

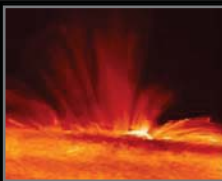


# NASA's Space Launch System: Exploration Missions 1 and 2 and Beyond

**AIAA Space 2014**  
*August 7, 2014*



# marshall



**Dawn Stanley**  
*SE&I Technical Manager*

# A Bolder Mission, A Deeper Purpose

## EARTH RELIANT

MISSION: 6 TO 12 MONTHS  
RETURN TO EARTH: HOURS



Mastering fundamentals  
aboard the International  
Space Station

U.S. companies  
provide access to  
low-Earth orbit

## PROVING GROUND

MISSION: 1 TO 12 MONTHS  
RETURN TO EARTH: DAYS



Expanding capabilities by  
visiting an asteroid redirected  
to a lunar distant retrograde orbit

The next step: traveling beyond low-Earth  
orbit with the Space Launch System  
rocket and Orion spacecraft

## MARS READY

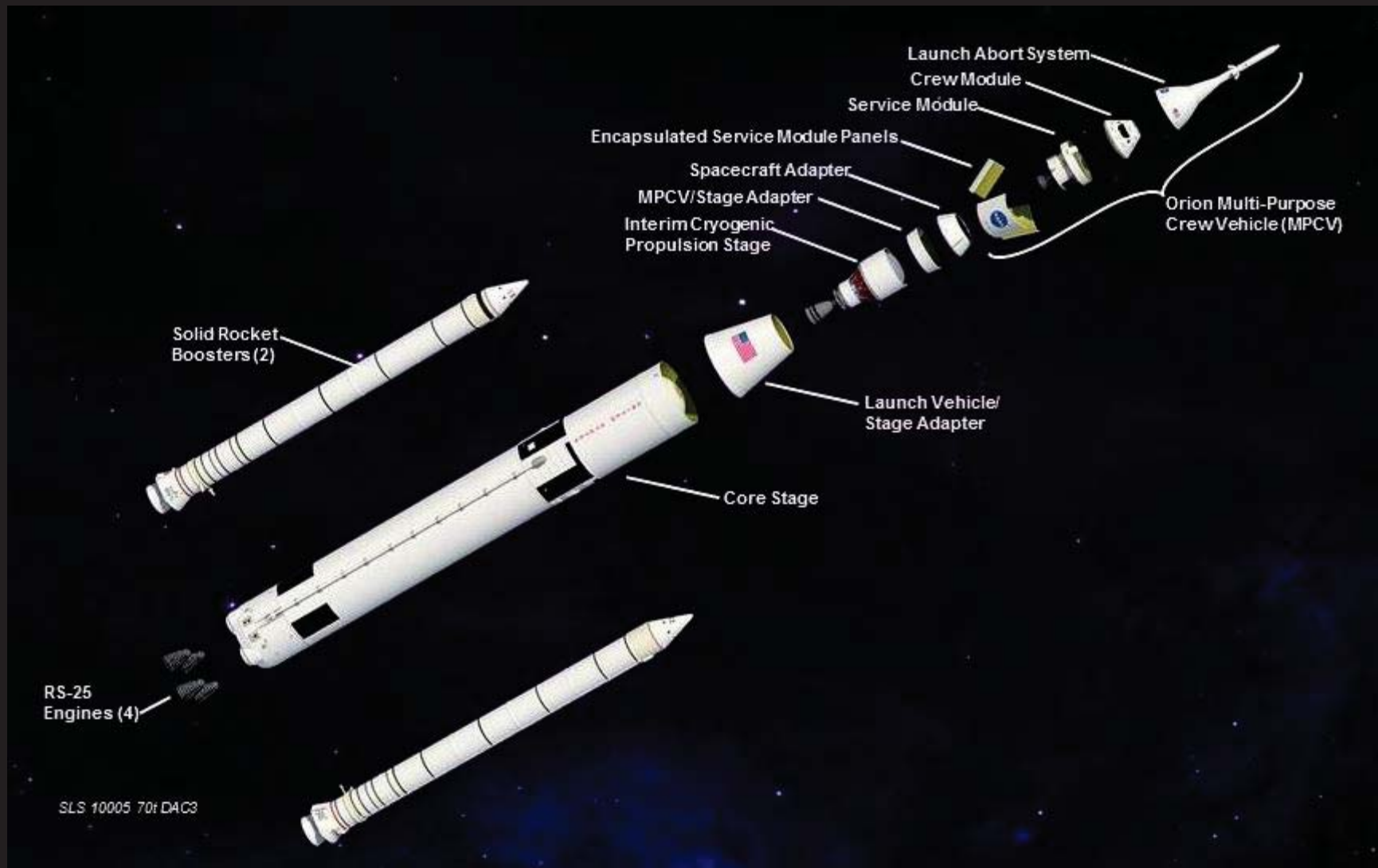
MISSION: 2 TO 3 YEARS  
RETURN TO EARTH: MONTHS



