



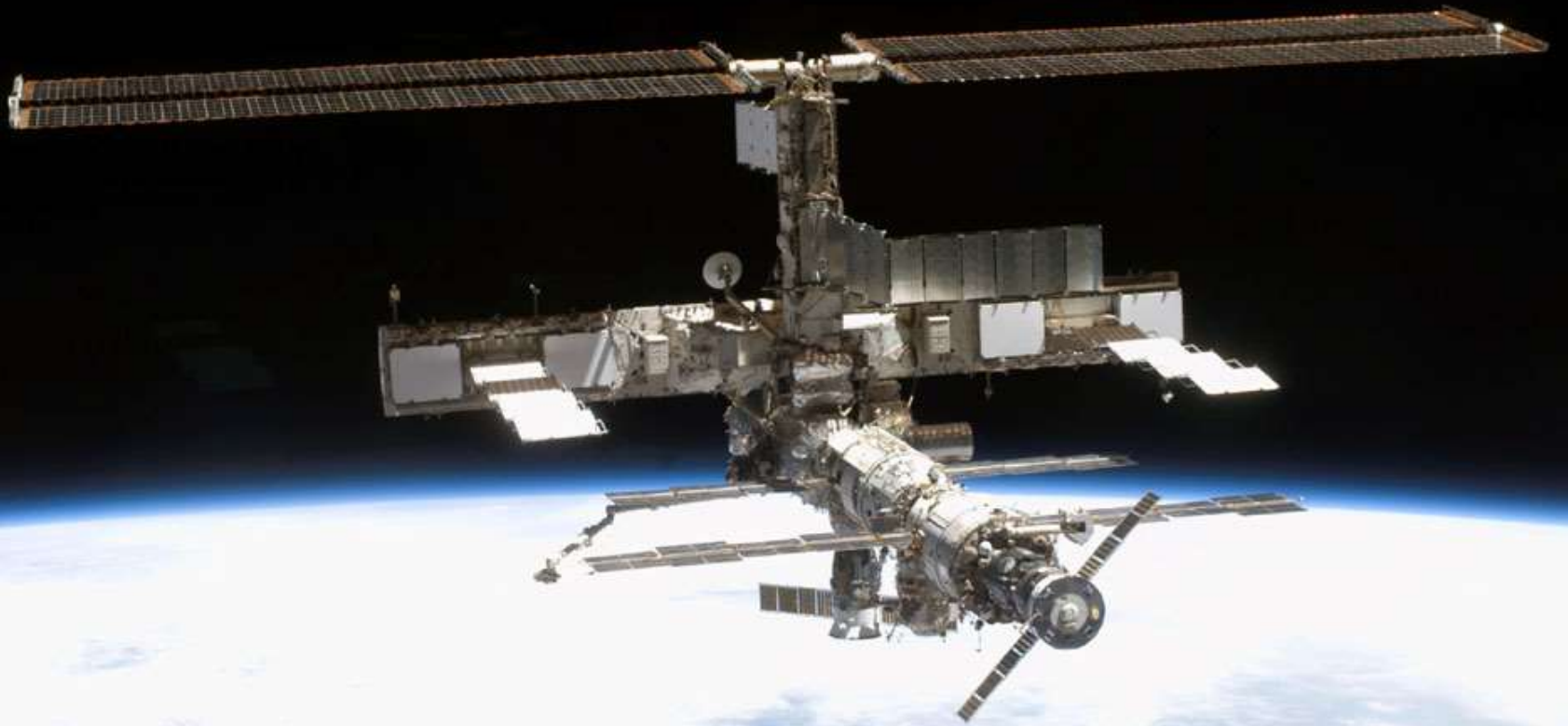
Human Exploration Update

Jim Paradise

LOCKHEED MARTIN



International Space Station (ISS)



This is the furthest we have gone in 42 years

The Old: Space Shuttle (now retired)

