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KEEPING OUR SIGHTS ON MARS PART 3: A STATUS UPDATE AND REVIEW OF NASA'S ARTEMIS INITIATIVE

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Chairman Beyer, Ranking Member Babin, and Members of the Subcommittee:

The Office of Inspector General (OIG) is committed to providing independent, objective, and comprehensive oversight of NASA programs and projects, and we welcome this opportunity to discuss the Agency's management of the Artemis program. Over the past 2 years, the OIG has issued seven audit reports that examine issues critical to NASA's effort to land humans on the Moon as a prelude to a crewed Mars mission. We assessed the Space Launch System (SLS) heavy-lift rocket, the Orion Multi-Purpose Crew Vehicle (Orion), the Gateway outpost that will orbit the Moon and serve as a "way station" for lunar exploration, a Human Landing System (HLS) to transport astronauts from lunar orbit to the Moon's surface, ground systems and launch infrastructure, next-generation spacesuits, and management of the Agency's astronauts corps. In addition, we reviewed NASA's management of the aging International Space Station (ISS) and the Agency's efforts to encourage alternative commercial destinations in low Earth orbit important to NASA's Artemis efforts. We summarize these reports later in this statement.

Our broad, years-long oversight has identified several interrelated challenges NASA must address to achieve its ambitious Artemis goals, including unsustainable costs, a lack of transparency into funding requirements, and risks associated with its modified program management and acquisition practices designed to reduce costs and accelerate the mission schedule.

First, the project's enormous expense. We estimate NASA will spend $53 billion on the Artemis program between fiscal years (FY) 2021 and 2025. The effort will require close coordination between NASA and its commercial and international partners to support multiple exploration systems, conduct research and technology demonstrations to return humans to the Moon, and prepare for an eventual crewed mission to Mars.[1] Over the past 6 years, the Agency has increasingly relied on public-private partnerships and alternative acquisition approaches to further its deep space exploration and Artemis ambitions. While these non-traditional efforts have made significant progress in several areas including commercial crew and cargo transportation to the ISS, these projects face multiple technical, financial, and programmatic challenges.

Specifically, NASA's initial three Artemis missions face varying degrees of technical difficulties that will push launch schedules from months to years past their current goals. With all necessary elements for the Artemis I mission now being integrated and tested at Kennedy Space Center, we estimate that NASA is progressing toward the first launch of the integrated SLS/Orion space flight system by summer 2022. With Artemis II, NASA is facing additional schedule delays—until at least mid-2024—due to the second mission's reuse of Orion components from Artemis I. Finally, given the time needed to develop and fully test the HLS and NASA's next-generation spacesuits needed for lunar exploration, the date for a crewed lunar landing likely will slip to 2026 at the earliest.

Moreover, our detailed examination of Artemis program contracts found its costs unsustainable. Given our estimate of a $4.1 billion per-launch cost of the SLS/Orion system for at least the first four Artemis missions, NASA must accelerate its efforts to identify ways to make its Artemis-related programs more

[1] We estimate NASA will spend $93 billion on the program from FY 2012 (when the Agency began Artemis-related work in earnest) through FY 2025. We derived this $93 billion figure from examining NASA's obligations, appropriations, and budget projections across all Mission Directorates for programs and projects involved in the Artemis program.

affordable.[2] Otherwise, relying on such an expensive single-use, heavy-lift rocket system will, in our judgment, inhibit if not derail NASA's ability to sustain its long-term human exploration goals of the Moon and Mars. In addition, the Agency has seen significant cost growth in the Mobile Launchers, spacesuits, and to a lesser degree the Gateway. However, since NASA is following its commercial crew model in the HLS procurement, cost increases may be controlled in part due to the fixed-price, milestone-based contracts where SpaceX, the contractor, shares the costs of development.

Second, the Artemis program lacks transparency. In particular, NASA does not have a comprehensive and accurate estimate that accounts for all Artemis program-related costs. Because NASA has not defined Artemis as a formal program under the Agency's Space Flight Program and Project Management Requirements, an Artemis-wide full life-cycle cost estimate is not required. Instead, NASA's disparate programs and projects individually submit budget estimates through their divisions and directorates to the Office of the Chief Financial Officer. As a result, for FYs 2021 through 2025 the Agency is relying on a rough cost estimate for the first three Artemis missions that excludes $25 billion it is planning to spend for key activities related to planned missions beyond Artemis III. When aggregating all relevant costs across Mission Directorates, we projected NASA will spend $93 billion on the Artemis effort from FY 2012 through FY 2025. Without NASA fully accounting for and accurately reporting the overall cost of current and future missions, it will be difficult for Congress, the Office of Management and Budget, and the American public to make informed decisions about NASA's long-term funding needs—a key to making Artemis a sustainable venture.

