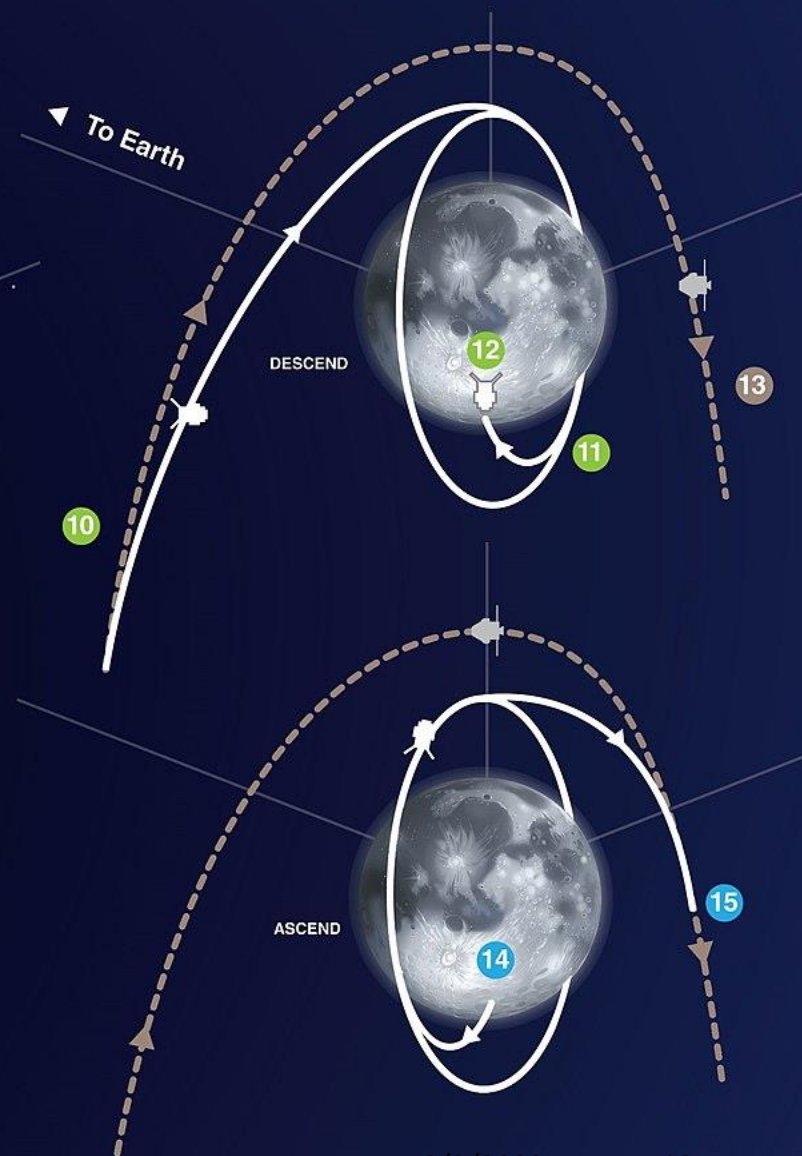




ARTEMIS III

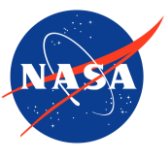
Landing on the Moon

- 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 NHRO 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 NHRO 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

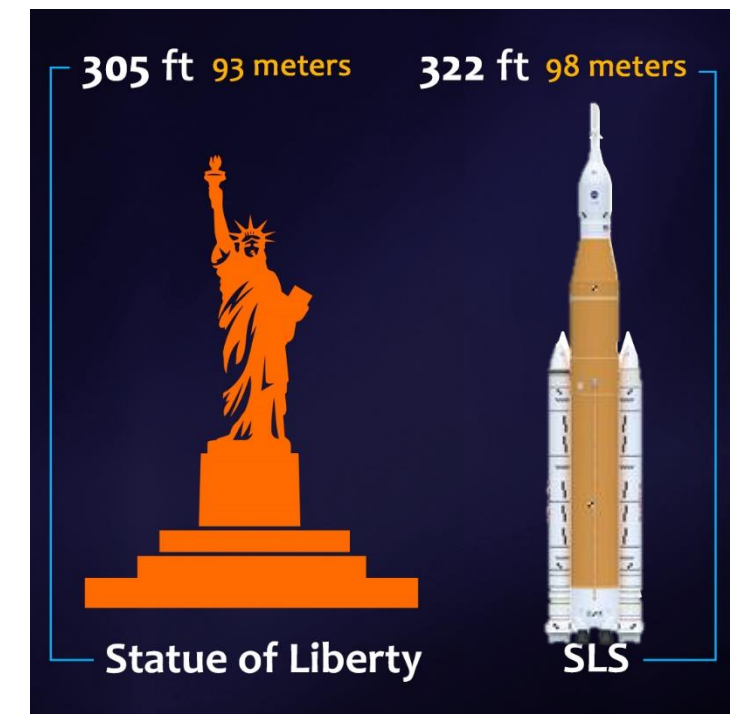
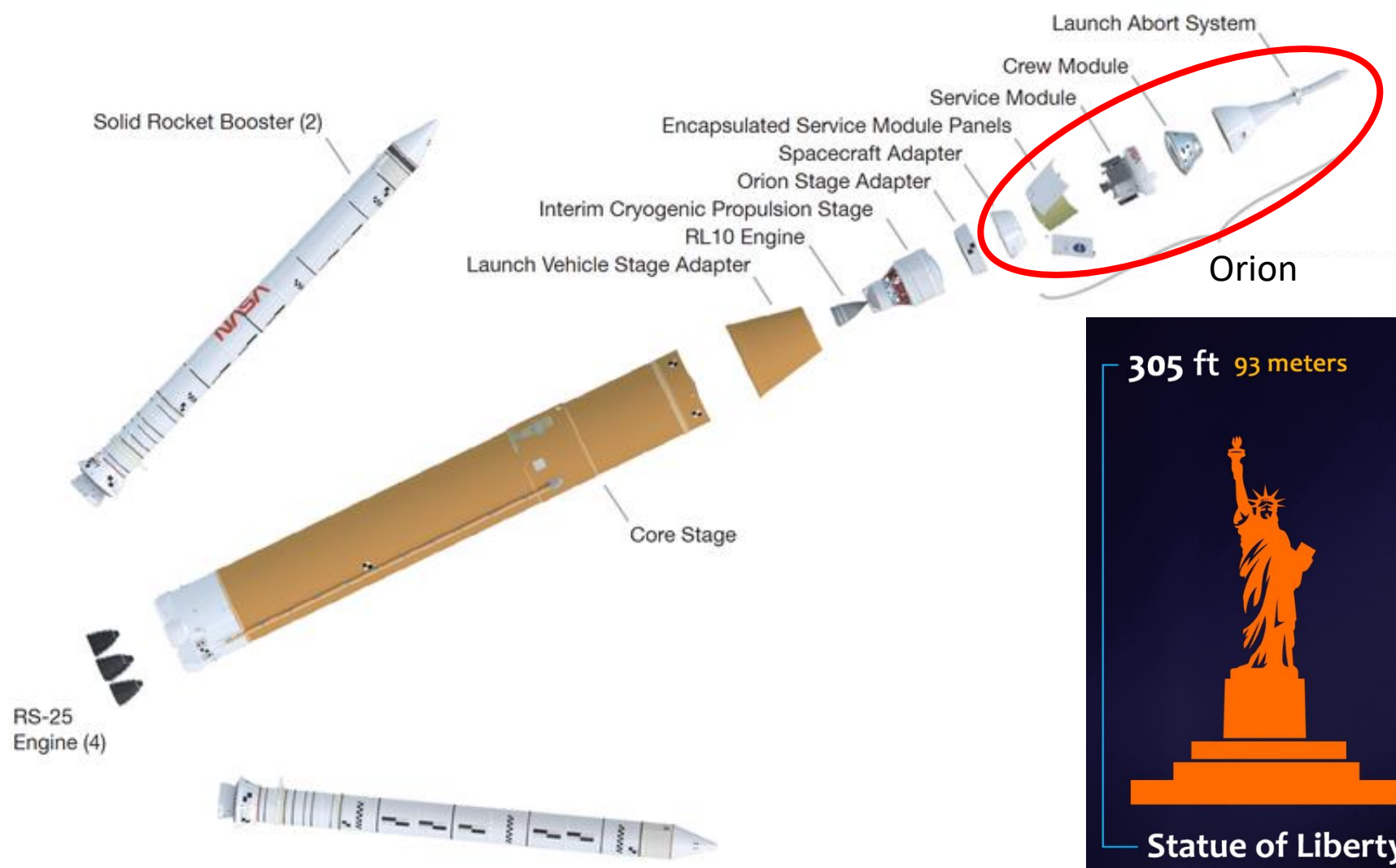