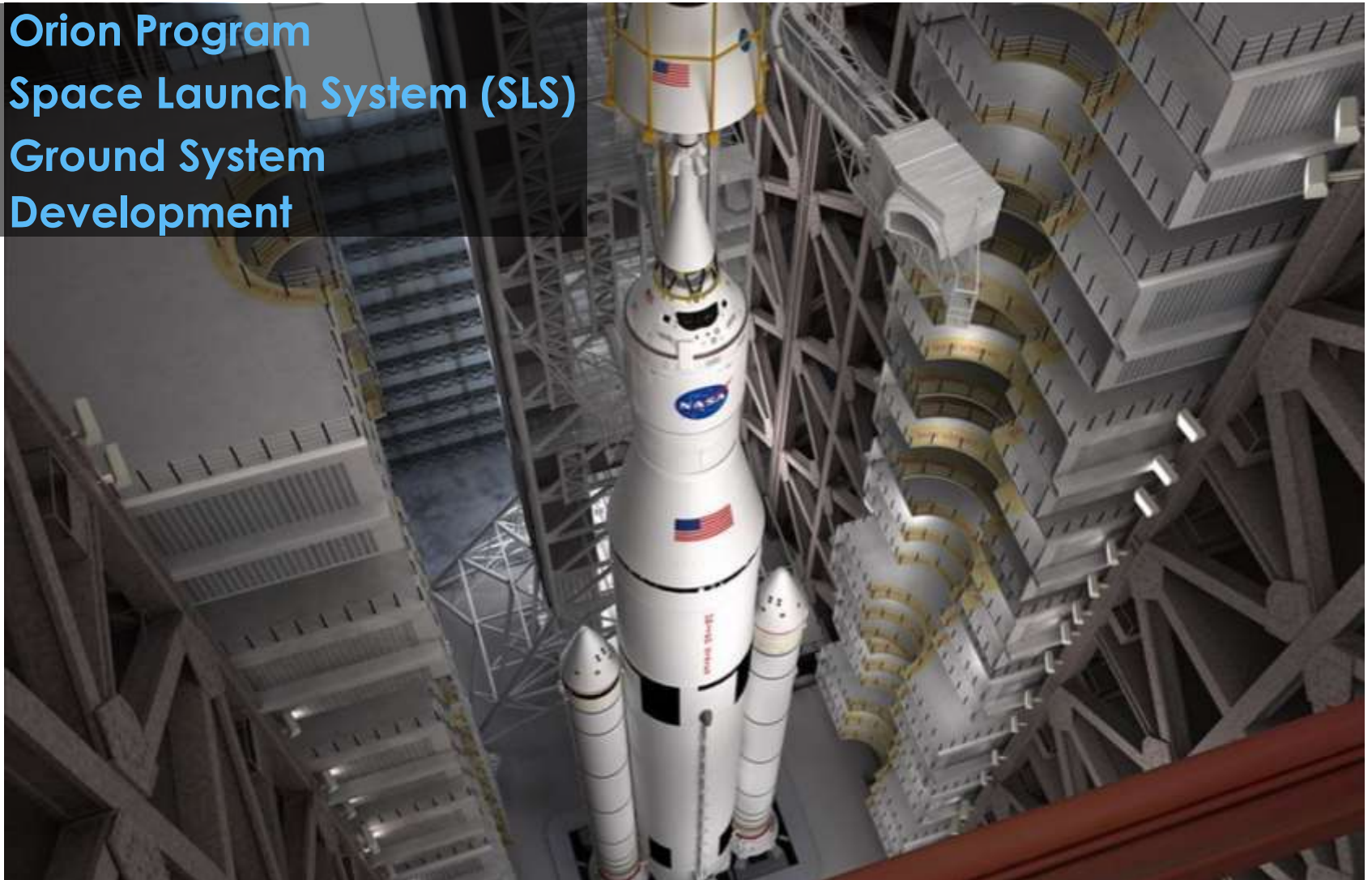


Image credit: NASA/JPL-Caltech

SLS

The New - Exploration Systems Development

- Orion Program
- Space Launch System (SLS)
- Ground System Development



Orion

Launch Abort System

- Protection for the CM
- Jettison after first stage flight

Crew Module

Service Module

Objective:
Take humans safely
beyond LEO ...

**... and return them
safely back to Earth**



June 23, 2014 Aviation Week

Orion Pad Abort Test (2010)

Enhances crew safety

by providing crew escape capability in the event of pad or ascent emergencies

Expands the envelope

of survivable abort conditions

over previous abort systems by providing active attitude control during aborts.

3 new solid rocket motors, successfully fired and operated together as a system during the successful Pad Abort 1 flight test