Finally, NASA needs to develop a realistic, risk-informed development schedule that includes sufficient margin to better align Agency and stakeholder expectations. Faced with a shortened timeframe for a crewed lunar landing, uncertain budgets, and the nascency of the required development work, NASA implemented modifications to its routine procurement and program management practices in an effort to reduce costs and accelerate the mission schedule. For example, NASA is procuring the Gateway's space flight hardware and the HLS transportation service using research and development contracts that leverage commercial capabilities and state-of-the-art innovation but require a Federal Acquisition Regulation deviation. Although these modified approaches have the potential to decrease costs and encourage innovation, they correspondingly raise schedule and performance risks on these critical human-rated systems. NASA can mitigate these risks by first ensuring system requirements are well defined, establishing effective review processes to evaluate space flight systems, and developing realistic launch schedules.

NASA's Management of the Artemis Missions (IG-22-003, November 15, 2021)

In this report, we found that NASA is projected to spend $93 billion on the Artemis effort from FY 2012 through FY 2025. However, because NASA decided not to classify Artemis as a formal program under the Agency's Space Flight Program and Project Management Requirements, Artemis officials were not required to develop an official Artemis-wide full life-cycle cost estimate. By failing to develop an official estimate that includes all relevant costs, NASA lacks transparency into the funding required to sustain the Artemis program over the long term.

[2] The $4.1 billion total cost represents production of the SLS, Orion, and ground operations needed to launch the space flight system including materials, labor, facilities, and overhead. The figure does not include money spent concurrently on the development of next-generation technologies such as the SLS's Exploration Upper Stage, Orion's docking system, or Mobile Launcher 2, nor does it include the billions of dollars spent in developing these systems.

We projected the current production and operations cost of a single SLS/Orion system at $4.1 billion per launch for Artemis I through IV. Multiple factors contribute to the high cost of Exploration Systems Development (ESD) Division programs—SLS, Orion, and Exploration Ground Systems—including the use of sole-source, cost-plus contracts; the inability to definitize key contract terms in a timely manner; and the fact that except for the Orion capsule, its subsystems, and supporting launch facilities, all components are expendable and "single use" unlike emerging commercial space flight systems. Without capturing, accurately reporting, and reducing the cost of future SLS/Orion missions, the Agency will face significant challenges to sustaining its Artemis program in its current configuration.

In addition, the initial three Artemis missions face varying degrees of technical difficulties and delays that will push launch schedules from months to years past the Agency's current goals. Although individual NASA divisions have their own integrated master schedules (IMS), NASA lacks a regularly updated, NASA-wide integrated Artemis IMS to serve as a bottom-up schedule that incorporates program inputs from both summary and detailed schedules. The Advanced Exploration Systems Division—responsible for Gateway, HLS, and spacesuits—is working to create mission-specific IMSs that will incorporate schedule information from both AES and ESD programs starting with Artemis III. While the AES-ESD schedule covers the main Artemis activities, we found the draft version is missing information from programs and projects outside of AES and ESD, such as the Lunar Discovery Exploration Program and those under the Space Technology Mission Directorate. Further, instead of using a systems integrator or Artemis program manager, NASA is establishing a variety of collaborative processes including new boards and a multi-directorate council to facilitate the communication and approval process.

For HLS, NASA has modified its traditional acquisition approach for large space flight programs to reduce costs, encourage innovation, and meet an aggressive schedule for its Artemis lunar landings. However, this approach is not without risk. While its acquisition approach relies on competition to drive down costs and ensure redundancy, NASA was able to select only one company for the HLS demonstration mission given the amount of funding it received for the program.[3]

HLS will also use less standardized milestone reviews and instead utilize other project management techniques throughout development and testing. While the HLS Program leveraged lessons learned and is modeled, in part, after the Commercial Crew Program, HLS tailored its programmatic milestone approach to better fit a services model approach versus a traditional hardware development program. The tailored approach replaces traditional hardware development milestones with annual synchronization reviews to provide oversight of provider development.[4] Although these modified approaches have the potential benefit of decreasing costs and encouraging innovation, they also raise the possibility of technical changes later in development coupled with schedule and performance risks on NASA's human-rated systems.