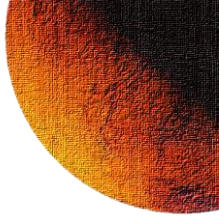
8/2/2022

18



Cohete Espacial de Lanzamiento





Nave Espacial Orion

Sistema de aborto de lanzamiento o Sistema de escape -
Puede activarse en milisegundos. Aceleró de cero a 405 mph en dos segundos.

Módulo de tripulación

Adaptador de nave espacial

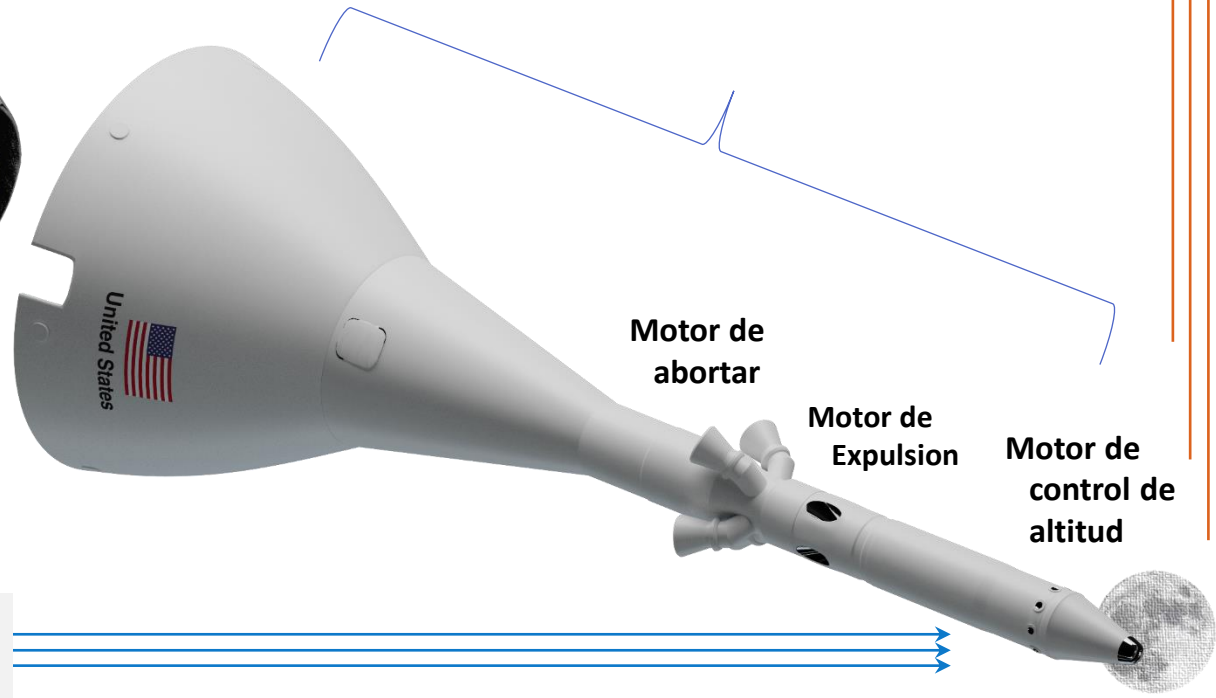
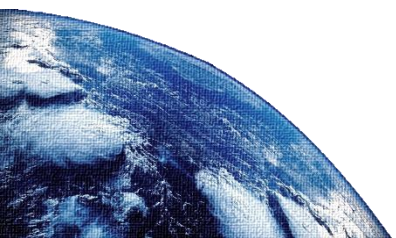
Módulo de servicio (SM)
Incluye el módulo de servicio europeo y el adaptador del módulo de tripulación de la NASA

Motor de abortar

Motor de Expulsion

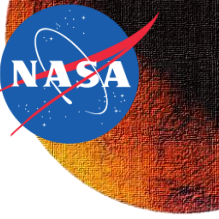
Motor de control de altitud

Tripulación 4
Duración de la misión ~26 – 42 días





Sistemas Termicos



El subsistema térmico mantiene las temperaturas adecuadas en todas las partes de la nave espacial.

