CORRECTIVE ACTION PLAN

In Response to Recent Programmatic Performance and
NASA's Designation on GAO's High Risk List

14 December 2018

Contents

Purpose

This Corrective Action Plan (hereinafter referred to as the "Plan," or the "CAP") encompasses a collection of specific initiatives and areas of emphasis that the National Aeronautics and Space Administration (the "Agency," or "NASA") commits to pursuing as it matures Agency program and project management policies and processes, as well as related surveillance of contractors through appropriate insight and oversight. NASA developed this Plan in response to recent challenges in cost and schedule growth experienced by several of the Agency's highest profile missions, as well as the continued inclusion of NASA's acquisition practices in the Government Accountability Office's (GAO) biennial High Risk Report. The Plan is also developed in support of the Agency's steadfast commitment to good governance and effective stewardship of the resources entrusted to it. The overall goal of the Plan is to strengthen the Agency's cutting-edge program and project management efforts across the board and to improve transparency for NASA's stakeholders.

Approach

GAO originally designated NASA's acquisition management as a "high risk" area in its inaugural High-Risk List released in 1990, citing what was at the time considered a history of persistent cost growth and schedule delays in the majority of the Agency's major products. In 2007, NASA established a Corrective Action Plan consisting of five broad focus areas and seven tactical initiatives that provided an Agency-wide coordinated approach to improve NASA's program and project management activities. The initiatives included in the 2007 Plan were all successfully closed by the end of 2012, and GAO has acknowledged that considerable progress toward strengthening and integrating NASA's acquisition management functions resulted from those efforts. Both the 2015 and 2017 High Risk Reports credited NASA with fully meeting three of the five criteria for removal from the High Risk List (leadership commitment, action plan, and monitoring), as well as partially meeting the remaining two criteria (capacity and demonstrated progress).

In September 2018, Agency senior leadership determined that a new CAP was necessary to continue driving improvements in NASA's program and project management policies and processes. NASA's Associate Administrator (AA) and the Chief Financial Officer (CFO) jointly issued a memorandum to this effect on September 6, 2018. The memo required that a new Plan be in place by the end of the 2018 calendar year, and established a working group comprised of relevant experts from across the Agency to develop the initiatives. It also called for the creation of a steering committee to provide guidance to the working group at key milestones in the development process. Finally, top-level direction for the new Plan would reside with the NASA AA (in coordination with the CFO), with official approvals routed through the Agency Program Management Council (APMC).

The working group held a kick-off on September 19, 2018, and met or communicated daily throughout the development of the Plan. The working group considered a variety of inputs during the formulation of each of the individual initiatives that comprise the Plan. These inputs include, but are not limited to, previous GAO High Risk Reports, GAO's 2018 Priority Recommendations Letter, reports issued by GAO during its annual programmatic reviews of NASA's major projects, as well as internal analyses conducted by the Agency. Direction from NASA senior leadership, the advice of subject matter experts drawn from across NASA, and feedback from GAO were also considered. Agency-wide stakeholder review was

conducted via the APMC community during November 2018, and the final document was approved at the December 6, 2018 APMC meeting.

Please see Appendix B for working group and steering committee membership. Please see Appendix C for a full development timeline that includes all APMC and steering committee meetings, as well as iterative touchpoints with GAO. Appendix D includes a list of spelled-out acronyms used in this document.

NASA Legacy of Programmatic Improvements: the 2007 Corrective Action Plan

NASA sees excellence in program and project management as a core capability and critical if the Agency is to successfully develop and operate technologies and systems for the human exploration of deep space; 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. To that end, the Agency continually assesses how to manage projects and prepare people to lead. As a result, NASA's project management and oversight practices have seen significant improvement since the Agency was first added to GAO's High Risk List in 1990.

A key milestone in the maturity of NASA's programmatic discipline was the Corrective Action Plan developed in 2007. The 2007 plan contained seven initiatives to address potential shortcomings in NASA's acquisition management practices. Those initiatives were: (1) Program/Project Requirements and Implementation Practices; (2) Agency Strategic Acquisition Approach; (3) Contractor Cost Performance Monitoring; (4) Project Management Training and Development; (5) Improve Life-Cycle Cost/Schedule Management Processes; (6) Integrated Enterprise Management Program (IEMP) Process Improvement; and, (7) Procurement Processes and Policies. Six of these seven initiatives were operationalized by 2012 through the introduction of new requirements, policies, procedures, training, and other tools to improve how we manage our major acquisitions and ensure our workforce has the necessary associated tools. In 2014, NASA declared that the one outstanding initiative, Contractor Cost Performance Monitoring, was closed. This initiative was originally designed to improve the availability of contractor data to support performance monitoring of programs and projects. The initiative would have been accomplished through the use of enhanced business systems and changes to the contractor cost reporting process. NASA performed analyses at that time to identify gaps in the existing key business systems and concepts and courses of action that could be implemented to address those gaps. As a result of this analysis, NASA and GAO agreed to replace the original objective, and instead instituted several process improvements designed to achieve greater insight into project performance, including contractor cost performance.

