



National Aeronautics and Space Administration

5...4...3...2...1...

# SPACE LAUNCH SYSTEM

**A NEW CAPABILITY FOR DISCOVERY**

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**Spacecraft/Payload Integration & Evolution**

*August 29, 2017*



# 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

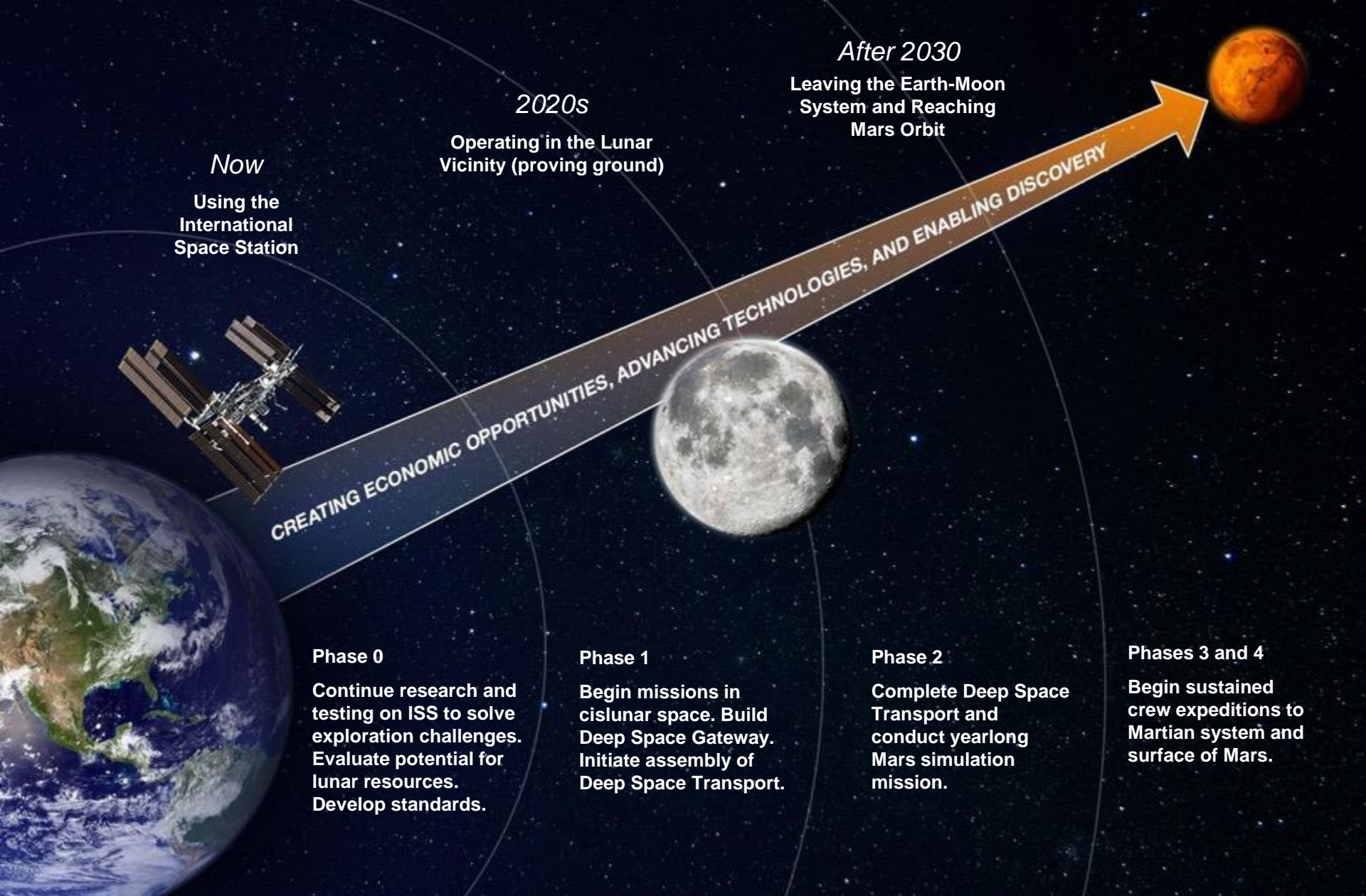
10-meter fairings for primary payloads

### Enables

Crewed Mars Orbit Missions

Crewed Mars Surface Missions





# A PHASED APPROACH TO HUMAN SPACEFLIGHT

SLS PLAYS A KEY ROLE INTO THE 2030s

# 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



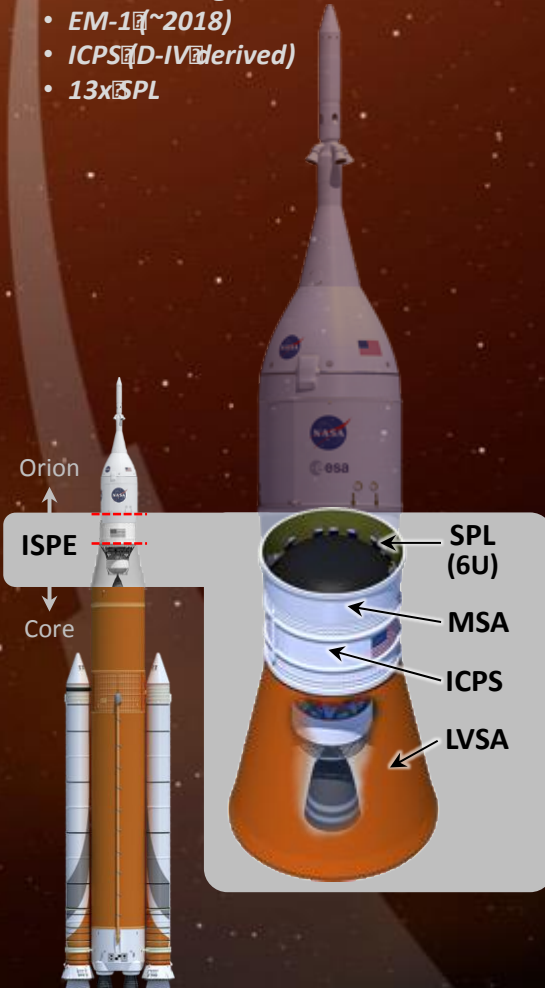
# SLS Spacecraft/Payload Integration & Evolution (SPIE)

