

National Aeronautics and
Space Administration



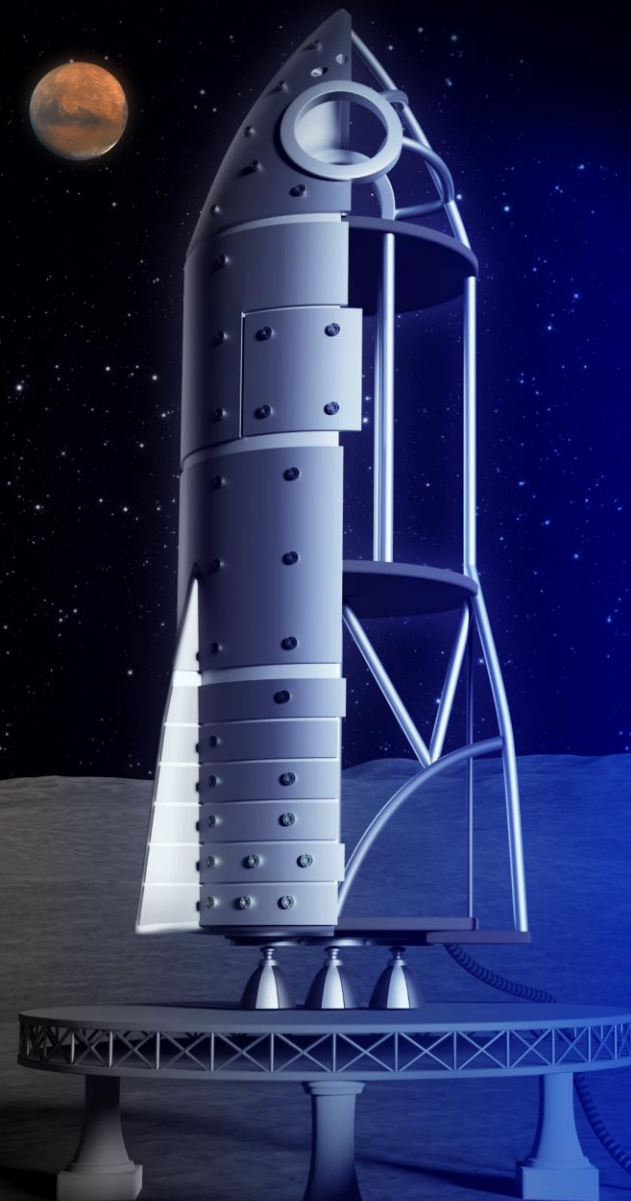
NASA's Moon to Mars Strategy

Kurt (Spuds) Vogel

*Director of Space Architectures
Office of the Administrator*

16 May 2023

Humans to Mars Summit

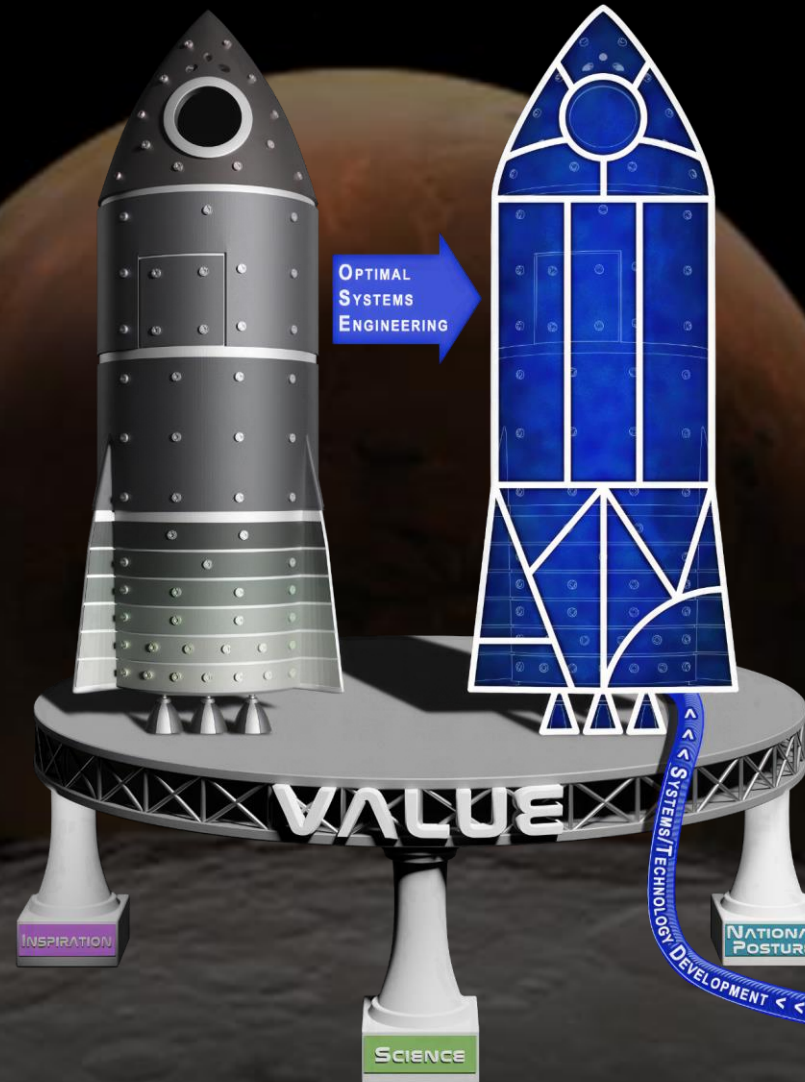


WHAT

- Rigorously Developed
- Detailed
- Consistent

