National Aeronautics and Space Administration

Commercial Crew Program and Orion/SLS Updates

The Next Steps in U.S. Space Transportation

Stephanie D. Wilson
NASA Astronaut

HUMAN EXPLORATION

NASA's Path to Mars

National Aeronautics and Space Administration

EARTH RELIANT

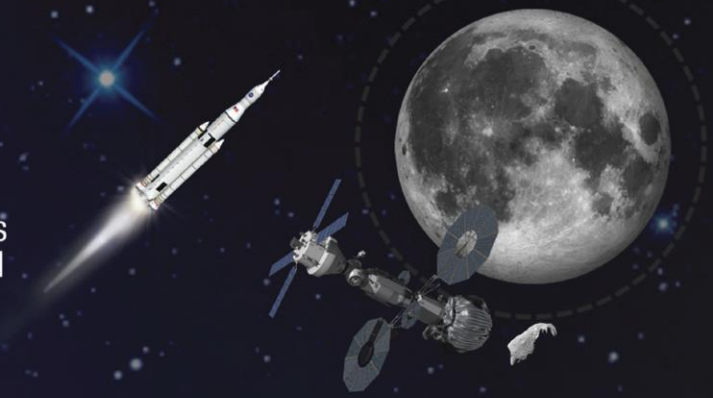
MISSION: 6 TO 12 MONTHS
RETURN TO EARTH: HOURS

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

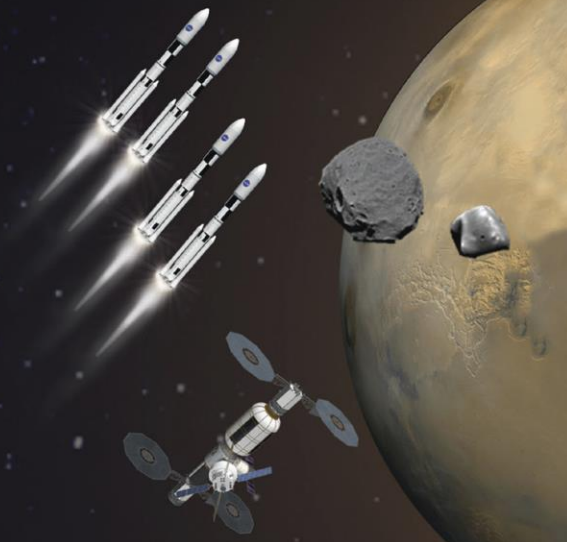


Expanding capabilities by visiting an asteroid redirected to a lunar distant retrograde orbit

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

www.nasa.gov

Current and Future Human Spaceflight

- 2015: (present day)
  - International Space Station (6 crew)
  - Soyuz 4 launches/year
  - ISS Resupply with International Partners (Progress, ATV, HTV)
  - ISS Resupply with Commercial Resupply Contract (Space-X and Orbital Sciences)
- ~2017 -2018
  - International Space Station (6+ Crew)
  - Soyuz 2 launches /year
  - Commercial Crew ~2 launches/year
  - ISS Resupply with International Partners (Progress, HTV)
  - ISS Resupply with Commercial Resupply Contract (new contract)
  - Orion Exploration Mission-1 (uncrewed, Circumlunar)
- ~2021
  - International Space Station (6+ Crew)
  - Soyuz 2 launches /year
  - Commercial Crew ~2 launches/year
  - ISS Resupply with International Partners (Progress, HTV)
  - ISS Resupply with Commercial Resupply Contract
  - Orion Exploration Mission-2 (crewed, Lunar orbit)

