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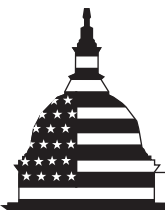
NASA

Issues Implementing the  
NASA Authorization Act of  
2010

Statement of

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## Why GAO Did This Study

NASA projects drive critical innovation in and understanding of space, but our work has shown that most cost more and take longer to develop than planned. Today's fiscal environment highlights why that pattern is unsustainable, now more than ever.

The NASA Authorization Act of 2010 challenged NASA to develop new technologies for space exploration. GAO issued two legal opinions this summer based on a request from several members of the House of Representatives about whether NASA's actions related to the Constellation program complied with restrictions in the 2010 Appropriations Act. Building on that request and prior GAO work, this testimony discusses (1) how the Continuing Appropriations Act of 2011 continues the restrictions in the fiscal year 2010 Appropriations Act, and how they relate to the recently enacted NASA Authorization Act of 2010 and (2) steps NASA should take to increase the likelihood of success as it implements its new direction. This statement is based on prior and ongoing GAO work. The audit work was done in accordance with generally accepted government auditing standards.

## What GAO Recommends

GAO has made several recommendations in prior work and NASA has implemented many. We are not making any new recommendations in this testimony, but are considering recommendations in our ongoing work.

View [GAO-11-216T](#) or key components. For more information, contact Cristina Chaplain at (202) 512-4841 or [chaplainc@gao.gov](mailto:chaplainc@gao.gov) or Susan Poling at (202) 512-2667 or [polings@gao.gov](mailto:polings@gao.gov)

## NASA

### Issues Implementing the NASA Authorization Act of 2010

## What GAO Found

NASA's fiscal year 2010 Appropriations Act contained a restriction prohibiting NASA from terminating any program, project, or activity of the Constellation program or creating new ones until provided for in a subsequent appropriations act. Currently, NASA is operating under a continuing resolution—a temporary funding mechanism that allows the agency to operate until a new appropriations bill is signed into law. The continuing resolution continues the restrictions of the 2010 appropriations Act. Therefore, NASA must carry out the recently enacted Authorization Act but without terminating or creating programs, projects, or activities of the Constellation program. In recent legal opinions, GAO found NASA had not violated any restrictions of its 2010 Appropriations Act. GAO found that while NASA conducted planning activities, this did not violate the restriction prohibiting it from using funds to begin a new program, project, or activity. Second, GAO found that NASA did not terminate a program, project, or activity, as it continued to fund the existing programs, projects, and activities. As long as NASA does not improperly create or terminate a program, project, or activity, it has discretion in how to carry out the Constellation program.

Regardless of its current restrictions, NASA will need to continue to implement new ways of doing business going forward to reduce acquisition risks that have plagued projects in the past. Critical to this will be ensuring the needs and expectations for a project match the resources available for it, effectively managing costs, increasing transparency into critical phases of development, and strengthening accountability. GAO work has shown a project's likelihood of success can increase when it has developed a sound business case, based on high levels of knowledge, before committing to a new development effort that matches the project's requirements to resources that are available or reasonably expected for it—including time, money, technology, and people. Over past several years NASA has taken steps to incorporate a more knowledge-based approach to managing its projects and instill a stronger focus on managing costs. However, recent studies and our ongoing work indicate that NASA has not fully addressed the following.

- Establish a common measure to assess design stability before allowing programs to move from the design phase to the test and integration phases of the development process. Recent studies and our work have tied acquisition problems to design issues.
- Provide enough transparency in the early, critical phases of development to help Congress identify risks and inefficiencies and ensure earlier accountability. For example, although NASA has already spent over \$9 billion combined on the Ares and Orion projects, they have yet to be baselined and therefore NASA is not required to publicly report cost and schedule data.
- Enhance its oversight and accountability functions to ensure that projects base their decisions on sound knowledge so that inherent risks are not exacerbated by poor management and oversight practices.

