

Human Exploration and Operations Mission Directorate (HEOMD)

National Aeronautics and
Space Administration



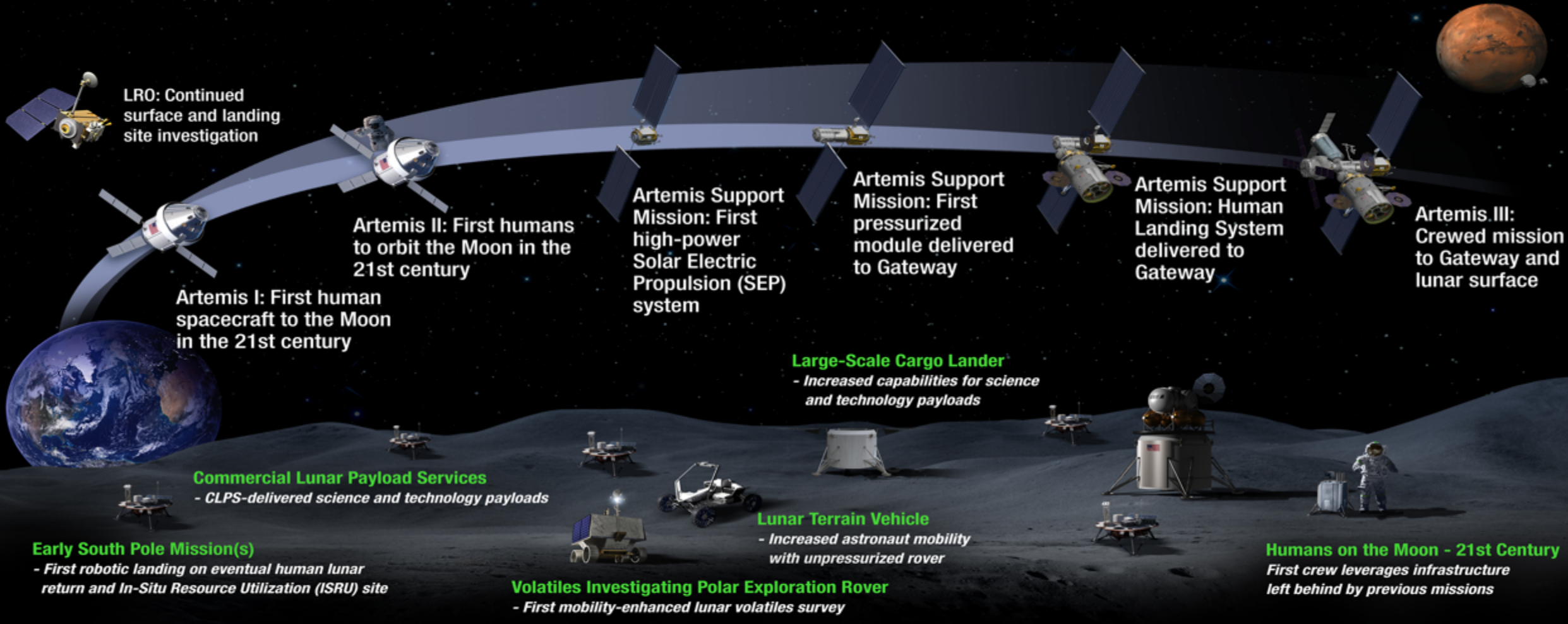
FY 2021 Program Review
For HEO NAC

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Artemis Phase 1: To The Lunar Surface by 2024



