National Aeronautics and Space Administration

NASA

Our Human Journey to Mars – The Next Steps

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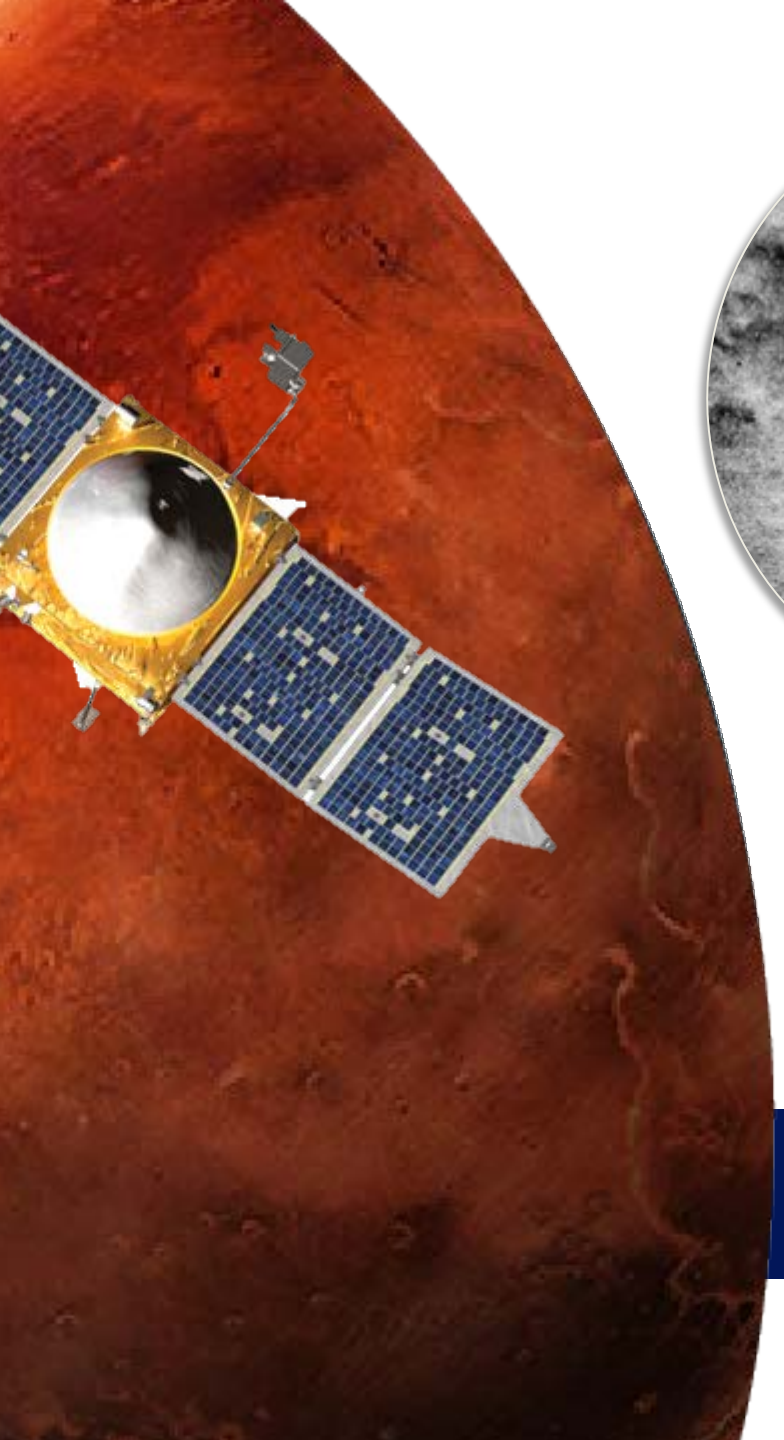
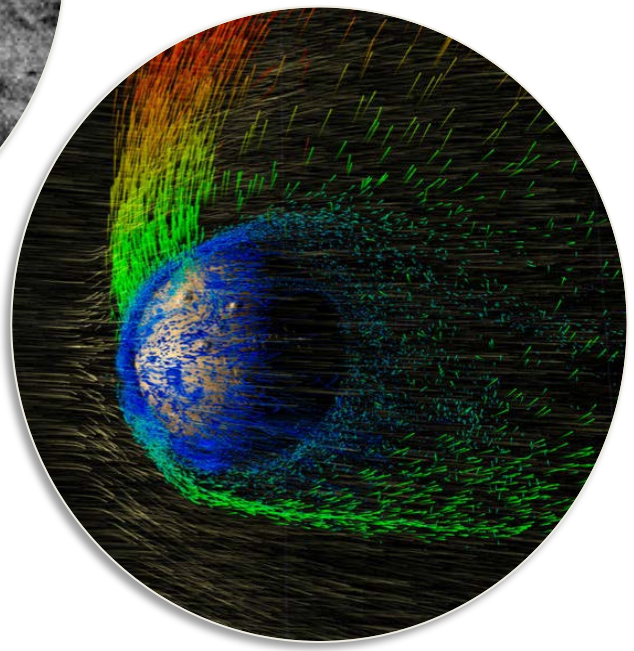
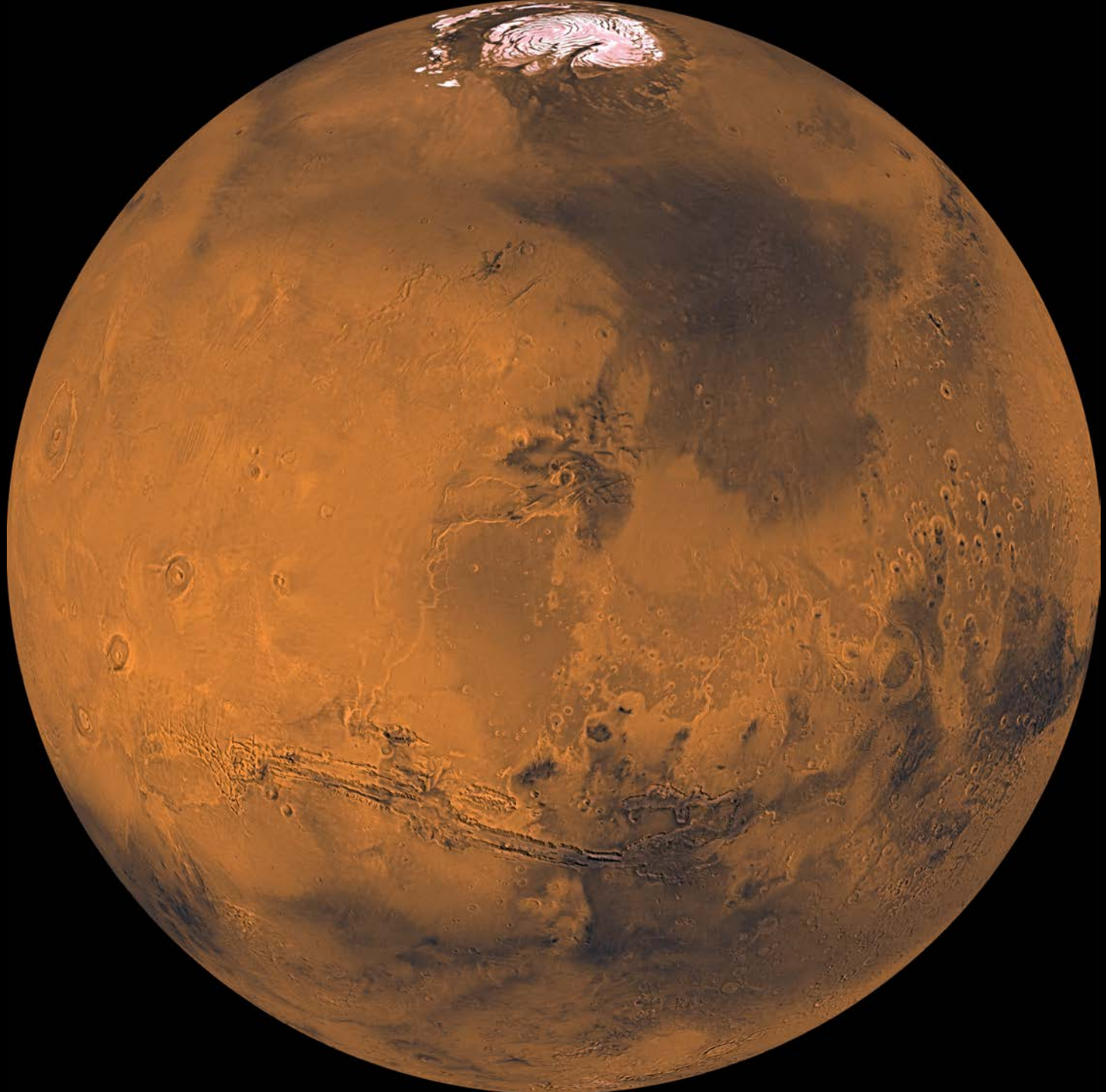
November 19, 2016