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Mr. Chairman and Members of the Committee:

Thank you for inviting us here today to discuss issues NASA faces as it transitions to and implements the direction outlined by the NASA Authorization Act of 2010.<sup>1</sup> The steps that NASA takes to implement the direction in the Authorization Act will set the stage for whether it can accomplish the goals of the authorization within the time frames and resources as directed. NASA projects have produced ground-breaking research and advanced our understanding of the universe. However, our work shows that another common theme binds most of the projects—they cost more and take longer to develop than planned. Frequently they are approved without evidence of a sound business case that ensures a match between requirements and reasonably expected resources. In today's fiscal environment, it is clear that this condition cannot be sustained.

In March, several members of the House of Representatives asked us for information and our views on, among other things, whether NASA complied with restrictions in the 2010 Exploration appropriation when it took certain actions pertaining to the Constellation program. Based on that request, we issued two legal opinions this summer.<sup>2</sup> The NASA Authorization Act of 2010, as signed into law by the President in October 2010, challenges NASA to develop new human spaceflight systems and use the commercial space industry and international partnerships to develop new technologies for space exploration, but NASA must still comply with the restrictions in the fiscal year 2010 Exploration appropriation. Regardless of the changes resulting from the Authorization Act, one thing that will remain constant is NASA's need to efficiently and effectively manage programs and projects. Against this backdrop, our testimony today will focus on: (1) how the Continuing Appropriations Act, 2011<sup>3</sup> continues the restrictions in the fiscal year 2010 Commerce, Justice, Science, and Related Agencies Appropriations Act,<sup>4</sup> and how they relate to the recently enacted NASA Authorization Act and (2) steps NASA should take to reduce its acquisition risk and increase the likelihood of success as it implements its new direction outlined in the NASA Authorization Act.

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<sup>1</sup> Pub. L. No. 111-267, 124 Stat. 2805 (Oct. 11, 2010).

<sup>2</sup> B-320091, July 23, 2010; B-319488, May 21, 2010.

<sup>3</sup> Pub. L. No. 111-242, 124 Stat. 2607 (Sept. 30, 2010).

<sup>4</sup> Pub. L. No. 111-117, div. B, tit. III, 123 Stat. 3034, 3113 (Dec. 16, 2009).

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In preparing this statement, we relied on completed and ongoing work. Our audit work examining best practices for system development and assessing NASA's major projects was performed in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Appropriation Restrictions Remain in Effect

In October 2009, the Review of U.S. Human Spaceflight Plans Committee issued a report which concluded that the human spaceflight program is on an "unsustainable trajectory."<sup>5</sup> The conference report accompanying the Consolidated Appropriations Act, 2010 stated that "the committee's work raises issues requiring thoughtful consideration by the Administration and the Congress" but that "it is premature for the conferees to advocate or initiate significant changes to the current program absent a bona fide proposal from the Administration and subsequent assessment, consideration and enactment by Congress."<sup>6</sup> Accordingly, Congress appropriated about \$3.7 billion for "exploration research and development activities," but provided that none of the funds from 2010 or prior years

"shall be available for the termination or elimination of any program, project or activity of the architecture for the Constellation program nor shall such funds be available to create or initiate a new program, project or activity, unless such program termination, elimination, creation, or initiation is provided in subsequent appropriations Acts."<sup>7</sup>

These are the restrictions that we addressed in our recent legal opinions. Currently, NASA is operating under the Continuing Appropriations Act, 2011 (Continuing Resolution), which Congress enacted on September 30. Continuing resolutions are temporary appropriations acts that Congress

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<sup>5</sup> Review of U.S. Human Spaceflight Plans Committee, *Seeking a Human Spaceflight Program Worthy of a Great Nation*, available at [www.nasa.gov/offices/hsf/home/index.html](http://www.nasa.gov/offices/hsf/home/index.html) (last visited Nov. 12, 2010). The Committee is commonly known as the Augustine Commission, after its chairman, Norman R. Augustine.

<sup>6</sup> H.R. Rep. No. 111-366, at 755 (2009).

<sup>7</sup> Commerce, Justice, Science, and Related Agencies Appropriations Act, 2010, Pub. L. No. 111-117, div. B, title III, 123 Stat. 3034, 3113, 3143 (Dec. 16, 2009).