[3] To help mitigate this constraint, the Agency is accelerating its Lunar Exploration Transportation Services (LETS) procurement and in September 2021 awarded five contracts worth $146 million to companies to continue developing HLS capabilities. These awards are intended to help prepare industry to be competitive for an award under the LETS procurement.

[4] For example, NASA is replacing the following milestone reviews that occur in a traditional acquisition: Key Decision Point-D is the milestone event that allows a project to proceed to Assembly, Integration and Test, and Launch; Key Decision Point-E moves the project into Operations and Sustainment. A Systems Integration Review ensures segments, components, and subsystems are on schedule to be integrated into the system. The Operational Readiness Review ensures that all system and support (flight and ground) hardware, software, personnel, procedures, and user documentation accurately reflect the deployed state of the system.

The OIG made nine recommendations to increase transparency of costs and improve program management. NASA agreed with most but disagreed with recommendations to develop an Artemis-wide cost estimate and track costs by mission. We believe that NASA will continue to underreport the full amount of funding required to sustain the Artemis program if it fails to develop an official estimate that includes all relevant costs.

NASA's Development of Next-Generation Spacesuits (IG-21-025, August 10, 2021)

Development of new spacesuits is a critical component to achieving NASA's goals of returning humans to the Moon, continuing safe operations on the ISS, and exploring Mars and other deep space locations. Currently, astronauts use spacesuits designed 45 years ago for the Space Shuttle Program and rely on these refurbished and partially redesigned suits for extravehicular activities on the ISS. NASA has been developing next-generation spacesuit technology since 2007, and in 2017 created the Exploration Extravehicular Mobility Units (xEMU) project to design, test, and produce six suits in-house. This included one design verification and test suit, two qualification suits, one ISS demonstration suit, and two flight-ready suits. By the time two flight-ready spacesuits are completed, NASA will have spent over a billion dollars on the development and assembly of its next-generation spacesuits.

NASA's schedule prior to 2019 planned for the design, testing, and development of the xEMU and the delivery of flight-ready spacesuits to the ISS by 2023 and to the Artemis III mission by 2028. However, when the timeline for the Artemis III mission was accelerated to 2024, NASA was required to fast-track its schedule by 4 years and planned to deliver flight suits to the HLS Program for integration no later than March 2023. As of March 2021, that date had been delayed by 20 months to November 2024 due to reduced funding for spacesuit development in FY 2021, COVID-19 impacts, and ongoing technical issues. Given those challenges, we found NASA's approach to spacesuit development would preclude a 2024 lunar landing. Further, evolving and competing requirements, including delivery date targets from key program stakeholders such as the HLS, ISS, and Gateway increases the risk of future cost, schedule, and performance issues in spacesuit development and production.

The OIG made four recommendations designed to reduce development risks and align needs across dependent programs, solidify technical requirements, and develop an acquisition strategy that meets ISS and Artemis program needs. During our audit, NASA began to explore a new commercial services acquisition approach for the spacesuits and in September 2021 issued a request for proposal to industry with plans to award a contract in April 2022. Under this new strategy, NASA will pay to use contractor-developed suits instead of building the xEMU qualification and flight suits in-house or purchasing extravehicular suits from a contractor. However, given this change in approach it is unclear to what extent NASA's investments in spacesuit development since 2007 will be utilized.

NASA's Management of Space Launch System Program Costs and Contracts (IG-20-012, March 10, 2020)

In this report, we found that NASA continued to struggle managing SLS Program costs and schedule as the launch date for the first integrated SLS/Orion mission slipped from December 2017 until November 2020—a date that has since slipped to no earlier than March 2022. Rising costs and delays were attributed to challenges with program management, technical issues, and contractor performance. We found the structure of the SLS contracts limited visibility into contract costs and prevented NASA

from determining the precise costs for each of the SLS's major elements. Specifically, rather than using separate contract line item numbers (CLIN) for each element's contract deliverables, the major contracts used a single CLIN to track all deliverables, making it difficult for the Agency to determine if the contractor was meeting cost and schedule commitments for each deliverable. Based upon the OIG's recommendation, NASA now tracks most of the deliverables by separate CLINs to help facilitate cost transparency.