These operationalized initiatives have yielded the desired results for NASA's small and medium-class missions, though the Agency recognizes that there is still work to be done. In particular, NASA needs to do better managing our larger, more complex projects, which typically involve the development of a significant number of new technologies, greater risk, and early estimation challenges. The 2018 Corrective Action Plan provided below intends to build upon the successful legacy of its 2007 predecessor, ensuring that NASA continues to enhance its programmatic rigor while pushing forward with the activities that will be necessary to initiate a bold new era of discovery.

Corrective Action Plan Overview

Ownership and Responsibilities

The NASA AA assumes ownership of the CAP. The Office of the Chief Financial Officer, Strategic Investments Division (OCFO SID), is responsible for maintaining CAP documentation, tracking and reporting progress against the CAP on an annual basis, and conducting any process updates for subsequent iterations on the CAP. Lead Executives or Lead Organizations as described in the various initiatives in the CAP are responsible for executing upon the initiatives as written, and reporting progress to either OCFO SID or other specific forums as described. The Supporting Organizations, where listed, will support the identified Lead Executives or Organizations in execution of the initiatives, as necessary.

Initiatives

The Corrective Action Plan is comprised of a set of initiatives evaluated by the working group and cross-Agency stakeholders to provide value for Agency acquisition management improvements. The initiatives are categorized by the following actionable characteristics:

- **Implement:** Initiatives that NASA has determined should proceed and become part of regular Agency business cadence. Any actions taken to support execution of the described initiatives will follow all established Agency control and oversight boards, as applicable, to ensure no unintended consequences are experienced.
- **Pilot:** Initiatives that NASA has determined show promise to provide value related to Agency acquisition management, but will initially be executed to a limited degree in scope and time until the Agency assesses and reaffirms continued execution.
- **Research:** Initiatives that are less conceptually mature but warrant dedicated effort to explore and develop with respect to generating value for Agency acquisition management.

Each initiative in the CAP includes the following sections:

- **Lead Executive/Organization:** The individual or office responsible for leading the initiative as described, and periodically reporting progress to OCFO SID for internal and external communications and for coordination purposes.
- **Supporting Organization(s):** The organization(s) required to support the Lead Executive/Organization execute the initiative as described. While the organizations listed are necessary and required to support the initiative, it is not necessarily an exhaustive list, as the Lead Executive/Organization may call on other Organizations to support.
- **Initiative Description:** A brief high-level summary of the initiative.
- **Background/Current State:** A description of the status quo and, as necessary, an overview of relevant background information and any policies, procedures, constraints, or other areas influencing the status quo.
- **Expected Benefits:** A review of the expected payoff from conducting and completing the described initiative.
- **Recent Accomplishments:** Where applicable, a review of recent progress and accomplishments with regard to the described initiative. Some initiatives already have momentum, which will be reflected here. Others, such as research initiatives for new ideas, will not have content for this section.

- **Planned Next Steps:** A high-level description of the planned progress for the initiative to occur over a period ranging up to two years.
- **Output and Outcome Metrics:** Where applicable, a list of appropriate methods of measurement to track progress and effectiveness of the described initiative.
- **Interdependencies:** Where applicable, a description of key dependencies that necessitate coordination or cognizance in support of initiative success.
- **Impediments and Challenges:** A brief description of possible pitfalls, risks, impediments, and challenges that can be reasonably expected to occur during execution of the described initiative.
- **Required Resources:** A preliminary assessment of possible resource requirements for successful execution of the described initiative. This does not represent committed resources and does not reflect a refined estimate of resources. Any funds required to execute any initiatives will proceed through the regular budget formulation processes for Agency approval.

Areas of Emphasis

NASA will emphasize adherence to current policies and practices in certain areas listed in this section, and encourage improvements that better position the Agency to manage cost and schedule performance. In contrast to the initiatives in the CAP, Areas of Emphasis do not currently have direct, measureable plans of action for the purposes of the Corrective Action Plan, but nevertheless are deemed critical to improving Agency performance.

