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Washington, DC 20548

Comptroller General
of the United States

Accessible Version

June 21, 2021

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 provide an update on the overall status of the National Aeronautics and Space Administration's (NASA) implementation of GAO's recommendations and to call your personal attention to areas where open recommendations should be given high priority.¹ In November 2020, we reported that, on a government-wide basis, 77 percent of our recommendations made 4 years ago were implemented.² NASA's recommendation implementation rate was 97 percent. As of April 2021, NASA had 52 open recommendations. Fully implementing these open recommendations could significantly improve agency operations.

Since our April 2020 letter, NASA has implemented one of our 12 open priority recommendations, and we closed two recommendations as not implemented.

- In June 2020, NASA approved new cost and schedule commitments for the Space Launch System (SLS) program and documented them in an updated Agency Baseline Commitment decision memorandum. In preparing the decision memorandum, NASA calculated SLS program developmental cost growth using a baseline adjusted to reflect the scope of work currently planned for the first mission. These calculations indicate the SLS program's estimated development cost has increased by greater than 30 percent. For programs that exceed this percentage, Congress may authorize continuation of the program, and if authorized, the Administrator must submit a new baseline report for the program.³ We believe these agency actions satisfy the intent of our June 2019 recommendation for NASA to calculate the development cost growth for the SLS

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

²GAO, *Performance and Accountability Report: Fiscal Year 2020*, [GAO-21-4SP](#) (Washington, D.C.: Nov. 16, 2020).

³51 U.S.C. § 30104(f).

program and determine whether development cost growth increased by 30 percent or more.

- We closed our June 2019 recommendation for NASA to update the Orion program cost estimate to reflect its April 2023 baseline launch date for the first crewed mission, known as Artemis II, as not implemented. NASA partially agreed with this recommendation, stating that providing an estimate to an earlier launch date was the most appropriate approach based on the status of the program at that time. Since we made this recommendation, the program has experienced delays and extended the forecasted launch date beyond the April 2023 baseline date. There is no longer an opportunity for NASA to take action on this recommendation now that the program no longer expects to launch in April 2023.
- We also closed our July 2018 recommendation for NASA to develop and maintain a contingency plan for ensuring a presence on the International Space Station (ISS) until a Commercial Crew Program contractor was certified as not implemented. While NASA took some actions to maintain a U.S. presence on the ISS, such as purchasing multiple seats on the Russian Soyuz spacecraft for NASA crew and providing us periodic updates on NASA's considerations for maintaining a continued presence, it did not develop and maintain a contingency plan. We are closing this recommendation as not implemented because NASA certified a Commercial Crew program contractor in November 2020. As a result, there is no longer an opportunity for NASA to take action on this recommendation.

We ask that you direct your attention to the remaining priority recommendations. We are also adding two new recommendations related to (1) establishing cost and schedule baselines for SLS Block 1B, SLS Block 2, Mobile Launcher 2, and Orion Docking System by their preliminary design reviews or as soon as practicable, and (2) establishing a time frame to develop an inventory of electronic information systems used to store agency records. This brings the total number of priority recommendations to 11. (See the enclosure for the list of recommendations.)

The 11 priority recommendations fall into the following two areas.

Monitoring program costs and execution.

NASA's acquisition management is one of the highest risks facing the agency. Many of our eight priority recommendations in this area are 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, in December 2020, we recommended that NASA 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. By establishing cost estimates by each system's preliminary design review, NASA would ensure that the project is sufficiently mature to begin development and that the cost and schedule are adequate to enable mission success with acceptable risk. NASA agreed with this recommendation. In April 2021, NASA stated that it was on track to establish baselines for SLS Block 1B and Mobile Launcher 2, and to rebaseline the Orion program to include the Docking system by September 30, 2021. 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.

In addition, in December 2019, we recommended that NASA create a life-cycle cost estimate for the Artemis III mission. NASA plans for this mission to return U.S. astronauts to the surface of the Moon by the end of 2024. NASA agreed with this recommendation but has not yet created this cost estimate. NASA officials 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 in 2024. The officials stated that the agency would establish cost and schedule commitments for projects but not the overall mission. However, to fully implement this recommendation, NASA needs to develop a life-cycle cost estimate for the lunar landing mission as a whole—Artemis III. 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 only includes a cost estimate for the first mission. As a result, there is still no comprehensive Artemis III life-cycle cost estimate.

Implementing these 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.

Ensuring cybersecurity.

We have designated information security as a government-wide, high-risk area since 1997 and 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.