Service Module Fairing Separation Test



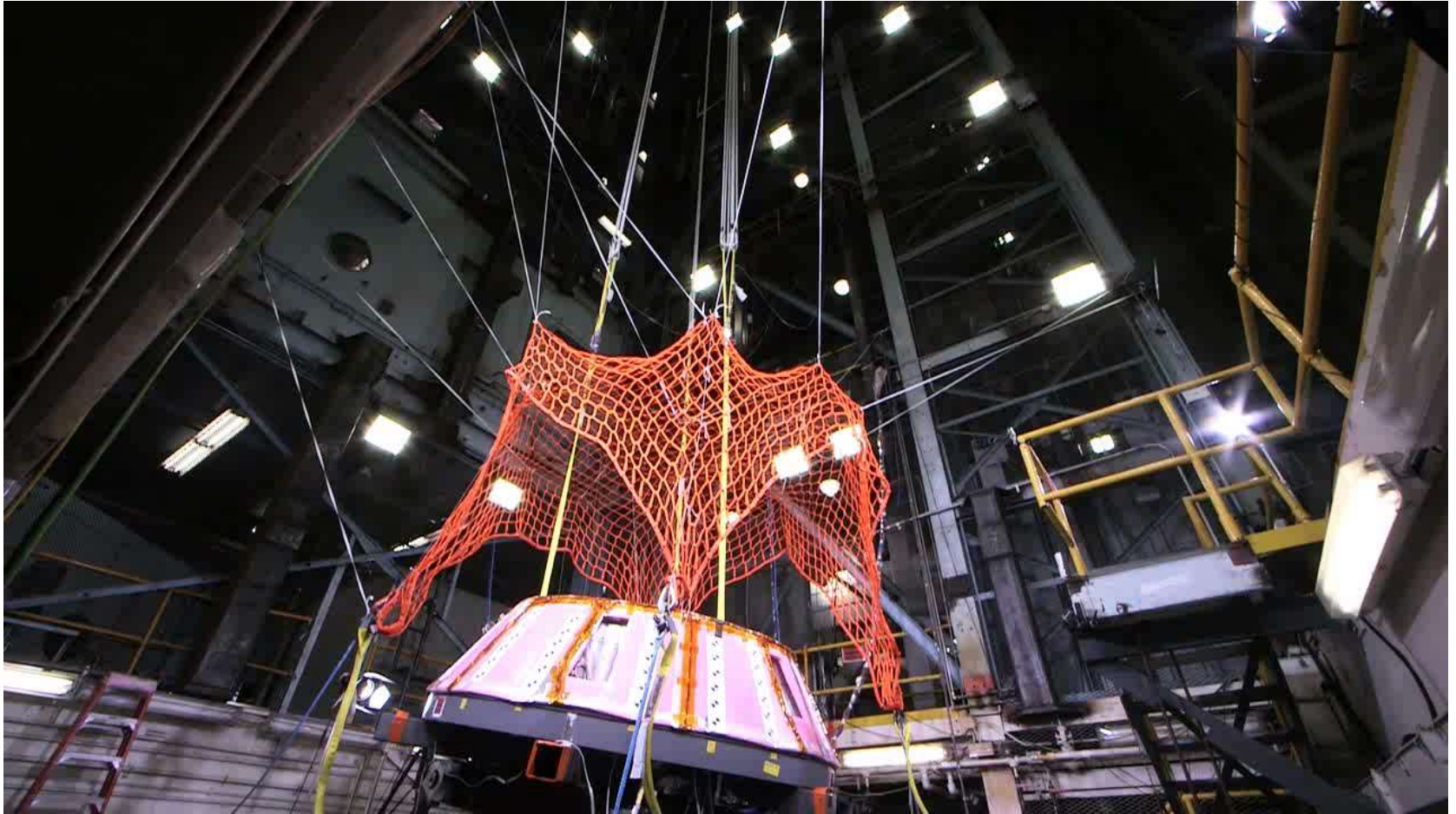
Parachute Drop Tests



HIB Drop Tests



Forward Bay Cover Separation Test



Crew Ascent Simulations



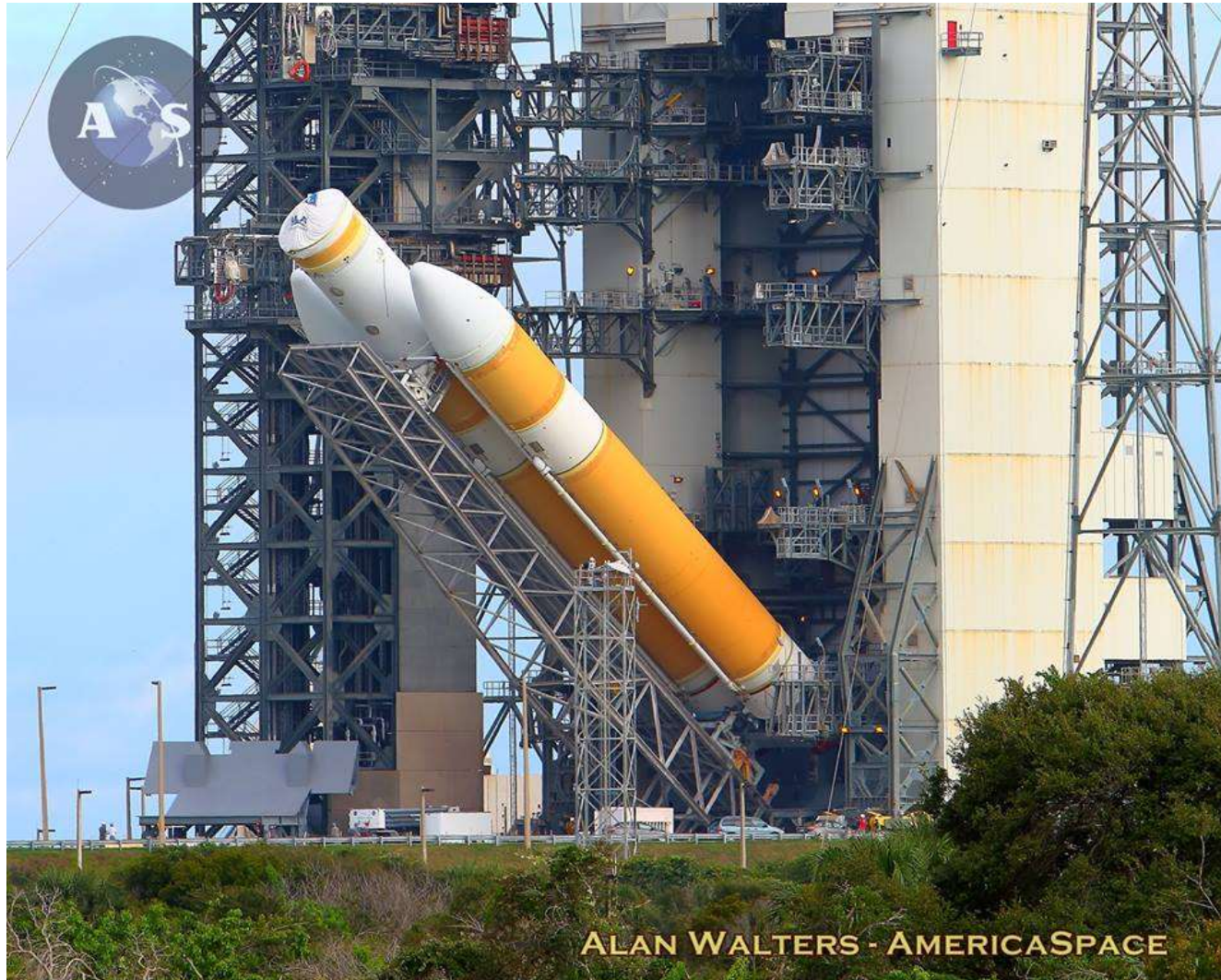