Severability

The initiatives contained herein are interrelated with respect to their connection to improving Agency acquisition management, but are not mutually dependent on one another for execution purposes, unless otherwise identified. As such, if the Agency should determine that any individual initiative be removed from the Corrective Action Plan for any reason, the Plan and remaining initiatives will remain in effect.

Progress Tracking and Reporting

Each initiative in the CAP includes planned next steps and metrics, where applicable. The Lead Organization(s) cited in the CAP will pursue actions as described. A subset of initiatives include specific forums for reporting progress or deliverables (e.g., APMC or Business Performance Review (BPR)). For all efforts in the CAP, OCFO SID will conduct an annual checkpoint to measure progress against the CAP. For odd-numbered years, the progress checkpoint will occur in the summer months. For even-numbered years, the progress checkpoint will be folded into the CAP update (see below). OCFO SID will provide the overall progress and status update to the AA. OCFO SID will also share and discuss progress with GAO annually at a minimum, and more often when applicable.

Corrective Action Plan Update Schedule

NASA will keep this Corrective Action Plan current and up to date until GAO removes the High Risk designation for the Agency. The update process in which initiatives and/or Areas of Emphasis are added, revised, or resolved will occur in the approximate period of May to September of even-numbered years. This timeframe allows an informed GAO consideration of any changes made to the CAP, and supports the GAO's timeline for preparation of the biennial publication of the High Risk Report (~January/February of odd-numbered years). The AA will retain the authority to make changes and revisions to the CAP at any time.

Initiatives to Implement

Enhance Earned Value Management Implementation

Lead Executive/Organization
Office of the Chief Financial Officer

Supporting Organization(s)
Mission Directorates; Centers; Programs and Projects

Initiative Description
NASA will improve and strengthen the Earned Value Management (EVM) discipline, and work to foster a culture at NASA where EVM is accepted by Programs and Projects and embraced by managers and employees.

Background/Current State
Earned Value Management (EVM) is an integrated management control system for assessing, understanding, and quantifying what a contractor or field activity is achieving with program dollars. EVM is a discipline with established industry-adopted standards outlined in EIA-748 that integrates technical, cost, schedule, and risk management. It requires an established performance measurement baseline (PMB) which allows for objective assessment and quantification of current project performance as well as helps to predict future performance based on trends. EVM provides project management with objective, accurate, and timely data for effective decision-making.

EVM system compliance and use is required on all acquisitions for development designated as major in accordance with the Office of Management and Budget (OMB) Circular A-11 and the Capital Programming Guide. At NASA, EVM is required for development or production contracts and subcontracts (including those for flight systems, ground systems, and institutional requirements (facility, information technology, investment, etc.)) valued at or greater than $20 million. EVM is required on NASA spaceflight projects with a lifecycle cost (LCC) of $250 million or greater. Science Mission Directorate (SMD) Mission Risk Class-D space flight projects and contracts with a LCC of up to $150 million (not including launch costs) have an approved deviation from the EVM requirements of NFS 1834.201. Class-D missions with a LCC of up to $150 million (not including launch costs) should use the processes per the SMD Class-D Tailoring/Streamlining Policy. The Aeronautics Research Mission Directorate (ARMD) has also recently tailored governance to require EVM on large crewed flight projects.

EVM reporting begins no later than 60 days post Key Decision Point-C (KDP-C). The primary consideration for EVM applicability is the nature of the work, associated risks, and the value of the effort. EVM is not recommended on Firm Fixed Price contracts or contracts that are exclusively Level of Effort (LOE).

Expected Benefits
Improved EVM will:

- Encourage rigorous upfront planning to establish a performance measurement baseline to assess NASA projects performance for cost, schedule and Estimate at Completions (EACs).
- Provide project managers with objective, accurate, and timely data for effective decision-making.
- Help the Agency progress toward removal from the GAO's High Risk List by enabling NASA programs and projects to identify and address issues and take corrective actions.

- Enable a central repository that provides relevant historical data for NASA to develop better cost and schedule estimates for NASA's future programs and projects.