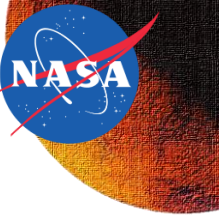
El Sol calienta un lado de la nave espacial y el espacio negro del otro lado extrae el calor. El lado caliente es, por lo tanto, cientos de grados más caliente que el lado frío. Además, las partes de la nave espacial que utilizan energía eléctrica generarán calor internamente y tenderán a calentarse mucho. En el espacio no hay aire, por lo que la convección no funciona pero para el calentamiento de reentrada de la capsula, si hay convección.



<https://mars.nasa.gov/mro/mission/spacecraft/parts/thermal/>



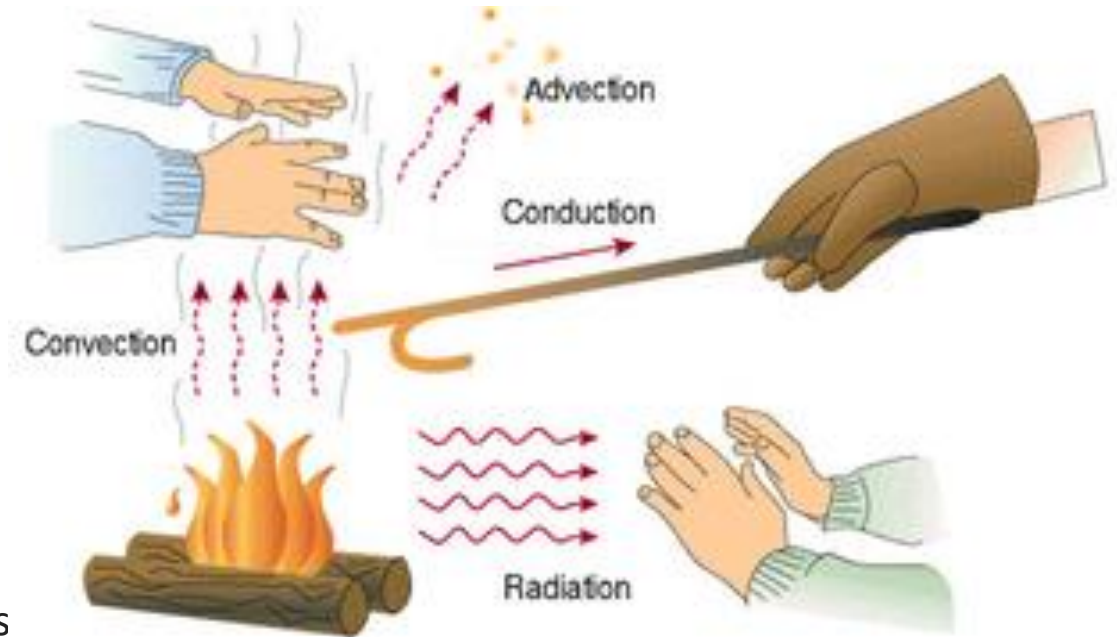
Sistemas Termicos

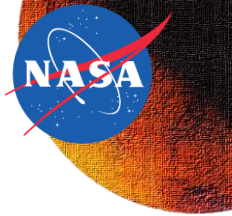
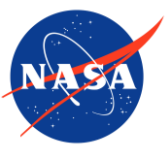


La **conducción** es el proceso por el cual el calor se mueve a través de sustancias y entre sustancias que están en contacto, como el agua de una piscina y tu piel, o una barandilla de metal frío y tu mano.

La **convección** en sí es el transporte de calor por medio del movimiento del fluido. Por ejemplo, al calentar el agua en una cacerola, el agua que entra en contacto con la base de la cacerola asciende al calentarse, mientras que el agua de la superficie desciende por los lados al enfriarse, y ocupa el lugar que dejó la porción caliente.

La **radiación**, o más correctamente, la radiación electromagnética, incluye todo, desde los rayos X hasta la luz solar y las ondas de radio. El calor que sientes en la cara cuando te acercas a un fuego es el resultado de la radiación infrarroja, que es un tipo de radiación electromagnética que se encuentra más allá del alcance que tus ojos pueden ver.





Tecnicas o Componentes de Control Termico

Ejemplos: Radiadores, Recubrimientos de superficie, Insulacion multicapa o mantas térmicas, Calentadores, materiales especiales