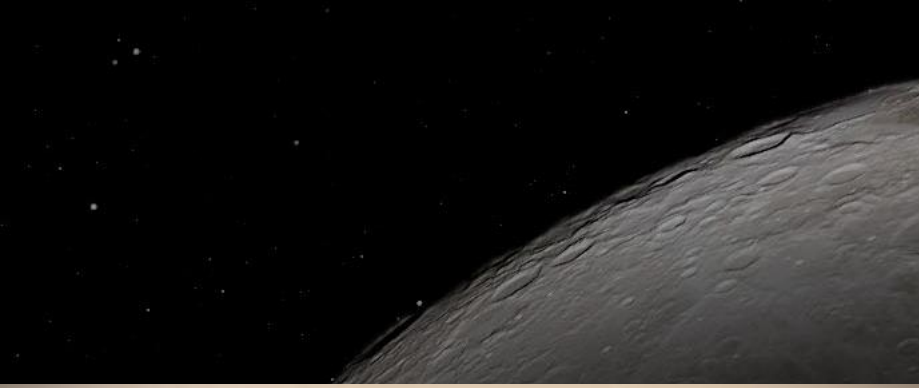
HOW

- Elements required to create the "What"
- Defined and Managed by a Program Office
- Approved by Leadership
- Sufficient Funding Required

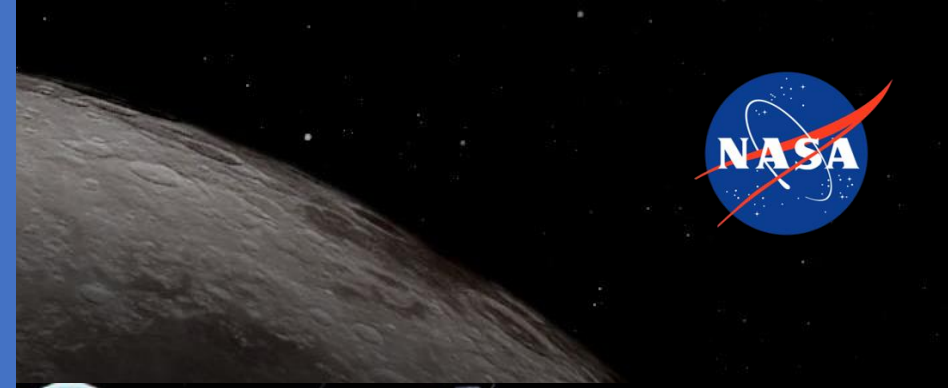


WHY





Create a blueprint
for sustained
human presence
and exploration
throughout the
solar system