LUNAR SOUTH POLE TARGET SITE

2020

Federal Government Use Only

2024

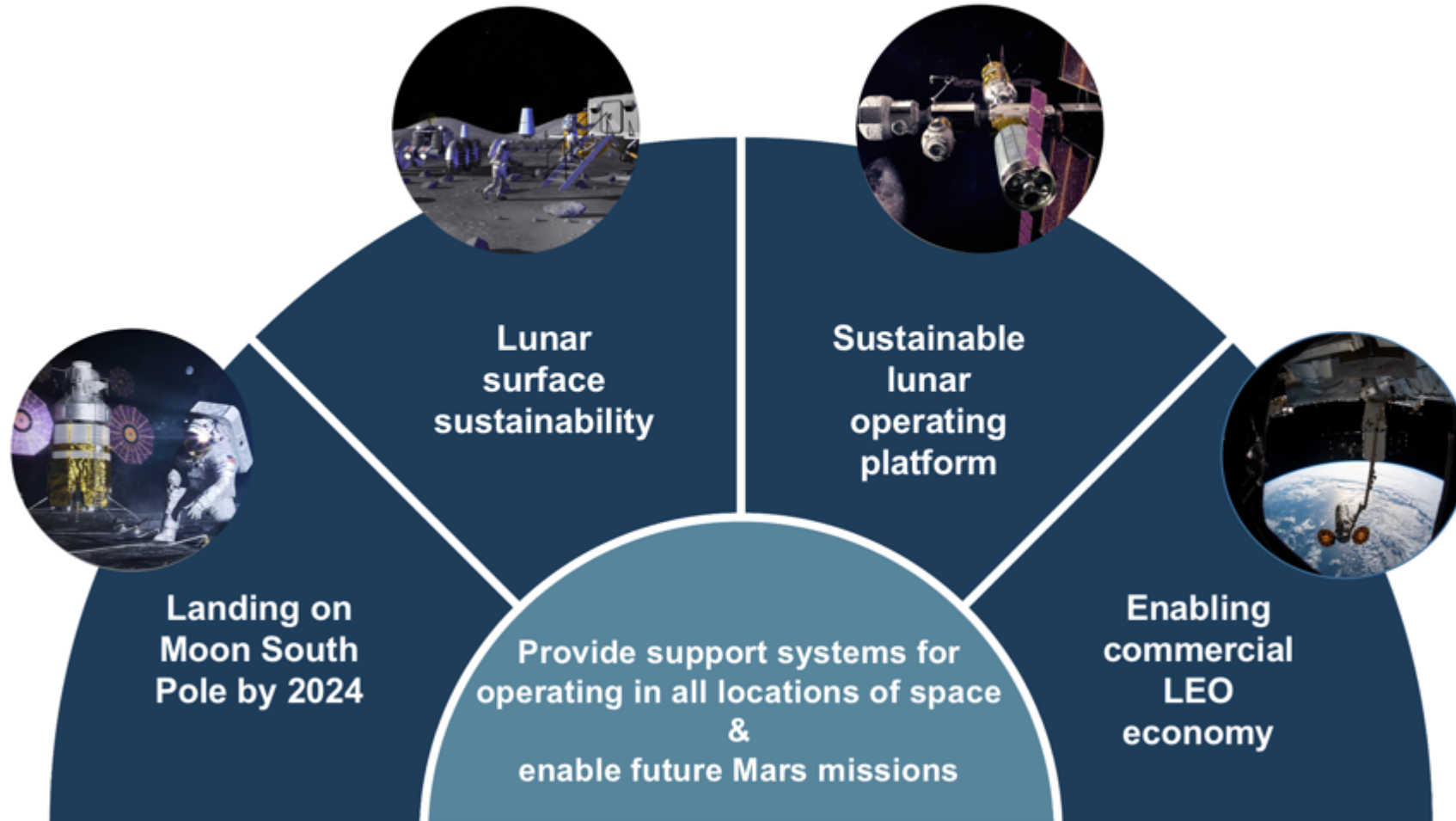
LEADING EXPLORATION - STRATEGIC PRINCIPLES



Continuity of Human Spaceflight and Scientific Exploration
Global Collaboration and Leadership Advancement of Commercial Partnerships
Continue to Inspire the Next Generation

STRATEGIC THEMES

Human Exploration and Operations



FY 2021 Budget Overview

Human Exploration and Operations



FY 2021 President's Budget provides \$12.9B for HEO (\$8.7B for Moon to Mars) to continue pursuit of the nation's exploration goals, consistent with National Space Policy