While areas for improvement still exist, the Agency has taken concrete steps to advance the EVM capability, including:

- Rolled out NASA's EVM Capability to Marshall Space Flight Center (MSFC), Kennedy Space Center (KSC), Goddard Space Flight Center (GSFC), and Johnson Space Center (JSC), comprising 98 percent of space flight project EVM requirements.
- Completed the EVM skills gap survey, developed an EVM training plan, and updated existing courses. Worked with the Program, Planning, and Control (PP&C) Working Group to include EVM training as part of the Agency's overall PP&C training curriculum.
- Developed an EVM change management plan that was approved by the EVM Steering Committee.
- Strengthened EVM surveillance to improve reliability of data and management use by updating the NASA/SP-2018-599 EVM Implementation Handbook, developing EVM surveillance job aids/tools, and conducting EVM System Validation Reviews where Defense Contract Management Agency (DCMA) delegated surveillance is not present.

Planned Next Steps

Mission Directorates (MD) and Centers will provide points of contact to work with the Agency EVM Steering Committee to jointly review and assign the following next steps and considerations:

- Roll out EVM Capability to remaining Centers as identified and approved by the EVM Steering Committee.
- Emphasize senior management support for implementation of the established EVM change management plan. Develop and issue policy per senior management, outlining the new requirements and expectations in regards to EVM reporting, surveillance, and data submittals.
- Ensure EVM considerations are included in the ongoing SMD implementation plan for improving project management.
- Improve EVM flow-down for contracts by updating training materials and procurement guide.
- Require EVM reporting periodically at the Baseline Performance Review (BPR) for applicable projects. At a minimum, require cost and schedule indices and EVM independent EAC calculations in these reports.
- Enhance in-house EVM surveillance:
  - Conduct EVM Assessments on a cadence negotiated for each project by OCFO, MDs and programs/projects.
  - Update annual EVM surveillance plan for project surveillance
- Enhance contracted EVM surveillance with DCMA and/or internal NASA resources:
  - Quantify existing contracts for DCMA delegations and delegate contracts with a remaining period of performance of 2 or more years
  - Projects will review DCMA surveillance reports as they are issued, and monitor EVM corrective action plans

- o Projects that do not delegate EVM System (EVMS) surveillance to DCMA should develop an EVMS surveillance plan to include EVM guidelines to be reviewed by contract on a cadence negotiated for each project by OCFO, MDs and programs/projects.
  - OCFO will identify contracts that require EVMS surveillance annually
  - Projects will document EVMS surveillance findings in a report
  - Projects will require corrective action plans for discrepancies and track them to closure
- Conduct EVM surveillance using NASA resources on other major suppliers, such as JPL, APL, and (Southwest Research Institute (SwRI), where DCMA does not have an existing presence. Evaluate whether all or a subset of projects should perform a monthly EVM data anomaly assessment. Require projects to report all EVM data anomalies to Mission Directorates and OCFO/SID, and require corrective action plans for resolution of any material issues.
- Require Integrated Program Management Report (IPMR) submittals to a central repository. The PP&C Working Group, in consultation with the EVM Steering Committee, will work implementation details seeking integration with related efforts where possible to minimize burden.

Output and Outcome Metrics
- All applicable contracts use DCMA for contract EVMS surveillance or an equally effective method as outlined in the project plan that is consistent with the agency overall surveillance approach.
- All issues identified in the EVM Assessment have been satisfactorily dispositioned with corrective action plans within a reasonable time of identification.
- A reduction of EVMS data integrity issues identified by GAO.
- EVM capability is rolled out to all NASA Centers with EVM requirements.
- Status meetings (e.g., BPR) include EVM data where applicable.

Interdependencies
The success of EVM implementation is predicated upon successful adoption and execution by all affected projects, programs, and mission directorates. It is also critical that NASA senior leadership emphasize the need for EVM performance data and act upon the data when anomalies are identified.

Impediments & Challenges
- Enforcement of current requirements and guidance is a challenge and calls for senior management emphasis and action. OCFO owns the functional responsibility, but projects implement the EVM requirement. Currently, the EVM community is splintered because the resources are owned by projects, which have varying approaches for implementation that may not be consistent with the overall Agency policies and goals.
- There is a perception that the cost of EVM is too high, which leads projects and programs to resist EVM and to request waivers and deviations from flow-down of EVM requirements to contractors.
- EVM is a disciplined project management process that promotes rigorous planning and control, and provides objective metrics. Without good PP&C skills, it is difficult to implement EVM. Increased training needs to continue across the agency.
- Frequent replanning and resetting of the EVM metrics erode the usefulness of the EVM metrics.