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enacts to keep existing programs functioning after the expiration of previous budget authority. Most continuing resolutions, including the one under which NASA is currently operating, incorporate by reference the conditions and restrictions contained in prior years' appropriations acts or the appropriations bills currently under consideration. In this case, the Continuing Resolution provided amounts to NASA

“at a rate for operations as provided in the applicable appropriations Acts for fiscal year 2010 and *under the authority and conditions provided in such Acts, for continuing projects or activities . . . that are not otherwise specifically provided for in this Act.*”<sup>8</sup>

(Emphasis added.) Like most continuing resolutions, the current Continuing Resolution also prohibits new activities and projects for which funds were not available in the prior fiscal year.<sup>9</sup>

About a month ago, Congress enacted the NASA Authorization Act of 2010 (Authorization Act),<sup>10</sup> which provided specific direction on a number of issues related to human space flight and space technology. The Authorization Act requires that NASA undertake a number of initiatives, but NASA still needs appropriations to carry out these activities. As you know, under the Constitution, “no Money shall be drawn from the Treasury, but in Consequence of Appropriations made by Law.”<sup>11</sup> The Continuing Resolution provides funds for NASA, but only “under the authority and conditions provided” in the fiscal year 2010 Exploration appropriation.<sup>12</sup>

One of the conditions in the fiscal year 2010 NASA appropriation is the limitation discussed in our recent opinions that funds are not available “for the termination or elimination of any program, project or activity of the architecture for the Constellation program” nor are they available to “create or initiate a new program, project or activity, *unless* such program termination, elimination, creation, or initiation is provided in subsequent

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<sup>8</sup> Pub. L. No. 111-242, § 101.

<sup>9</sup> Pub. L. No. 111-242, § 104.

<sup>10</sup> Pub. L. No. 111-267.

<sup>11</sup> U.S. Const. art. I, § 9, cl. 7.

<sup>12</sup> Pub. L. No. 111-242, § 101.

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appropriations Acts” (emphasis added). Thus NASA must still comply with the restrictions contained in the fiscal year 2010 Exploration appropriation. What this means for NASA’s implementation of the Authorization Act is that NASA must carry out the Authorization Act<sup>13</sup> but without terminating, eliminating any program, project, or activity of the Constellation program and without creating or initiating a new program, project, or activity.<sup>14</sup>

Because the continuing resolution subjects NASA’s current appropriation to the fiscal year 2010 restriction, our two opinions this year may offer NASA some guidance as it goes forward since we analyzed various actions related to the Constellation program to determine if NASA was complying with the restriction. In both opinions, we concluded that NASA did not violate the restrictions in the fiscal year 2010 Exploration appropriation. In May,<sup>15</sup> we noted that Congress prohibited NASA from using Exploration funds to bring into being a new program, project, or activity.<sup>16</sup> We concluded that NASA did not violate this restriction when it convened study teams to conduct planning activities. Agencies must conduct planning activities as part of the budget process, and the prohibition in the Exploration appropriation did not preclude the use of funds for planning

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<sup>13</sup> “[W]hen two statutes are capable of co-existence, it is the duty of the courts, absent a clearly expressed congressional intention to the contrary, to regard each as effective.” *Andrus v. Glover Construction Co.*, 446 U.S. 608, 618-619 (1980).

<sup>14</sup> In addition to the restriction pertaining specifically to the Constellation program, the Continuing Resolution also bars the use of funds “to initiate or resume any project or activity for which appropriations, funds, or other authority were not available during fiscal year 2010.” Pub. L. No. 111-242, § 104.

<sup>15</sup> B-319488, May 21, 2010.

<sup>16</sup> A “program, project, or activity” is “[a]n element within a budget account. For annually appropriated accounts, the Office of Management and Budget (OMB) and agencies identify [programs, projects, or activities] by reference to committee reports and budget justifications.” GAO, *A Glossary of Terms Used in the Federal Budget Process*, [GAO-05-734SP](#) (Washington, D.C.: September 2005).