- Landing the first woman and next man on the Moon's South Pole by 2024
 - Exploration Systems Development (ESD) achieving launch readiness for Block 1 based delivery of Orion carrying crew for the 2024 Artemis III lunar landing mission
 - Develop lunar landing system through Human Landing System (HLS) Program that will return humans to the Moon in 2024
 - Includes support for an accelerated development of lunar landing systems with multiple commercial partners
 - Utilize competition to incentivize partners to contribute resources to lander development
 - Surface suit development and initial ground and International Space Station (ISS)-based testing to assure ability to explore lunar surface on 2024 mission

FY 2021 Budget Overview (continued)

Human Exploration and Operations



- Lunar surface sustainability
 - Develop a sustainable surface landing system
 - Establish an annual cadence of lunar surface missions to build an affordable and sustainable human presence
 - Continue surface suit development for long duration missions
 - Enable space exploration beyond low Earth orbit and to the Moon by reducing risks to human health and performance through basic, applied and operational research
 - Leverage the work of the Science Mission Directorate and Space Technology Mission Directorate to enable affordable and sustainable presence on the Moon.
- Sustainable lunar operating platform
 - Deploy initial functional elements of Gateway
 - Assemble a coalition of partners for sustainable and affordable Gateway
 - Deep Space Exploration
 - Demonstrate deep space operations (including automated deep space rendezvous and docking and logistics support) and technologies to support lunar sustainability and future Mars exploration
 - Conduct long-duration in-space acclimation demos based at both ISS and Gateway coupled with lunar surface missions to test crew/systems

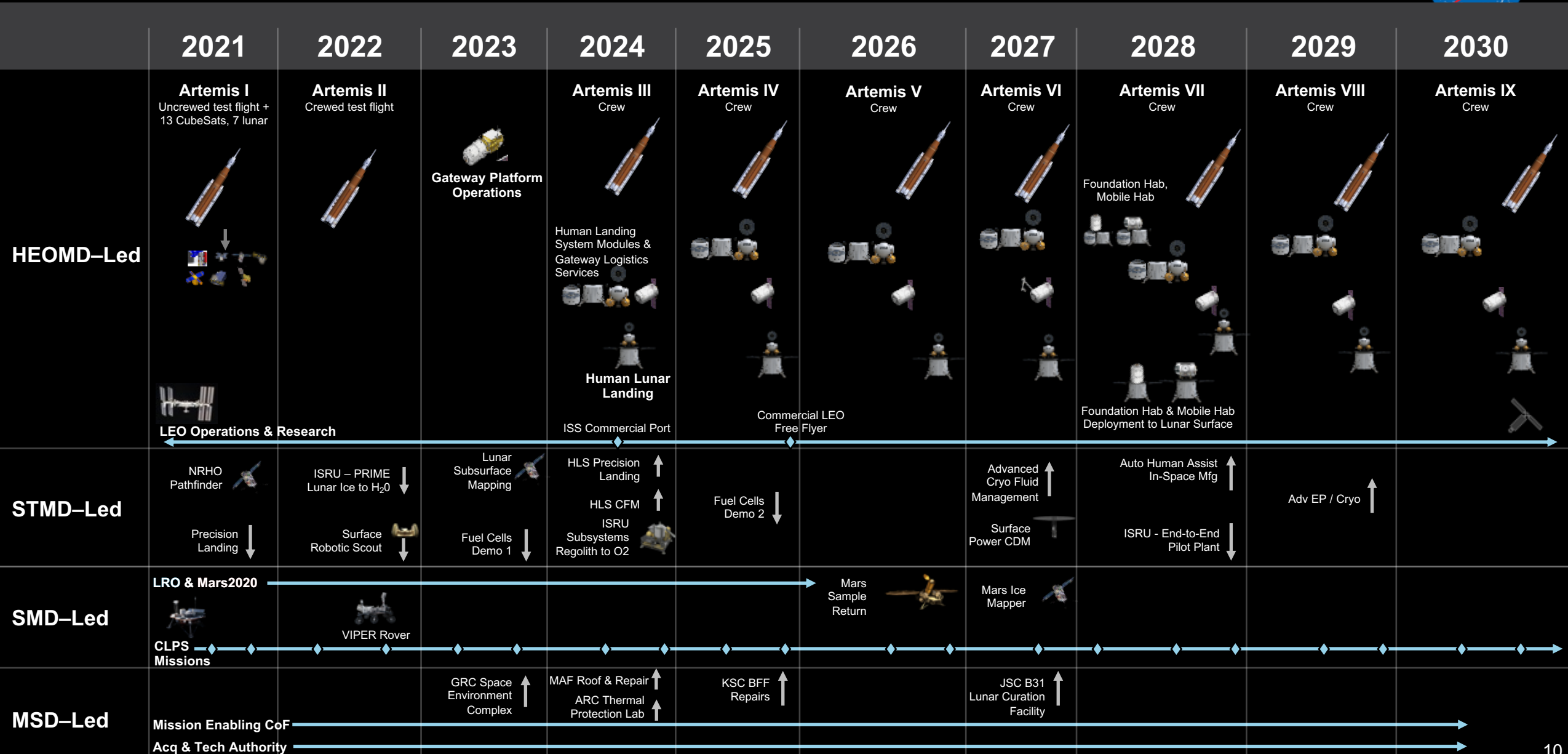
FY 2021 Budget Overview (continued)

