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Statement of

Stephen Jurczyk
Associate Administrator
National Aeronautics and Space Administration

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Mr. Chairman and Members of the Committee, I am pleased to have this opportunity to discuss NASA program management accomplishments and challenges.

NASA is focused on its mission of science and exploration. With consistent support from Congress, we look forward to extending human presence beyond low Earth orbit, exploring potentially habitable environments around the solar system, deepening our understanding of our home planet, pushing our observations of the universe back to the time when the first stars were forming, and opening the space frontier. In support of this mission, the Agency has developed a rigorous process for program formulation, approval, implementation and evaluation. We see excellence in program management as a core capability, and critical for enabling exploration. NASA's program management expertise brings together the people, resources and processes necessary to execute the most challenging and complex programs as we explore our world and our universe.

We take our responsibilities as stewards of limited federal resources very seriously and we will apply a robust set of available authorities to accomplish our mission efficiently and effectively. At the same time, the nation expects NASA to embrace big challenges. NASA must continue to manage risk to acceptable levels. Our missions will continue to incorporate cutting-edge technologies and to pursue the challenging goals that can only be accomplished in the hostile environment of space. NASA missions do things that have never been done before. The Parker Solar Probe will dive into the Sun's corona. The James Webb Space Telescope (JWST) will unfold itself almost a million miles from Earth and operate at extremely cold temperatures -- approximately -380 degrees Fahrenheit or -228 degrees Celsius. The Space Launch System (SLS) will enable humans to travel deep into space. These missions will employ technologies that must be developed and tested on Earth, but can only be demonstrated in space. Innovation is

the foundation of everything NASA does, and we cannot encourage innovation and discovery without accepting some level of risk and uncertainty.

NASA's challenge is to develop and improve our program/project management capabilities necessary to ensure both efficiency and accountability in what is, inevitably, a dynamic and challenging development environment. We appreciate that, in order to retain the confidence of Congress and the American people, we must execute and deliver missions on cost and on schedule. At the same time, we must identify and characterize risks as quickly as possible so we can promptly take the appropriate corrective action, whether that is mitigating, accepting, evaluating, or monitoring.

NASA Procedural Requirement 7120.5E establishes NASA's rigorous process for project formulation, development, and execution. Projects proceed through a series of key decision gates and generate cost and schedule estimates with increasing levels of fidelity as they transition through the project development lifecycle. The Agency makes the decision on whether a project should proceed out of its formulation phase and into its development phase, and establishes the cost and schedule baselines, at Key Decision Point C (KDP-C). At KDP-C, projects with a life cycle cost of $250 million or more must generate a resource-loaded schedule and produce a Joint Confidence Level (JCL) estimate for cost and schedule. A JCL calculates the probability that cost will be equal or less than the targeted cost ***and*** schedule will be equal or less then the targeted schedule date. The JCL estimate is risk-informed and executable within the available annual resources and launch constraints. For each major project, NASA establishes an independent review board. NASA's selection and vetting process ensures the necessary technical and programmatic areas are covered expertly and adequately, while simultaneously satisfying the Agency-level need to have an informed, independent assessment and recommendation to the convening authorities and decision authority at KDPs. The review board functions independently of the program or project, with members selected from outside the program or project management chain, free of any organizational or personal conflicts of interest (or have approved mitigation plans in place where necessary). The review board evaluates the inputs to the project-generated estimates and produces its own JCL results for management that considers the independently-informed risks.

With a decision to proceed at KDP-C, the Agency commits externally to deliver the project within the established baseline cost and schedule. This "Agency Baseline Commitment" (ABC) is the appropriate baseline against which to evaluate performance. Typically, the ABC is established around a 70 percent confidence level based on the JCL estimate, meaning that a degree of programmatic risk exposure remains as the project is implemented. Because some programmatic uncertainty remains following KDP-C, projects continue to generate estimates, and independent review boards continue to evaluate the project as it enters the next phases of the development life cycle. Specifically, these reviews evaluate the project's cost and schedule performance and provide forewarning should any project begin to significantly deviate from its ABC.