NASA

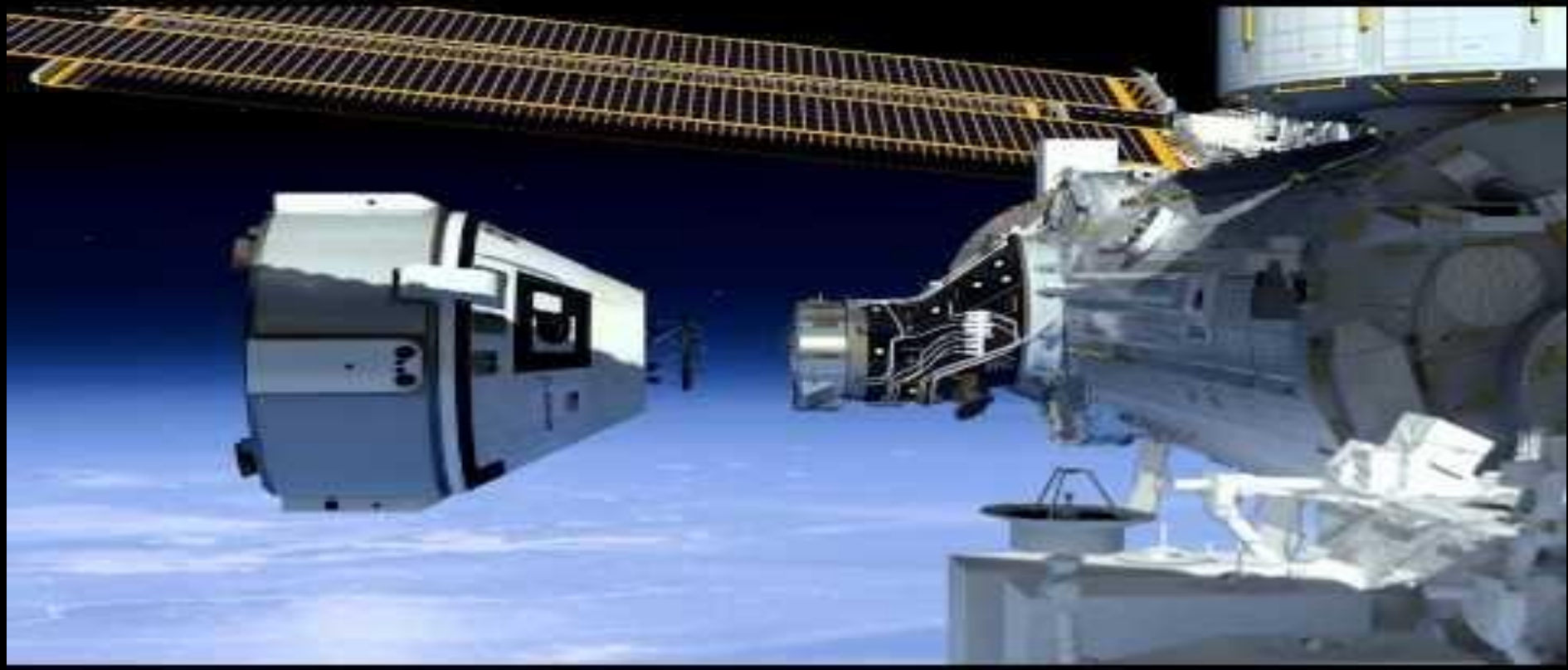
COMMERCIAL CREW

National Aeronautics and Space Administration

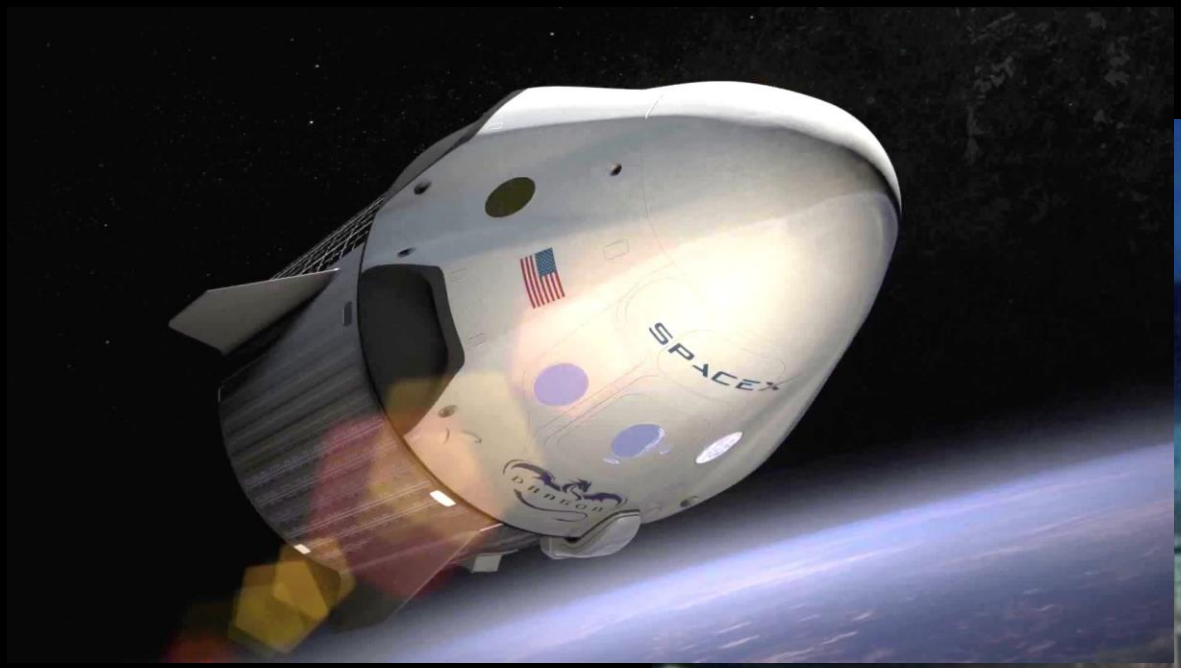
SP-2012-09-179-KSC

Boeing: CST-100 "Starliner"/ Atlas V

Boeing: CST-100 / Atlas V



Space X: Dragon / Falcon 9



Space X: Dragon Pad Abort Test

"These distinguished, veteran astronauts are blazing a new trail, a trail that will one day land them in the history books and Americans on the surface of Mars."