Methodology Principles of the M2M Strategy



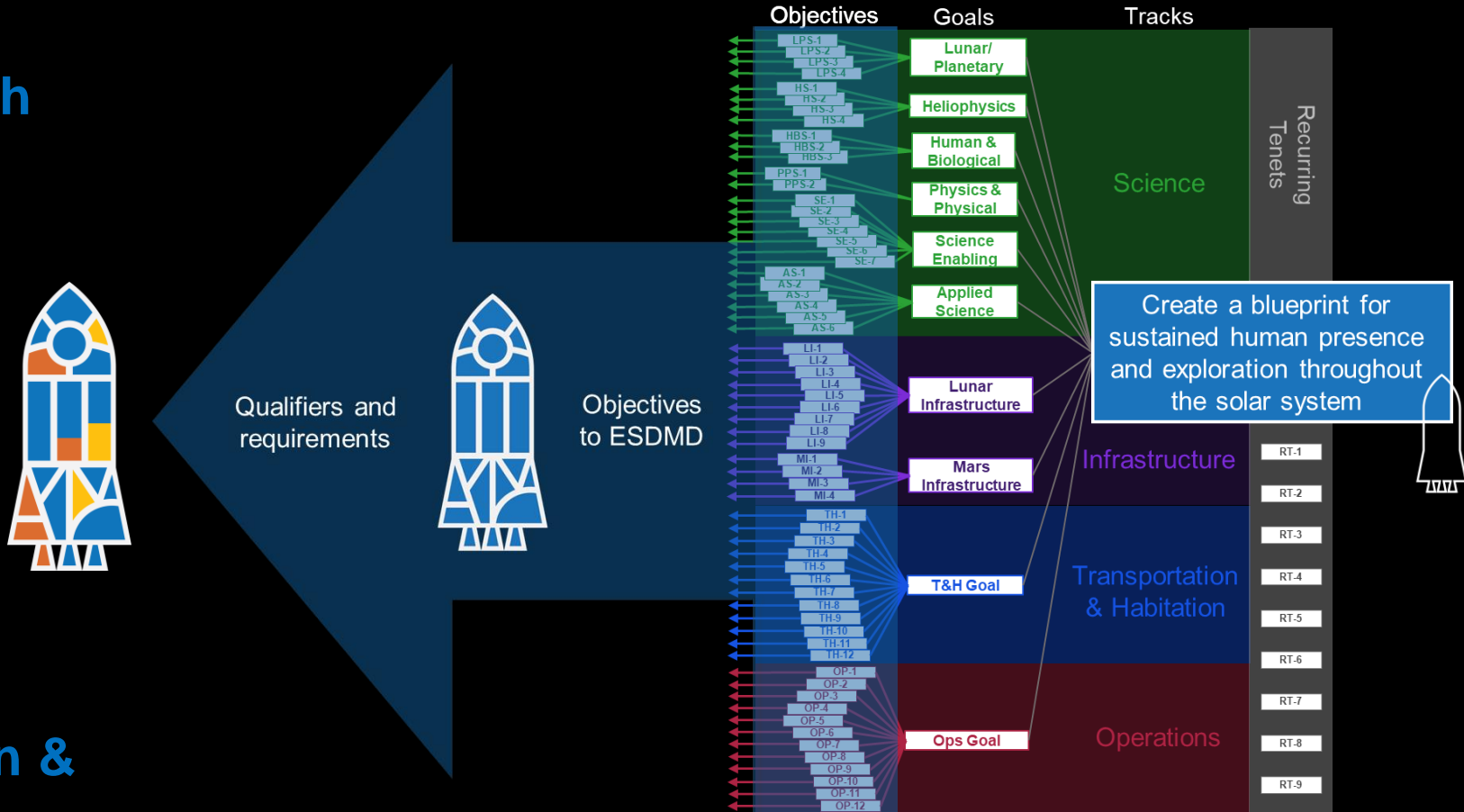
Objective-Based Approach

Architect from the Right

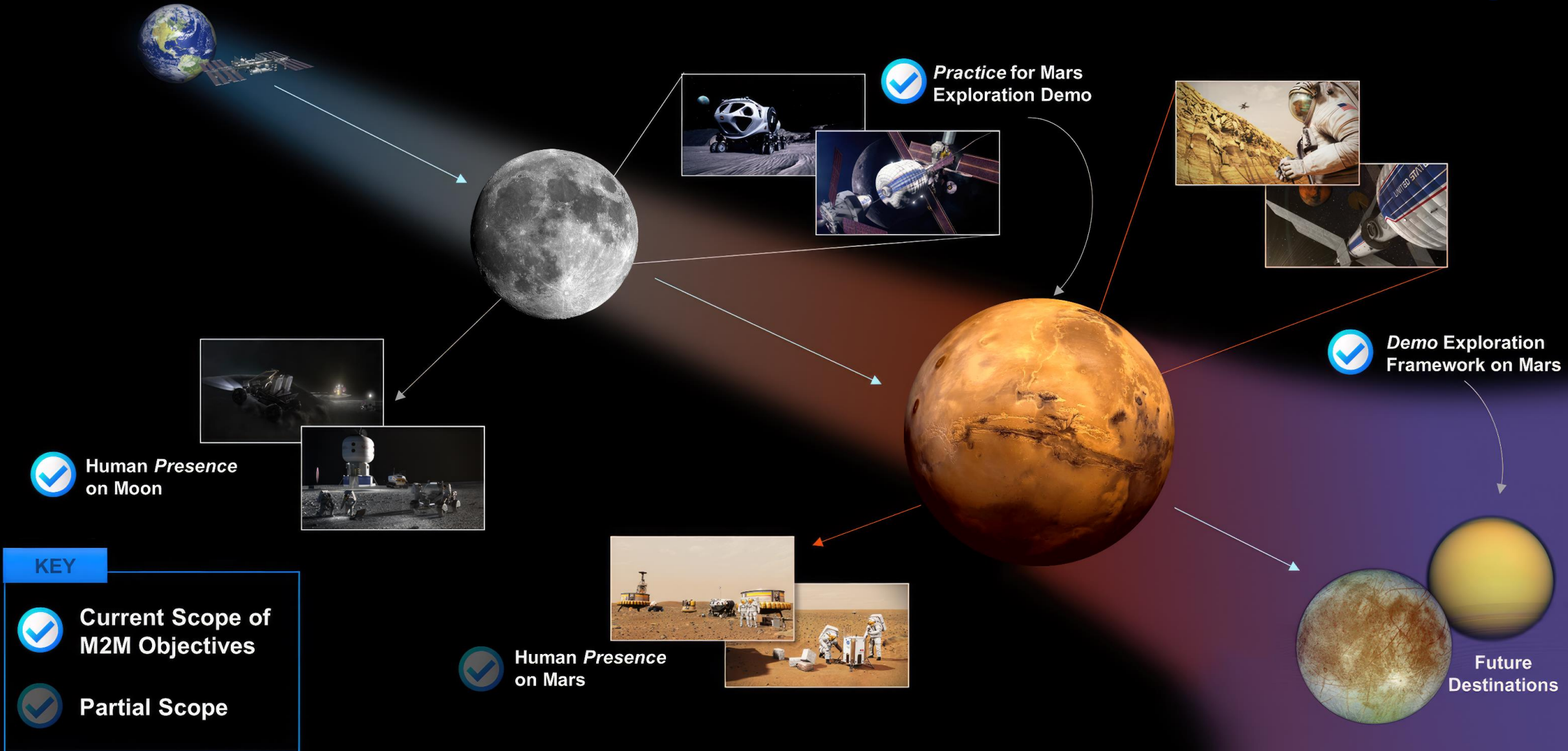
Constancy of Purpose

Unity of Purpose

Enhanced Communication & Engagement



Current Moon to Mars Scope



Moon to Mars Top-Level Goals



Lunar/Planetary Science (LPS) Goal: Address high priority planetary science questions that are best accomplished by on-site human explorers on and around the Moon and Mars, aided by surface and orbiting robotic systems.