Notably, in our review of SLS Program cost reporting we found that the Program exceeded its Agency Baseline Commitment (ABC)—that is, the cost and schedule baselines committed to Congress against which a program is measured—by at least 33 percent at the end of FY 2019. This was due to cost increases tied to development of Artemis I and a December 2017 replan that removed almost $1 billion of costs from the Program's ABC without lowering the baseline, thereby masking the impact of Artemis I's projected 19-month schedule delay. NASA subsequently notified Congress of its adjusted baseline that reflected both the cost increase—projected to reach 43 percent by November 2021—and the removal of costs identified by our office.

We projected NASA would have spent more than $17 billion on the SLS Program by the end of FY 2020, including almost $6 billion not tracked or reported as part of the ABC. Each of the major element contracts for building the SLS for Artemis I—Stages, Interim Cryogenic Propulsion Stage, Boosters, and RS-25 Engines—have experienced technical challenges, performance issues, and requirement changes that collectively have resulted in $2 billion of cost overruns and increases and at least 2 years of schedule delays. We reported in October 2018 that Core Stage production was the primary factor contributing to overall SLS launch delays due to its position on the critical path and corresponding management, technical, and infrastructure issues driven mostly by The Boeing Company's poor performance.[5]

The OIG made eight recommendations aimed at increasing the sustainability, accountability, and transparency of NASA's efforts to manage the five major SLS element contracts.

Audit of NASA's Development of Its Mobile Launchers (IG-20-013, March 17, 2020)

NASA is developing two mobile launchers that will serve as the ground structure to assemble, process, transport, and launch the SLS. The first mobile launcher (ML-1)—originally constructed in 2010 for the since-canceled Constellation Program's Ares I launch vehicle at a cost of $234 million—required large-scale modifications to support the SLS. After nearly a decade of development, ML-1 is nearing completion in support of the launch of Artemis I. However, NASA greatly exceeded its cost and schedule targets in developing the ML-1. As of January 2020, modification of the ML-1 to accommodate the SLS has cost $693 million—$308 million more than the Agency's March 2014 budget estimate—and the project was more than 3 years behind schedule. The Agency's acquisition approach for ML-1 lacked coordination and competition with design contractors and that, coupled with immature SLS requirements, resulted in design errors and integration challenges that drove the project's cost increases and schedule delays. Looking ahead, the project faces a risk of further cost increases and schedule slippage after Artemis I is completed and ML-1 undergoes modifications for Artemis II.

[5] Our previous October 2018 SLS audit examined cost and schedule challenges related to The Boeing Company's Stages contract. NASA OIG, *NASA's Management of the Space Launch System Stages Contract* (IG-19-001, October 10, 2018).

At the time of our report, we found that NASA was missing opportunities to improve project management and oversight of the $486 million second mobile launcher (ML-2) project. First, the ML-2 schedule is risky due to expected vehicle load and requirements changes for the Orion and later variations of the SLS. Second, the ML-2's design-build contract structure—in which NASA contracts with one organization for both project design and construction—utilizes award fees which if implemented similar to the ML-1 project may limit the Agency's ability to motivate the ML-2 contractor to improve performance and control costs. Finally, NASA's approach to managing the ML-2 project lacks key project management requirements that would provide greater levels of oversight and transparency.

The OIG made four recommendations to improve potential outcomes on the ML-2 project. In August 2021, the OIG initiated a new audit to assess whether NASA is meeting cost and schedule goals for the development of the ML-2.

NASA's Management of the Orion Multi-Purpose Crew Vehicle Program (IG-20-018, July 16, 2020)

NASA has been developing the Orion spacecraft since 2006 to transport astronauts beyond low Earth orbit. In July 2020, we reported that Orion's total projected life-cycle cost through FY 2030 was $29.5 billion and found that NASA's exclusion of more than $17 billion in Orion-related costs has hindered the overall transparency of the vehicle's complete costs. Since cost and schedule baselines were set in 2015, the Program has experienced over $900 million in cost growth through 2019, a figure expected to rise to at least $1.4 billion through 2023.

