
National Aeronautics and Space Administration
NASA
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SPACE LAUNCH SYSTEM
A TRANSFORMATIVE CAPABILITY FOR DEEP SPACE MISSIONS
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www.nasa.gov/sls
SLS
SPACE LAUNCH SYSTEM

# SLS CAPABILITY AVAILABILITY

## SLS Block 1
## As Early As 2019

**Provides**

Initial Heavy-Lift Capability

**Enables**

Orion Test

SmallSats to Deep Space

## SLS Block 1B Crew
## As Early As 2022

**Provides**

105 t lift capability via Exploration Upper Stage

Co-manifested payload capability in Universal Stage Adapter

**Enables**

**Deep Space Gateway**

Larger CubeSat- and ESPA-Class Payloads

## SLS Block 1B Cargo
## As Early As 2022

**Provides**

8.4-meter fairings for primary payloads

**Enables**

Europa Clipper/Lander

**Deep Space Transport**

Ice or Ocean Worlds Missions

Large-Aperture Space Telescopes

## SLS Block 2
## As Early As 2028

**Provides**

130 t lift capability via advanced boosters

10-meter fairings for primary payloads

**Enables**

**Crewed Mars Orbit Missions**

**Crewed Mars Surface Missions**

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# BOOSTER PROGRESS

# CORE STAGE PROGRESS

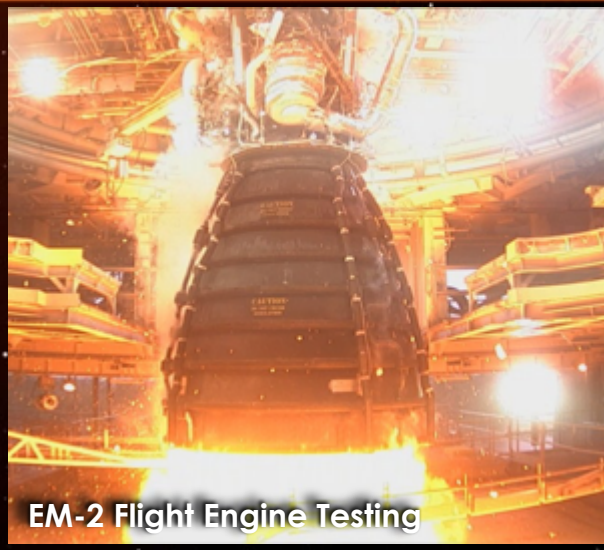
# ENGINE PROGRESS

# IN-SPACE STAGE AND ADAPTER PROGRESS

# PROGRESS TOWARD EM-2/BLOCK 1B

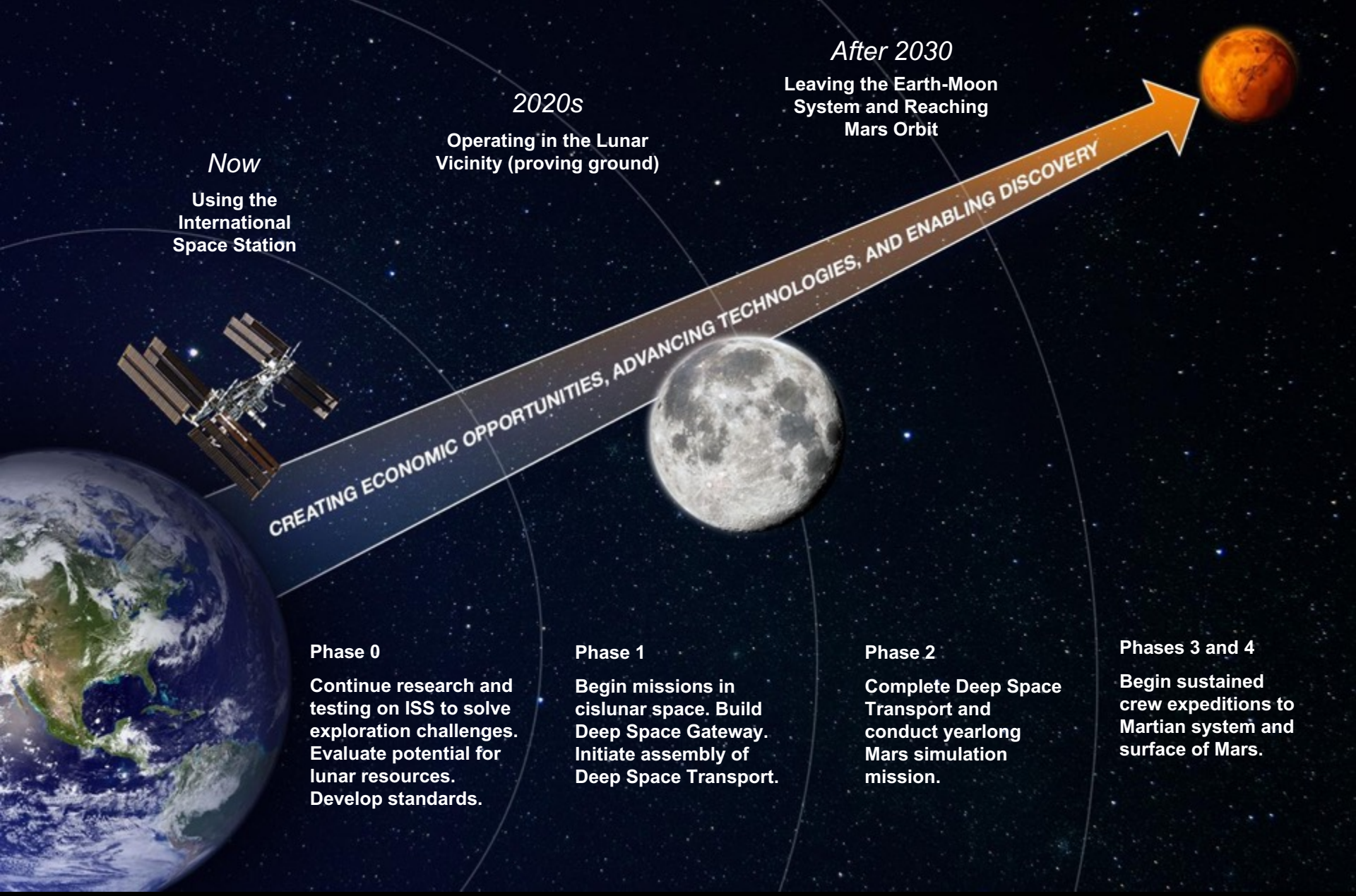

EM-2 Core Stage Welding


EM-2 Booster Insulation Installation


EM-2 Flight Engine Testing


EUS Development Panel Forming

Universal Stage Adapter Contract




# A PHASED APPROACH TO HUMAN SPACEFLIGHT

## SLS PLAYS A KEY ROLE INTO THE 2030s

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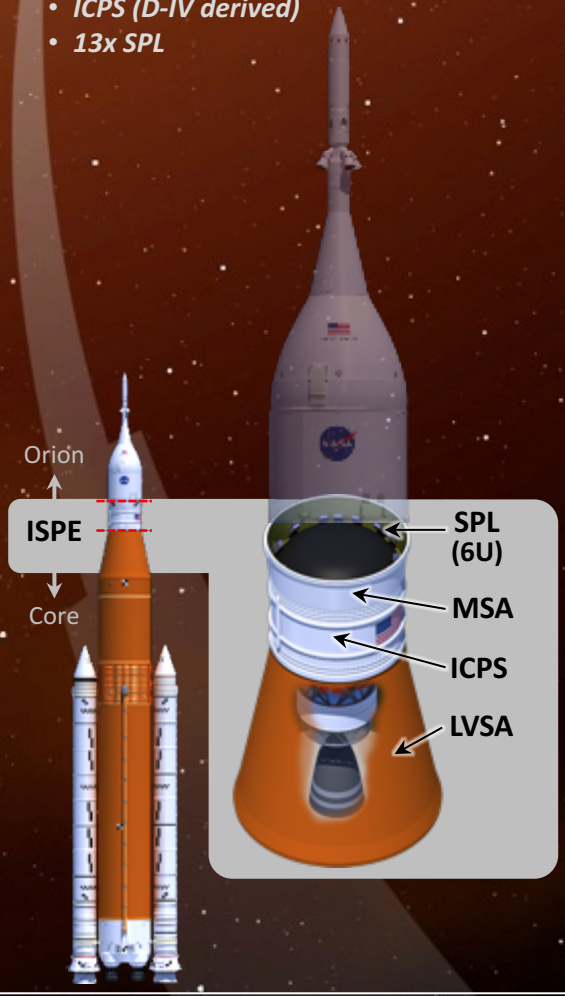
# SLS Spacecraft/Payload Integration & Evolution (SPIE)