Mission Control Center Ready



EFT-1 Delta IV Heavy Launch Vehicle



ULA Delta IV Heavy at the launch pad



ESA Service Module Readied



KENNEDY SPACE CENTER, FL

Heat Shield prepped and ready



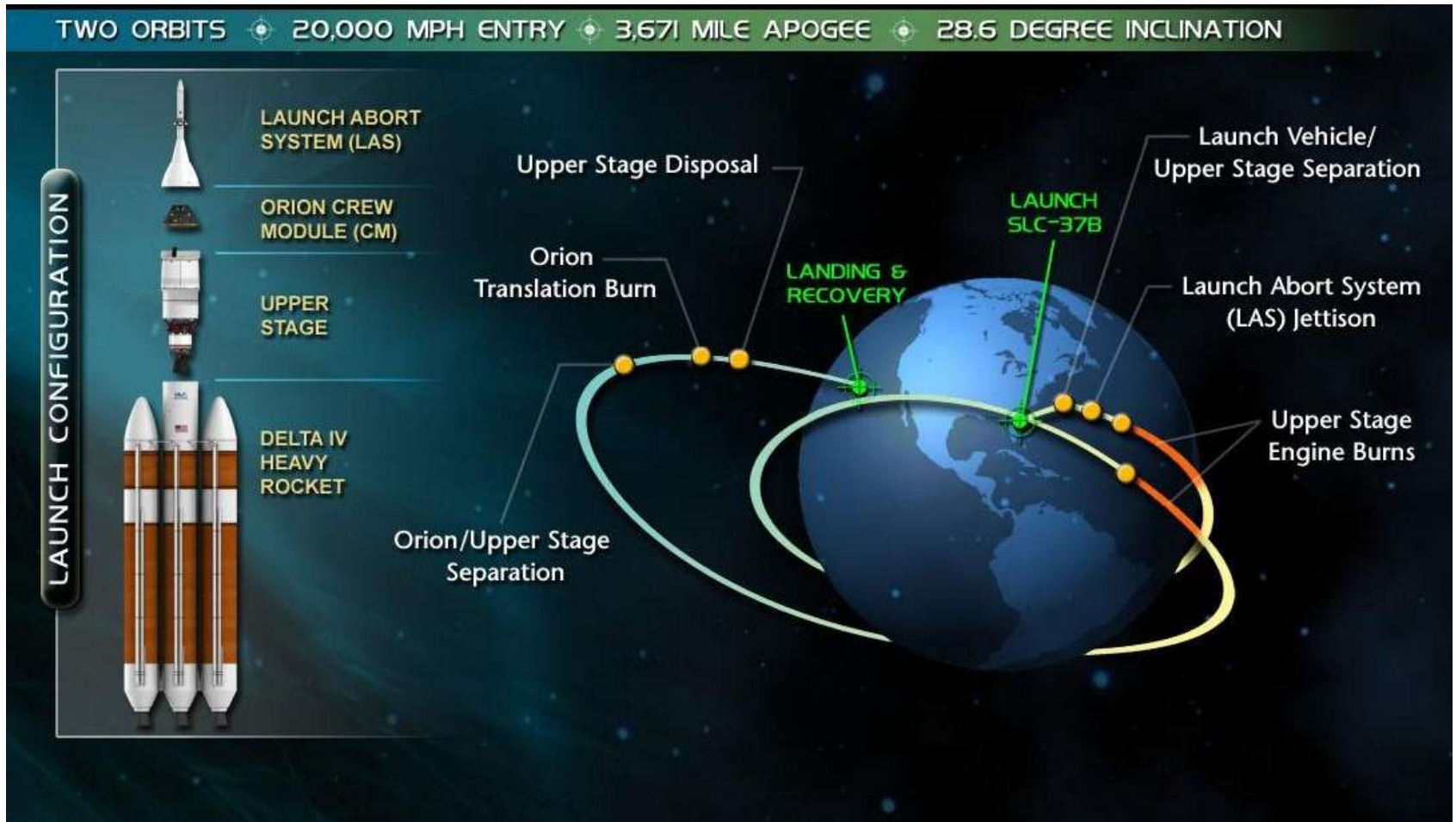