– Charles Bolden, NASA Administrator

LAUNCH AMERICA

COMMERCIAL CREW TRANSPORTATION

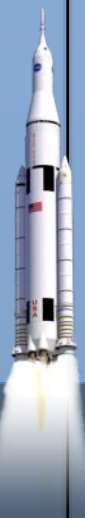

ORION

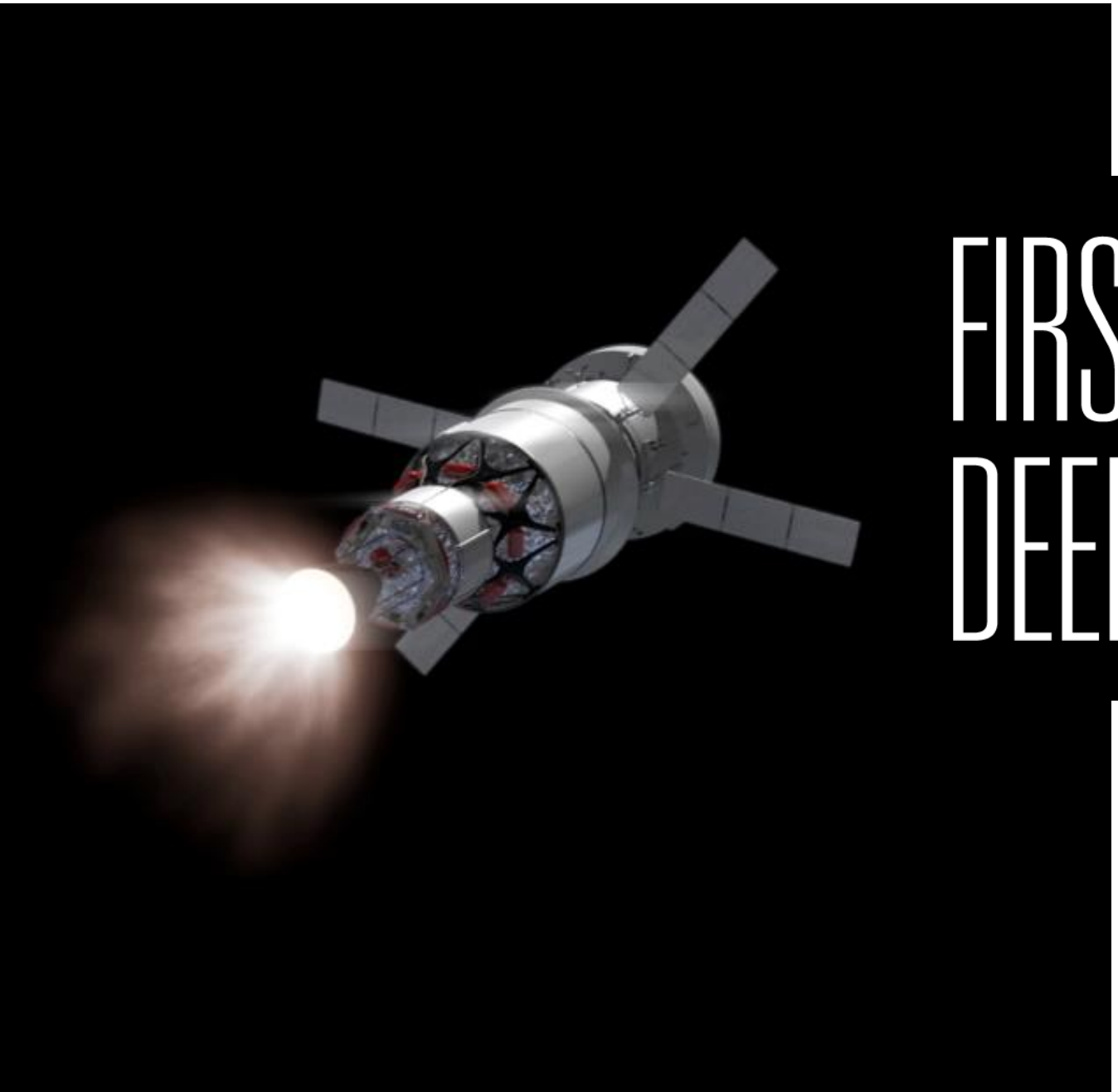
Space Launch System

21st Century Launch Operations

Orion Flight Manifest

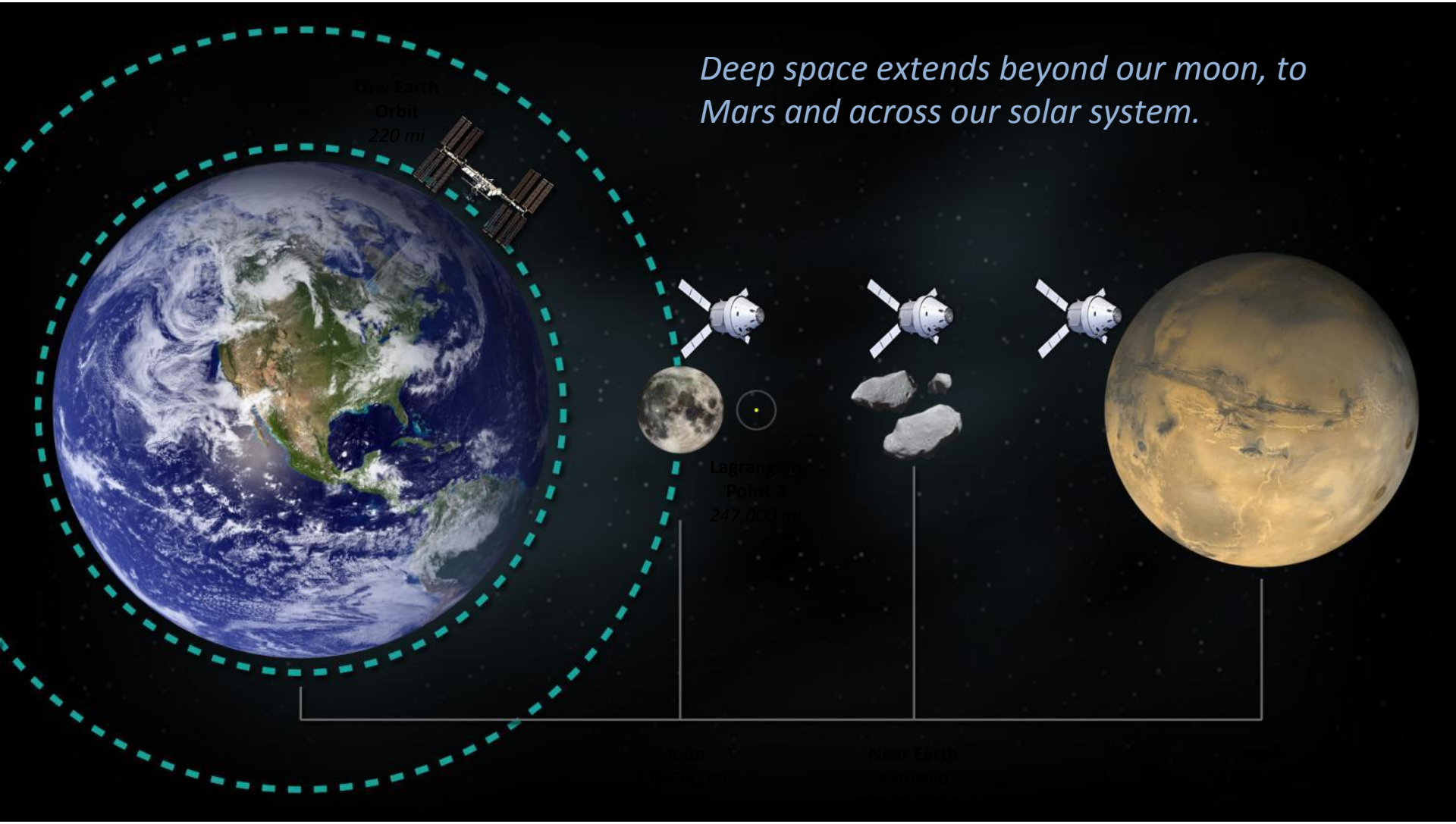
FY 13	FY 14	FY 15	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22
	▼				▼	▼		▼	
	EFT-1 **2014**				**EM-1** **2017** Uncrewed	**AA2** **2018**		**EM-2** **2021** Crewed	