*ISPE Hardware Development & Payload Integration for SLS Missions*

## SLS Block 1

### *Test Flight*

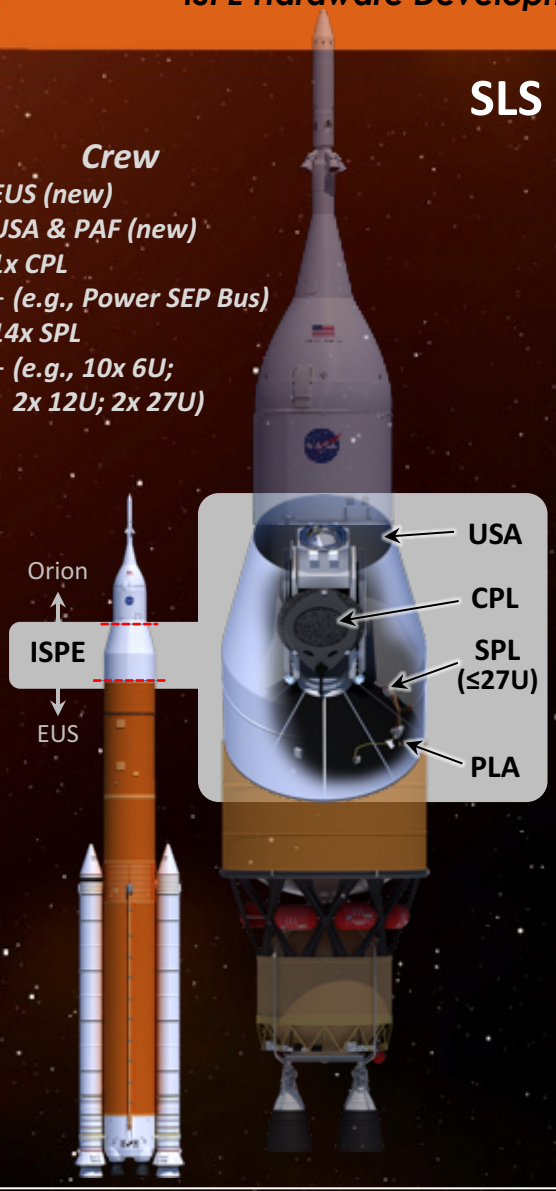
- *ICPS (D-IV derived)*
- *13x SPL*




## SLS Block 1B

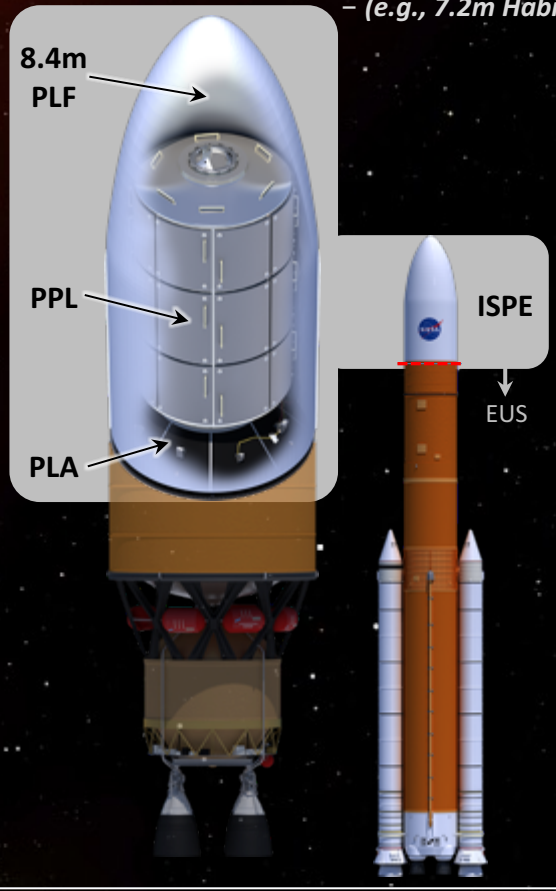
### *Crew*

- *EUS (new)*
- *USA & PAF (new)*
- *1x CPL*
  - *(e.g., Power SEP Bus)*
- *14x SPL*
  - *(e.g., 10x 6U; 2x 12U; 2x 27U)*




### *Cargo*

- *EUS*
- *PLF (new)*
- *1x PPL*
  - *(e.g., 7.2m Habitat)*




