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441 G St. N.W.
Washington, DC 20548

Comptroller General
of the United States

May 3, 2023

The Honorable Bill Nelson
Administrator
National Aeronautics and Space Administration
300 E Street Southwest
Washington, DC 20546

Priority Open Recommendations: National Aeronautics and Space Administration

Dear Administrator Nelson:

The purpose of this letter is to update you on the overall status of the National Aeronautics and Space Administration's (NASA) implementation of our recommendations and to call your continued personal attention to areas where open recommendations should be given high priority.[1] In November 2022, we reported that, government-wide, 77 percent of our recommendations made 4 years ago were implemented.[2] NASA's recommendation implementation rate was 80 percent. As of January 2023, NASA had 53 open recommendations. Fully implementing these open recommendations could significantly improve agency operations.

Since our July 2022 letter, NASA has implemented one of our nine open priority recommendations.[3] Specifically, NASA

- documented the process to determine the program and technical management practices and tools that it will apply to the Artemis III and later missions.[4] By determining the management practices and tools needed to guide mission-level decisions and oversight, NASA is better positioned to reduce the risk that it will discover gaps late in development.

We ask your continued attention to the remaining eight priority recommendations. We are also adding one new recommendation related to NASA defining and documenting the role of the senior agency official for privacy or other designated privacy official. This brings the total

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[1]Priority recommendations are those that we believe warrant priority attention from heads of key departments or agencies. They are highlighted because, upon implementation, they may significantly improve government operations, for example, by realizing large dollar savings; eliminating mismanagement, fraud, and abuse; or making progress toward addressing a high-risk or duplication issue.

[2]GAO, *Performance and Accountability Report: Fiscal Year 2022*, GAO-23-900398 (Washington, D.C.: Nov. 15, 2022).

[3]GAO, *Priority Open Recommendations: National Aeronautics and Space Administration,* GAO-22-105726 (Washington, D.C.: July 20, 2022).

[4]GAO, *NASA Lunar Programs: Significant Work Remains, Underscoring Challenges to Achieving Moon Landing in 2024,* GAO-21-330 (Washington, D.C.: May 26, 2021).

number of priority recommendations to nine. (See the enclosure for the list of recommendations.)

The nine priority recommendations fall into the following three major areas.

Monitoring program costs and execution. NASA's acquisition management is one of the highest risks facing the agency due to the history of cost growth and schedule delays of its major projects. Implementing six priority recommendations in this area is critical for NASA to provide assurance that it will sustain the progress it has made toward addressing key acquisition management issues on its largest and most complex missions. These recommendations primarily focused on improving transparency into long-term costs and affordability of human spaceflight programs and improving the reliability of data used to inform acquisition decisions. For example, NASA should establish cost and schedule baselines for Space Launch System (SLS) Block 1B, SLS Block 2, Mobile Launcher 2, and Orion Docking System at their preliminary design reviews or as soon as practicable in advance of critical design reviews.

Doing so will help ensure that each project is sufficiently mature to begin development and that the cost and schedule are adequate to enable mission success with acceptable risk. In addition, NASA has yet to create a life-cycle cost estimate for the Artemis III mission, which is important as NASA plans for this mission to return U.S. astronauts to the surface of the moon in 2025.

Ensuring cybersecurity. We have designated information security as a government-wide high-risk area since 1997. We subsequently expanded this high-risk area to include protecting cyber-critical infrastructure and securing personally identifiable information. Accordingly, federal agencies need to take urgent actions to ensure that they have programs in place to protect their information technology systems and sensitive information against increasing cyber risks. We have two priority recommendations aimed at NASA having a qualified, well-trained cybersecurity workforce and defining and documenting the roles of key privacy officials. Implementing these recommendations will enhance NASA's ability to improve workforce planning and incorporate privacy protections into its systems.

Using federal contracting metrics. We found that the use of outcome-oriented performance metrics to manage procurement organizations helps organizations to determine whether they are achieving desired outcomes, such as reducing costs and improving performance. Our one priority recommendation in this area is for NASA to use a balanced set of performance metrics to manage the agency's procurement organizations, including outcome-oriented metrics to measure (a) cost savings/avoidance, (b) timeliness of deliveries, and (c) quality of deliverables. Using such metrics can help NASA make more informed management decisions.