ISPE Hardware Development & Payload Integration for SLS Missions

## SLS Block 1

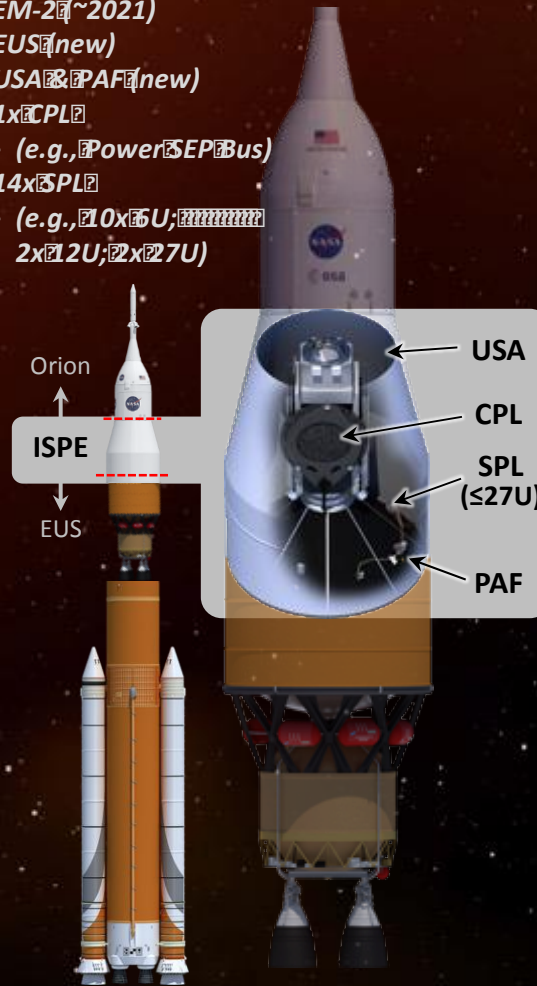
### Test Flight

- EM-1 (~2018)
- ICPS (D-IV derived)
- 13x SPL



### Crew

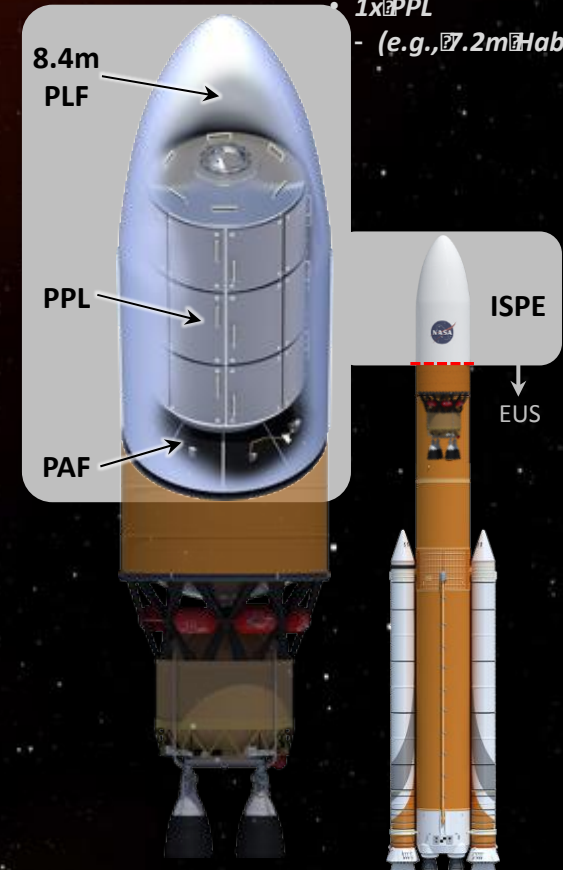
- EM-2 (~2021)