*Notes: ISPE – Integrated Spacecraft Payload Element SPL – Secondary Payload MSA– MPCV Stage Adapter ICPS – Integrated Cryogenic Propulsion Stage LVSA – Launch Vehicle Stage Adapter EUS – Exploration Upper Stage USA – Universal Stage Adapter CPL – Co-manifested Payload PLA – Payload Adapter PLF - Payload Fairing PPL – Primary Payload*

*ISPE Separation Plane*

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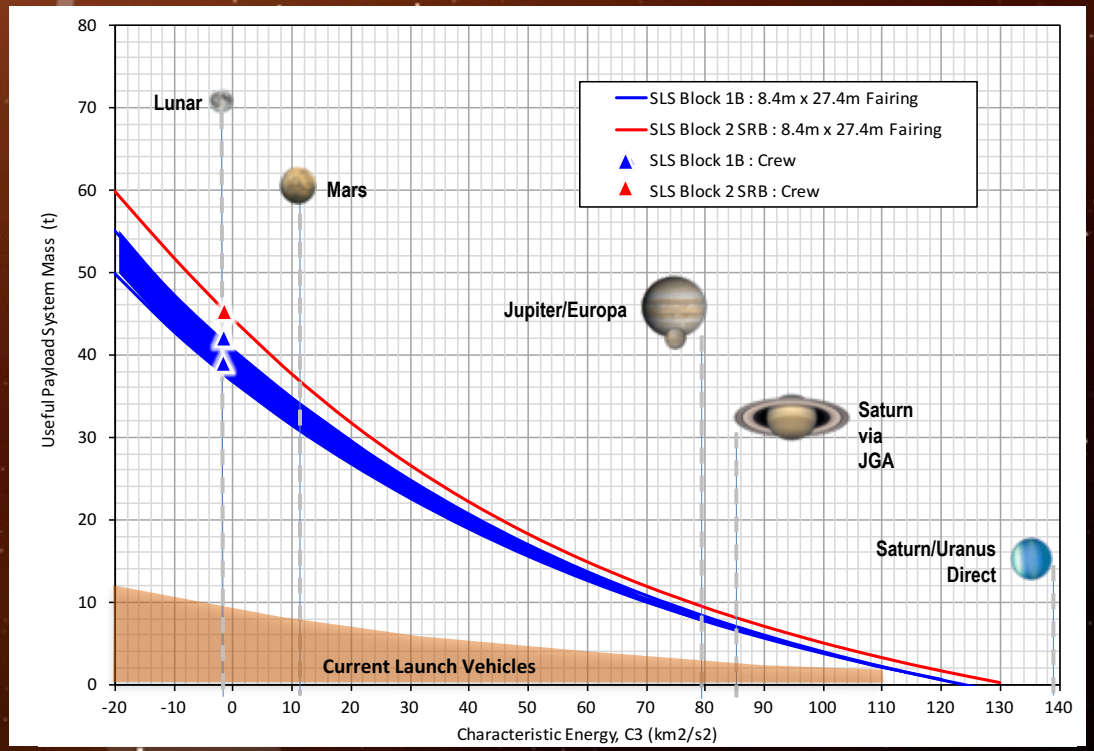
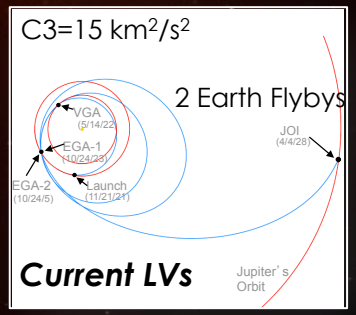
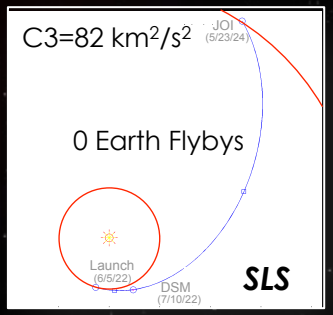
# SLS TIME TO DESTINATION