NASA policy does not require a program or project to continue to recalculate the JCL through the balance of the program/project development, but uses a variety of performance metrics,

including Earned Value Management, to assess how well the program or project is performing against its plan. NASA appreciates the open dialog we have had over the past several years with the Government Accountability Office (GAO) as we have refined our project management requirements and discussed best practices that might apply to our projects at different stages in their lifecycles.

NASA first established its JCL policy in 2009 by requiring a JCL of major projects coming to confirmation. This requirement was subsequently expanded to include cost and schedule ranges for projects going through Key Decision Points during the Formulation Phase. Since the Agency established its JCL policy, programmatic performance has improved as NASA has launched more projects at or nearer their original cost and schedule baselines. NASA's approach to conducting JCLs has evolved as we have gained more experience, and the Agency continues to improve the process.

NASA is currently undergoing critical development activities on several major space flight systems. These larger projects typically involve the development of a greater number of new technologies and a significantly higher degree of system complexity, which present greater risk and are more difficult to estimate and assess at the outset. Other challenges commonly found in larger projects may include extensive and critical interagency or international partnerships, high fixed labor costs, a large multi-state distributed workforce, multi-build/production projects, among others that are difficult to capture in the baseline plan estimates feeding JCL and similar analysis.

In 2015, NASA made a decision to reorganize and realign the Agency's independent assessment function toward the goals of ensuring mission success and clarifying management accountability. Programmatic Analysis Capability, which consists of resource analysis, schedule management, cost estimation, program/project performance progress and forecasting, and independent assessment activities, faced particular examination. The most significant action in support of this intent was the dissolution of the Independent Program Assessment Office (IPAO), as well as that of its umbrella organization, the Office of Evaluation (OoE). The other functioning office, the Cost Analysis Division (CAD), transitioned to the Office of the Chief Financial Officer (OCFO). Again, the intent of this action was not about eliminating independent assessment of programs and projects; that function remains vital to NASA's long-term success. Rather it is about the need to clarify accountability of the Mission Directorates and the performing Centers, as well as about enabling more of our skilled workforce toward in-line program/project work. In addition, in alignment with the Program Management Improvement and Accountability Act (PMIAA), NASA has designated a Program Management Improvement Officer reporting directly to the Associate Administrator (Chief Operating Officer), who will ensure proper fulfillment of requirements set forth in the soon-to-be-released OMB PMIAA implementation guidance.

NASA is working to strengthen Program Planning and Control (PP&C) through a series of initiatives, including the application of industry standard Earned Value Management (EVM) processes. NASA began the process of applying an in-house EVM capability in 2013, and has broadened its use in steps over time. EVM is a powerful project management tool that ensures good upfront planning and supports reliable cost and schedule performance data, including accurate Estimate-At-Completion (EAC) forecasts, and has already begun to pay dividends by

helping the Agency improve performance in both cost and schedule commitments. NASA recognizes that tailoring and honing processes to meet a project's unique risk posture and environment is key to effective management. As such, NASA continues to employ EVM policy with the goal of maximizing efficiencies.

NASA is leading an effort, through the Schedule Initiative, to strengthen schedule management by building a community to identify and reinforce schedule management best practices. NASA is updating its schedule management handbook to formally capture best practices proven to be successful within the Agency, which will enhance continuous improvements to schedule processes and capabilities. A centralized, formal PP&C training curriculum, including schedule management, is being defined to cultivate the development and grow proficiency levels within the schedule management workforce.

Contractor Accountability and Acquisition Strategy

NASA's strategic acquisition process supports obtaining or advancing the development of science, aeronautics, space technology and human exploration to fulfill the Agency's mission. NASA utilizes multiple authorities to meet these objectives. NASA's acquisition authorities include, but are not limited to: Federal Acquisition Regulation (FAR)-based contracts, grants, cooperative agreements, international agreements, and Space Act Agreements (SAA). In deciding on the best acquisition strategy for a program or project, NASA considers such factors as: resource availability; impact on the Agency workforce; maintaining core capabilities; make-or-buy planning; potential for partnerships; and the availability of the industrial base capability and supply chain needed to design, develop, produce, and support the program or project. Another important element in the development of the acquisition strategy for a program or project is the selection of contract type and associated contractor incentive structures. NASA weighs the use of various contract types and incentive structures to motivate optimal contractor performance and achieve mission success while at the same time, controlling costs and meeting schedule milestones.