NASA agreed with and is taking action to implement our three priority recommendations in this area, which are aimed at strengthening NASA’s ability to implement cyber protections. For example, in July 2019, we recommended that the NASA Administrator establish a process for conducting an organization-wide cybersecurity risk assessment. NASA agreed with this recommendation, and in April 2021, stated that it planned to implement this recommendation by September 30, 2021. NASA will need to provide evidence of its completed actions for us to consider these recommendations fully implemented.

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In March 2021, we issued our biennial update to our [High-Risk List](#), which identifies government operations with greater vulnerabilities to fraud, waste, abuse, and mismanagement or the need for transformation to address economy, efficiency, or effectiveness challenges.⁴

One of our high-risk areas—[NASA Acquisition Management](#)—centers directly on NASA.

Several other government-wide, high-risk areas also have direct implications for NASA and its operations, including (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](#),⁵ and (5) [government-wide personnel security clearance](#)

⁴GAO, *High-Risk Series: Dedicated Leadership Needed to Address Limited Progress in Most High-Risk Areas*, [GAO-21-119SP](#) (Washington, D.C.: Mar. 2, 2021).

⁵With 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*:

[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.

Copies of this report are being sent to the Director of the Office of Management and Budget and appropriate congressional committees including the Committees on Appropriations, Budget, and Homeland Security and Governmental Affairs, and Commerce, Science, and Transportation, United States Senate, and the Committees on Appropriations, Budget, and Oversight and Reform, and Science, Space, and Technology, House of Representatives. In addition, the report will be available on the GAO website at <http://www.gao.gov>.

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 Michele Mackin, Managing Director, Contracting and National Security Acquisitions, at 202-512-4841 or mackinm@gao.gov. Contact points for our Offices of 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 52 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,

A handwritten signature in black ink that reads "Gene L. Dodaro". The signature is fluid and cursive, with a large, prominent "D" at the end.

Gene L. Dodaro
Comptroller General
of the United States
Enclosure – 1

cc: The Honorable Shalanda Young, Acting Director, Office of Management and Budget
Mr. Bob Cabana, Associate Administrator, NASA
Ms. Kathy Lueders, Associate Administrator for Human Exploration and Operations,
NASA
Mr. Jeffrey Seaton, Chief Information Officer, NASA

Enclosure - Priority Open Recommendations to National Aeronautics and Space Administration (NASA)

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.

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. If NASA decides to fly the SLS Block I beyond EM-2, 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, stating that it 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 April 2021, NASA stated that it plans to establish a cost and schedule baseline for the SLS Block 1B Exploration Upper Stage and associated capabilities in 2021. Further, NASA stated that it will identify for Exploration Systems Development programs a transition point for sustainment and operations and provide a 5-year cost estimate of production and operation costs on an annual basis. NASA plans to calculate its initial estimate of production and operation costs in September 2021. 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 estimates for future SLS work.

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 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 April 2021, NASA stated that it plans to establish in 2021:

- (1) an updated baseline commitment of the Orion system for Artemis II to include a docking capability and
- (2) a separate cost and schedule baseline commitment for work required to support the SLS Block 1B Exploration Upper Stage and Mobile Launcher 2.

Further, NASA stated that it will identify for Exploration Systems Development programs a transition point for sustainment and operations and provide a 5-year cost estimate of production and operation costs on an annual basis. NASA plans to calculate its initial estimate of production and operation costs in September 2021. 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 Development and Operations capability block that encompass all life-cycle costs, including operations and sustainment.

Director: W. William Russell, Contracting and National Security Acquisitions

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

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.

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 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. In April 2021, NASA stated that it plans to establish separate cost and schedule baselines for work required to support the SLS Block 1B Exploration Upper Stage and Mobile Launcher 2 and to update the Orion baseline to include docking capability. To fully implement this recommendation, NASA needs to provide documentation that it established baselines for each capability upgrade exceeding \$250 million. 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.

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. In April 2021, NASA stated that it plans to establish a separate cost and schedule baseline commitment for work required to support the SLS Block 1B Exploration Upper Stage and Mobile Launcher 2 in 2021. 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 possible SLS missions beyond Artemis I and how its planned missions would fit within NASA's funding profile.

Director: W. William Russell, Contracting and National Security Acquisitions

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

NASA: Earned Value Management Implementation across Major Spaceflight Projects is Uneven. GAO-13-22. Washington, D.C.: November 19, 2012.

Recommendation: To improve NASA management and oversight of its spaceflight projects, and to improve the reliability of project earned value management (EVM) data, the NASA Administrator should direct the appropriate offices to modify the NASA Procedural Requirements 7120.5 to require projects to implement a formal surveillance program that: (1) Ensures anomalies in contractor-delivered and in-house monthly EVM reports are identified and explained, and report periodically to the center and mission directorate's leadership on relevant trends in the number of unexplained anomalies. (2) Ensures consistent use of work breakdown

structures (WBSs) for both the EVM report and the schedule. (3) Ensures that lower-level EVM data reconcile with project-level EVM data using the same WBS. (4) Improves underlying schedules so that they are properly sequenced using predecessor and successor dependencies and are free of constraints to the extent practicable so that the EVM baseline is reliable.