Demands on the EVM staff within OCFO and at the Centers indicate that the Agency has been under-resourced and under-staffed in recent years for EVM implementation and surveillance. To implement the steps in this plan, additional resources will be required depending on the Agency's final strategy. If the full EVM surveillance is assumed by the Agency for both total project (in-house) and contracts, it is estimated that an additional 10 full-time equivalents (FTE)/work-year equivalents (WYE) would be required. If the Agency continues to utilize DCMA for contracts, and focuses more on project (in-house) surveillance and increasing EVM analysis at the project level, then approximately three additional FTE/WYEs would be required. Finally, to conduct EVM surveillance at contractor specific institutions (such as the Jet Propulsion Laboratory (JPL), the Applied Physics Laboratory (APL), and the Southwest Research Institute (SwRI)), to continue to conduct EVM assessment in their current state, and to use DCMA for contracts, then approximately five additional FTE/WYEs would be required. The CAP Working Group (CAPWG) recommends that the level of adequacy for EVM resources be assessed during the next logical Planning, Programming, Budgeting, and Execution (PPBE) budget formulation process and that the results of that assessment be reflected in the budget.

NOTE: If the agency were to choose not to use DCMA for EVM surveillance on contracts, the risk would be that the current memorandum of understanding (MOU) for surveillance could be rescinded by DCMA. This could reduce the likelihood of DCMA conducting these types of reviews in the future because they could adjust their workforce based on the reduced scope of work with NASA. Finally, DCMA has a stronger presence in the industrial base because the Department of Defense's budget is much larger than NASA's and DCMA EVMS surveillance findings carry more influence with the industrial base than findings by civil agencies carry.

Notional resource levels (to be reviewed in established NASA budget formulation process):

NASA does all of EVMS surveillance including all contracts	NASA does EVMS surveillance on total project (in-house) and JPL, APL, SwRI, etc.	Current State, plus additional support to implement CAP plan
+~10 FTE/WYEs	+~5 FTE/WYEs	+~3 FTE/WYEs

Improve HEOMD Portfolio Insight and Status

Lead Executive/Organization
HEOMD RMO Special Assessments and Analysis Branch

Supporting Organization(s)
HEOMD Programs; OCFO SID

Initiative Description
In an effort to improve the Human Exploration and Operations Mission Directorate's (HEOMD) internal portfolio analysis and planning, the HEOMD Resource Management Office (RMO) is enhancing the process for cross-portfolio risk assessments (including technical, schedule, and cost risk), cross-portfolio interdependency tracking, acquisition and development status tracking, and performance evaluation against HEOMD and Agency goals and objectives. These processes are being unified within the RMO assessment and analysis team to enable appropriate level-setting of risks and impacts across the Mission Directorate and to support enhanced management actions on emerging issues and contractor performance.

Background/Current State
Each program within the HEOMD portfolio performs and manages cost, schedule, and risk progress and analysis. The results of each program's progress and analysis is communicated to HEOMD leadership through formal meetings, such as the HEO Directorate Program Management Council, RMO Quarterly Reporting, and other less formal meetings and exchanges (including weekly senior leadership tag-ups and executive teleconferences). In addition to program-level analysis, broader analysis and review is also conducted. For example, Exploration Systems Development (ESD) is an enterprise-level organizational structure for programmatic and technical integration for the Space Launch System (SLS), Orion, and Exploration Ground Systems (EGS) programs. ESD provides in-line and independent review of the SLS, Orion and EGS programs regarding integrated technical, cost, schedule, and risk assessment for the HEOMD Deputy Associate Administrator for ESD. While program progress and analysis is managed by each program with management oversight by HEOMD leadership, there is currently a limited amount of systematic HEOMD-wide portfolio analysis and assessment.

Budget estimation in HEOMD is performed in phases. Initial budget estimation during pre-formulation and initial formulation is handled through concept study teams, parametric cost modeling, and other analogy based cost modeling. These methods are state-of-the art, but still inherently inexact; they are based on system modeling based on sub-characteristics of previous systems, that may or may not have eventual similarity to the one-of-a-kind type of development needed in human spaceflight planning. Reserve posture, acquisition type, and risk level are additionally factored to modify the base cost estimate to fit the projected mission. These initial cost estimates are used in initial budget projections for new system developments such the current Gateway and lander program. As a program moves through formulation into development, more detailed cost estimating is performed prior to major contract initiation. Depending on the type of acquisition model, a detailed vehicle model may be generated leading to a detailed bottom up cost model based on specific sub-system and manufacturing choices, or requirements definitions may lead to RFPs being used to solicit direct competing proposals to inform system cost. In both cases the government estimates are used until specific contractual agreements are in place that fully scope the work to be performed and financial agreements put in place. Once contractual agreements are established, initial detail planning is completed, and schedule

baselines are put in place, detailed cost projections and commitments can be formed. For vehicle development projects this typically encompasses a single operational flight with potential for development flight tests included. For production and operational systems this typically encompasses multiple flight sets, missions, or vehicles so manufacturing bases can be established and maintained and savings for production quantity can be realized.