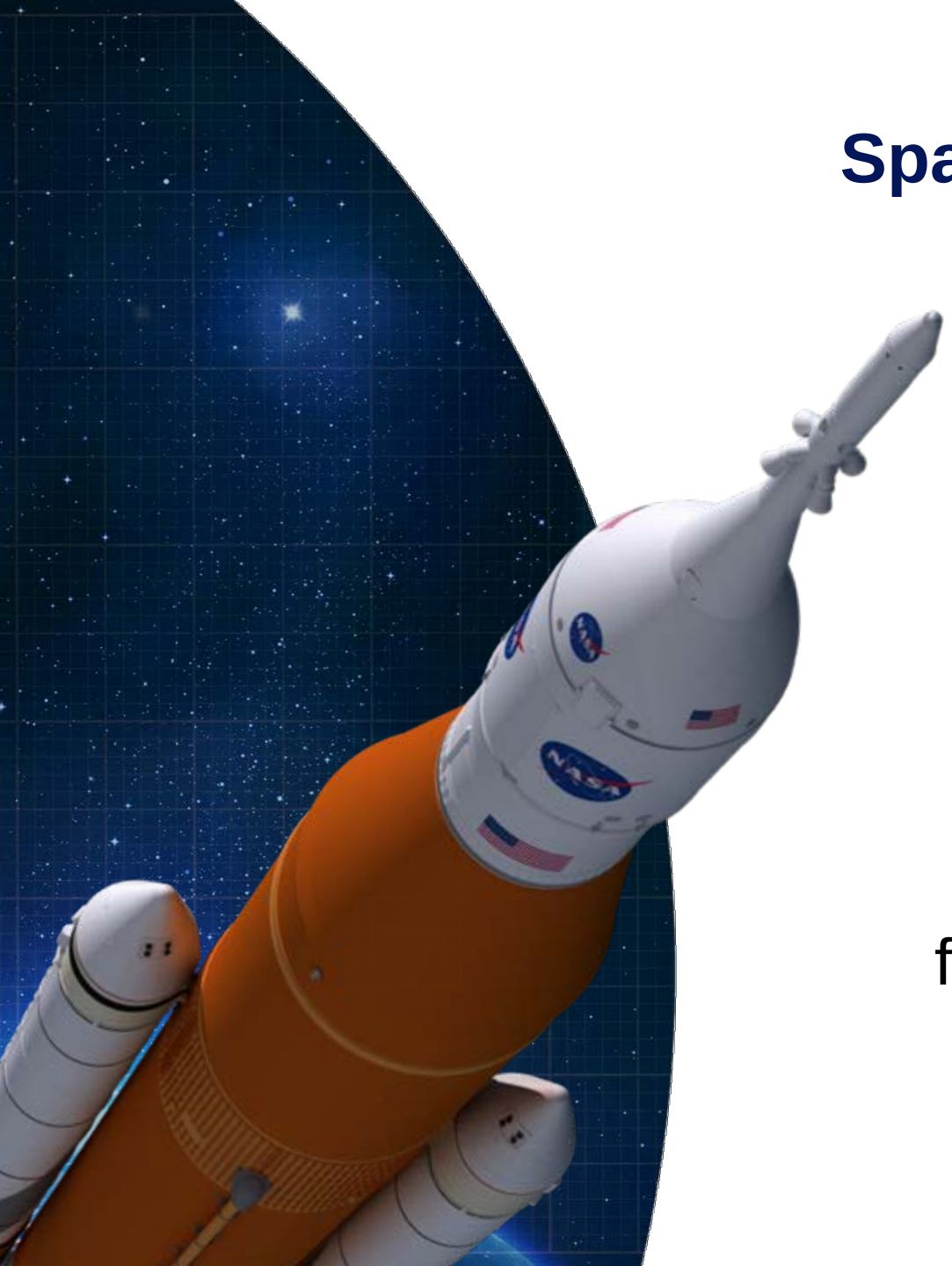
MARSHALL
SPACE FLIGHT CENTER





Exploring Mars





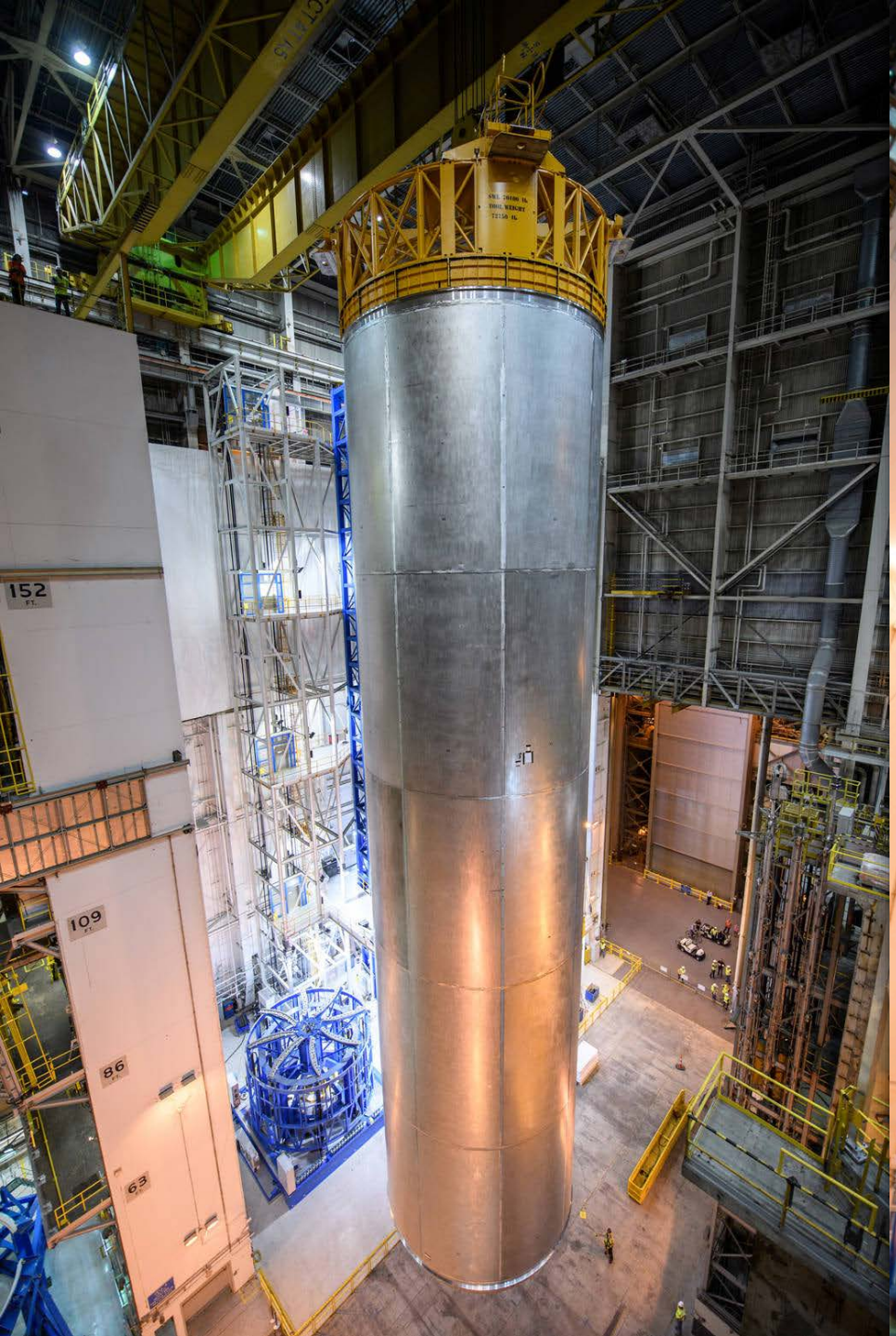
Space Launch System

The **only** vehicle capable of sending humans to deep space **and** the large systems necessary for human exploration

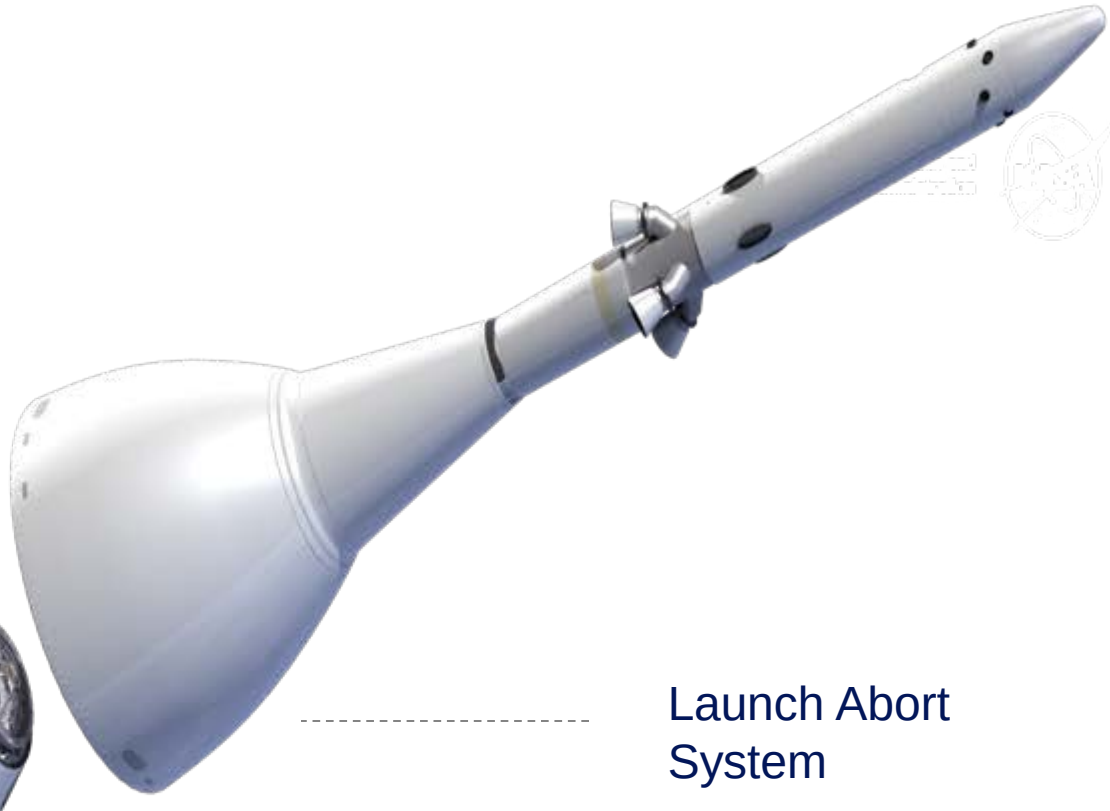

Solid Rocket Boosters

RS-25 Core Engines

Core Stage



Orion Spacecraft



Launch Abort System

Crew Module

Service Module

Spacecraft Adapter Jettison Panels

Ground Systems Development and Operations

- Initial demonstration of SLS and Orion capabilities
- Launch uncrewed Orion into distant retrograde orbit around the moon