FIRST STEP TO DEEP SPACE

Future of NASA Human Exploration



Orion is built for going Beyond Earth Orbit

OXYGEN

BEO
190 L

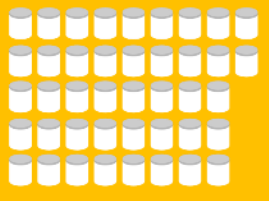
LEO
36 L

ADVANCED CARBON DIOXIDE REMOVAL SYSTEM

CARBON DIOXIDE FILTER

BEO
42

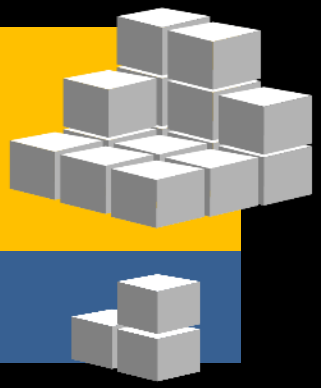
LEO
8



FOOD

BEO
14.8 FT^3

LEO
2.8 FT^3



DRINKING WATER

BEO
210 Liters

LEO
40 Liters

BEO
18,965 lb

LEO
7,800 lb

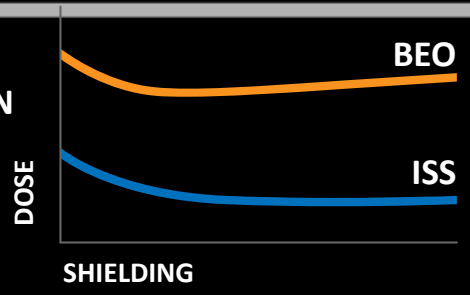
PROPELLANT

REENTRY SPEED

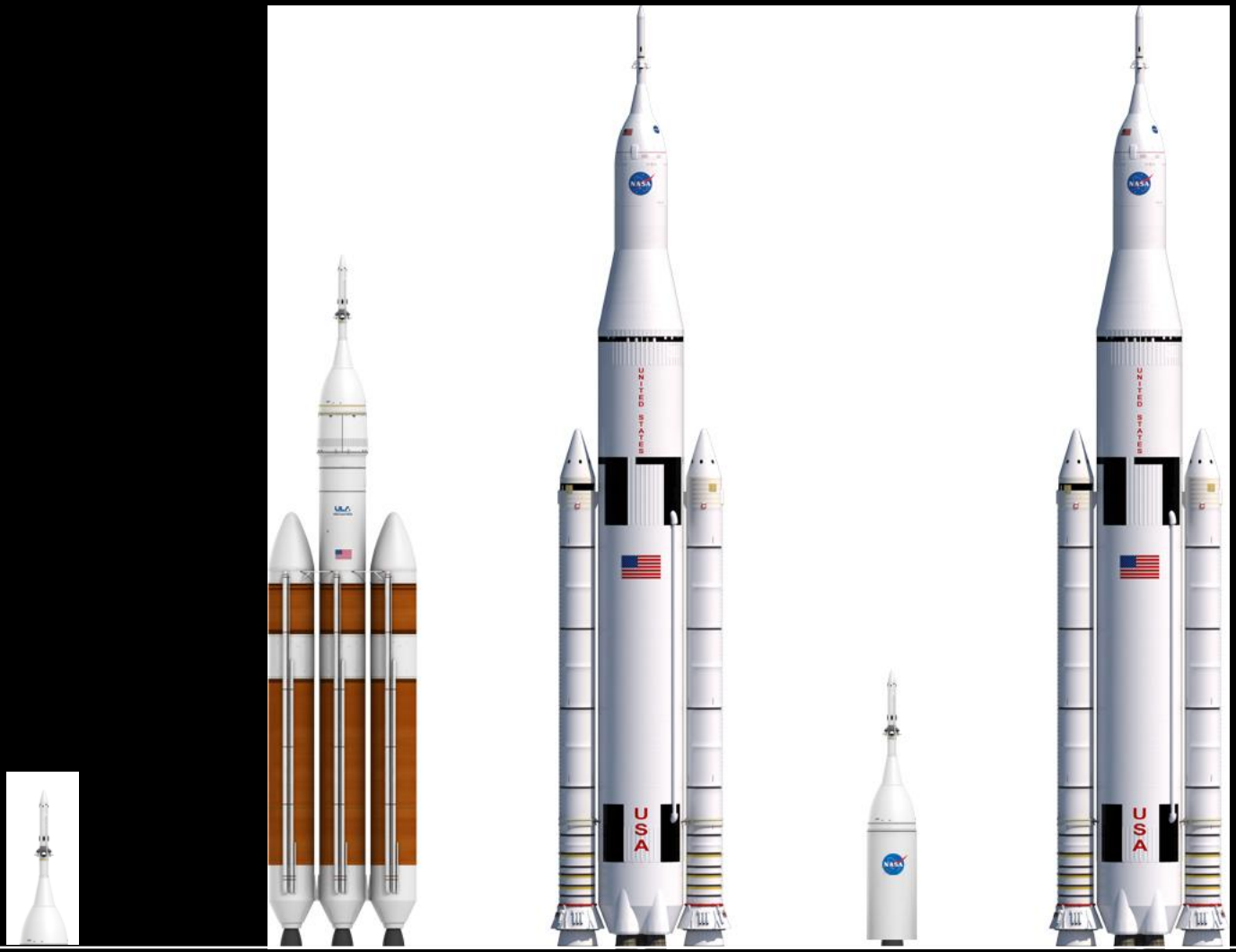