Heliophysics Science (HS) Goal: Address high priority heliophysics science and space weather questions that are best accomplished using a combination of human explorers and robotic systems at the Moon, at Mars, and in deep space.

Human and Biological Science (HBS) Goal: Advance understanding of how biology responds to the environments of the Moon, Mars, and deep space to advance fundamental knowledge, support safe, productive human space missions and reduce risks for future exploration.

Physics and Physical Science (PPS) Goal: Address high priority physics and physical science questions that are best accomplished by using unique attributes of the lunar environment.

Science-Enabling (SE) Goal: Develop integrated human and robotic methods and advanced techniques that enable high-priority scientific questions to be addressed around and on the Moon and Mars.

Applied Science (AS) Goal: Conduct science on the Moon, in cislunar space, and around and on Mars using integrated human and robotic methods and advanced techniques, to inform design and development of exploration systems and enable safe operations.

Lunar Infrastructure (LI) Goal: Create an interoperable global lunar utilization infrastructure where U.S. industry and international partners can maintain continuous robotic and human presence on the lunar surface for a robust lunar economy without NASA as the sole user, while accomplishing science objectives and testing for Mars.

Mars Infrastructure (MI) Goal: Create essential infrastructure to support initial human Mars exploration campaign.

Transportation and Habitation Goal: Develop and demonstrate an integrated system of systems to conduct a campaign of human exploration missions to the Moon and Mars, while living and working on the lunar and Martian surface, with safe return to Earth.

Operations Goal: Conduct human missions on the surface and around the Moon followed by missions to Mars. Using a gradual build-up approach, these missions will demonstrate technologies and operations to live and work on a planetary surface other than Earth, with a safe return to Earth at the completion of the missions.

SCIENCE

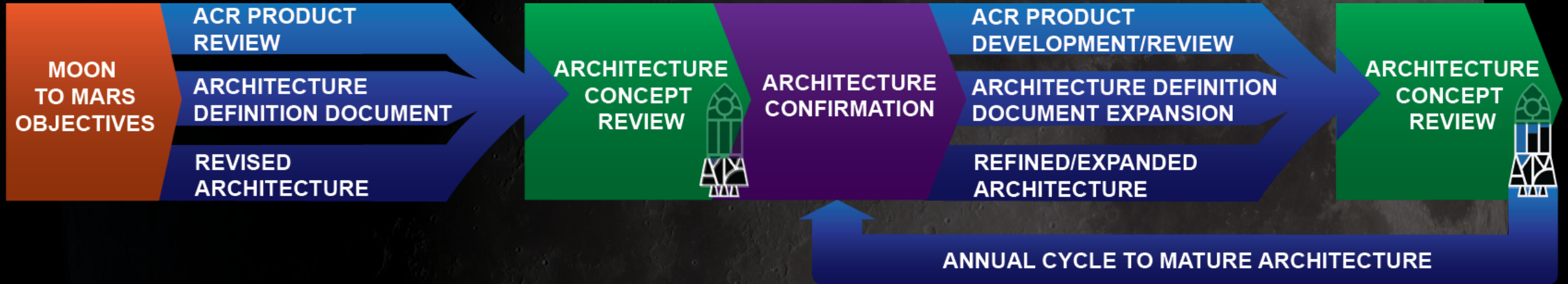
INFRA

T&H

OPS

Evolutionary Architecture Process

Formulating architecture and exploration strategy based on objectives



Architecture Concept Review Products



www.nasa.gov/MoonToMarsArchitecture



Architecture Definition Document

Detailed documentation of a snapshot of NASA's human spaceflight architecture and exploration strategy

Moon to Mars Architecture Summary
High-level overview of NASA's Moon to Mars architecture and exploration strategy