Orion stacked and moving to the launch pad

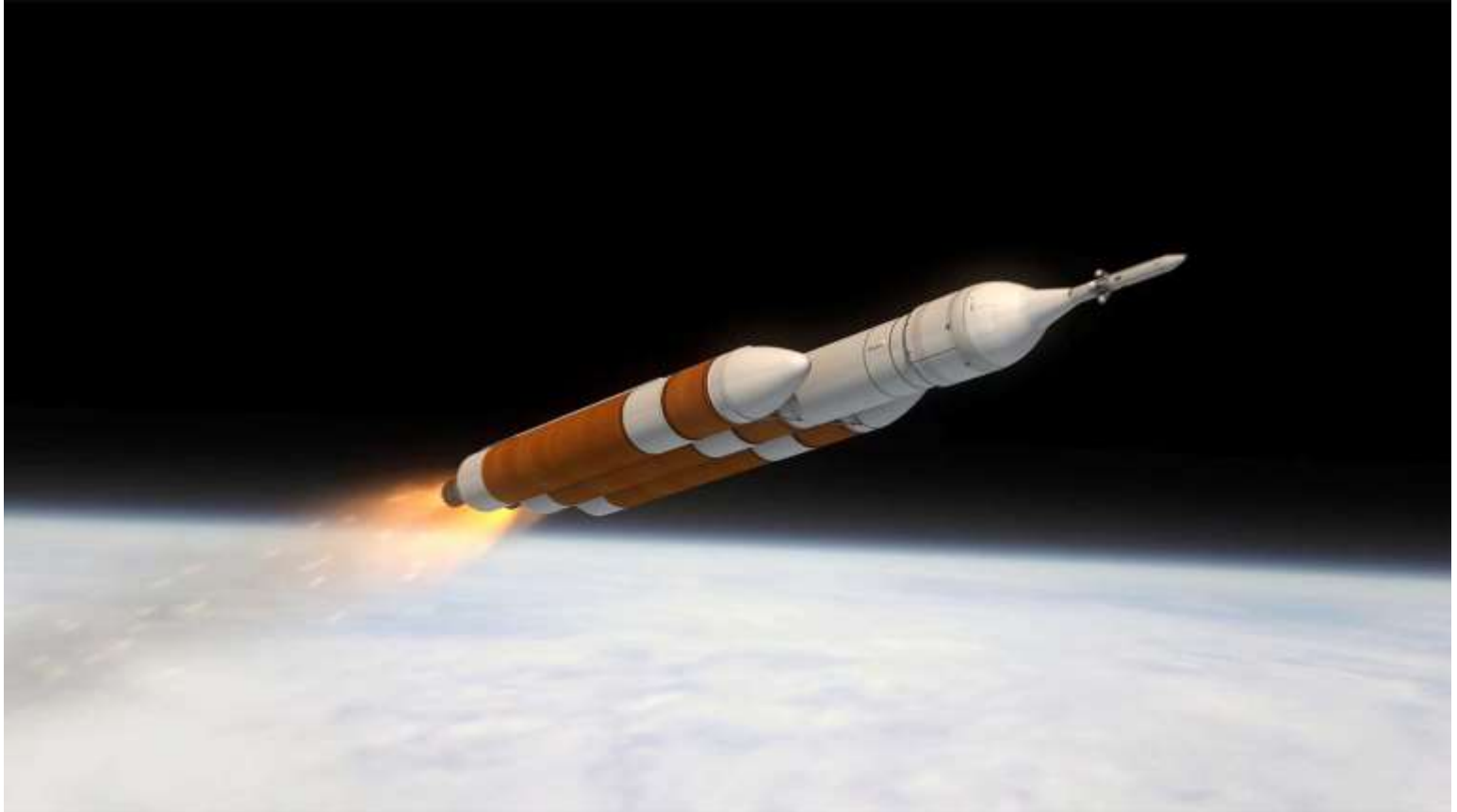


Exploration Flight Test – 1



2014

BECO



Booster Separation



Upper Stage MES1 – Panel/LAS Jettison



MECO1



MES2

#Orion