- EUS (new)
- USA & PAF (new)
- 1x CPL
- (e.g., Power SEP Bus)
- 14x SPL
- (e.g., 10x 5U, 2x 12U; 2x 27U)



## SLS Block 1B

### Cargo

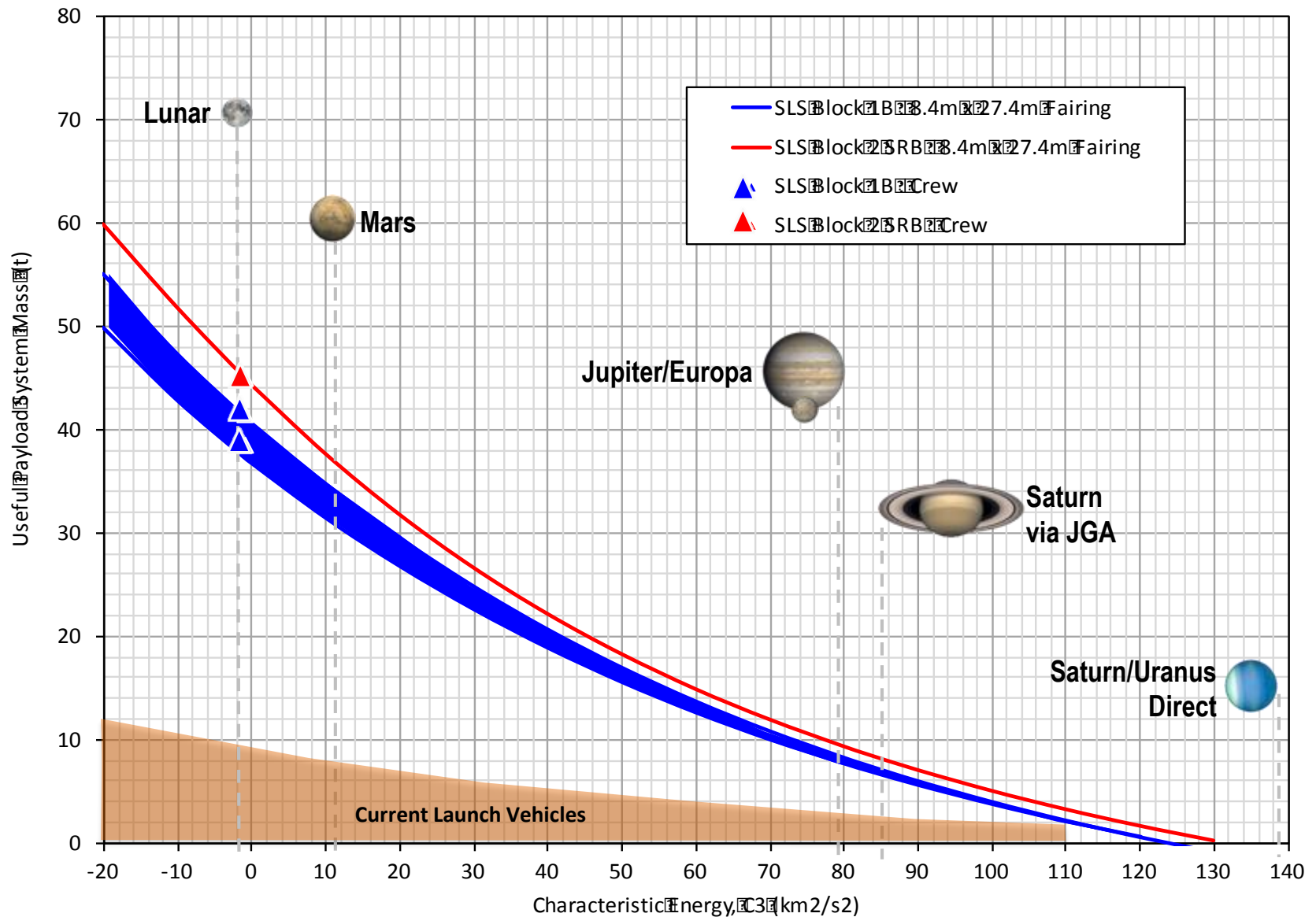
- EM-7 (~2027)
- EUS
- PLF (new)
- 1x PPL
- (e.g., 7.2m Habitat)