At the time of our report, Orion was proceeding with production of crew capsules for future Artemis missions before completing key development activities, increasing the risk of additional cost growth and schedule delays. In addition, despite significant cost increases and schedule delays, the contractor, Lockheed Martin Corporation (Lockheed), received nearly all available award fees over a 9-year period due to a variety of factors including the use of an "Award Fee for End-Items" contracts clause that in our judgement disincentivizes contractor performance by offering the contractor the opportunity to, at the end of a final award fee period, earn previously unearned award fees. We calculated that, at a minimum, NASA paid at least $27.8 million in excess award fees throughout development for the "Excellent" performance ratings Lockheed received while the Orion Program was experiencing substantial cost increases and schedule delays.

The OIG made three recommendations to increase the sustainability, accountability, and transparency of the Orion Program as it pursues the goal of landing astronauts on the Moon.

NASA's Management of the Gateway Program for Artemis Missions (IG-21-004, November 10, 2020)

NASA's lunar Gateway—a small space station in an orbit around the Moon—is intended to provide a staging location for lunar missions and eventually deep space operations and is essential to support sustained Artemis operations. Initial Gateway elements consist of the Power and Propulsion Element (PPE) that powers the spacecraft in orbit, and the Habitation and Logistics Outpost (HALO) that provides a docking location for the Orion capsule and living and working spaces for crew members staying less than 30 days. Once fully completed with all elements attached, Gateway will include living quarters,

internal and external payload accommodations for science and research, and docking ports for spacecraft.

In our report, we found that NASA is modifying its standard acquisition practices by using a commercially focused research and development contract and a sole-source award to reduce the time needed to acquire Gateway elements. With this approach, the Agency is moving forward with development before requirements are firm. As requirements are further defined, the overall cost and the time needed to complete the development of the PPE and HALO will likely increase. To that end, we found that the PPE contract value increased by $78.5 million since the fixed-price contract was awarded in May 2019 with more increases expected as the project rebaselines to accommodate additional evolving requirements and technical challenges. Many of these requirements were not built into the original schedule assumptions and, as a result, additional time and funding will be needed to test and integrate these systems.

Given the time needed for developing, launching, and moving the Gateway into its lunar orbit, we reported that the earliest the system was projected to be available for Artemis missions is 2025. NASA's goal is now to have the Gateway in an orbit around the Moon to support Artemis IV.

The OIG made eight recommendations designed to solidify program requirements, create realistic development schedules, and improve contract definitization processes.

NASA's Management of Its Astronaut Corps (IG-22-007, January 11, 2022)

As NASA enters a new era of human space flight, including returning to the Moon and eventually landing humans on Mars, effective management of its astronaut corps is critical to the Agency's success. Astronauts serve as the face and voice of the Agency's efforts to inspire the next generation of explorers, scientists, and engineers. After reaching its peak of nearly 150 astronauts in 2000, the size of the corps diminished with the end of Space Shuttle missions in 2011 and now stands at 44, one of the smallest cadres of astronauts in the past 20 years. With the crewed Artemis II mission scheduled to launch by mid-2024, the margin of time available to identify skillset needs, recruit and hire additional astronaut candidates, develop a framework for Artemis training, and adjust current processes for sizing, aligning, training, and assigning astronauts is quickly diminishing.

In our report, we found the processes NASA uses to size, train, and assign astronauts to specific missions are primarily calibrated toward meeting the current needs of the ISS. The Artemis program offices work with the Flight Operations Directorate and Astronaut Office to identify required skillsets for space flight missions beyond the ISS and we found that skillsets may need to be augmented to ensure sufficient capacity to execute Artemis missions and achieve Agency diversity, equity, inclusion, and accessibility objectives.

As NASA prepares for crewed Artemis missions, astronaut training needs will change. The Astronaut Office is in the process of developing a framework for Artemis training, but this framework has not been formally chartered nor have any Artemis crews been announced. Delays in moving beyond the current ISS-focused approach for current and future astronauts increase the risk of delays in developing the necessary training to meet Artemis mission goals.

Additionally, as NASA moves from low Earth orbit missions on the ISS to deep space Artemis missions, it has begun the process of reviewing its policies and conducting additional studies on human health

impacts from longer duration missions and missions beyond low Earth orbit. If the nature of Artemis missions medically disqualifies certain astronauts as a result of exceeding the Agency-set maximum level of exposure because of the duration of the mission beyond low Earth orbit, NASA may need to adjust its astronaut corps size and assignment process.

The OIG made four recommendations designed to help ensure the astronaut corps is aligned to meet current and future mission needs.