## Europa Clipper

- Desired launch date of June 2022
- Jovian system transit time reduced by 65% over existing launch vehicles
- Reduced mission operations cost over time




<u>Earliest Launch</u>

*Period: 6/4/22 – 6/24/22 (SLS)
*Period: 6/18/22 – 7/8/22 (Atlas)

<u>Cruise:</u>

2.5 Years (SLS)
7.4 Years (Atlas)

<u>Jupiter Orbit Insertion</u>

12/24/24 or 5/1/25 (SLS)
11/26/29 (Atlas)

<u>Jovian System Operations</u>

Prime Europa Flyby
Campaign: 36 months

# RANGE OF PAYLOAD ENCAPSULATION


| Enclosure | 5.4m PLF | 5.1m PLF | 8.4m USA | 8.4m USA PLF | 8.4m PLF, Short | 8.4m PLF, Long | 10m PLF |
|---|---|---|---|---|---|---|---|
| Type | 5m PPL | 5m PPL | 8.4m CPL | 8.4m PPL | 8.4m PPL | 8.4m PPL | 10m PPL |
| Length | 55.8 ft | 62.7 ft | 32.8 ft | 47.2 ft | 62.7 ft | 90 ft | 90 ft |
| | 17.0 m | 19.1 m | 10.0 m | 14.4 m | 19.1 m | 27.4 m | 27.4 m |
| Diameter | 17.7 ft | 16.7 ft | 27.6 ft | 27.6 ft | 27.6 ft | 27.6 ft | 32.8 ft |
| | 5.4 m | 5.1 m | 8.4 m | 8.4 m | 8.4 m | 8.4 m | 10.0 m |
| Internal Diameter | 15.1 ft | 15.1 ft | 24.6 ft | 24.6 ft | 24.6 ft | 24.6 ft | 29.9 ft |
| | 4.6 m | 4.6 m | 7.5 m | 7.5 m | 7.5 m | 7.5 m | 9.1 m |
| Available Volume | 7,740 $ft^3$ | 9,030 $ft^3$ | 10,100 $ft^3$ | 11,260 $ft^3$ | 18,970 $ft^3$ | 31,950 $ft^3$ | 46,610 $ft^3$ |
| | 219.2 $m^3$ | 255.7 $m^3$ | 286.0 $m^3$ | 319 $m^3$ | 537 $m^3$ | 905 $m^3$ | 1,320 $m^3$ |