Exploration Mission-1

SUN
- **CuSP** – Southwest Research Institute, Texas

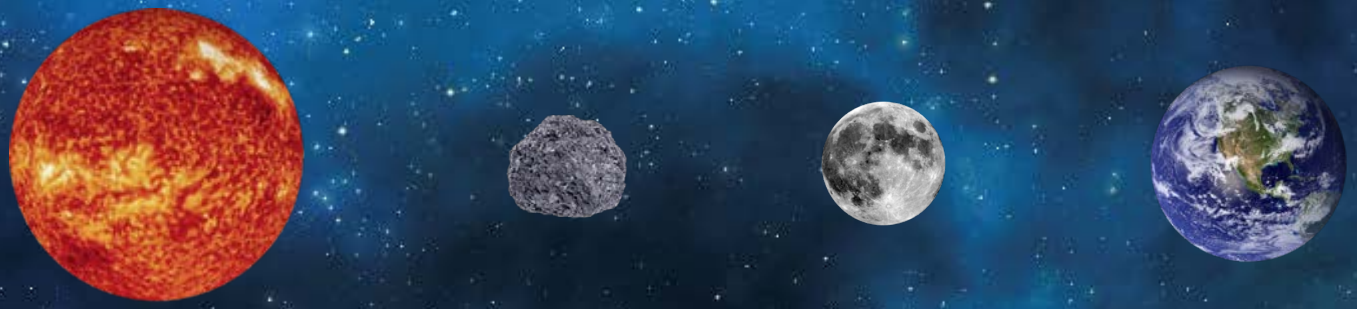
ASTEROID
- **NEA Scout** – Marshall Space Flight Center, Alabama

MOON
- **Lunar Flashlight** – Jet Propulsion Laboratory, California
- **Lunar IceCube** – Morehead State University, Kentucky
- **LunaH-Map** – Arizona State University, Arizona
- **OMOTENASHI** – JAXA/University of Tokyo
- **SkyFire** – Lockheed Martin, Colorado

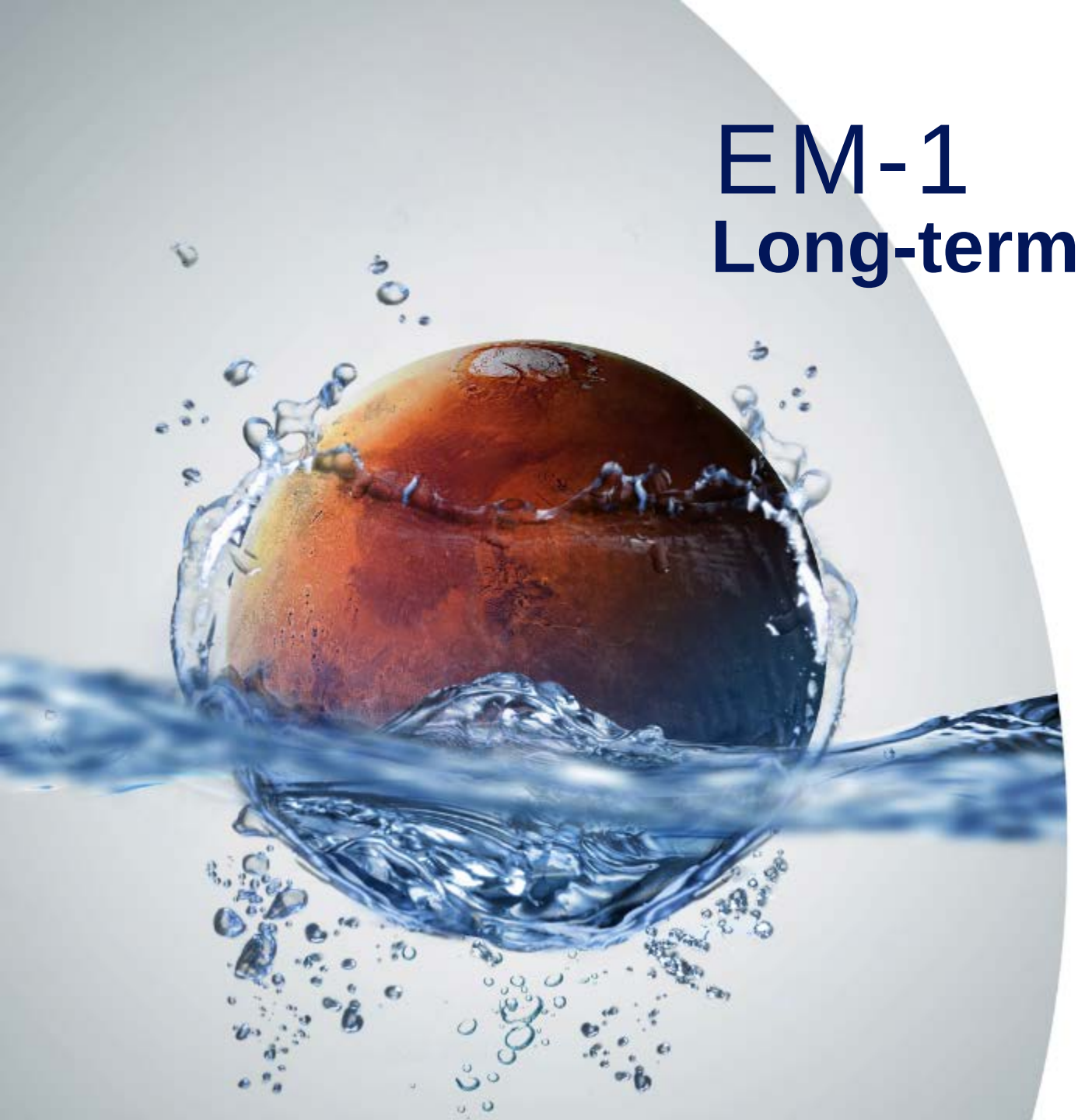
EARTH
- **EQUULEUS** – JAXA, University of Tokyo