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In April 2023, we issued our biennial update to our High-Risk List. This list identifies government operations with greater vulnerabilities to fraud, waste, abuse, and mismanagement. It also identifies the need for transformation to address economy, efficiency, or effectiveness challenges.[5] One of our high-risk areas—NASA Acquisition Management—centers directly on NASA.

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[5]GAO, *High-Risk Series: Efforts Made to Achieve Progress Need to Be Maintained and Expanded to Fully Address All Areas*, GAO-23-106203 (Washington, D.C.: Apr. 20, 2023).

Several other government-wide, high-risk areas also have direct implications for NASA and its operations. These include (1) improving the management of IT acquisitions and operations, (2) improving strategic human capital management, (3) managing federal real property, (4) ensuring the cybersecurity of the nation,[6] and (5) managing the government-wide personnel security clearance process.

We urge your attention to the NASA and other government-wide, high-risk issues as they relate to NASA. Progress on high-risk issues has been possible through the concerted actions and efforts of Congress, Office of Management and Budget, and the leadership and staff in agencies, including within NASA. In March 2022, we issued a report on key practices to successfully address high-risk areas, which can be a helpful resource as your agency continues to make progress to address high-risk issues.[7]

Copies of this report are being sent to the Director of the Office of Management and Budget and the appropriate congressional committees. In addition, the report will be available on the GAO website at http://www.gao.gov.

In addition to your continued attention on these issues, Congress plays a key role in providing oversight and maintaining focus on our recommendations to ensure they are implemented and produce their desired results. Legislation enacted in December 2022 includes a provision for GAO to identify any additional congressional oversight actions that can help agencies implement priority recommendations and address any underlying issues relating to such implementation.[8]

There are various strategies Congress can use in addressing our recommendations, such as incorporating them into legislation. Congress can also use its budget, appropriations, and oversight processes to incentivize executive branch agencies to act on our recommendations and monitor their progress. For example, Congress can hold hearings focused on NASA's progress in implementing GAO's priority recommendations, withhold funds when appropriate, or take other actions to provide incentives for agencies to act. Moreover, Congress could follow up during the appropriations process and request periodic updates. Congress also plays a key role in addressing any underlying issues related to the implementation of these recommendations. For example, Congress could introduce legislation providing an agency explicit authority to implement a recommendation or requiring an agency to take certain actions to implement a recommendation.

I appreciate NASA's continued commitment to these important issues. If you have any questions or would like to discuss any of the issues outlined in this letter, please do not hesitate to contact me or Timothy J. DiNapoli, Managing Director, Contracting and National Security Acquisitions, at (202) 512-4841 or DinapoliT@gao.gov. Contact points for our Offices of

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[6]With regard to cybersecurity, we also urge you to use foundational information and communications technology supply chain risk management practices set forth in our December 2020 report. GAO, *Information Technology: Federal Agencies Need to Take Urgent Action to Manage Supply Chain Risks*, GAO-21-171 (Washington, D.C.: Dec. 15, 2020).

[7]GAO, *High-Risk Series: Key Practices to Successfully Address High-Risk Areas and Remove Them from the List*, GAO-22-105184 (Washington, D.C.: Mar. 3, 2022).

[8]James M. Inhofe National Defense Authorization Act for Fiscal Year 2023, Pub. L. No. 117-263, § 7211(a)(2), 136 Stat. 2395, 3668 (2022); H.R. Rep. No. 117-389 (2022) (accompanying Legislative Branch Appropriations Act, H.R. 8237, 117th Cong. (2022)).

Congressional Relations and Public Affairs may be found on the last page of this report. Our teams will continue to coordinate with your staff on all of the 53 open recommendations, as well as those additional recommendations in the high-risk areas for which NASA has a leading role. Thank you for your attention to these matters.

Sincerely yours,

Gene L. Dodaro
Comptroller General
of the United States

Enclosure

cc: The Honorable Shalanda Young, Director, Office of Management and Budget
        Mr. Robert D. Cabana, Associate Administrator, NASA
        Mr. James Free, Associate Administrator for Exploration Systems Development, NASA
        Mr. Jeffrey Seaton, Chief Information Officer, NASA

Enclosure

Priority Open Recommendations to National Aeronautics and Space Administration

Monitoring Program Costs and Execution

NASA: Actions Needed to Improve Transparency and Assess Long-Term Affordability of Human Exploration Programs. GAO-14-385. Washington, D.C.: May 8, 2014.