BEO 11.2 KM / SEC

LEO 7.8 KM / SEC

RADIATION



Exploration Mission Timeline



2010
PA-1

2014
EFT-1

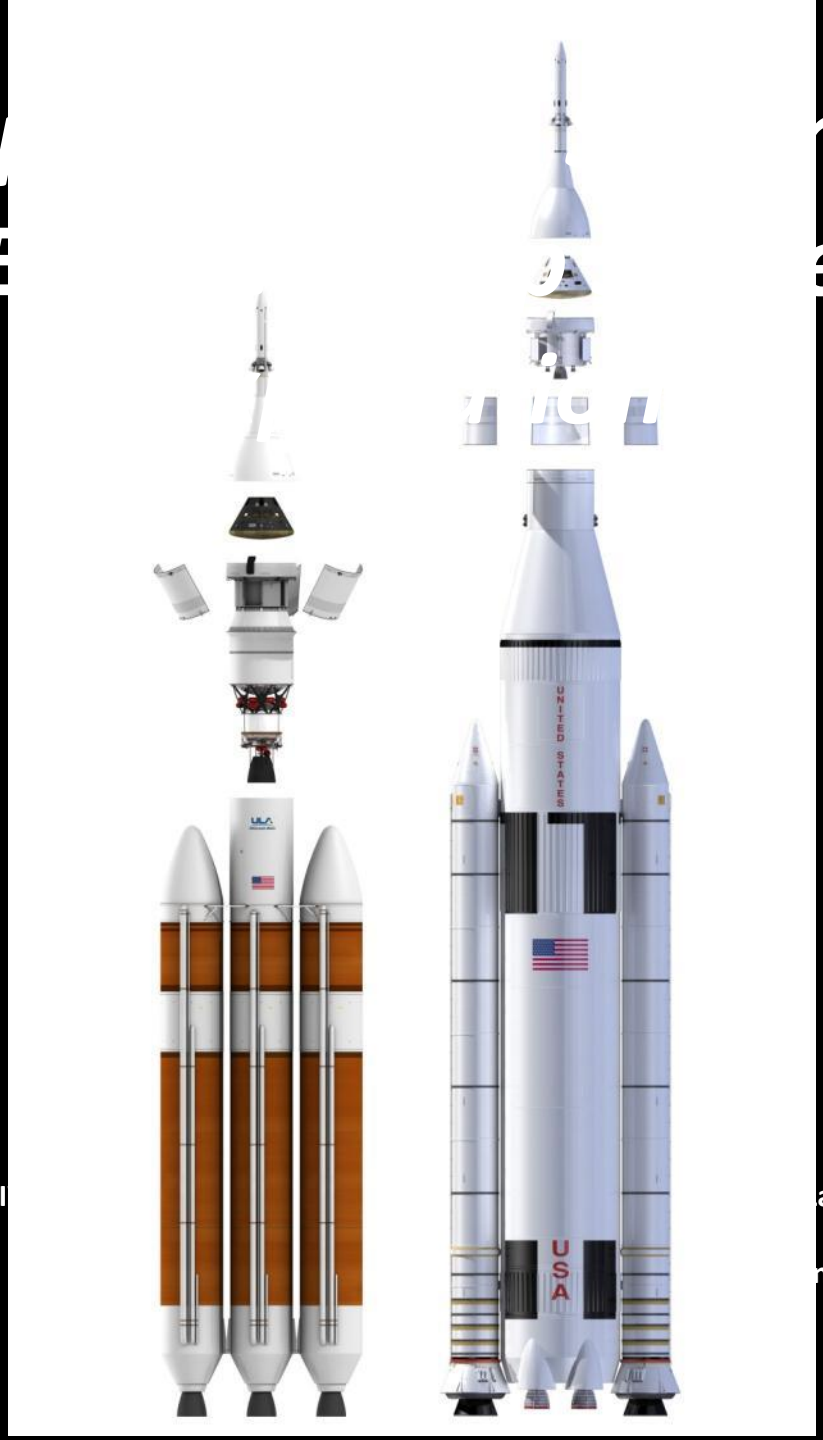
2017
EM-1

2019
AA-2

2021
EM-2

Exploration Systems Development

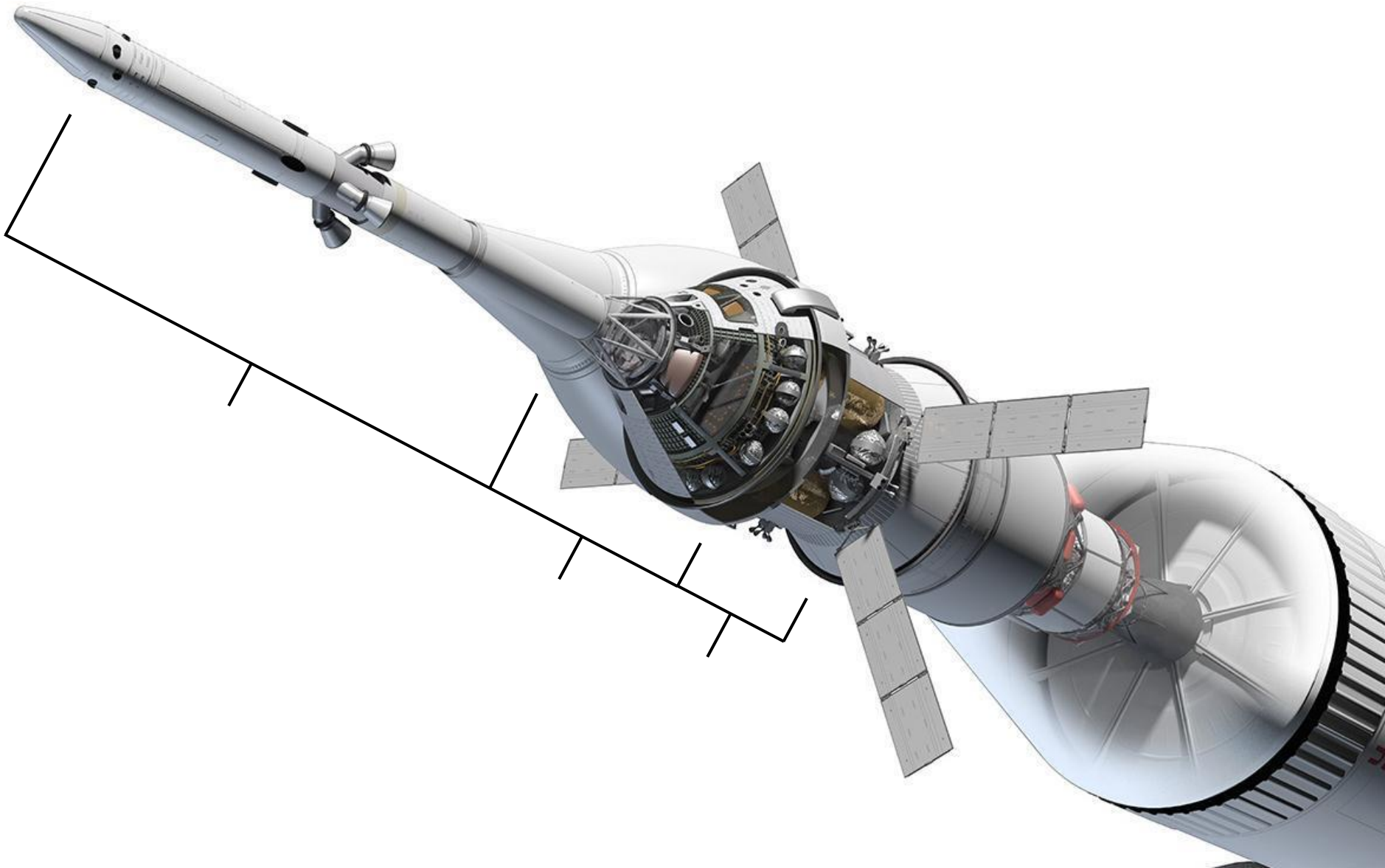
S m
B e



Delta I aunch

nd EM-2

The Orion Spacecraft



Beyond Earth Orbit *Crew Safety Complexity*

45 MINUTES TO EARTH

5 TO 11 DAYS TO EARTH

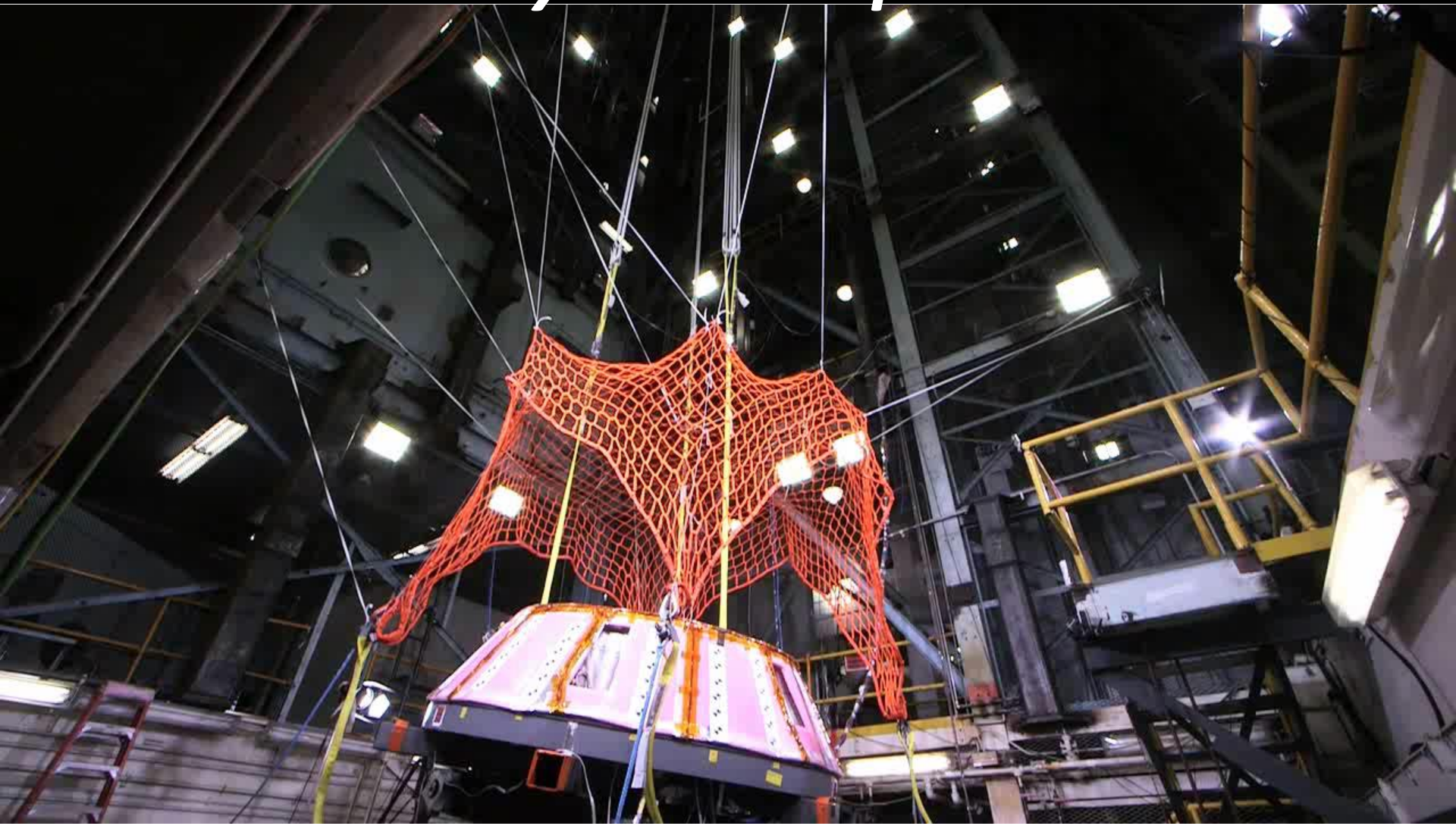
Beyond Earth Orbit *Crew Safety Complexity*