Block 1B

Block 2

*COTS: Commercial Off-the-Shelf* *CPL: Co-manifested Payload* *PPL: Primary Payload* *PLF: Payload Fairing*

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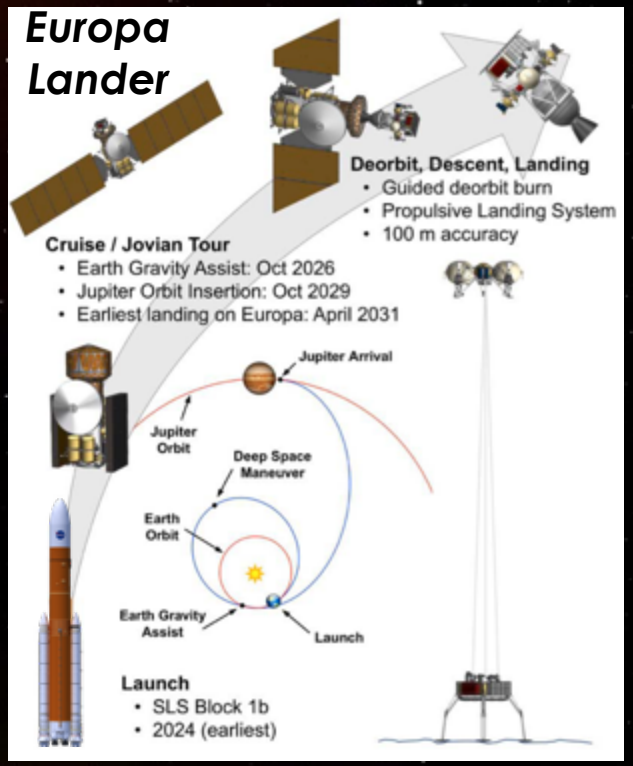
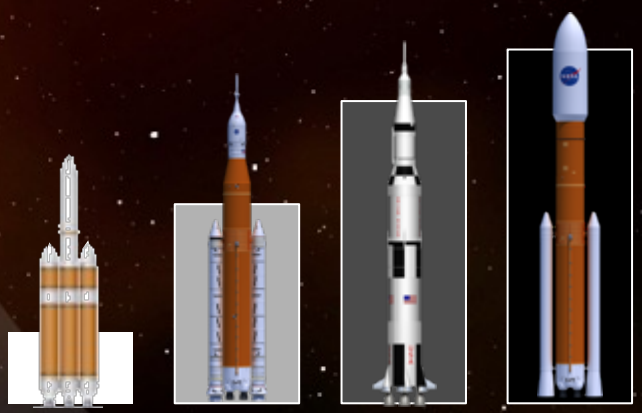
# SLS MASS TO DESTINATION

- **Up to 5 times greater mass to orbit capability than current launch systems**
  - Increases payload mass margins
  - Offers range of injection propulsion options
- **New Horizons**
  - SLS would have doubled delivered payload mass to Pluto
- **Europa Lander**
  - 16 mT delivery to outer planets (with margin)

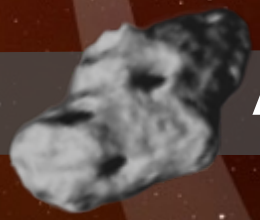

***Payload Lift Comparison***



# ONE LAUNCH, MULTIPLE DISCIPLINES

## Moon

- Lunar Flashlight (NASA)
- Lunar IceCube (Morehead State University)
- LunaH-Map (Arizona State University)
- OMOTENASHI (JAXA)



## Asteroid

- NEA Scout (NASA)

## Sun

- CuSP (Southwest Research Institute)

## Earth

- EQUULEUS (JAXA)
- LunIR (Lockheed Martin)

## And Beyond

- Biosentinel (NASA)
- ArgoMoon (ESA/ASI)
- Cislunar Explorers (Cornell University)
- CU$^3$ (University of Colorado Boulder)
- Team Miles (Fluid & Reason)

# THE ADVENTURE BEGINS NOW.

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