Year Recommendations Made: 2014

Recommendation: To provide the Congress with the necessary insight into program affordability, ensure its ability to effectively monitor total program costs and execution, and facilitate investment decisions, the NASA Administrator should direct the Human Exploration and Operations Mission Directorate to establish a separate cost and schedule baseline for work required to support the Space Launch System (SLS) Block I Exploration Mission (EM)-2 and report this information to the Congress through NASA's annual budget submission.[9] If NASA decides to fly the SLS Block I beyond EM-2, NASA should establish separate life-cycle cost and schedule baseline estimates for those efforts, to include funding for operations and sustainment, and report this information annually to Congress via the agency's budget submission.

Actions Needed: NASA partially agreed with this recommendation. Officials stated that NASA defined and documented life-cycle costs for SLS to a first demonstrated capability, consistent with cost estimating best practices and NASA project and program management policy. In February 2023, NASA officials stated that following the successful launch of Artemis I, the agency is updating the schedule for Artemis II. In spring 2022, SLS and the ground systems programs provided the first 5-year operational cost estimate and NASA plans to update it in spring 2023. Additionally, NASA plans to create a cost estimate for Artemis III informed by the development baselines of capabilities that will fly on the mission.

To fully implement this recommendation, NASA needs to provide documentation of these efforts to determine the extent to which it has developed cost and schedule baseline estimates for future SLS work. Taking these actions would help NASA develop insight into the program's costs and allow decision makers to monitor program execution, including efforts to improve long-term affordability.

Recommendation: To provide the Congress with the necessary insight into program affordability, ensure its ability to effectively monitor total program costs and execution, and facilitate investment decisions, the NASA Administrator should direct the Human Exploration and Operations Mission Directorate to establish separate cost and schedule baselines for each additional capability that encompass all life-cycle costs, to include operations and sustainment. NASA intends to use the increased capabilities of the SLS, Orion, and Ground Systems Development and Operations efforts well into the future and has chosen to estimate costs associated with achieving those capabilities. When NASA cannot fully specify costs due to lack of well-defined missions or flight manifests, it should forecast a cost estimate range—including

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[9]EM-2 was renamed Artemis II when NASA renamed its efforts to return to the moon and eventually on to Mars.

life-cycle costs—having minimum and maximum boundaries. These baselines or ranges should be reported to Congress annually via the agency's budget submission.

Actions Needed: NASA partially agreed with this recommendation, stating that it had established separate programs for SLS, Orion, and the ground systems and adopted a block upgrade approach for SLS. In August 2021, NASA established an updated baseline commitment of the Orion system for Artemis II to include a docking capability. In February 2023, NASA reported SLS and the ground systems have begun annually reporting a 5-year cost estimate of operational costs. NASA officials also stated they are still in the process of establishing baselines for SLS's Exploration Upper Stage and associated capabilities and the Mobile Launcher 2.

To address this recommendation, NASA needs to provide evidence that it established separate cost and schedule baselines for each additional SLS, Orion, and ground systems capability block that encompass all life-cycle costs, including operations and sustainment. Doing so will enable Congressional insight into program costs.

Director: William Russell, Contracting and National Security Acquisitions
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Space Launch System: Resources Need to Be Matched to Requirements to Decrease Risk and Support Long Term Affordability. GAO-14-631. Washington, D.C.: July 23, 2014.

Year Recommendations Made: 2014

Recommendation: To provide the Congress with the necessary insight into program planning and affordability, and to decrease the risk of cost and schedule overruns, the NASA Administrator should direct the Human Exploration and Operations Mission Directorate to structure each future increment of SLS capability—with a total cost exceeding the $250 million threshold for designation as a major project—as a separate development effort within the SLS program. In doing so, NASA should require each increment to complete both the technical and programmatic reviews required of other major development projects, per the agency's acquisition and system engineering policies.

Actions Needed: NASA agreed with this recommendation. NASA established an updated baseline commitment of the Orion system for Artemis II to include a docking capability in August 2021. As of February 2023, NASA had not established separate cost and schedule baselines for each additional SLS and ground systems block, though the agency previously stated it plans to.