Developing planetary independence  
by exploring Mars, its moons and  
other deep space destinations

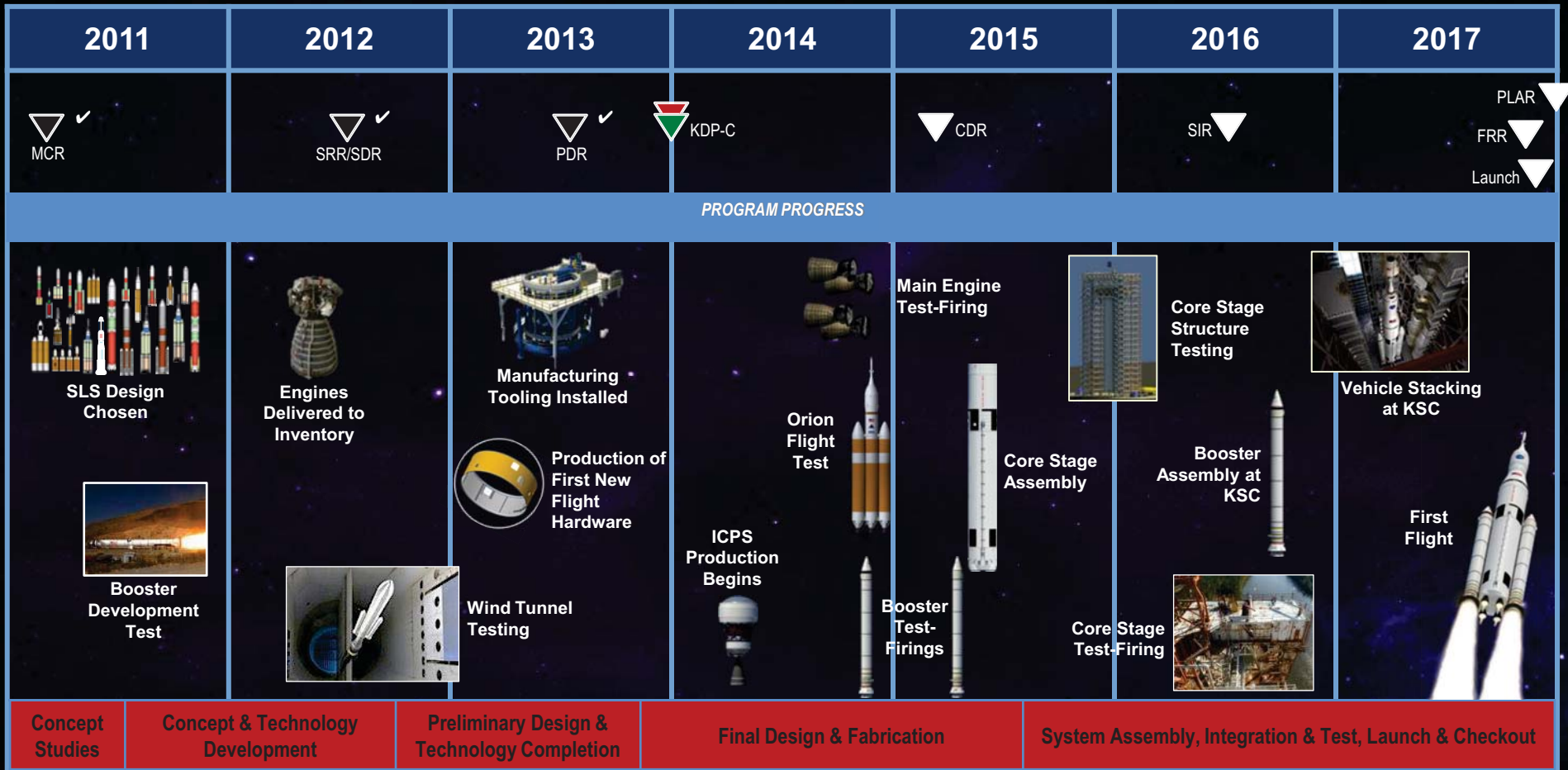
*We reach for new heights and reveal the unknown  
for the benefit of humankind.*