Given the nature of NASA's mission, many of our procurements are for complicated research and development efforts that involve complex requirements, where the likelihood of changes makes it difficult to estimate performance costs in advance. Consequently, in many cases, a cost-plus type contract is appropriate due to these complex requirements, significant technical risk, and cost uncertainty. In order to mitigate the cost risk associated with cost type contracts, NASA utilizes the full range of contract incentives afforded in the FAR in order to properly incentivize the contractor to control costs while performing at an optimal level and delivering the products or services that meet the agency's requirements on schedule. NASA has expanded its use of fixed-price contracts where appropriate. The agency has utilized fixed price contracts when industry products are mature and flight proven, and when we are purchasing a service. The percentage of funds NASA spends on firm fixed-price contracts has increased from 26 percent in 2013 to 35 percent in 2016. These contracts can be more advantageous to the government by shifting a substantial portion of the cost risk to the contractor, thus significantly incentivizing the contractor to control costs.

Additionally, NASA has employed an innovative partnership approach to developing some needed capabilities while encouraging commercial innovation. NASA's Commercial Orbital Transportation Services (COTS) and Lunar Cargo Transportation and Landing by Soft Touchdown (Lunar CATALYST) initiatives both represent examples of NASA using Space Act Agreements to provide support to industry partners developing commercial space capabilities that could eventually support both government and commercial users. The particular approaches to be employed in future partnerships will depend on a variety of factors and on applicable lessons learned from previous partnerships.

NASA's commitment to responsible stewardship of federal resources is also reflected in the Agency's policy to detect and correct instances of fraud and corruption. This policy is important in order to maintain operational readiness, recoup lost financial resources, maintain public confidence in NASA procurement and non-procurement activities, and to prevent future fraudulent conduct. For over a decade, NASA has instituted and maintained the Office of the General Counsel Acquisition Integrity Program, a comprehensive coordination of fraud remedies program to: (1) promote transparency, accountability, and integrity throughout the acquisition process; (2) improve effectiveness of Agency operations and enhance the Agency mission by combating fraud, waste, and abuse on NASA contracts, other funding instruments, and other commitments of NASA resources; and (3) monitor and ensure the coordination of criminal, civil, contractual, and administrative (suspension and debarment) remedies. Throughout the duration of the program, the Acquisition Integrity Program has helped the federal government recover over $365 million and handled over 270 suspension and debarment related actions to protect the government's interest and ensure the integrity of the acquisition process.

GAO's most recent assessment of major NASA projects "NASA: Assessments of Major Projects" (GAO-18-280SP), provides NASA with a valued independent perspective on our major acquisitions. The report includes assessments of our 26 major projects in development. NASA recognizes some development challenges exist in these projects that have resulted in recently revised cost and schedule plans. We value the insights and recommendations provided to us in this report as an independent source of information that we use internally to inform and make new policy decisions toward programmatic improvement.

Space Launch System (SLS)/Orion Deep Space Missions

SLS, Orion, and the Exploration Ground Systems (EGS) that support them are critical capabilities for maintaining and extending U.S. human spaceflight leadership beyond low-Earth orbit (LEO) to the Moon and eventually, to Mars and beyond.. NASA plans to launch an initial, uncrewed deep space test flight of the new heavy-lift SLS and Orion spacecraft to lunar orbit on Exploration Mission-1 (EM-1), in FY 2020, in preparation for the first crewed mission, EM-2. The FY 2019 budget fully funds the Agency baseline commitment schedule to fly the Orion spacecraft on EM-2 no later than FY 2023 while enabling NASA to begin work on post EM-2 missions. FY 2018 appropriations (including direction to develop a second Mobile Launcher [ML] at the Kennedy Space Center specifically for the SLS Block 1B and a decision to use a Block 1 SLS for EM-2 for roughly $600 million), provide an opportunity to potentially accelerate the EM-2 crewed mission by 6-months relative to a currently estimated launch in mid-2023. Missions on the SLS and Orion in the 2020s will reaffirm and sustain U.S. leadership in

orbit around and on the surface of the Moon, and establish the capability to operate safely and productively in deep space for decades to come.