White Papers

Six papers on architecture study details for frequently discussed topics

Moon to Mars Architecture Segments

**Human Lunar
Return**



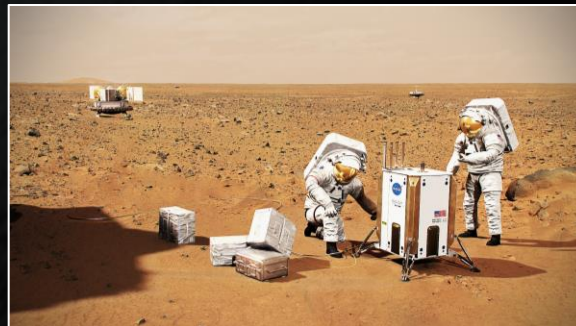
**Foundational
Exploration**

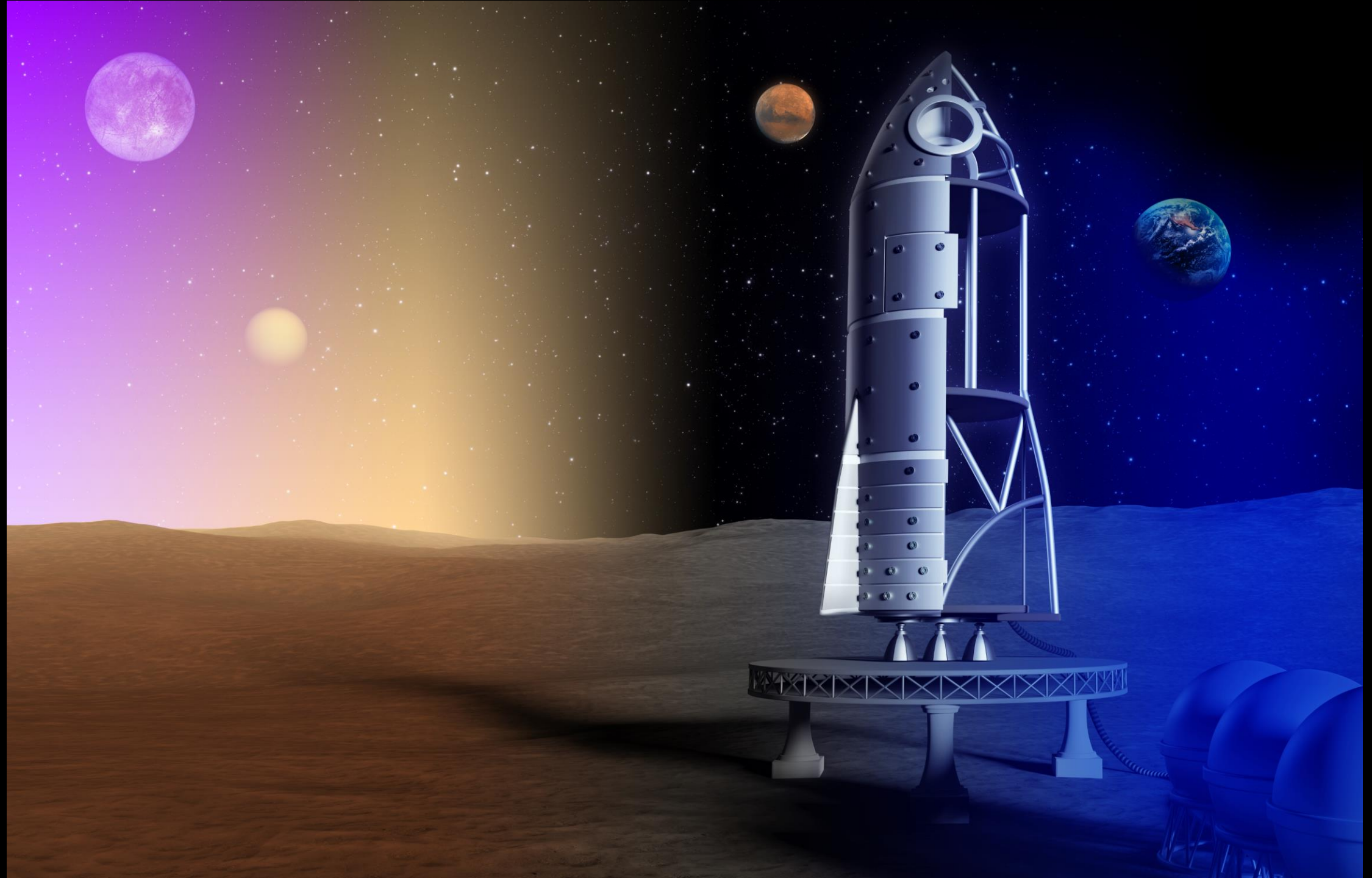


**Sustained
Lunar
Evolution**



**Humans To
Mars**

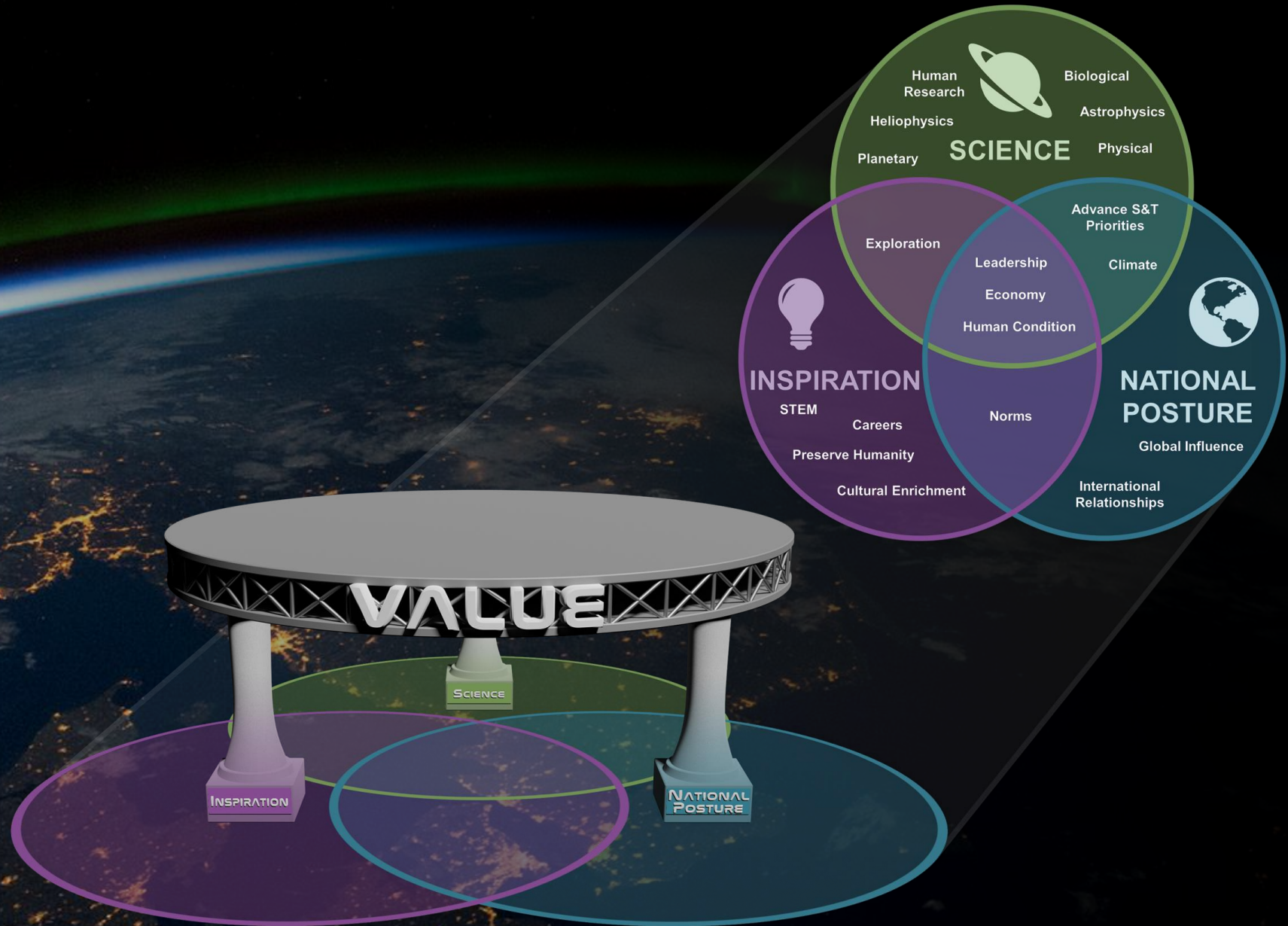




Back-up

Why Go?