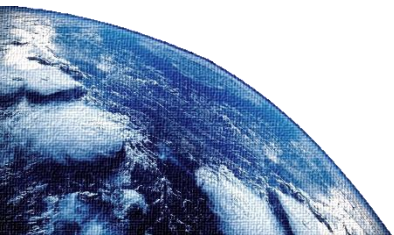
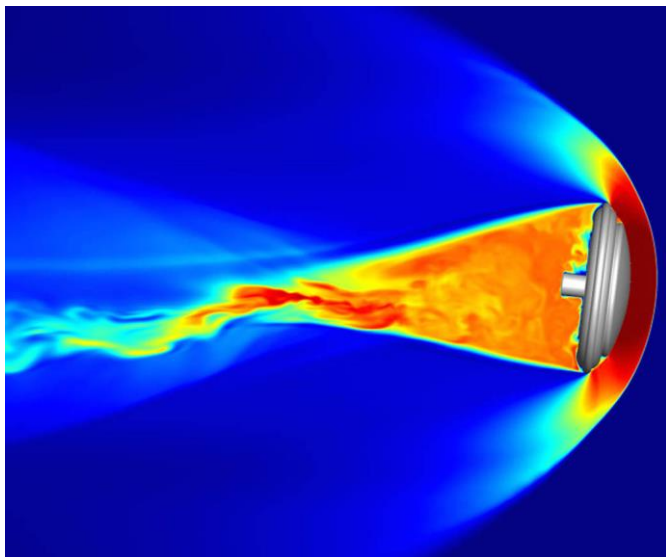
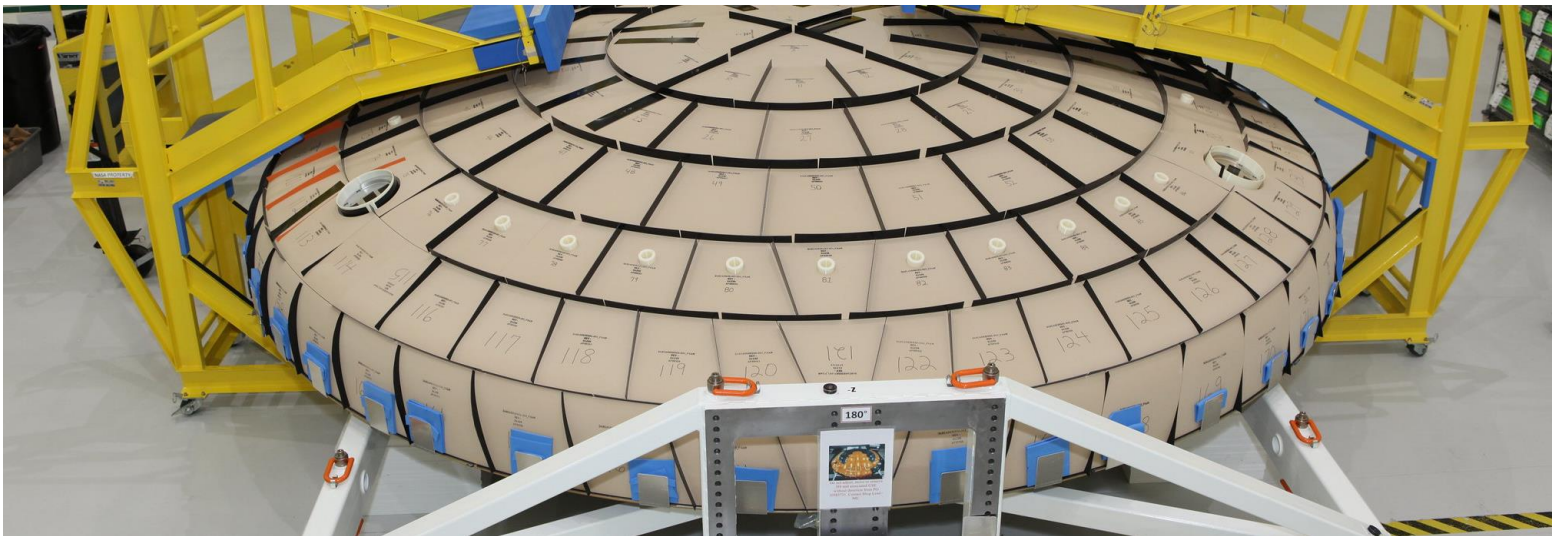
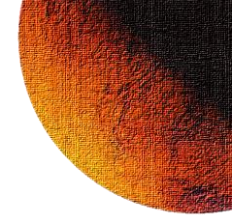


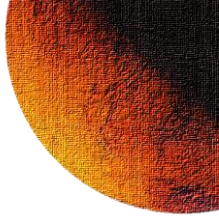
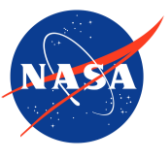
<https://mars.nasa.gov/mro/mission/spacecraft/parts/thermal/>



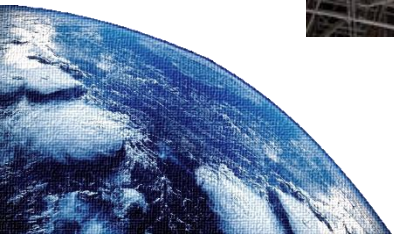


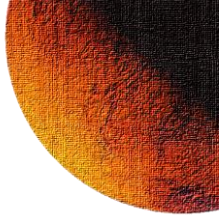
Escudo Térmico



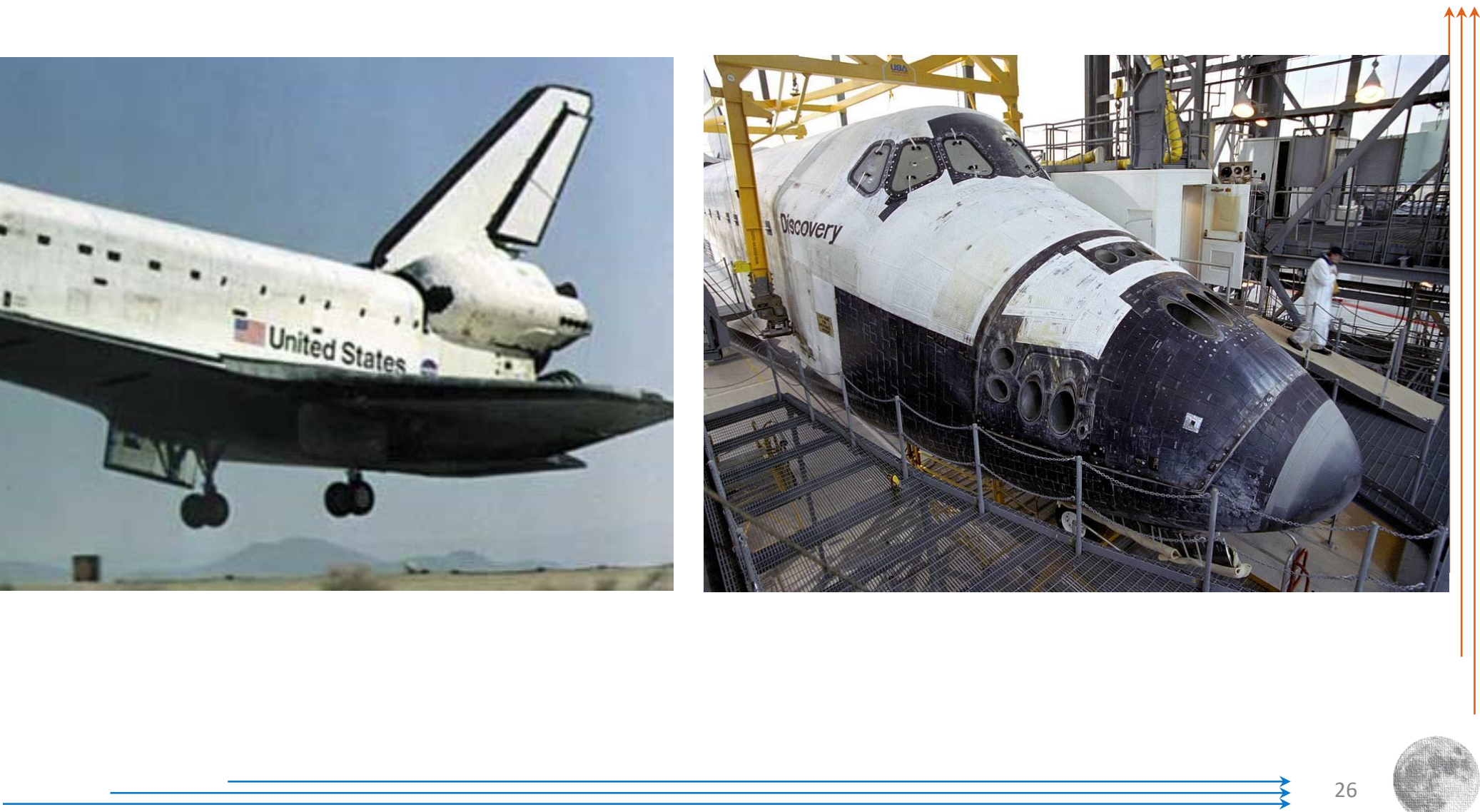
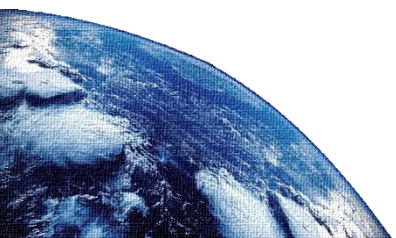