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purposes. Further, NASA's planning activities did not result in the use of funds to create or initiate a new program, project, or activity.<sup>17</sup>

In July,<sup>18</sup> we considered whether NASA improperly terminated or eliminated any program, project, or activity of the Constellation program. We determined that NASA had five programs, projects, or activities within the "Constellation Systems" category:

- Program Integration and Operations,
- Orion Crew Exploration Vehicle,
- Ares I Crew Launch Vehicle,
- Ares V Cargo Launch Vehicle, and
- Commercial Crew and Cargo.<sup>19</sup>

We concluded that NASA did not terminate or eliminate any program, project, or activity of the Constellation program because NASA continued to obligate Exploration appropriations to all five of the Constellation programs, projects, and activities. NASA diverted no Exploration funds to create a new program, project, or activity. We also noted that as long as NASA does not improperly create or terminate a program, project, or activity, the agency has discretion in how it carries out the Constellation program consistent with Congress's statutory direction. Shifts in priority do not in themselves constitute the termination or elimination of a program, project, or activity.

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<sup>17</sup> NASA's actions differed from those of the Department of Energy (DOE) when it began to implement a loan guarantee program. B-308715, Apr. 20, 2007. There we found that DOE had staffed and operated a program office, drafted regulations, and solicited and evaluated "pre-applications." Therefore, we concluded that DOE violated a statutory provision that barred it from using funds to "implement or finance" the loan guarantee program. In contrast, NASA had not created a new office or drafted any regulations; instead, NASA staff developed preliminary plans.

<sup>18</sup> B-320091, July 23, 2010.

<sup>19</sup> NASA, *Fiscal Year 2010 Budget Estimates*, at EXP-2, available at [www.nasa.gov/news/budget/FY2010.html](http://www.nasa.gov/news/budget/FY2010.html) (last visited Nov. 10, 2010).

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## Steps NASA Should Take to Reduce Acquisition Risk and Increase the Likelihood of Success as it Implements the Authorization Act

Regardless of its current restrictions, once NASA begins to implement the new direction outlined in the Authorization Act, it will need to adopt new ways of doing business—particularly with respect to matching requirements to resources, managing costs, increasing transparency into the most critical phases of development, and strengthening accountability—to reduce acquisition risk and increase likelihood of success. Our work has consistently shown that NASA’s projects cost more and take longer to develop than planned. This year, for example, we reported that 10 NASA projects that had their cost and schedule baselines set within the last 3 years experienced cost growth averaging \$121 million, or 18.7 percent, and schedule growth averaging 15 months.<sup>20</sup> Many of the projects we reviewed experienced challenges developing new or retrofitting older technologies, stabilizing engineering designs, and managing the performance of contractors and development partners. These challenges, and the significant cost growth experienced by NASA projects after they were baselined, occurred as a result of projects being approved with considerable unknowns about requirements, technologies, costs, or other resources. Our reports have highlighted the risk that the Constellation Program was headed in this same direction. For example, in 2009 we reported that Constellation program had significant technical and design challenges that until resolved would hinder NASA’s ability to reliably estimate the time and funding needed to execute the program. In addition, the Constellation program’s poorly phased funding plan has affected the program’s ability to deal with technical challenges.<sup>21</sup> Similarly, the Review of U.S. Human Spaceflight Plans Committee reported that “the U.S. human spaceflight program appears to be on an unsustainable trajectory. It is perpetuating the perilous practice of pursuing goals that do not match allocated resources.”<sup>22</sup>

While space development projects are complex and difficult by nature, and most are one-time efforts, the nature of the work should not preclude NASA from being accountable for achieving what it promises when requesting and receiving funds. Moreover, measures can be taken to better

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<sup>20</sup> GAO, *NASA: Assessments of Selected Large-Scale Projects*, [GAO-10-227SP](#) (Washington, D.C.: Feb. 1, 2010).

<sup>21</sup> GAO, *NASA: Constellation Program Cost and Schedule Will Remain Uncertain Until a Sound Business Case Is Established*, [GAO-09-844](#) (Washington, D.C.: Aug. 26, 2009).

<sup>22</sup> Review of U.S. Human Spaceflight Plans Committee, *Seeking a Human Spaceflight Program Worthy of a Great Nation*, available at [www.nasa.gov/offices/hsf/home/index.html](http://www.nasa.gov/offices/hsf/home/index.html).