NASA's new deep space exploration system is seeing specific areas of targeted challenges consistent with first-time production and testing of a complex human spacecraft system for deep space. Most recently, SLS has been managing a slower-than-expected ramp up in core stage production, due in part to contamination recently seen in some of the propellant lines installed in the engine section. These issues be resolved through a continued focus on managing processes and resources at the Michoud Assembly Facility in Louisiana. NASA is also closely managing the development and testing of hardware and software to support integration at KSC, and working well with the European Space Agency to ensure delivery of the Orion service module this summer.

Some flight hardware is already in production for EM-2, including the crew module pressure vessel and European Service Module for Orion, and the boosters and early work on core stage for SLS. In addition, the direction in the FY 2018 appropriations act to build a second ML allows NASA the technical and scheduling flexibility to use the SLS Block 1 configuration for the first crewed flight on EM-2, rather than Block 1B, thereby relieving a significant technical and schedule dependency between the two. This allows NASA to extend work on the more powerful Block 1B variant to a first flight in the 2024 timeframe. NASA (as well as the General Accountability Office) is reviewing the integrated schedules for EM-1 and EM-2 and will provide an updated assessment when this review is complete. With NASA's multi-mission approach to deep space exploration, we have hardware in production for the first three missions. As teams complete hardware for one flight, they move on to the next set of flights. Extreme focus on early flights can be harmful to future missions in a multi-flight program, and focusing solely on the first flights of EM-1 for SLS and EM-2 for Orion can impact the ability to deliver a human deep space exploration system for use in the decades to come. The flight test data we will collect on EM-1 and EM-2 will ensure the success of the exploration campaign in the years to come.

James Webb Space Telescope

Webb's flight hardware is comprised of two elements. One half of the observatory – the optical telescope and science payload – is complete and has been tested successfully. The other half of the observatory – the sunshield and the spacecraft bus – is complete and ready for testing. Earlier this year, the Webb Standing Review Board (SRB) assessed the project's plans for the time and cost necessary to complete development, in light of challenges encountered during spacecraft and sunshield integration, and additional time needed to integrate these two elements into final flight configuration and complete testing. The SRB estimated that, at a 70 percent joint cost and schedule confidence level, launch readiness will be approximately May 2020, instead of the baseline launch readiness estimate of October 2018. We also implemented leadership changes and revised oversight strategy to mitigate issues identified by the SRB and recommendations by the upcoming Independent Review Board report.

Subsequent to the SRB's assessment, NASA established an external Webb Independent Review Board (IRB), chaired by Thomas Young, a highly respected NASA and industry veteran who is often called on to chair advisory committees and analyze organizational and technical issues. The

Webb IRB is evaluating all factors, including those identified by the SRB as influencing JWST's success, to ensure that NASA's approach to completing Integration and Test (I&T), the launch campaign, and the commissioning of the Webb Telescope is appropriate for the Agency's next flagship observatory.

The Webb IRB, convened by NASA's Science Mission Directorate, includes individuals with extensive experience in program and project management, schedule and cost management, systems engineering, risk management, and the integration and testing of large and complex space systems, including systems with science instrumentation, unique flight hardware, and science objectives similar to Webb.

The Webb IRB review process will take approximately two months. Once the review concludes, the board members will deliver a presentation and final report to NASA providing their observations, concerns, findings, and recommendations. NASA will review that feedback along with other inputs to determine updates to the remaining JWST development schedule and cost, which NASA plans to provide to Congress in a report this summer.

Conclusion

We take our responsibilities as stewards of limited federal resources very seriously and we recognize that executing our projects consistent with our baseline cost and schedule commitments is critical to the continued support of Congress and our continued success on behalf of the American people. Excellence in program and project management is a requirement if we are to successfully develop and operate technologies and systems for the human exploration of deep space; encourage the creation of a thriving commercial space economy in LEO and beyond; execute robust programs of robotic missions to monitor the Sun and Earth, explore the planets of our solar system, and observe the universe beyond; and continue to make aviation safer, more efficient, and more environmentally friendly.

Thank you for the invitation to testify before you today, and I look forward to answering any questions you may have.