Upper Stage Re-Ignition

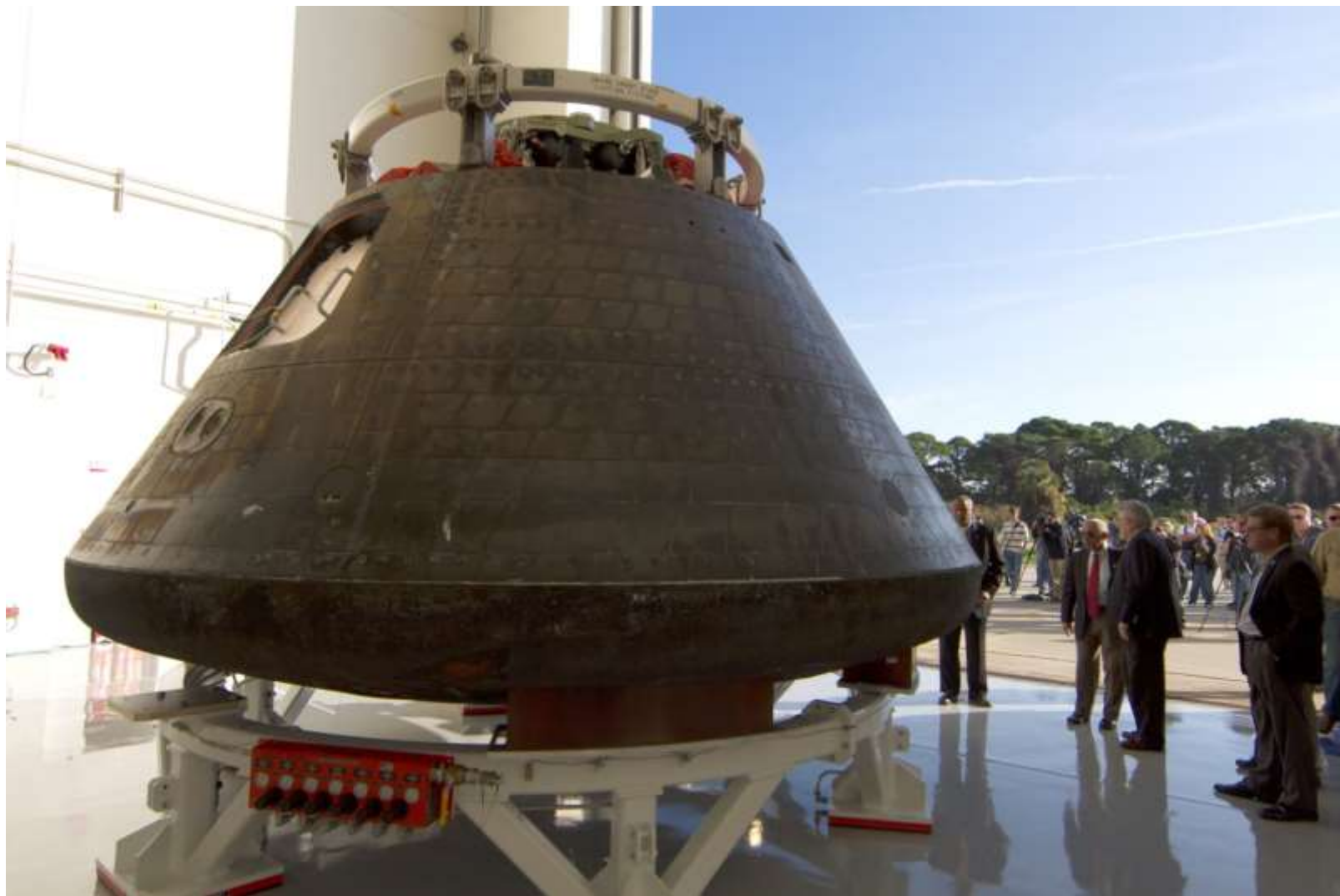


Crew Module beginning Re-entry

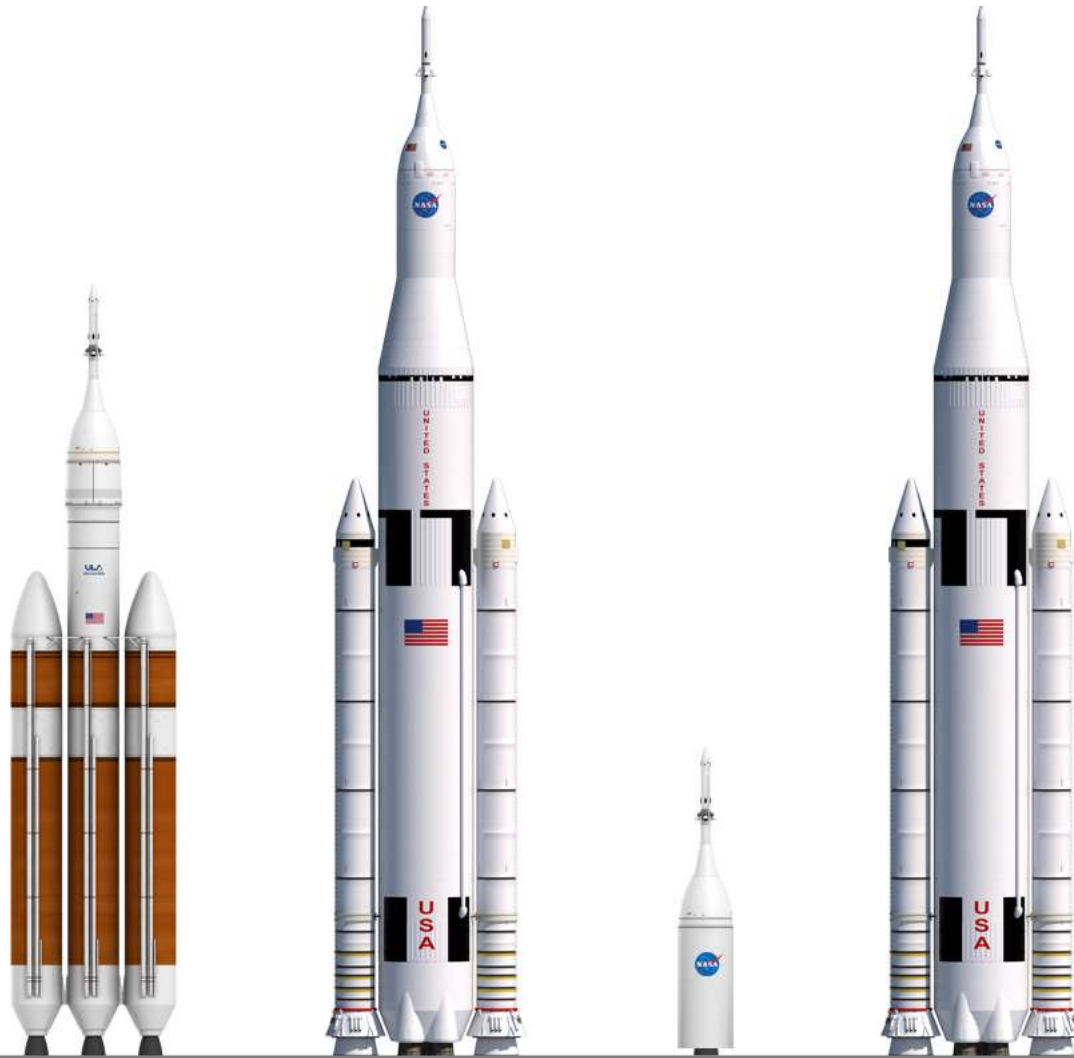


Recovery Testing Complete





What's Next? Orion Mission Timeline