# Capability for a New Era of Space Exploration





# SLS Development Schedule



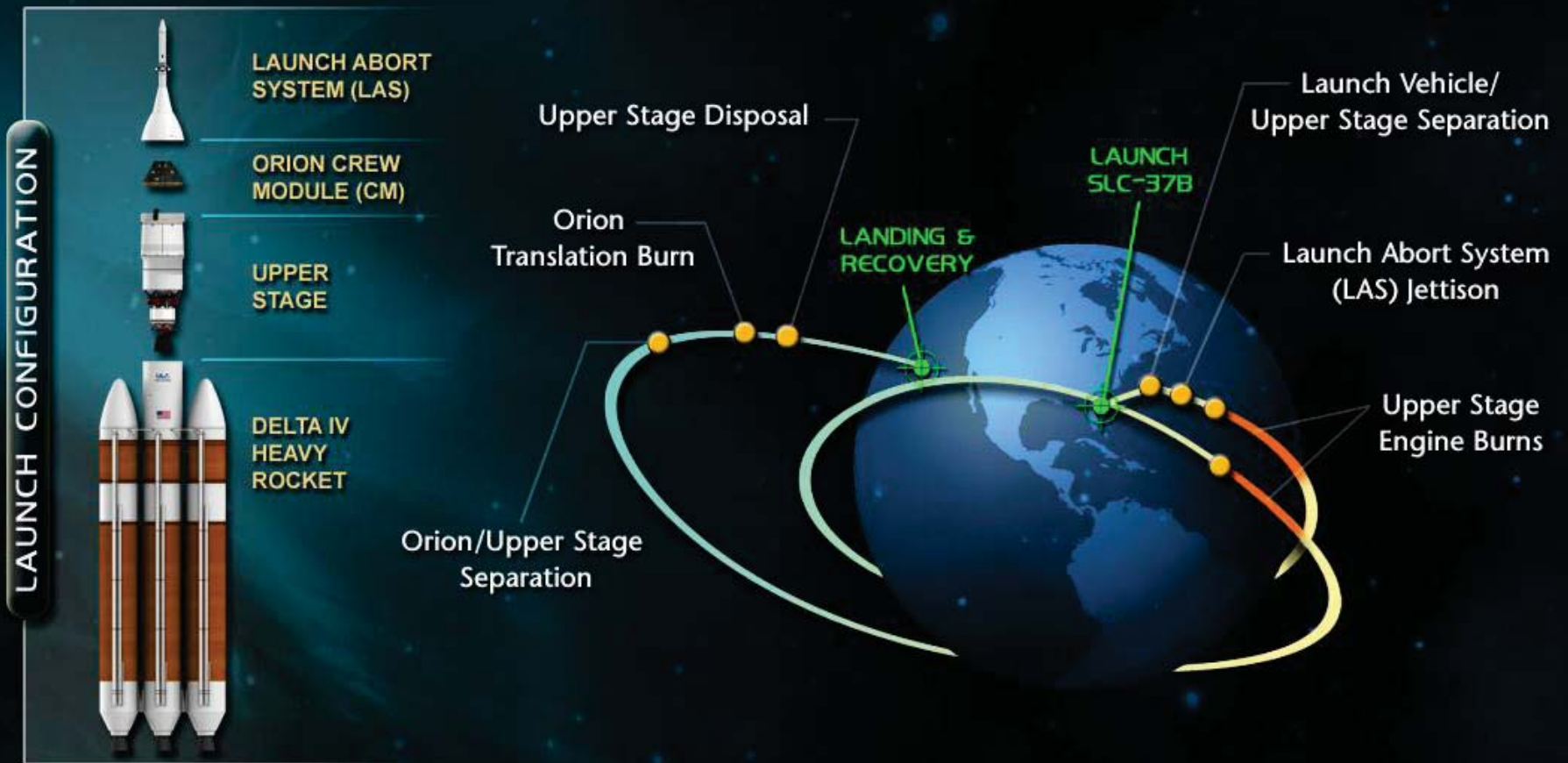
|                                 |                                 |
|---------------------------------|---------------------------------|
| MCR: Mission Concept Review     | CDR: Critical Design Review     |
| SRR: System Requirements Review | SIR: System Integration Review  |
| SDR: System Definition Review   | FRR: Flight Readiness Review    |
| PDR: Preliminary Design Review  | PLAR: Post-Launch Asses. Review |