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position programs for success, which we believe should be emphasized as the Authorization Act is implemented. Specifically, our past work has shown that developing a sound business case, based on matching requirements to available and reasonably expected resources—including time, dollars, technology, and people—before committing to a new development effort, reduces risk and increases the likelihood of success.<sup>23</sup> GAO’s work has shown that how well an agency matches resources with requirements sets the stage for the eventual outcome—desirable or problematic—of the project. The match is ultimately achieved in every development project, but in successful development projects, it occurs before significant commitments and investments are made.

We have reported that steps agencies should take prior to undertaking new projects include:

- Prioritizing investments so projects can be fully funded and it is clear where projects stand in relation to the overall portfolio.
- Following an evolutionary path toward meeting needs rather than attempting to satisfy all needs in a single step.
- Matching requirements to resources—that is, time, money, technology, and people—before undertaking a new development effort.
- Researching and defining requirements before projects start and limiting changes after they start.
- Ensuring cost estimates are complete, accurate, and updated regularly.
- Committing to fully fund projects before they begin.
- Ensuring critical technologies are proven to work as intended before projects start.
- Assigning more ambitious technology development efforts to research departments until they are ready to be added to future generations (increments) of a project.
- Using systems engineering to close gaps between resources and requirements before launching the development process.<sup>24</sup>

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<sup>23</sup> GAO, *Defense Acquisitions: Key Decisions to Be Made on Future Combat System*, [GAO-07-376](#) (Washington, D.C.: Mar. 15, 2007); *Defense Acquisitions: Improved Business Case Key for Future Combat System’s Success*, [GAO-06-564T](#) (Washington, D.C.: Apr. 4, 2006); *NASA: Implementing a Knowledge-Based Acquisition Framework Could Lead to Better Investment Decisions and Project Outcomes*, [GAO-06-218](#) (Washington, D.C.: Dec. 21, 2005); *NASA’s Space Vision: Business Case for Prometheus 1 Needed to Ensure Requirements Match Available Resources*, [GAO-05-242](#) (Washington, D.C.: Feb. 28, 2005).

<sup>24</sup> GAO, *Space Acquisitions: Major Space Programs Still at Risk for Cost and Schedule Increases*, [GAO-08-552T](#) (Washington, D.C.: Mar. 4, 2008).

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Our work has shown that projects that have not attained the level of knowledge needed to support a sound business case that proceed to development have been plagued by cost overruns, schedule delays, decreased capability, and overall poor performance. This phenomenon is not unique to NASA—the Department of Defense and the Department of Homeland Security experience the same outcomes with many of their acquisition programs. If the knowledge the project has attained does not confirm the business case on which the acquisition was originally justified, the best practice organizations we have studied do not allow the project to proceed.

Critical to success is performance and requirements flexibility in early phases of development. NASA needs to be open to reducing expectations, deferring them to future projects, or to investing more resources up front to eliminate gaps between resources and expectations. In successful projects we have studied, requirements were flexible until a decision was made to commit to development given the desire to obtain the capability as soon as possible. This makes it acceptable to reduce, eliminate, or defer some capabilities so the project's requirements could be matched with the resources available to deliver it within the desired time frame.

In addition to ensuring projects establish a business case before they are approved for long-term financial commitments, both program officials and senior leaders need to be held accountable for executing the project by the most efficient and effective means. To that end, the NASA projects need to be structured to ensure that decision makers, including NASA and Congress, have the insight necessary to make informed, knowledge-based decisions and hold project managers accountable for managing projects effectively and efficiently. We have reported that during development, NASA should ensure its decision makers do the following:

- Use quantitative data and demonstrable knowledge to make go/no-go decisions, covering critical facets of the project such as cost, schedule, technology readiness, design readiness, production readiness, and relationships with suppliers.
- Establish consistent metrics to measure design readiness and ensure they are met before development proceeds.
- Empower project managers to make decisions about the direction of the project and to resolve problems and implement solutions and hold them accountable for their choices.
- Ensure contractors are holding suppliers accountable to deliver high-quality parts for their products through such activities as regular

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supplier audits and performance evaluations of quality and delivery, among other things.

- Encourage project managers to share bad news, and promote collaboration and communication.