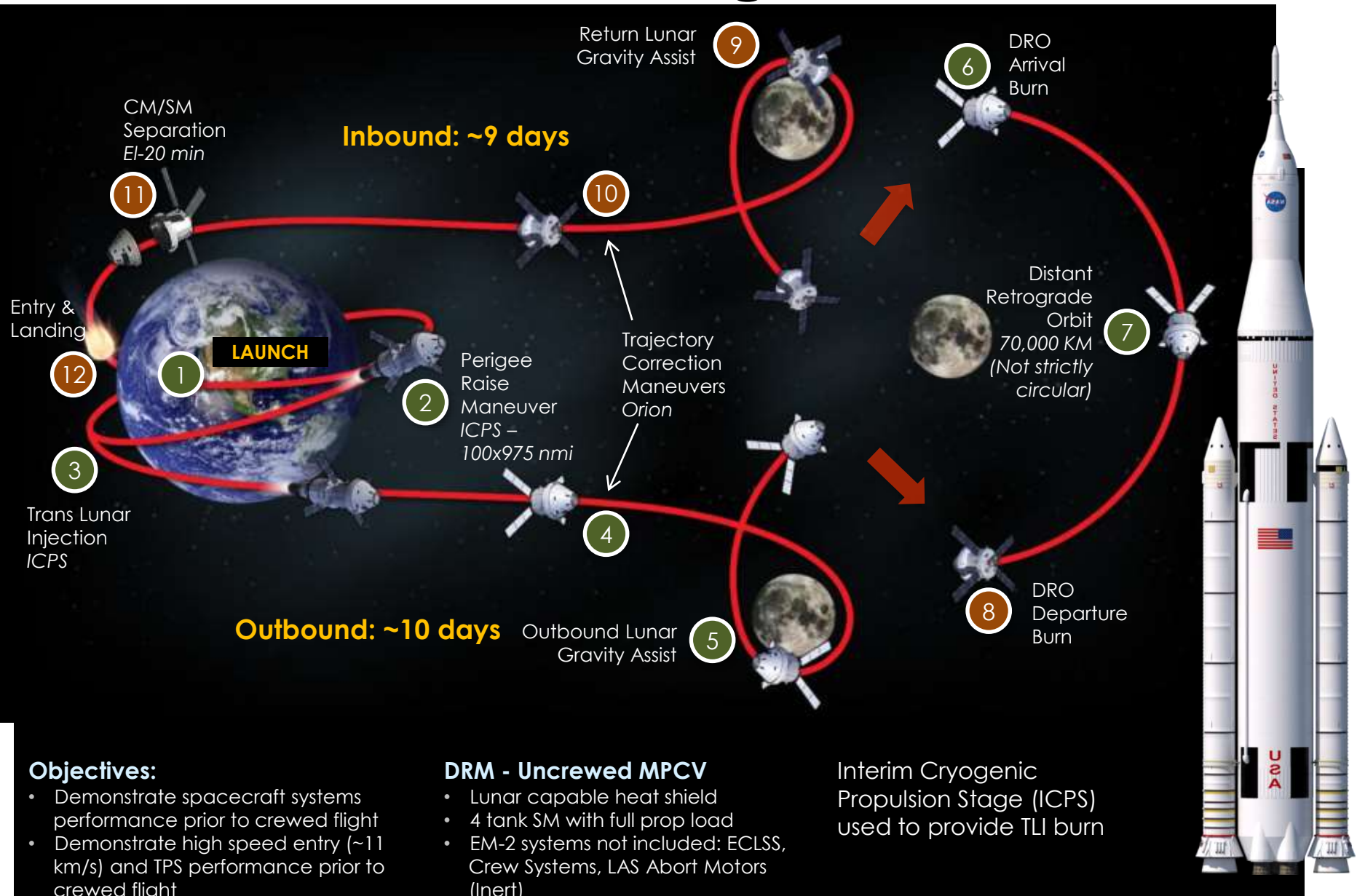
2014
EFT-1

2018
EM-1

2018
AA2

2021
EM-2

EM-1: Distant Retrograde Orbit 2018



Stepping Stones

A series of exploration missions building incrementally towards the long term goal of exploring Mars.