Human Exploration and Operations



- Enabling a commercial LEO economy
 - Continues support of commercial crew access and commercial cargo delivery to LEO
 - Partners with industry on development and demonstration of commercial destinations at ISS or as free-flyers
 - Partners with industry to strengthen LEO economy through scalable and sustainable non-NASA demand for products and services
 - Refocuses ISS National Laboratory towards effective partnerships with non-NASA users, scientific discovery, and enabling commercial growth
- Providing support systems for operating in all locations of space
 - ISS provides human and other research and technology demonstrations, Extravehicular Activities (EVA), and commercial transportation
 - Provides critical communication, operations, navigation, launch services, rocket propulsion testing, human research, and other services (i.e., Space Flight Crew Operations, Crew Health and Safety) for exploration near-Earth, at the Moon, and into deep-space
 - Demonstrates feasibility of commercially provided satellite communications services for near-Earth assets

NASA Exploration: 2021-2030



FY 2021 Planned Activities

Human Exploration and Operations



- Landing the first woman and next man on the Moon's South Pole by 2024
 - Launch Artemis I, first uncrewed Flight Test
 - Continue Artemis II preparations including hardware production and software development
 - EGS will start modifications to its infrastructure to accommodate crewed flight missions beginning with Artemis II
 - Continue hardware procurements and software development and integration for Artemis III
 - HLS program down-select for crewed demonstrations to return to the lunar surface in 2024 and establish sustainability through subsequent missions each year thereafter
- Lunar surface sustainability
 - Studies will be conducted in Advanced Cislunar and Surface Capabilities (ACSC) to support lunar surface architecture components including for surface habitation, mobile habitat and power systems
 - Environmental Control and Life Support (ECLSS) evolution and ISS flight demonstration by 2025 (e.g. improved air and water systems, increased recycling of air and water, waste management, environmental monitoring)

FY 2021 Planned Activities (continued)

Human Exploration and Operations



- Sustainable lunar operating platform
 - Implement Gateway strategy focusing on a minimal configuration that enables human lunar missions starting in 2024
 - Conduct Gateway Phase 1-focused Preliminary Design Review (PDR)
 - Conduct Habitation and Logistics Outpost (HALO) PDR
 - Demonstrate xEVA space suit life support sub-systems on ISS for use on lunar landing missions
 - Complete the Power Propulsion Element (PPE) System Integration Review
- Enabling commercial LEO economy
 - Develop-and demonstrate commercial destinations in LEO
 - Continue demonstrating promising new markets (e.g. advanced materials manufacturing and industrialized biomedicine) through the ISS National Laboratory and activities funded by the ISS and Commercial LEO Development programs
 - Support five Commercial Resupply Services (CRS)-2 launches and two commercial crew launches