Orion can sustain crew for nearly a week in a depressed cabin

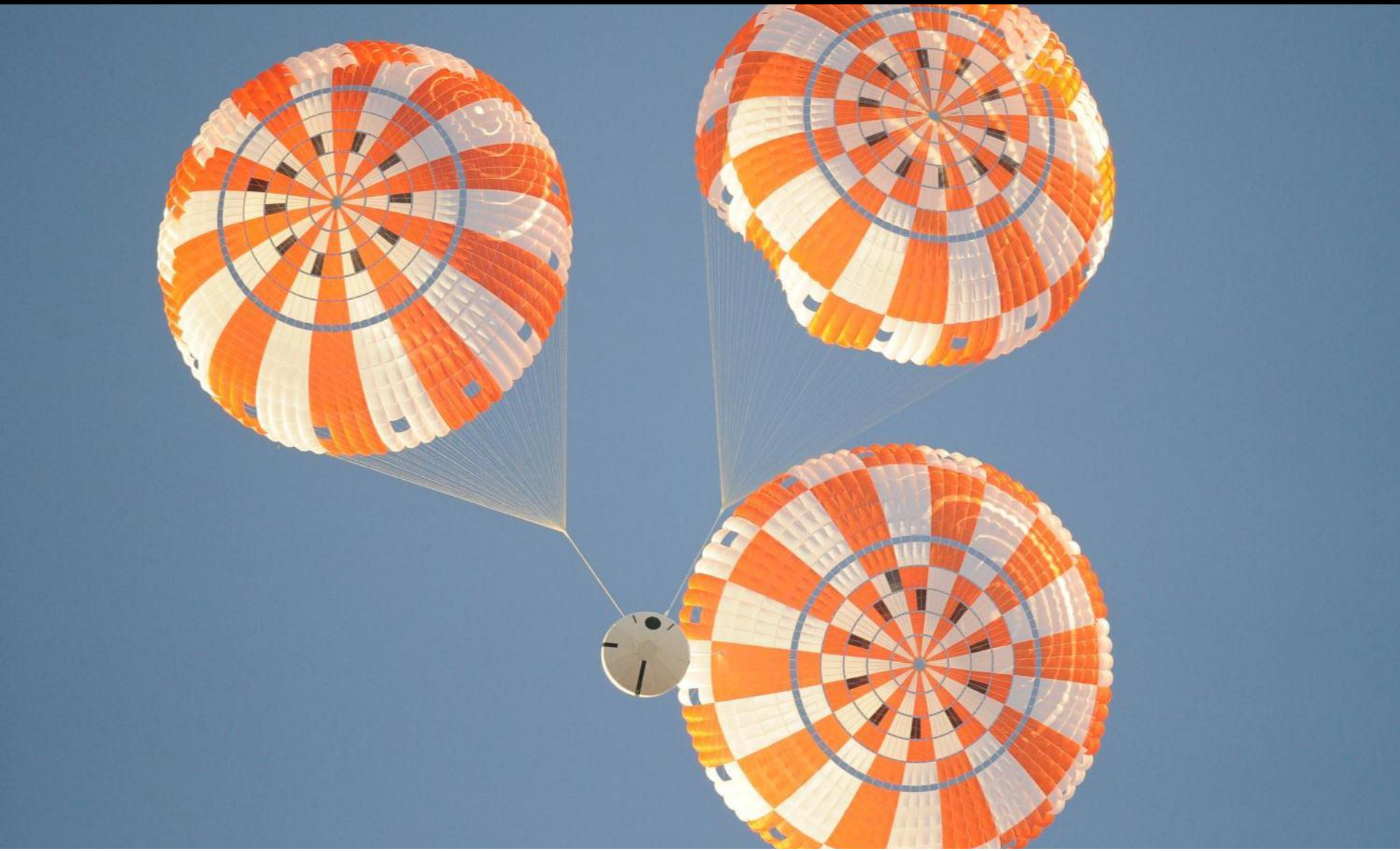
Launch Abort System

Service Module Fairing Separation Test

Forward Bay Cover Separation Test



Parachute Drop Tests



ARMY YUMA PROVING GROUND, AZ

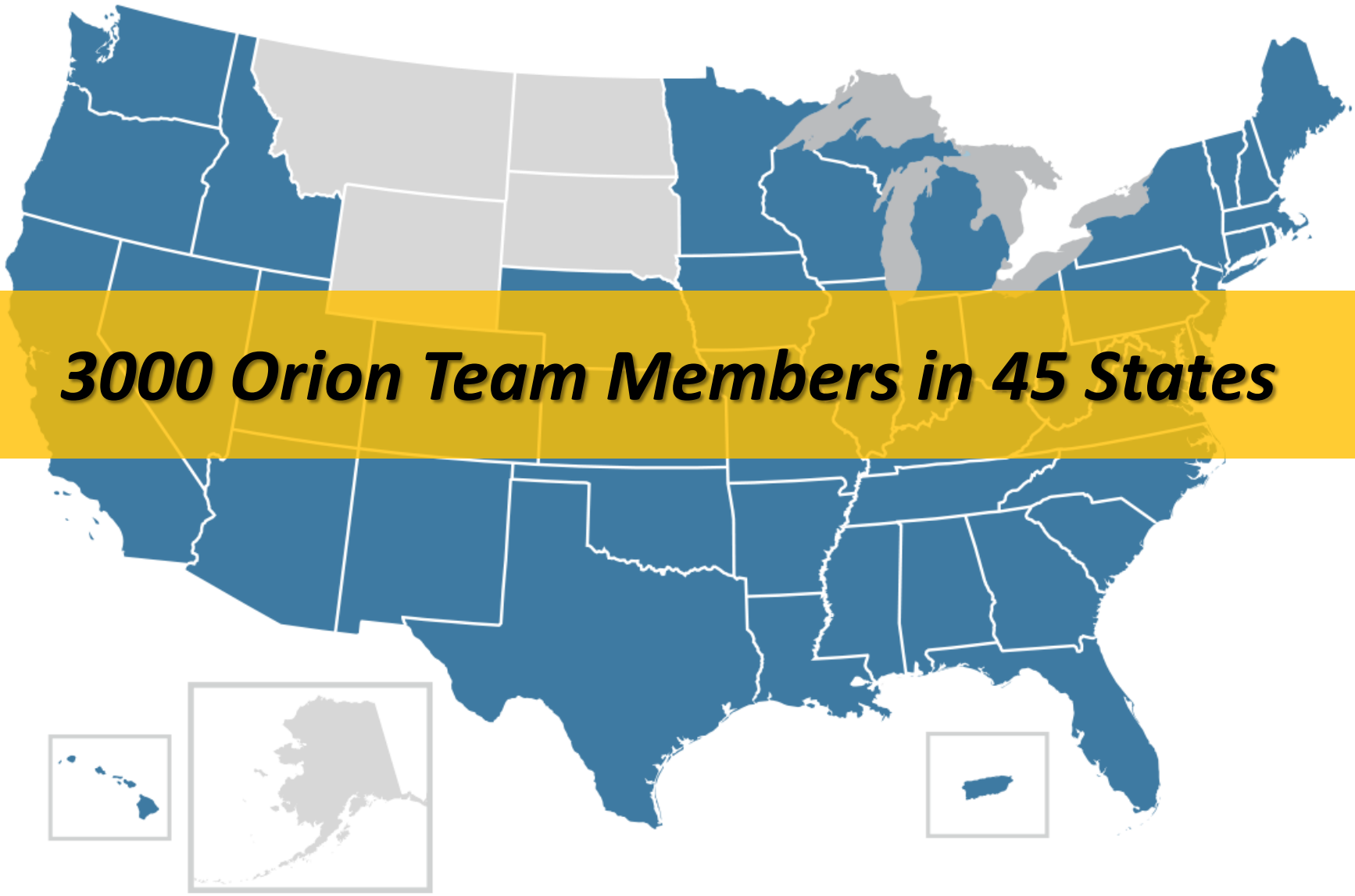
Parachute Drop Test

Orion Continues International Space Station Legacy

EUROPEAN SPACE AGENCY SERVICE MODULE

Service Module