NASA's Management of the International Space Station and Efforts to Commercialize Low Earth Orbit (IG-22-005, November 30, 2021)

NASA's plans for long-term, deep space human exploration missions depend on continuous access to a research laboratory in low Earth orbit. The Artemis missions, aimed at returning humans to the Moon and ultimately landing astronauts on Mars, are not feasible without continued human health research and technology demonstrations on the ISS and its eventual replacement. As long as humans intend to travel in space, NASA expects research and testing will be needed in the microgravity environment of low Earth orbit.

Under the Agency's current projections, health risk mitigation and technology demonstration efforts for Mars missions will not be complete by 2030, the expected retirement date of the ISS. Meanwhile, the Agency's plans to mitigate outstanding health risks for short-duration lunar missions face delays because critical systems such as the HLS and xEMU remain in development and astronauts need to be able to train using these systems in order to fully characterize and mitigate associated risks. The risk of deep space human exploration missions will increase significantly if NASA is not able to conduct the required microgravity health research and technology demonstrations on a habitable space destination in low Earth orbit. As a result, the Agency will have to accept a higher level of health risk for deep space missions or delay those missions until adequate mitigation strategies are developed.

Given the ISS's inevitable retirement and NASA's continuing need for low Earth orbit research, the success of the Agency's Plan for Commercial Low Earth Orbit Development is crucial to avoid a gap in low Earth orbit access. NASA's plan to close that gap is for one or more commercial low Earth orbit destinations to be operational by 2028, which would allow a 2-year overlap with the ISS before its anticipated retirement in 2030. We found that the Agency's near-term actions to commercialize the ISS show promise, with NASA's recent efforts resulting in market interest and growth, especially for private astronaut missions. However, NASA faces significant challenges with fully executing the plan in time to meet its 2028 goal and avoid a gap in the availability of a low Earth orbit destination. Challenges of commercialization include limited market demand, inadequate funding, unreliable cost estimates, and still-evolving requirements.

Conclusion

Over the past year, NASA's Artemis systems (SLS, Orion, and Exploration Ground Systems Programs) have made steady progress and are, in our estimation, positioned to launch the first Artemis mission by summer 2022.[6] Despite this progress, NASA's goal to land astronauts on the Moon faces multiple

[6] NASA OIG, *NASA's Strategy for the Artemis Missions* (IG-22-003, November 15, 2021).

significant challenges including major technical risks, an unrealistic development schedule, and lower-than-requested funding levels. As a result, the date for a crewed lunar landing likely will slip to 2026 at the earliest.

More concerning, however, is the long-term sustainability of the Artemis program. Historically, NASA has struggled to establish credible mission cost estimates. Given that NASA is likely to spend $93 billion on the Artemis program through FY 2025, the Agency's lunar and Mars ambitions have the potential to cost hundreds of billions of dollars over the next two decades. However, the Agency has disagreed with our recommendations to develop an overall Artemis cost estimate or calculate per-mission costs. In light of the $4.1 billion price tag per launch for at least the first four Artemis missions —half of which is related to SLS—the Agency faces significant challenges to reduce costs to ensure the program is sustainable in the mid- to long-term.

NASA has acknowledged the high costs of its lunar and Mars goals and is exploring ways to make the missions sustainable by transitioning some programs to fixed-price contracts, although in the case of Orion, this is not expected to occur until Artemis IX. With the emerging capabilities provided by commercial partners, the Agency may have future options that can help control costs to meet its exploration goals. While NASA has made strides to ensure communication and integration between the Artemis programs—such as establishing a Directorate Systems Engineering and Integration Function, Federated Boards, a Joint Directorate Program Management Council, and Joint Program Boards—these nascent procedures remain at risk to unfamiliarity and changes in organization, leadership, or program priorities.

Whether acquiring space flight systems for Artemis or eventually for crewed missions to Mars, NASA must determine the procurement and programmatic strategies to best support its objectives. This includes encouraging competition, using appropriate contracting instruments, and employing insight and oversight mechanisms to ensure NASA receives systems that meet its needs. Importantly, understanding the state of technology development and level of maturity of requirements for each Artemis system will help inform decision makers on the best approach and produce realistic schedule and cost estimates.[7]

We look forward to helping NASA achieve its ambitious Artemis goals. To that end, we plan to continue examining key challenges in NASA's human exploration missions to the Moon and Mars.

[7] NASA OIG, *NASA's Management of the Gateway Program for Artemis Missions* (IG-21-004, November 10, 2020).