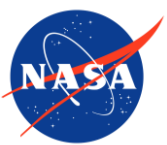
Sistema de Escape



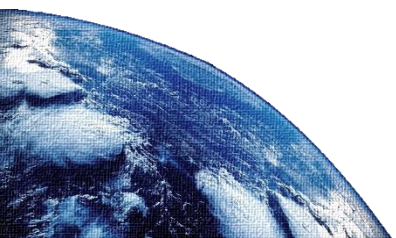
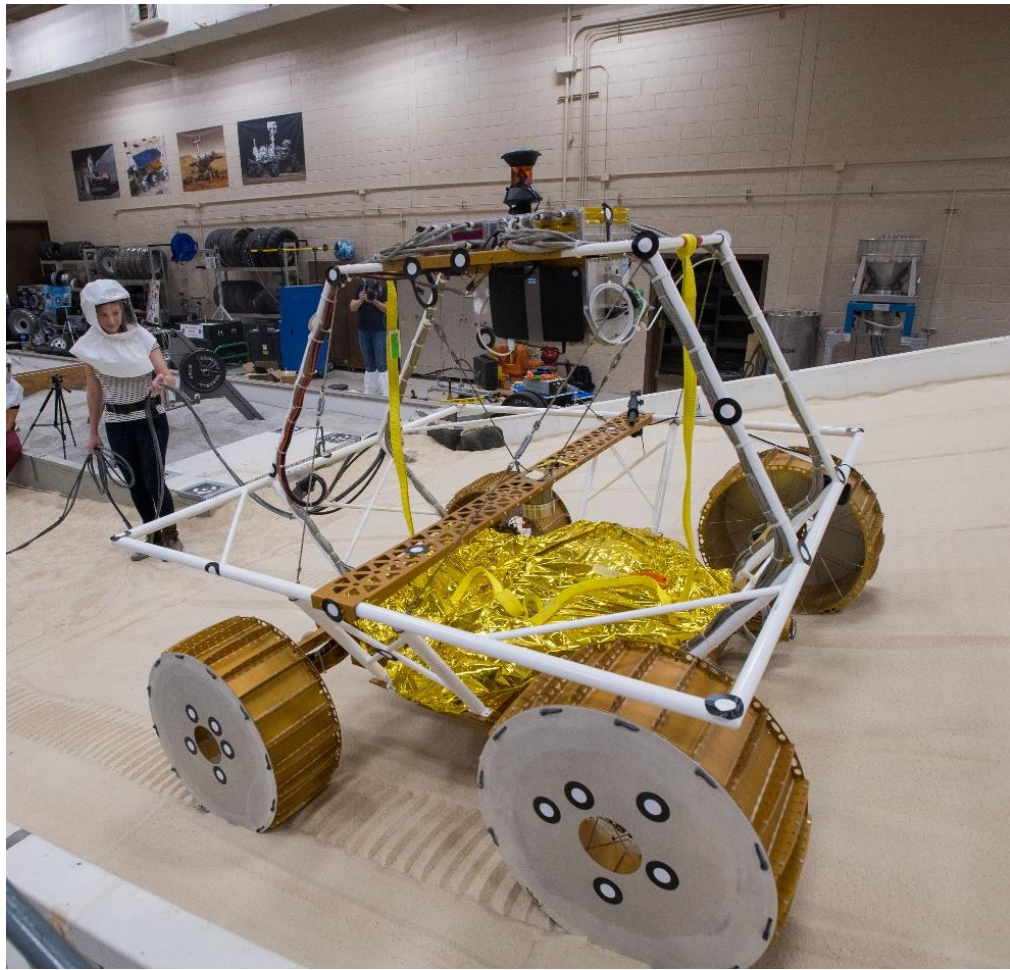
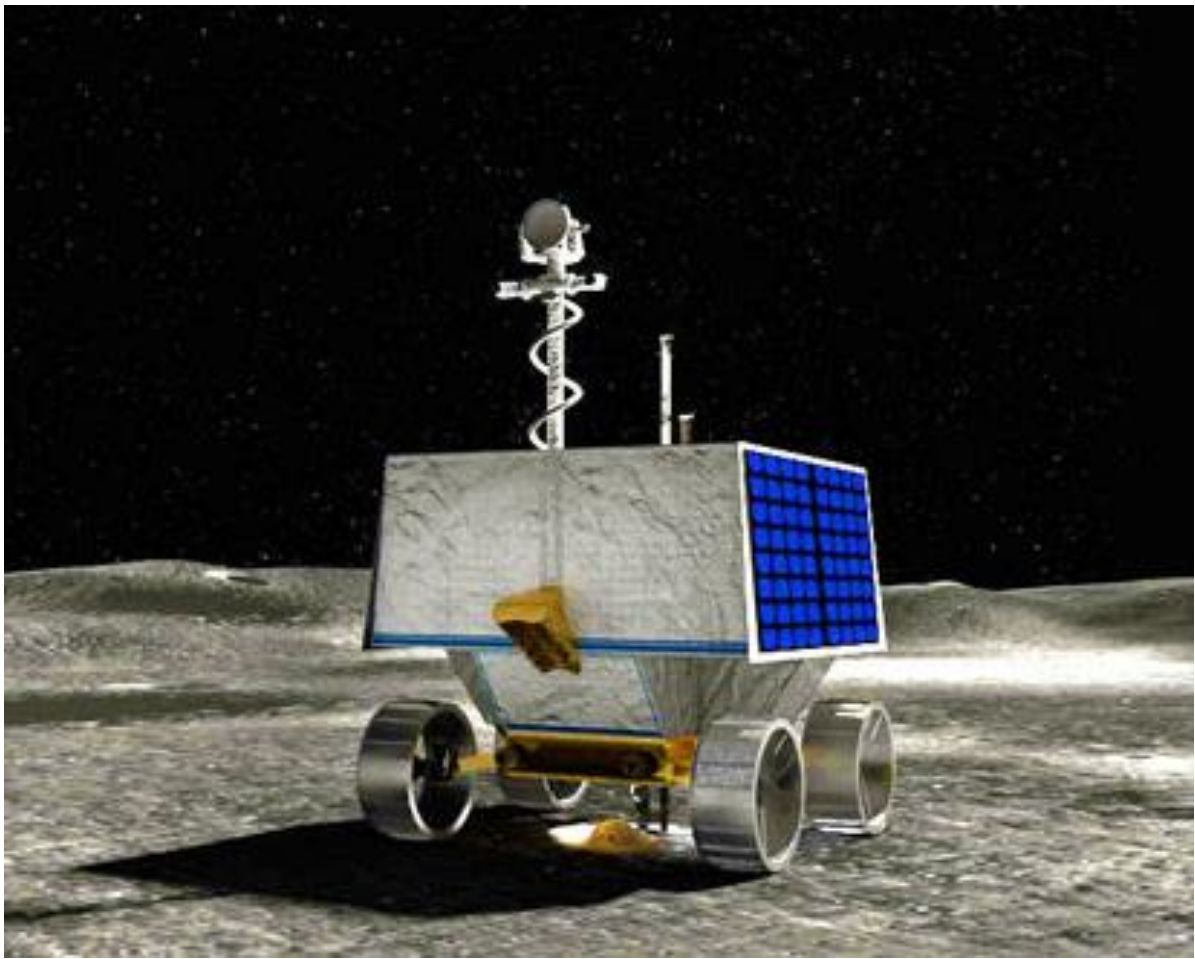
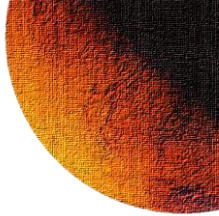