FY 2021 Planned Activities (continued)

Human Exploration and Operations



- Providing support systems for operating in all locations of space
 - Plan new ISS long-duration missions, FY 2021 through FY 2024, to address health risks associated with lunar missions
 - Continue to operate ISS and support critical research and technology demonstrations
 - Provide assured critical communication coverage near Earth and throughout the solar system to enable all NASA and partner missions (Space, Near Earth and Deep Space Networks)
 - Award demonstrations of commercially provided communications services to support future NASA missions
 - Enable propulsion test infrastructure for NASA programs, commercial partners and Department of Defense, and maintain prioritized core capability of skilled test and engineering crews and test stand facilities
 - Acquire commercial launch services, including certification of new launch providers
 - Provide trained astronauts for all NASA human space flight efforts and maintain Crew Health and Safety

HEO Program Financial Plan

Human Exploration and Operations



Budget Authority (\$ in millions)	FY 2020 (Proposed IOP)	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
Human Exploration and Operations	10,107.4	12,949.0	14,447.0	15,752.4	15,035.0	13,109.4
Deep Space Exploration Systems	5,998.8	8,761.7	10,299.7	11,605.1	10,887.7	8,962.1
Exploration Systems Development	4,495.3	4,042.3	4,011.2	4,071.7	3,767.7	3,634.8
Orion Program	1,406.7	1,400.5	1,322.3	1,391.0	1,239.9	1,084.7
Space Launch System	2,528.1	2,257.1	2,238.4	2,249.2	2,091.8	2,087.1
Exploration Ground Systems	560.5	384.7	450.6	431.6	436.0	463.0
Exploration Research & Development	1,503.5	4,719.4	6,288.5	7,533.4	7,120.0	5,327.4
Adv Cislunar and Surface Capabilities	38.0	212.1	821.4	1,664.4	1,502.1	1,152.6
Human Landing System Program	710.6	3,369.8	4,388.1	5,100.4	4,971.3	3,428.3
Gateway Program	421.0	739.3	712.1	481.8	376.5	476.4
Advanced Exploration Systems	208.9	258.2	226.9	146.7	130.1	130.1
Human Research Program	125.0	140.0	140.0	140.0	140.0	140.0
LEO and Spaceflight Operations	4,108.6	4,187.3	4,147.3	4,147.3	4,147.3	4,147.3
International Space Station	1,446.1	1,400.7	1,390.7	1,338.4	1,314.1	1,319.2
Commercial LEO Development	15.0	150.0	175.0	200.0	200.0	200.0
Space Transportation	1,793.7	1,877.8	1,771.4	1,826.8	1,848.7	1,843.4
Commercial Crew Program	234.9	99.7	63.2	63.2	64.6	64.6
Crew and Cargo Program	1,558.8	1,778.1	1,708.1	1,763.6	1,784.1	1,778.7
Space and Flight Support	853.8	758.7	810.2	782.1	784.5	784.7
21st Century Space Launch Complex	15.0	-	-	-	-	-
Space Communications and Navigation	588.6	506.0	517.4	487.1	481.1	481.1
Communication Services Program	2.7	23.4	42.0	51.2	58.9	58.9
Human Space Flight Operations	106.4	89.9	101.1	103.7	104.6	104.8
Launch Services Program	94.4	91.9	101.9	92.2	92.2	92.2
Rocket Propulsion Test	46.7	47.6	47.8	47.8	47.8	47.8
Construction and Environment Compliance	127.3	46.2	-	-	-	-
Deep Space Exploration Systems	109.9	22.3	-	-	-	-
Orion Program	2.5	-	-	-	-	-
Space Launch System	75.0	8.9	-	-	-	-
Exploration Ground Systems	32.4	13.4	-	-	-	-
LEO and Spaceflight Operations	17.4	23.9	-	-	-	-
Space Communications and Navigation	16.0	23.9	-	-	-	-
Launch Services	0.3	-	-	-	-	-
Rocket Propulsion Test	1.1	-	-	-	-	-

Totals may not add due to rounding



EXPLORE MOON *to* MARS