OTHER MISSIONS
- **BioSentinel** – Ames Research Center, California
- **ArgoMoon** – European Space Agency/ASI, **ArgoTec**, Italy

CENTENNIAL CHALLENGES
- **Three CubeQuest Winners**



EM-1 Payload Mission Focus



EM-1
Long-term Benefits

Evolvable Design

Science Missions	ARM Mission	Orion with short-duration hab module	5m fairing w/robotic lunar lander & short-duration hab module	8m fairing with large aperture telescope	10m fairing w/notional Mars payload
400m³	**400m³**	**400m³**	**600m³**	**1200m³**	**1800m³**

JOURNEY TO MARS

All elements needed for a human Mars mission are in development now.

EARTH RELIANT
NOW - MID-2020s

- International Space Station operation through commercial development of low-Earth orbit
- Development of deep space systems life support and human health

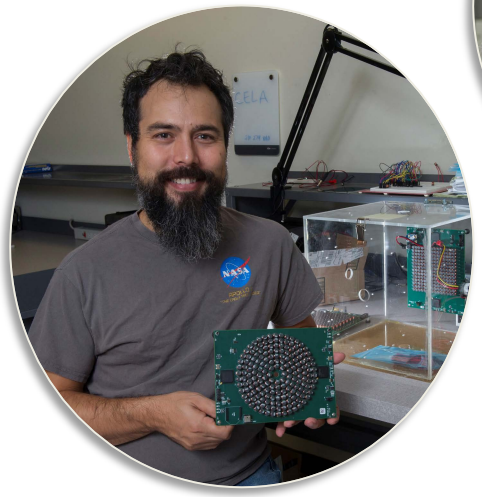
PROVING GROUND
2018-2030

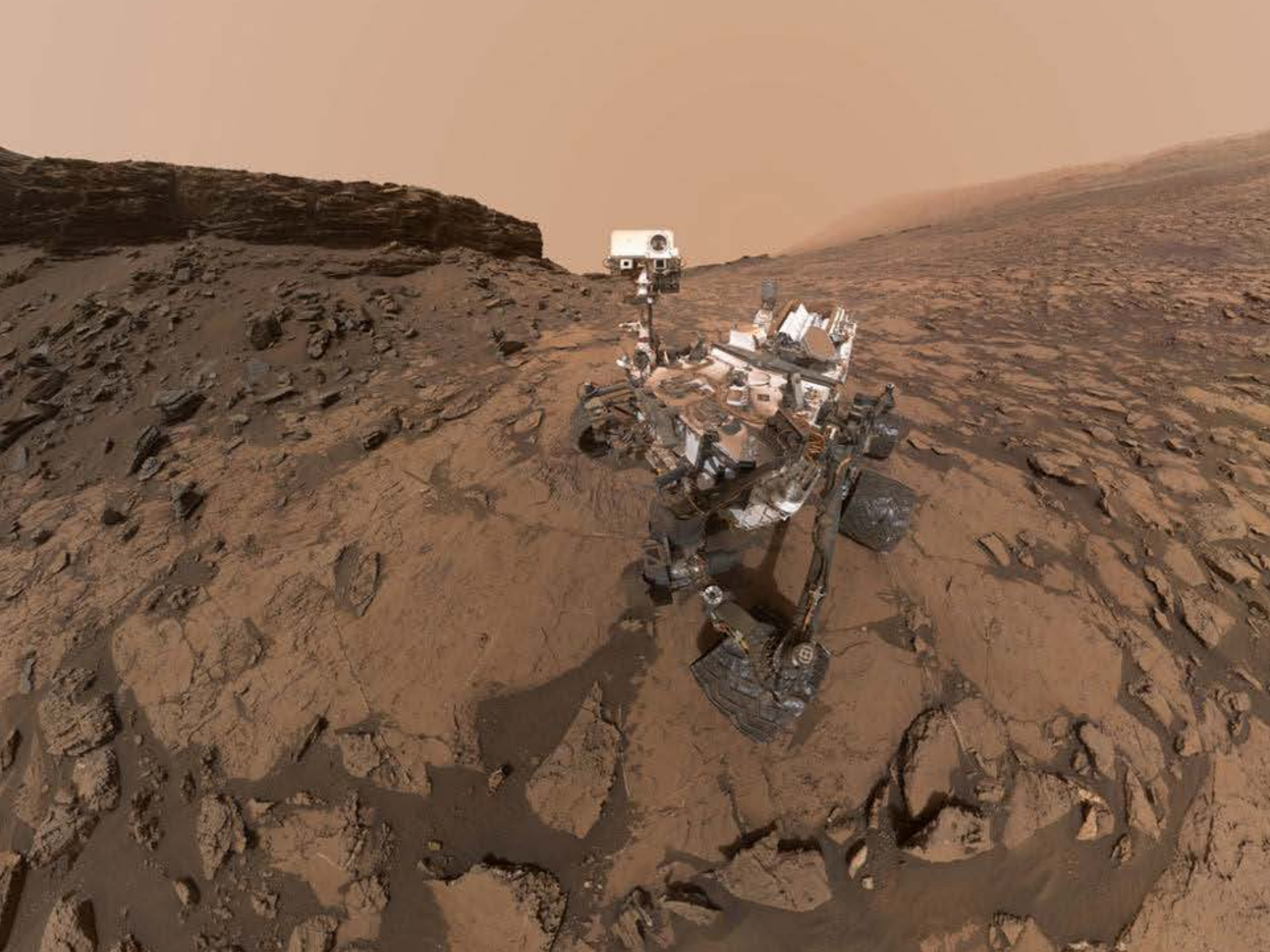
- Regular crewed missions and spacewalks in cislunar space
- Verify deep space habitation and conduct a yearlong mission to validate readiness for Mars
- Demonstrate integrated human and robotic operations by redirecting and sampling an asteroid boulder

EARTH INDEPENDENT
NOW – 2030s and beyond

- Science missions pave the way to Mars
- Demonstrate entry, descent, and landing and in-situ resource use
- Conduct robotic roundtrip demonstration with sample return in the late 2020s
- Send humans to orbit Mars in the early 2030s


NASA
WE NEED YOU





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