Transbordador Espacial



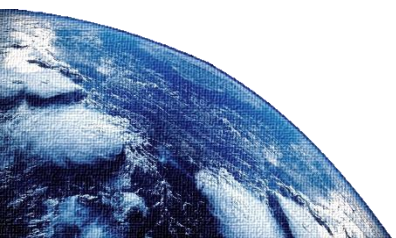
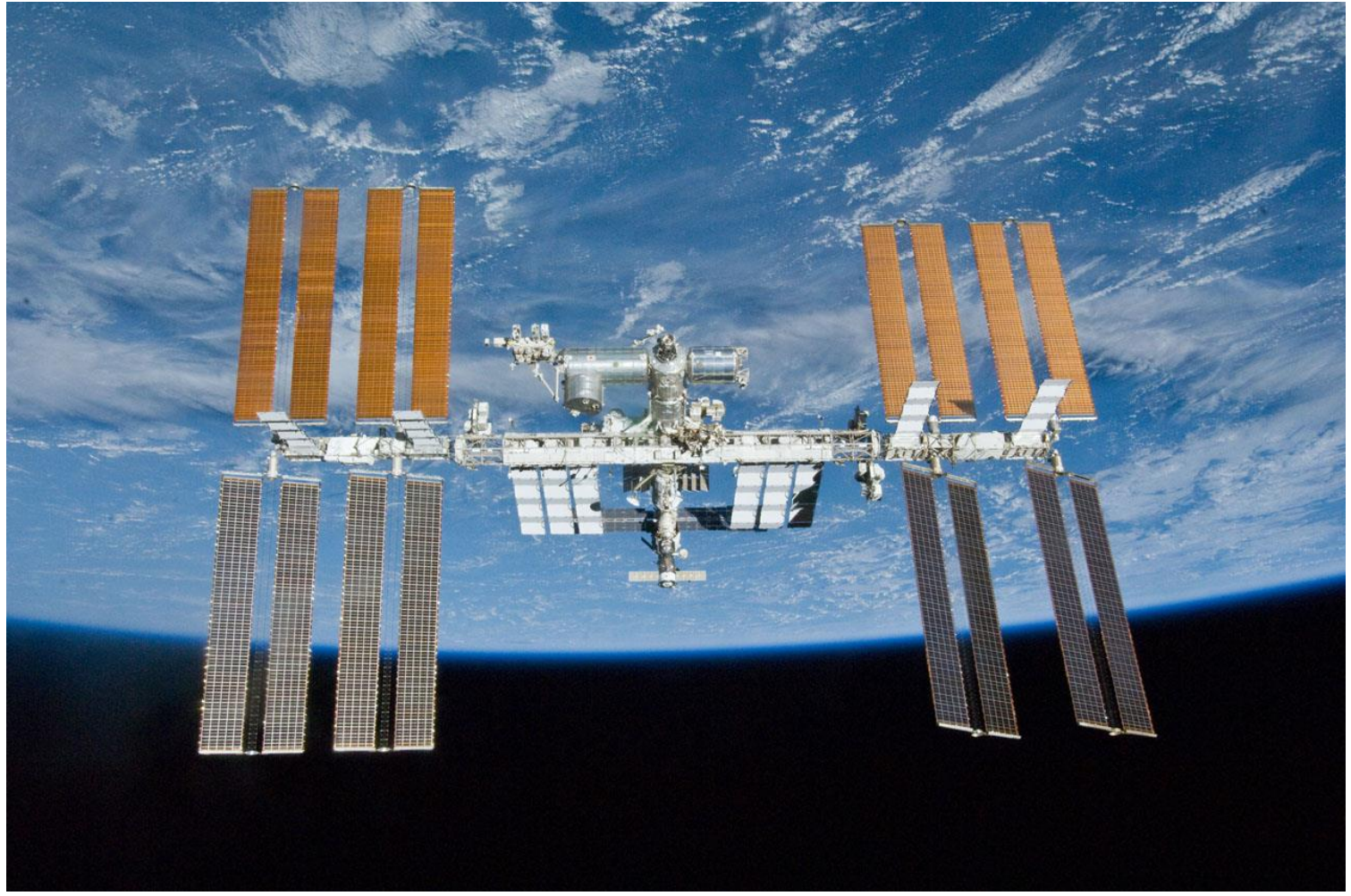
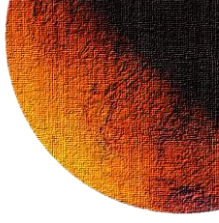