Actions needed: NASA partially agreed with this recommendation, stating that the reliability and utility of the EVM data needed to be improved but that it did not plan to implement a formal surveillance plan due to resource constraints. In April 2020, NASA stated that EVM reporting is ongoing, all projects with the EVM requirement are submitting data to the EVM central repository, and NASA has updated training and a procurement guide. NASA also stated that funding challenges still exist, which affects additional surveillance efforts and rolling out the capability to remaining centers. To fully implement this recommendation, NASA will need to take action and provide documentary support for several of its identified planned next steps to enhance EVM surveillance. Without implementing proper surveillance, NASA may be utilizing unreliable EVM data in its analyses to inform its cost and schedule decision making.

Director: W. William Russell, Contracting and National Security Acquisitions

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Orion Multi-Purpose Crew Vehicle: Action Needed to Improve Visibility into Cost, Schedule, and Capacity to Resolve Technical Challenges. GAO-16-620. Washington, D.C.: July 27, 2016.

Recommendation: To provide the Congress and NASA reliable estimates of program cost and schedule that are useful to support management and stakeholder decisions, the NASA Administrator should direct the Orion program to perform an updated Joint Cost and Schedule Confidence Level analysis including updating cost and schedule estimates in adherence with cost and schedule estimating best practices.

Actions Needed: NASA partially agreed with this recommendation, stating that the agency reviewed, in detail, the Orion program integrated cost and schedule and risk analysis methodology and determined the rigor to be a sufficient basis for the agency commitments. In April 2021, NASA stated that it plans to establish in 2021 an updated baseline commitment of the Orion system for Artemis II. To fully implement this recommendation, NASA will need to provide evidence that it updated its joint confidence level analysis when the Orion program holds its Key Decision Point D review, scheduled for fall 2021.

Director: W. 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.

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 and stated that the agency will 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 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 in 2024. The officials stated that the agency would establish cost and schedule commitments for projects but not the overall mission. However, to fully implement this recommendation, NASA needs to develop a life-cycle cost estimate for the lunar landing mission as a whole—Artemis III. 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 only includes a cost estimate for the first mission. As a result, there is still no comprehensive Artemis III life-cycle cost estimate.

Director: W. William Russell, Contracting and National Security Acquisitions

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

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 stated that it is on track to establish a baseline for SLS Block 1B and a separate baseline for Mobile Launcher 2 by September 30, 2021. NASA has decided to rebaseline the Orion program to include the Docking system. NASA also plans to complete this rebaseline by September 30, 2021. 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.

Director: W. 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.

Recommendation: The Administrator of the National Aeronautics and Space Administration (NASA) 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 2021, NASA stated that it plans to implement the recommendation by November 12, 2021. To fully implement this recommendation, NASA will need to provide documentation that it has assigned appropriate NICE framework work role codes to its positions in the 2210 IT management occupational series and assessed the accuracy of position descriptions.

Director: David Hinchman, Information Technology and Cybersecurity

Contact Information: hinchmand@gao.gov, (214) 777-5719

Cybersecurity: Agencies Need to Fully Establish Risk Management Programs and Address Challenges. GAO-19-384. Washington, D.C.: July 25, 2019.

Recommendation: The Administrator of NASA should establish a process for conducting an organization-wide cybersecurity risk assessment.

Action needed: NASA agreed with this recommendation and, in April 2021, stated that it planned to implement this recommendation by September 30, 2021. In order to close this recommendation, NASA will need to provide evidence that this process has occurred.

Director: Jennifer R. Franks, Information Technology and Cybersecurity

Contact Information: franksj@gao.gov, (404) 679-1831

Information Management: Selected Agencies Need to Fully Address Federal Electronic Recordkeeping Requirements. [GAO-20-59](#). Washington, D.C.: February 27, 2020.

Recommendation: The Administrator of the National Aeronautics and Space Administration should establish a time frame to develop an inventory of electronic information systems used to store agency records that includes all of the required elements.

Action Needed: NASA agreed with this recommendation. In April 2021, NASA stated that it continues to work toward this requirement, which will fall out of its current data inventory initiative. To fully implement this recommendation, NASA will need to provide evidence that it established a time frame to develop an inventory of electronic information systems to store agency records that includes all of the required elements.

Director: Nick Marinos, Information Technology and Cybersecurity

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