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 PAF – Payload Attachment Fitting PLF – Payload Fairing PPL – Primary Payload

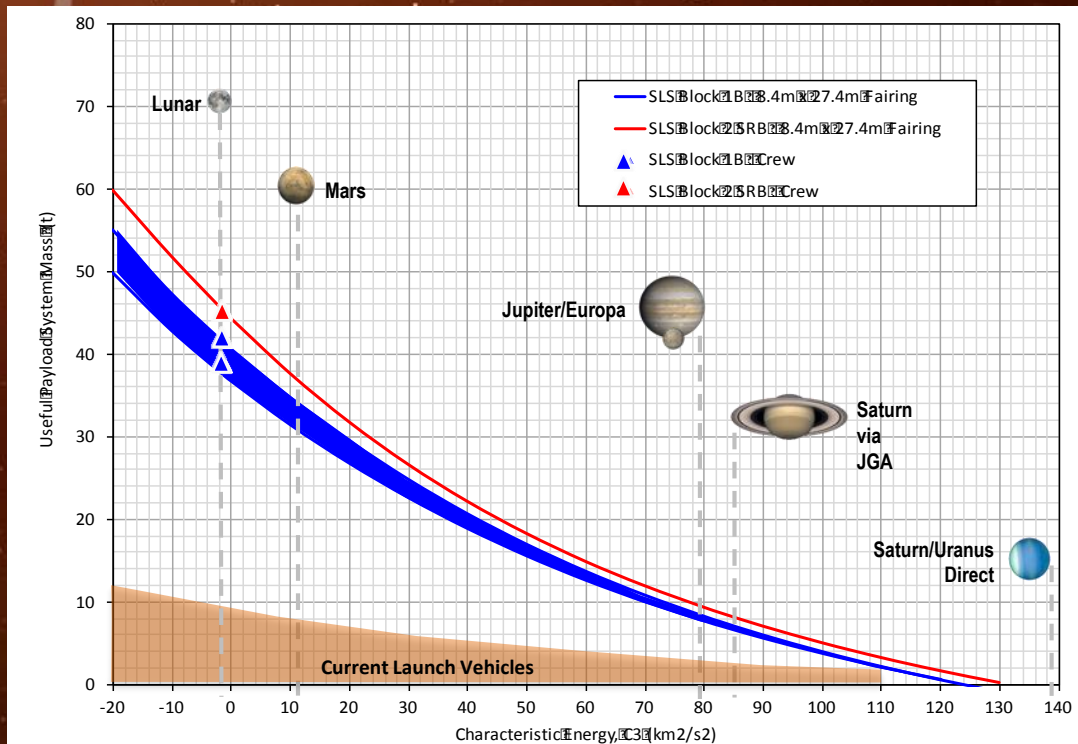
----- ISPE Separation Plane

# SLS PAYLOAD MISSION CAPTURE



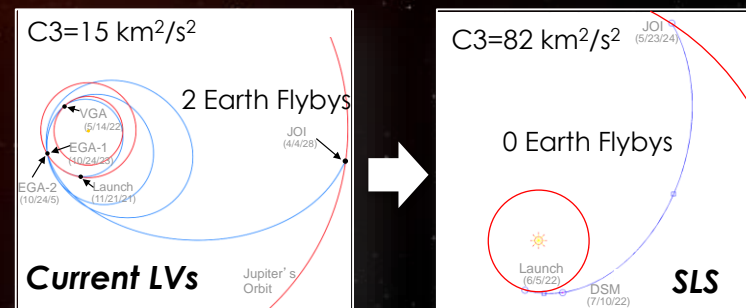


# SLS TIME TO DESTINATION



## 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



## Earliest Launch

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

## Cruise:

- 2.5 Years (SLS)
- 7.4 Years (Atlas)