To fully implement this recommendation, NASA needs to provide evidence that it established separate cost and schedule baselines for each additional SLS and ground systems block exceeding the $250 million threshold for designation as a major project. Further, NASA needs to provide evidence that each capability upgrade is designated a major project and is required to complete the technical and programmatic reviews required of other major development projects. Structuring future SLS increments as separate development efforts can provide decision makers transparency into costs and enable them to assess long-term affordability and progress.

Recommendation: To provide the Congress with the necessary insight into program planning and affordability, and to decrease the risk of cost and schedule overruns, NASA's Administrator should direct the Human Exploration and Operations Mission Directorate to identify a range of

possible missions for each future SLS variant that includes cost and schedule estimates and plans for how those possible missions would fit within NASA's funding profile.

Actions Needed: NASA agreed with this recommendation. As of February 2023, NASA stated that as it implements the new organization of the Exploration Systems Development Mission Directorate, it will develop a manifest for missions beyond Artemis IV, including the hardware available for the missions. Additionally, NASA is developing Moon to Mars objectives, which will outline anticipated capability and mission needs.

To fully address this recommendation, NASA needs to provide documentation that it established cost and schedule estimates for each future SLS variant and its plan for how possible missions would fit within NASA's funding profile. Further, NASA needs to identify cost and schedule estimates for SLS missions beyond Artemis I and how its planned missions would fit within NASA's funding profile. Identifying a range of mission possibilities and their required funding will ensure the decision makers have information to make decisions about the affordability of the program within the agency's funding profile.

Director: William Russell, Contracting and National Security Acquisitions
Contact information: russellw@gao.gov, (202) 512-4841

NASA Lunar Programs: Opportunities Exist to Strengthen Analyses and Plans for Moon Landing. GAO-20-68. Washington, D.C.: December 19, 2019.

Year Recommendation Made: 2020

Recommendation: The NASA Administrator should ensure that the NASA Associate Administrator for Human Exploration and Operations creates a life-cycle cost estimate for the Artemis III mission.

Actions Needed: NASA agreed with the recommendation. Officials stated that NASA would provide a preliminary cost estimate for the Artemis III mission by the end of calendar year 2020. However, NASA has not yet created this cost estimate. NASA officials previously told us that a 5-year funding plan provided to Congress in September 2020 serves as the agency's cost estimate through the Artemis III mission, which was at the time planned for 2024. The officials stated that the agency would establish cost and schedule commitments for projects but not the overall mission. However, in February 2023, NASA officials added that they are developing a methodology to provide Congress with an assessment of each Artemis mission's costs. NASA officials stated that the mission estimates will include the cost of hardware production, integration costs, and operations costs, but did not provide a time frame for when this would be completed.

To fully implement this recommendation, NASA needs to develop a life-cycle cost estimate for the lunar landing mission as a whole. This is because the 5-year funding plan includes costs outside of this mission, such as costs for the Artemis I and II missions. Similarly, project baseline commitments do not necessarily include the scope of work required for the Artemis III mission. For example, the SLS baseline commitment included a cost estimate only for the Artemis I mission. As a result, there is still no comprehensive Artemis III life-cycle cost estimate. Without an overall cost estimate for the Artemis III mission, decision makers have limited cost information to inform decisions on the overall lunar investment.

Director: William Russell, Contracting and National Security Acquisitions

Contact information: russellw@gao.gov, (202) 512-4841

NASA Human Space Exploration: Significant Investments in Future Capabilities Require Strengthened Management Oversight. GAO-21-105. Washington, D.C.: December 15, 2020.

Year Recommendation Made: 2021

Recommendation: The NASA Administrator should ensure that the NASA Associate Administrator for Human Exploration and Operations Mission Directorate establish cost and schedule baselines for SLS Block 1B, SLS Block 2, Mobile Launcher 2, and Orion Docking System at their preliminary design reviews or as soon as practicable in advance of critical design reviews.

Actions Needed: NASA agreed with this recommendation. In April 2021, NASA officials stated that it was on track to establish a baseline for SLS Block 1B and a separate baseline for Mobile Launcher 2 by September 30, 2021. As of February 2023, however, NASA had not released cost and schedule baselines for either effort. To fully implement this recommendation, NASA will need to provide documentation that it established cost and schedule baselines for all four systems—including SLS Block 2—before their respective critical design reviews. Establishing cost and schedule baselines for these programs will provide decision makers an important oversight tool to monitor program performance.