VIPER



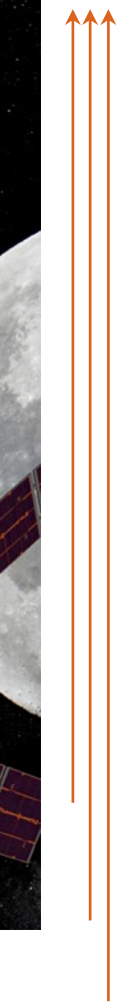
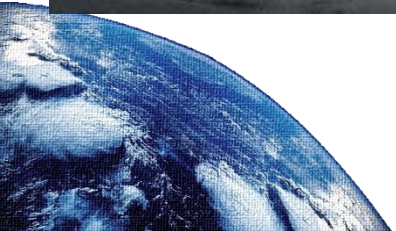
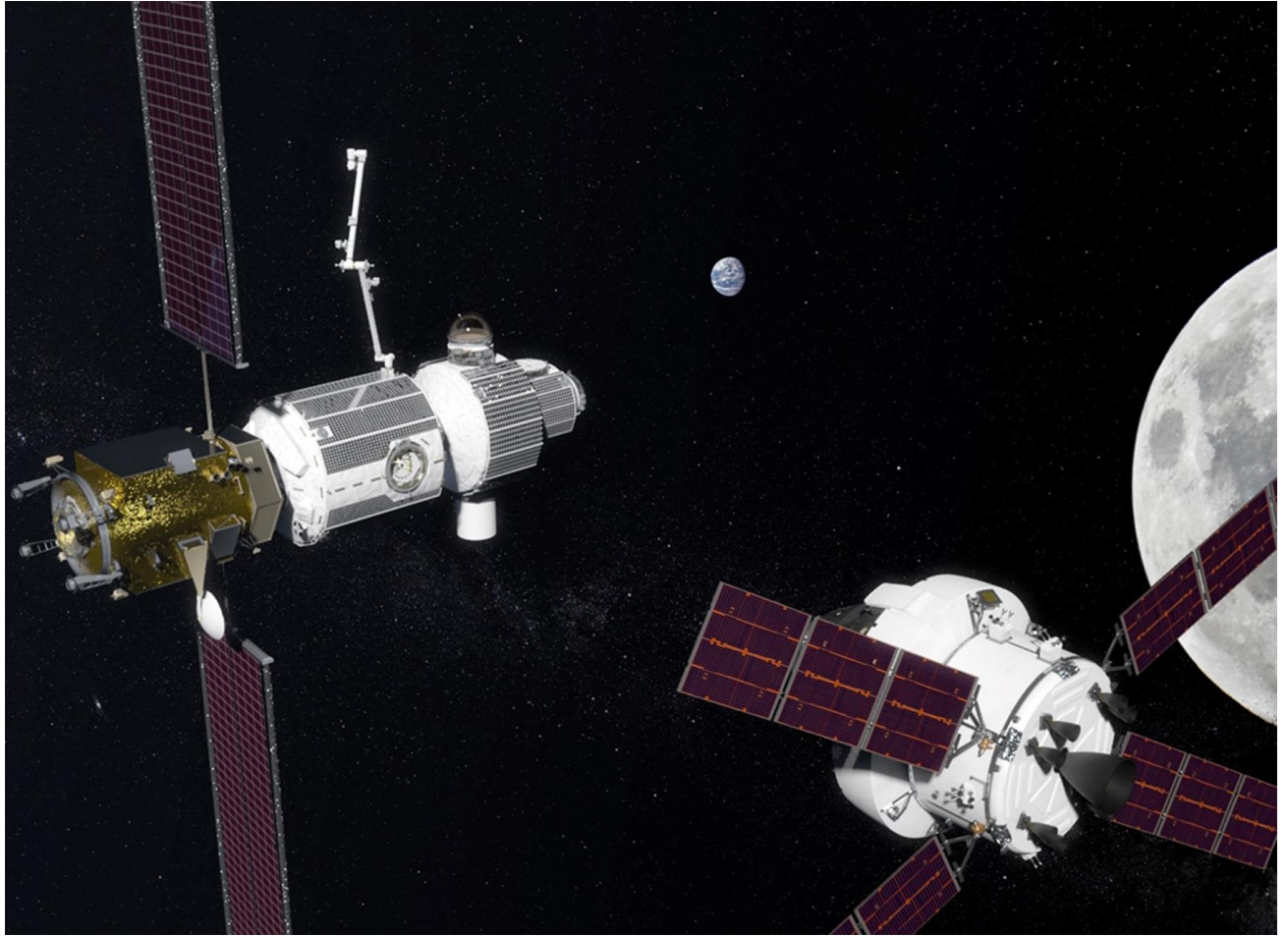
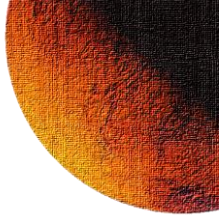