## Jupiter Orbit Insertion

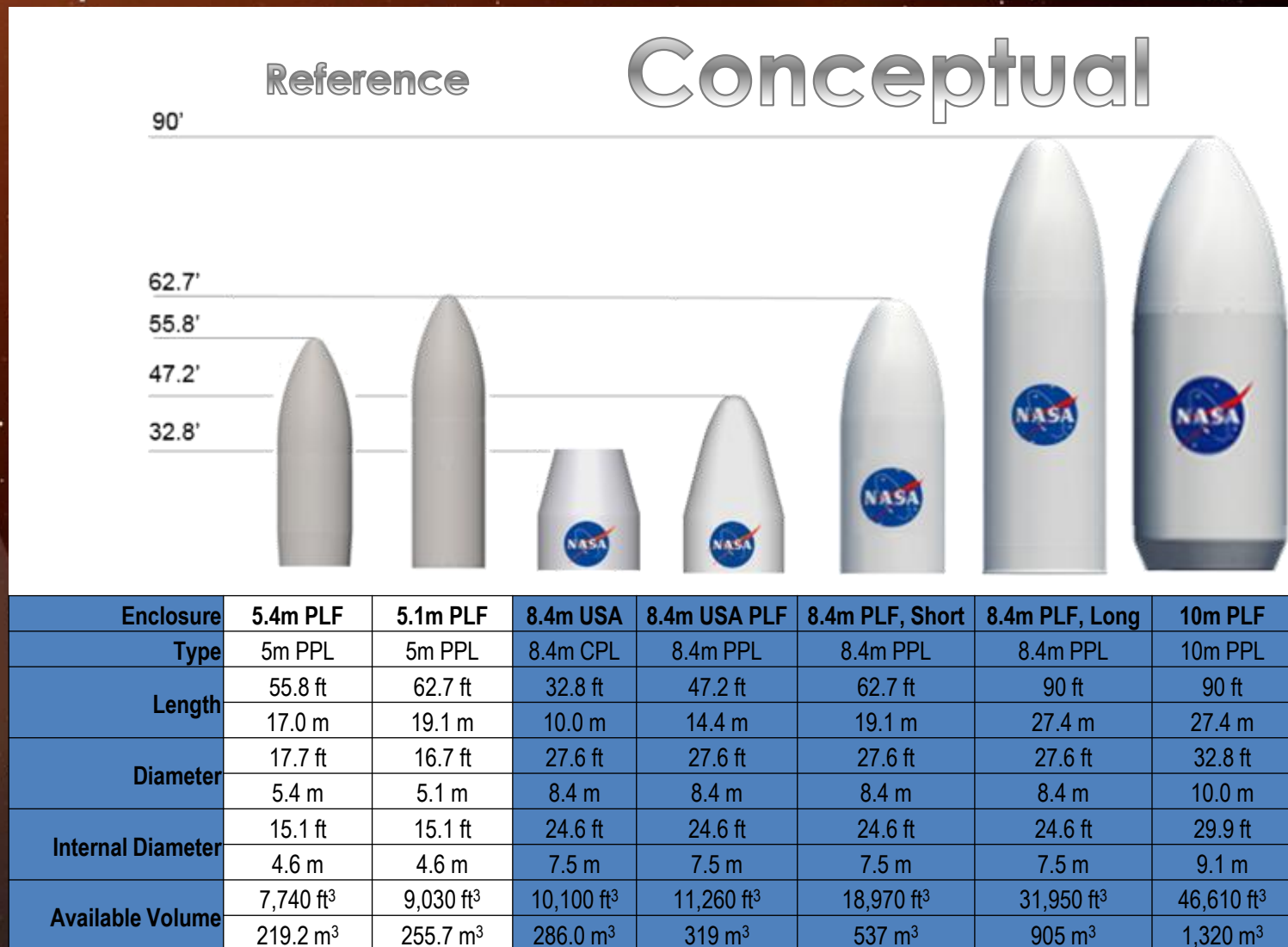
- 12/24/24 or 5/1/25 (SLS)
- 11/26/29 (Atlas)