Director: William Russell, Contracting and National Security Acquisitions
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Ensuring Cybersecurity

Cybersecurity Workforce: Agencies Need to Accurately Categorize Positions to Effectively Identify Critical Staffing Needs. GAO-19-144. Washington, D.C.: March 12, 2019.

Year Recommendation Made: 2019

Recommendation: The NASA Administrator should take steps to review the assignment of the "000" code to any positions at NASA in the 2210 IT management occupational series, assign the appropriate National Initiative for Cybersecurity Education (NICE) framework work role codes, and assess the accuracy of position descriptions.

Action needed: NASA agreed with our recommendation and stated that it would complete a review of the assignment of the "000" code to its positions in the 2210 IT management occupational series, assign the appropriate NICE framework work role codes, and assess the accuracy of position descriptions. In April 2022, NASA provided evidence showing that it has assigned appropriate NICE framework work role codes to its positions in the 2210 IT management occupational series. However, NASA had not yet provided sufficient evidence that it had assessed the accuracy of position descriptions. In February 2023, NASA officials said they are reviewing positions to ensure the correct assignment of the "000" codes, which they anticipate completing in May 2023. To close this recommendation, NASA needs to provide evidence that it assessed the accuracy of position descriptions. Accurately categorizing its positions will provide decision makers with reliable information that they can use to examine its cybersecurity workforce, and improve workforce planning.

Director: David Hinchman, Information Technology and Cybersecurity
Contact information: hinchmand@gao.gov, (214) 777-5719

Privacy: Dedicated Leadership Can Improve Programs and Address Challenges. GAO-22-105065. Washington, D.C.: September 22, 2022.

Year Recommendation Made: 2022

Recommendation: The Administrator of NASA should fully define and document the role of the senior agency official for privacy or other designated privacy official in reviewing and approving system categorizations, overseeing privacy control assessments, and reviewing authorization packages.

Action Needed: NASA agreed with this recommendation and officials said they were developing plans to address it. As of February 2023, NASA officials said they approved and implemented multiple policy documents to define the roles of the Senior Agency Official for Privacy and other key privacy officials. The officials also stated they re-issued guidance on assessment and authorization to include the Senior Agency Official for Privacy in the process. To fully implement this recommendation, NASA needs to ensure that the roles of the senior agency official for privacy or other designated officials, as appropriate, are defined and documented in the relevant policies and procedures. Taking these steps will help NASA ensure that privacy protections are adequately incorporated into its systems with personally identifiable information.

Director: Jennifer Franks, Information Technology and Cybersecurity
Contact information: FranksJ@gao.gov, (404) 679 -1831

Using Federal Contracting Metrics

Federal Contracting: Senior Leaders Should Use Leading Companies' Key Practices to Improve Performance. GAO-21-491. Washington, D.C.: July 27, 2021.

Year Recommendation Made: 2021

Recommendation: The NASA Administrator should ensure the NASA Senior Procurement Executive uses a balanced set of performance metrics to manage the agency's procurement organizations, including outcome-oriented metrics to measure (a) cost savings/avoidance, (b) timeliness of deliveries, (c) quality of deliverables, and (d) end-user satisfaction.

Action Needed: NASA agreed with the recommendation. In January 2022, NASA provided evidence that it was using an outcome-oriented metric to measure end-user satisfaction. In February 2022, the NASA Senior Procurement Executive shared plans to implement metrics in the future to measure (a) cost savings/avoidance, (b) timeliness of deliveries, and (c) quality of deliverables. As of February 2023, NASA reported it developed an E-Business Systems Office within the Office of Procurement that is responsible for defining and managing data and creating a Procurement Dashboard, metrics, and analytical data tools, among other things.

In order to close this recommendation, NASA will need to provide evidence that it has implemented the performance metrics to manage the agency's procurement organizations. Using a balanced set of performance measures, including both process- and outcome-oriented

measures—and obtaining complete and reliable performance information—can help federal agencies identify improvement opportunities, set priorities, and allocate resources.

Potential Financial Benefit if Implemented: $100 million or more annually

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