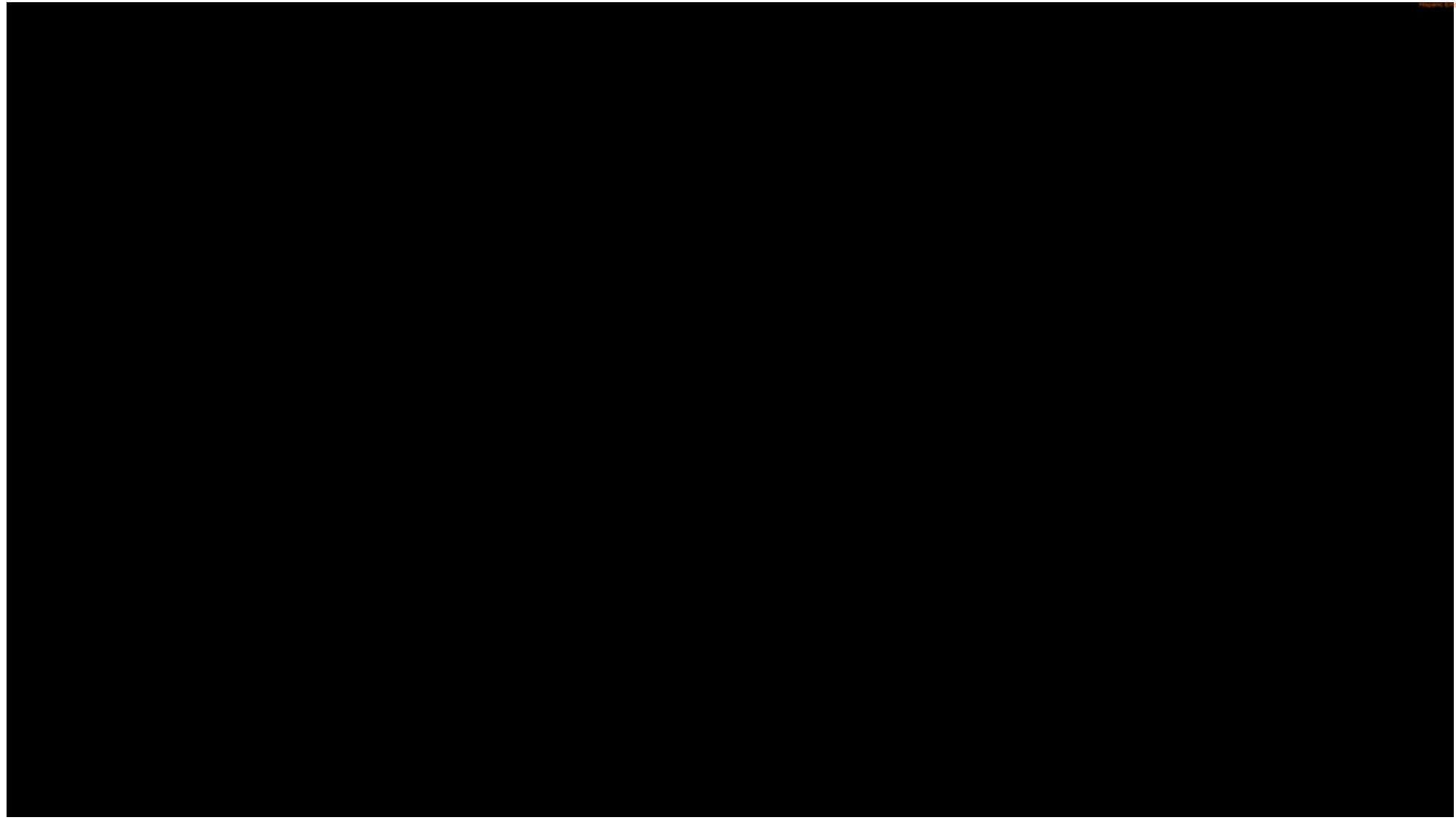
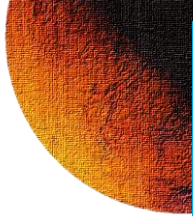
Estacion Espacial Internacional



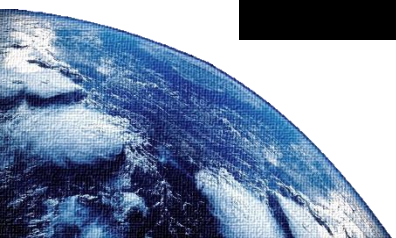


Mas Ejemplos





https://www.youtube.com/watch?v=_fRSaLAEW2s





A screenshot of the NASA website homepage. The top navigation bar includes links for Missions, Galleries, NASA TV, Follow NASA, Downloads, About, and NASA Audiences. Below this is a secondary navigation bar with links for Humans in Space, Moon to Mars, Earth, Space Tech, Flight, Solar System and Beyond, STEM Engagement, History, and Benefits to You. The main content area features a large banner image of the James Webb Space Telescope's golden hexagonal mirrors being assembled in a facility. Below the banner is a text overlay: "Join the Virtual Global Social for the Reveal of the James Webb Space Telescope's". To the right of the banner are two smaller article teasers. The first is titled "Solar System and Beyond" and "NASA Reveals Surface of Asteroid Bennu is Like Plastic Ball Pit". The second is titled "NASA Events" and lists upcoming events: "Tues., July 12, 10:30 a.m. EDT: Live coverage of the release of the first images of the James Webb Space Telescope", "Wed., July 13, 3 p.m. EDT: NASA Science Live: Webb's First Full-Color Images Explained", and "Thurs., July 21, 9:30 a.m. EDT: Coverage of the Russian/European Space Agency spacewalk at the International Space Station". At the bottom right, there is a link to "NASA TV Schedule" and "Launches and Landings".

Encuentra mas en nasa.gov o en las redes sociales @nasaartemis