## Jovian System Operations

- Prime Europa Flyby
- Campaign: 36 months



# RANGE OF PAYLOAD ENCAPSULATION



Block 1B

Block 2



COTS: Commercial Off-the-Shelf

CPL: Co-manifested Payload

PPL: Primary Payload

PLF: Payload Fairing

[www.nasa.gov/sls](http://www.nasa.gov/sls)



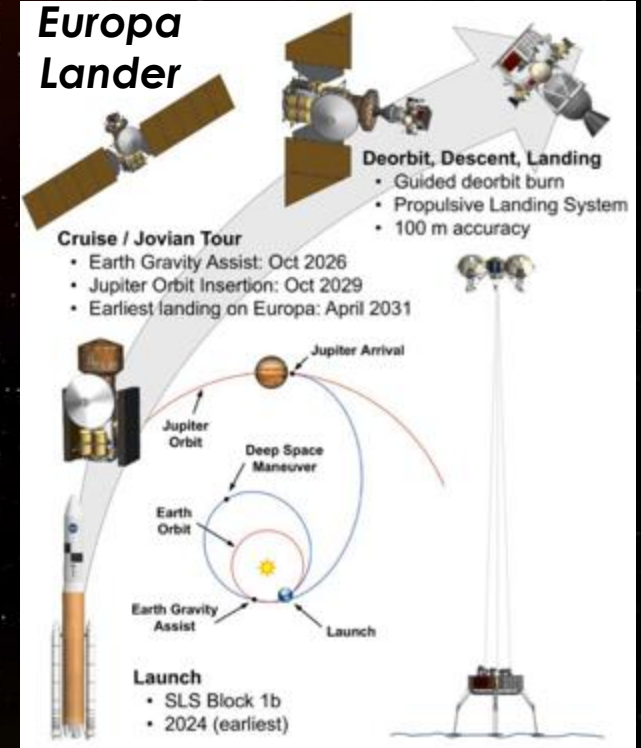
# SLS MASS TO DESTINATION

- ◆ **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)

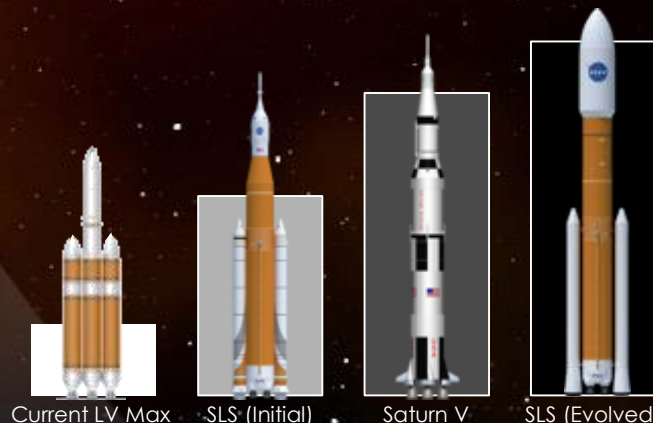
## New Horizons



## Europa Lander



## Payload Lift Comparison



# SLS COST TO DESTINATION

B1 B1B B2



## Representative Timeline

Launch Date	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
SLS Opportunity	EM-1 ▽			EM-2 ▽C	Europa ▽	EM-3 ▽C	EM-4 ▽C	EM-5 ▽C	EM-6 ▽C	EM-7 ▽C	EM-8 ▽C	EM-9 ▽C	EM-10 ▽C

Crew Block1 Block1B Block2

- ◆ **Plan to fly at least 1 crewed SLS per year**
  - System has capability to fly up to 3 SLS's per year
- ◆ **Orion Co-manifested Payloads cost limited to launch vehicle integration activities**
  - More volume than Shuttle Payload Bay
  - Up to 10 mT of payload to cis-lunar space
- ◆ **Multiple payload combinations possible**
  - New 8.4m class (w/COTS separation systems)
  - ELV 5m class (w/COTS separation systems)
  - ESPA ring class (w/COTS separation systems)
  - Up to 27U Cubesats (w/COTS dispenser systems)



Largest existing  
5m fairing

Orion Co-manifested  
Payload (8.4m USA)



# THE ADVENTURE BEGINS NOW.



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