# Developing the Crew Capability

## EXPLORATION FLIGHT TEST ONE

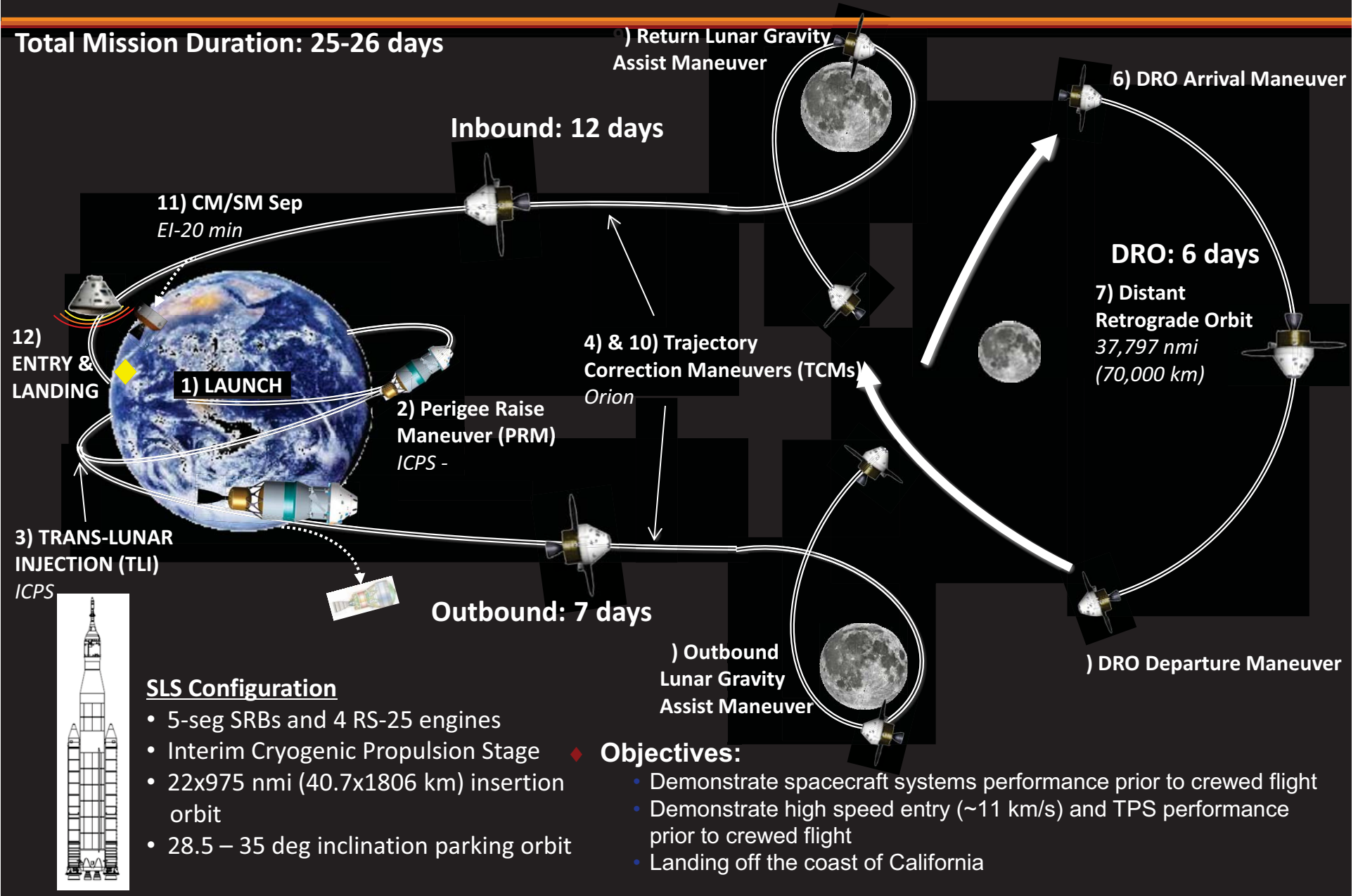
OVERVIEW

TWO ORBITS ♦ 20,000 MPH ENTRY ♦ 3,671 MILE APOGEE ♦ 28.6 DEGREE INCLINATION



# EM-1 Mission Overview: Uncrewed Distant Retrograde Orbit

Total Mission Duration: 25-26 days



## SLS Configuration

- 5-seg SRBs and 4 RS-25 engines
- Interim Cryogenic Propulsion Stage
- 22x975 nmi (40.7x1806 km) insertion orbit
- 28.5 – 35 deg inclination parking orbit