Benefit to Citizens



Architecture Processes

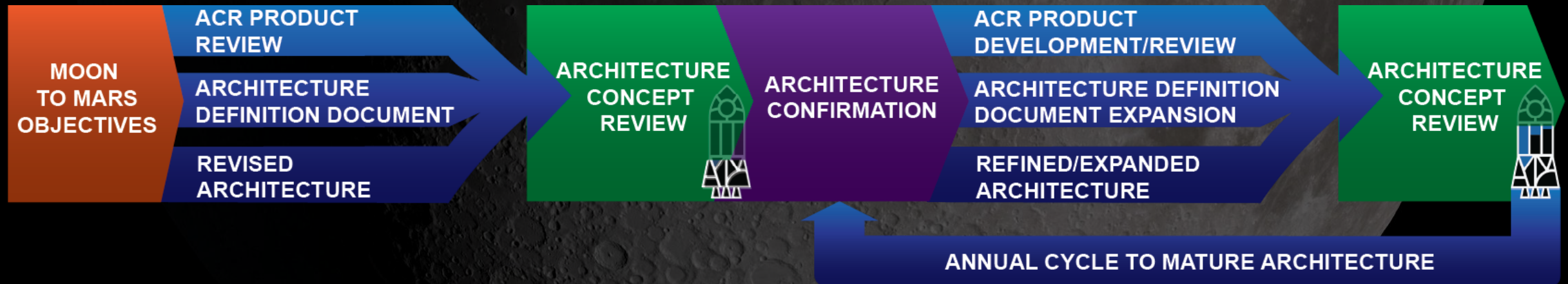


Strategic Analysis Cycle

Moon-to-Mars Campaign
Campaign and Architecture Development
Element Formulation
Modeling and Simulation
Rapid Prototyping and Human in the Loop Testing

Evolutionary Architecture Process

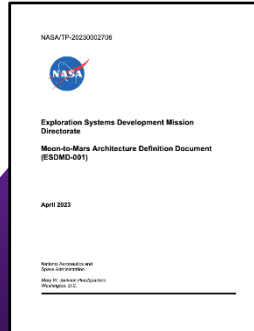
Formulating architecture and exploration strategy based on objectives



Architecture Concept Review Products

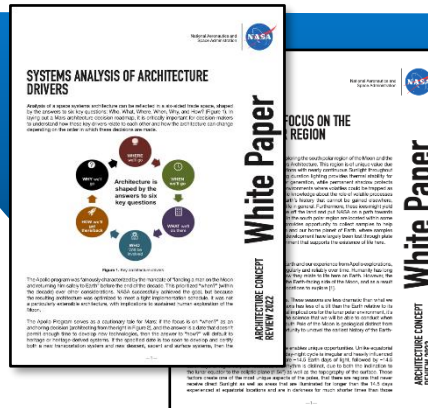
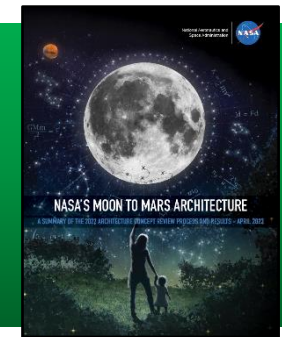


www.nasa.gov/MoonToMarsArchitecture



Architecture Definition Document
Detailed documentation of a snapshot of NASA's human spaceflight architecture and exploration strategy

Moon to Mars Architecture Summary
High-level overview of NASA's Moon to Mars architecture and exploration strategy



White Papers
Six papers on architecture study details for frequently discussed topics