KENNEDY SPACE CENTER, FL


3000 Orion Team Members in 45 States

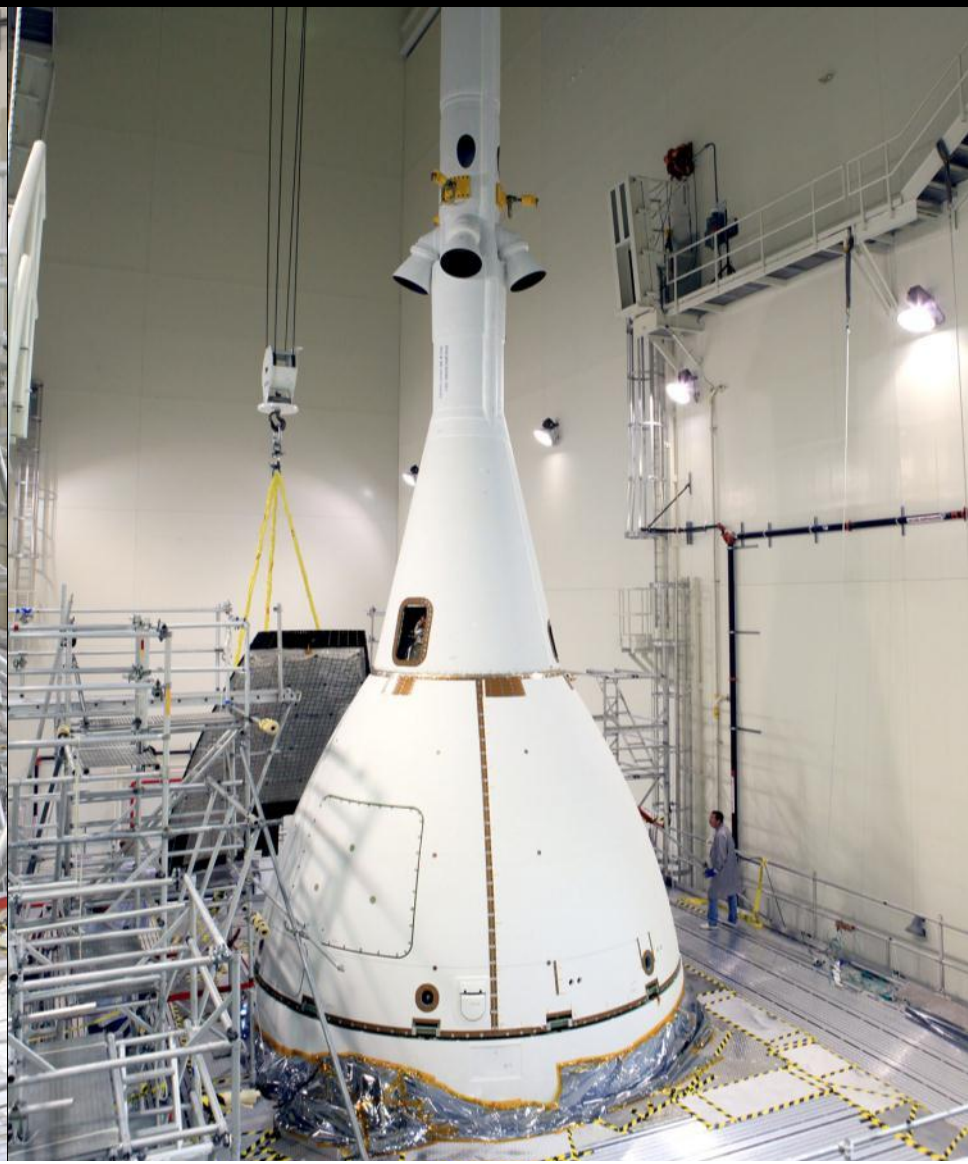
Crew Module

KENNEDY SPACE CENTER, FL

Crew Module

KENNEDY SPACE CENTER, FL

Launch Abort System



KENNEDY SPACE CENTER, FL

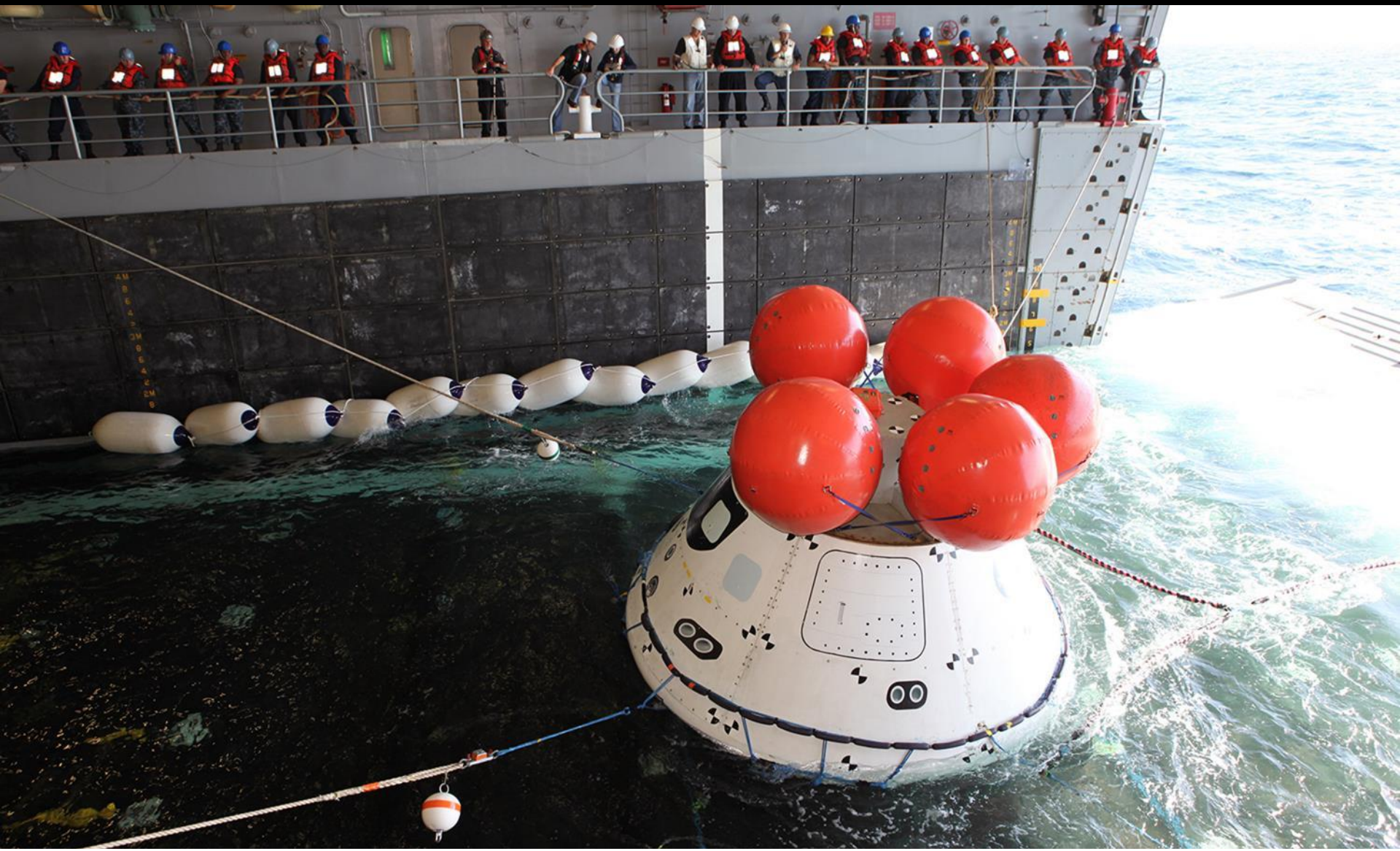
Astronauts helping design Orion

JOHNSON SPACE CENTER, TX

Mission Control Center

JOHNSON SPACE CENTER, TX

Underway Recovery Test



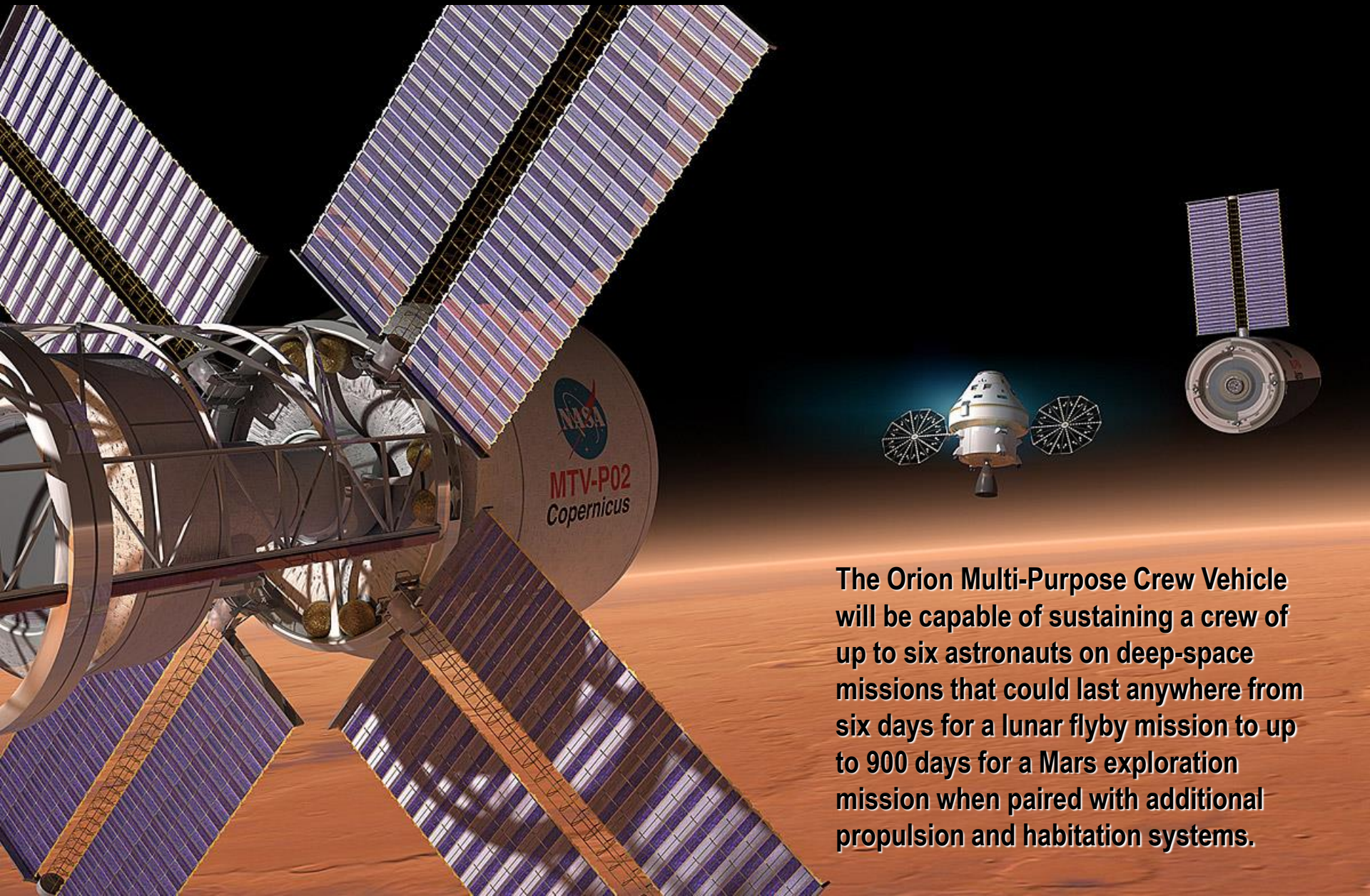
SAN DIEGO, CA

Underway Recovery Test

EFT-1 Launch Vehicle

CAPE CANAVERAL AIR FORCE STATION, FL

Deep Space Exploration Vehicle



The Orion Multi-Purpose Crew Vehicle will be capable of sustaining a crew of up to six astronauts on deep-space missions that could last anywhere from six days for a lunar flyby mission to up to 900 days for a Mars exploration mission when paired with additional propulsion and habitation systems.