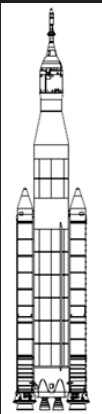
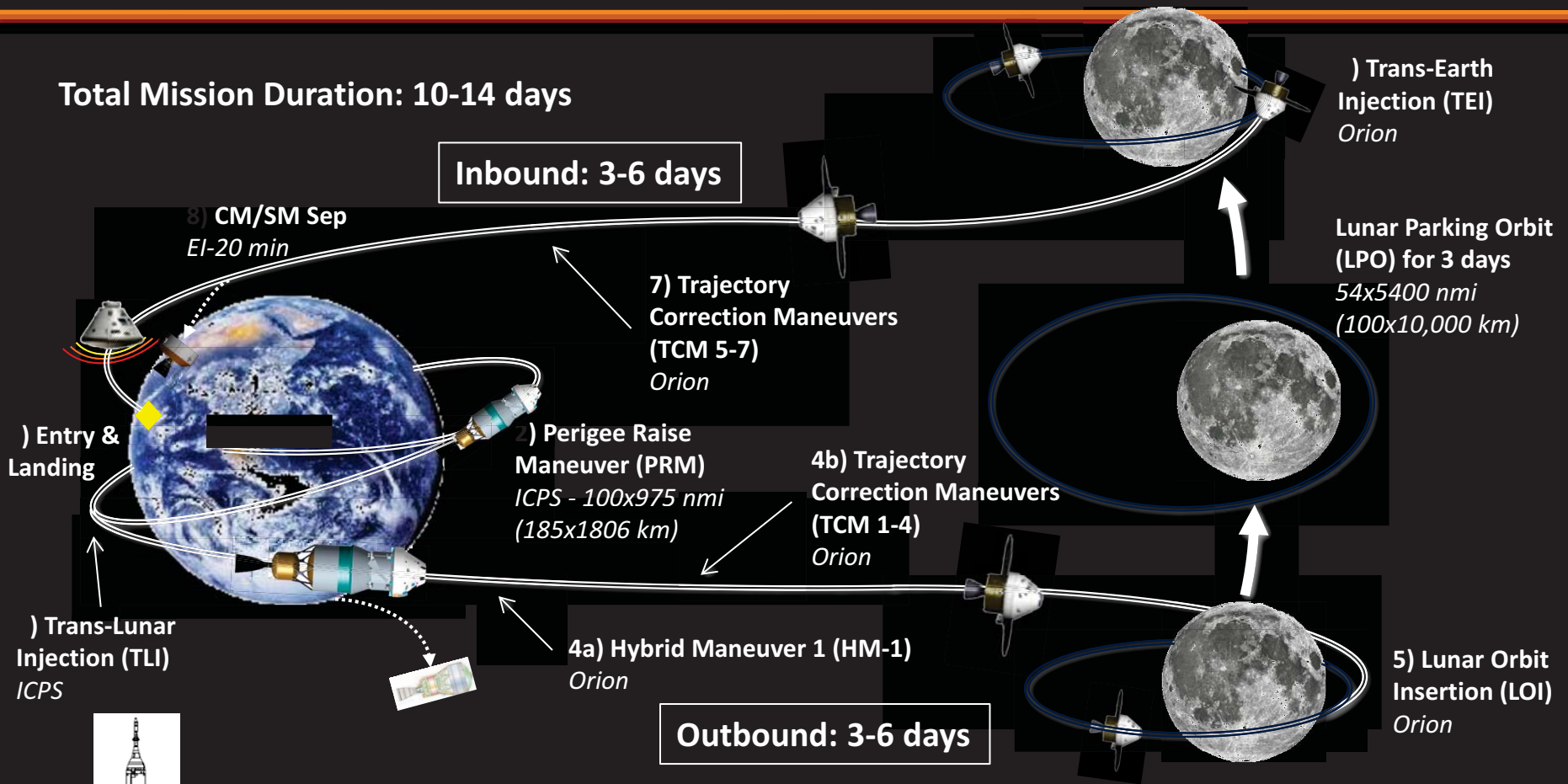
## Objectives:

- Demonstrate spacecraft systems performance prior to crewed flight
- Demonstrate high speed entry (~11 km/s) and TPS performance prior to crewed flight
- Landing off the coast of California



# EM-2 High Lunar Orbit (HLO) Mission Overview

Total Mission Duration: 10-14 days



## SLS Configuration

- 5-seg SRBs and 4 RS-25 engines
- 22x975 nmi (40.7x1806 km) insertion orbit
- 28.5 deg inclination

◆ **Objective:** Demonstrate 1<sup>st</sup> crewed flight of SLS/Orion beyond LEO

# Recent Progress

**Launch Vehicle Stage Adapter:** Contract awarded in February 2014.

**Avionics:** Avionics “first light” marked in January 2014; currently testing most powerful flight system computer processor ever.