Each mission will address science objectives relating to the formation of the solar system and the origins of life.

2023
Deimos scout

2031 – 2035
Red Rocks: explore Mars from Deimos

2024, 2025, 2029
Plymouth Rock: Humans explore asteroids like 1999 AO10 and 2000 SG344

2018 – 2023
L2 Farside: Explore the Moon's far side from Earth-Moon L2 point

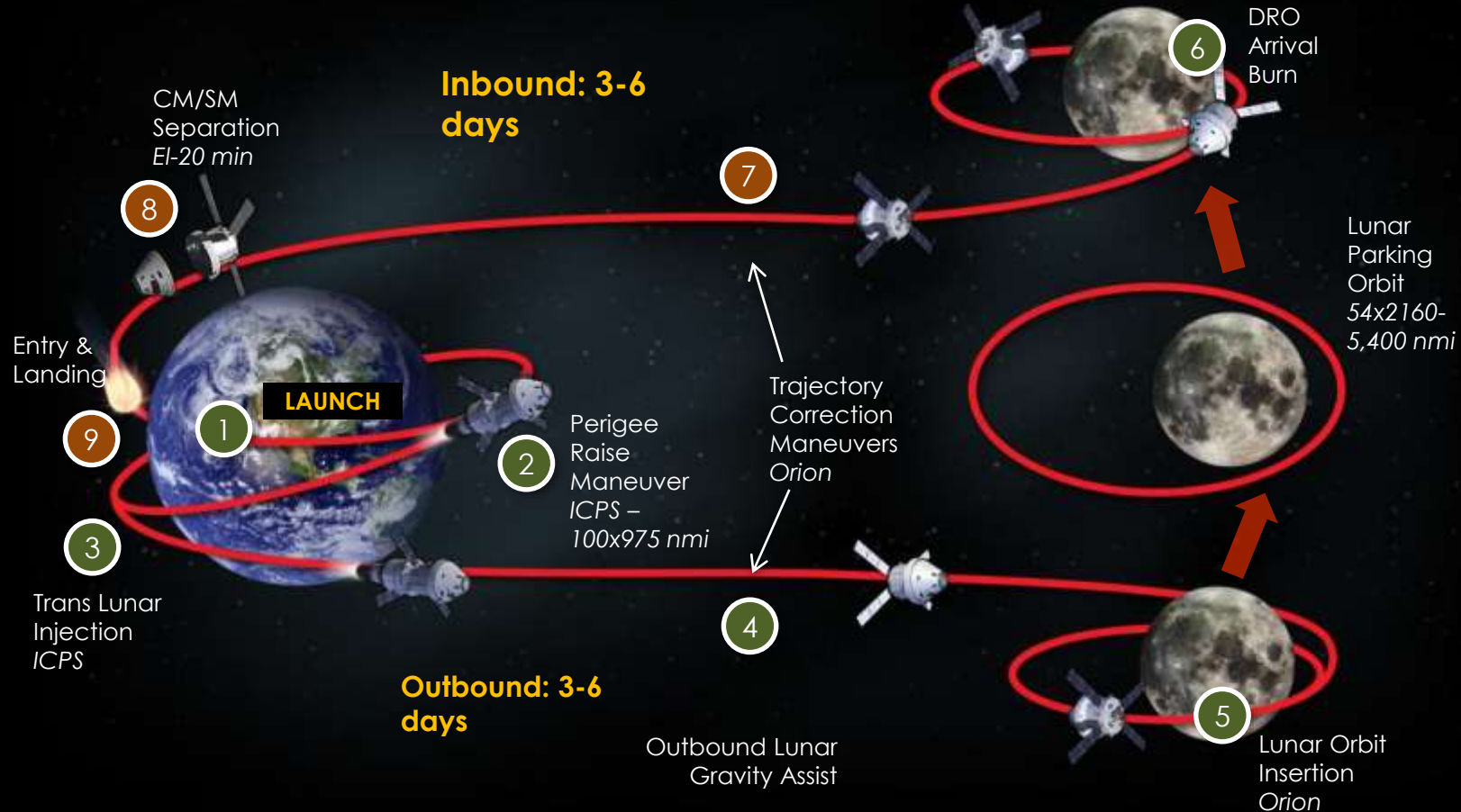
2017
SLS test flight

2013 – 2020
Human Systems extended duration tests on ISS

2017
Asteroid scout

2016
Asteroid survey

EM-2: Crewed High Lunar Orbit 2021



Objectives:

- Demonstrate crewed flight beyond LEO

DRM - Crewed MPCV

- Lunar capable heat shield
- 4 tank SM with full prop load
- Up to 4 crew

Interim Cryogenic Propulsion Stage (ICPS) used to provide TLI burn