Over the past several years NASA has moved to incorporate a more knowledge-based approach to managing its development projects and instill a stronger focus on managing costs. For example, NASA has taken steps to enhance cost-estimating methodologies and ensure that independent estimates are used to provide decision makers with an objective representation of likely project cost and schedule. As a result, NASA has begun to budget its projects at a higher degree of confidence. Broader steps NASA is taking focus on strengthening program and project management, facilitating monitoring of contractor cost performance, improving agencywide business processes, and improving financial management.<sup>25</sup>

While NASA has laid out a broad plan for reducing acquisition risk, more needs to be done as the Authorization Act is implemented. For example,

- NASA does not use a common measure to assess design stability before allowing programs to move from the design phase to the test and integration phases of the development process. At the same time, our studies and others have found that significant cost growth occurs in these phases and, in some instances, has tied these problems to issues related to design. Moreover, a recent study by the National Research Council found that the critical design review milestone for many missions may be held prematurely—driven by schedule rather than driven by design maturity. GAO reports and this study have found that critical design review approval of an immature design can cause downstream problems for complex acquisitions such as integration difficulties and late changes.
- NASA does not provide enough transparency in the early, critical phases of development to help Congress identify risks and inefficiencies and ensure earlier accountability. Currently, NASA only begins to publicly share cost and schedule information for projects that have been formally approved to enter development. To add some perspective to this timing, neither the Ares nor Orion projects have reached this point, despite having spent over \$9 billion dollars combined; and the James Webb Space Telescope (JWST) just reached

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<sup>25</sup> GAO, *High-Risk Series: An Update*, [GAO-09-271](#) (Washington, D.C.: January 2009).

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this point in 2008, despite having spent nearly \$2 billion prior to that time. While there is a need to allow projects a period of time for discovery and to pursue different concepts—particularly highly complex efforts such as JWST—inadequate transparency into their progress for what sometimes amounts to 5 or more years can preclude effective oversight and accountability and make it even more difficult to stop projects that are not on track to meet the agency’s goals with available resources.

- An independent study released just last week of problems affecting the James Webb Telescope program concluded that significant changes are still needed in NASA’s oversight and accountability functions to ensure that programs base their decisions on sound knowledge, noting that NASA’s governance policy is not consistent with accountability for project execution. In particular, the study found that lack of clear lines of authority and accountability contributed to a lack of executive leadership in resolving the broken JWST life-cycle cost baseline. The study found that JWST’s flawed budget should have been discovered as part of the Goddard Spaceflight Center’s execution responsibility, but the interpretation of the agency’s governance policy on the role of the center in this regard is ambiguous and not uniformly interpreted within NASA. The study also noted that ongoing, regular independent assessment and oversight processes at the agency are missing.

Because NASA is pushing the exploratory envelope, it is reasonable for unexpected problems and discoveries to occur. Not all projects will go as planned. On the other hand, it is clear from recent findings from the JWST Independent Review, the National Research Council (NRC), and GAO’s continued assessments of major projects that inherent risks to spacecraft development are being exacerbated by poor management and oversight practices. While NASA still needs to make fundamental changes to how it plans, manages, and oversees its major investments, it will be a challenging endeavor as the agency is faced with implementing a new direction for its human spaceflight programs, retiring the space shuttle, and balancing investments among its science portfolios. Our reports, as well as recent studies by the NRC and the JWST Independent Review Team, however, provide a map that can help NASA adopt best practices and more effectively manage investments. As stressed in our 2009 high-risk report, to maximize NASA’s investment dollars, implementation of these steps needs to be complemented by vigorous executive leadership to foster the expansion of a business-oriented culture and a sustained commitment to identify and take action on projects that are not achieving

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cost, schedule, or performance goals upon which they were based when they were initiated.<sup>26</sup>

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Mr. Chairman, this concludes our prepared statement. We would be glad to answer any questions that you or Members of the Committee have at this time.

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<sup>26</sup> [GAO-09-271](#).

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# Appendix I: GAO Contacts and Staff Acknowledgments

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## GAO Contacts

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## Staff Acknowledgments

In addition to the contacts above, Thomas H. Armstrong (Assistant General Counsel for Appropriations Law), Julia Matta (Assistant General Counsel for Budget Issues), Shelby S. Oakley (Assistant Director), Kristine R. Hassinger, Morgan Delaney-Ramaker, Omari Norman, and Jose Ramos all made key contributions to this testimony.

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