**Boosters:** Forward Skirt test completed May 2014; preparations underway for QM-1.



**MPCV-to-Stage Adapter:** First flight hardware currently in Florida for Exploration Flight Test-1 in Fall 2014.

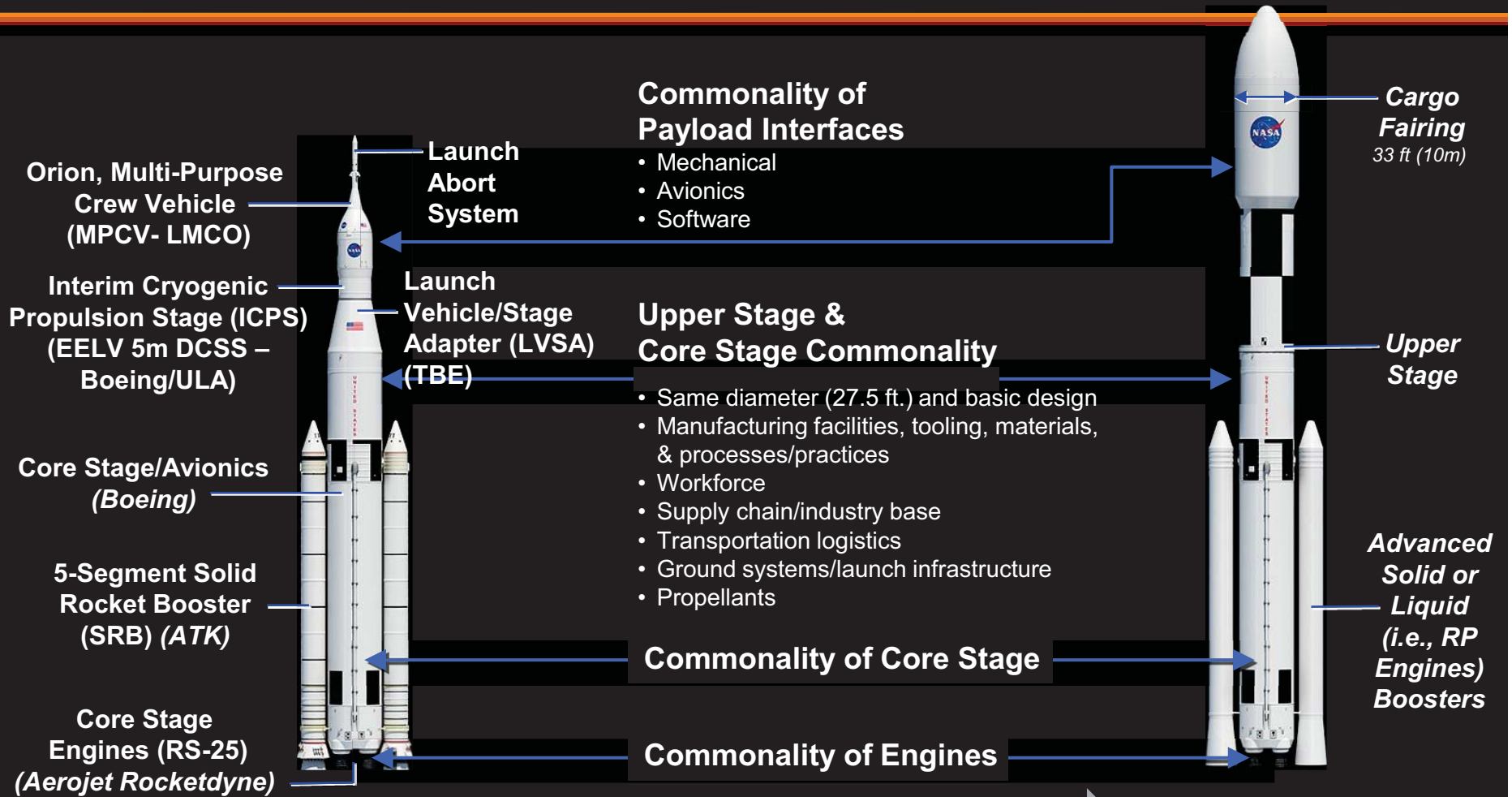
**Core Stage:** Initial confidence barrels and domes completed; Vertical Assembly Center installation to be completed in July 2014.



**Engines:** First RS-25 engine fitted to A-1 stand at Stennis Space Center; testing begins August 2014.



# Evolving Capability



## Evolutionary Path to Future Capabilities

- Minimizes unique configurations
- Allows incremental development

# NASA's Next Giant Leap