Within ESD, currently both SLS and Orion are in between the development mode and the production and operation mode, which is further complicated by having different contractual models for various vehicle elements.

- The SLS Program was congressionally directed to use the existing Space Shuttle Main Engines (SSMEs, or generically RS-25s) stockpile as much as possible. This led to a multi-phased approach. First, modifying the existing engines and testing necessary new components for use in a new vehicle. Second, restarting the extinct production line of RS-25 Engines so that more than 4 flights of SLS could be performed (16 existing engines, 4 engines per flight). And finally, producing engines to sustain flight rate capability of SLS. The SLS Program is in the midst of the contract for restarting the production of RS-25s and is initiating the follow-on production purchases for RS-25 engines beyond the fifth flight of SLS as is needed due to long-lead parts procurement for the complicated engine production. This mixed status means cost per flight is not a clean story even in regards to just the core-stage engines for SLS, as the contractual environment and content inclusion varies between flights 1-4, 5, and 6+.

- The SLS booster contract is handled separately. For the first 8 flights of SLS, the boosters are using partially used systems from shuttle heritage. Booster casings are available through flight 8, but remaining subsystem components are mixed between refurbished, new builds, and sustaining production. As such, contracts for booster production are released in batches of flights sets through flight 8, with additional funding to handle the obsolescence of the booster cases and other systems after flight 8. Through flight 8 the booster systems are independent of SLS block configuration (Block 1 vs 1B); as such the acquisition and cost phasing is based on batch buys to sustain booster production capability at cost-efficient prices.

- SLS core and upper stages are handled separately from Engines and Boosters. The SLS Program is currently developing and building both the first and second core stage, with primary focus on completing development and first flight unit production. The contract for the overall development has different line items for various portions of the development, but has not been extended past the second flight for the core stage or past the first flight development and production unit of the exploration upper stage. As of December 2018, the manifest shows that the first flight of SLS Block 1B with EUS is not planned until after the second flight of SLS. Consequently, a continuation of the purchasing of ICPS upper stages is underway, and there is a mix of contractual and detailed planning for the various portions of the core and upper stage for flights 1 and 2 and no definitized contract for content beyond the second flight.

- The Orion Program has a contract for the initial development and production of first an uncrewed test flight and then the first crewed flight of the Orion crew vehicle with a separate international partnership for the service module. The Orion Program is mid build for both of these first two flights, but does not have a ratified contract for flights beyond

EM-2 as it is currently in-between RFP and establishing a contract for a set of flights beyond the first crewed flight.

Due to the mixed nature of the major contracts for the major vehicle elements of SLS and Orion, ESD is currently managing cost estimation and control based on the individual elements and contracts and not based on individual flights. This is currently deemed the most efficient and effective way to provide specific accountability for the entire system by managing accountability at the element level over the course of multiple flight sets per element. As part of the affordability planning, ESD is working towards aligning the various element contracts to a common set of flights, but that alignment will be earlier than the sixth flight of SLS due to the status of currently established contracts and new hardware production. HEOMD agrees that Agency Commitments and Joint Cost and Confidence Levels (JCLs) for a single vehicle development are effective tools for insight, cost control, accountability, and communication, but single flight commitments within a multi-flight production environment are not effective or reasonable. Communication of individual element performance by contract can be achieved taking into account the variable nature of ESDs contracts over multiple prime contracts until a time when contract alignment allows for consistent communication of flight aligned hardware production.

Expected Benefits
The initiative is expected to improve HEOMD program and project management effectiveness. It is designed to lead to:

- Proactive investigation of program progress such that problems are detected early and overall project performance can be improved;
- Comprehensive review of existing metrics, processes, and tools to monitor program execution;
- An increase in cross-HEOMD communication of management best-practices and unsuccessful initiatives.

Secondary benefits of the initiative include the improvement of cost and schedule projections for programs and projects in formulation by consolidating the historical programmatic database. This will help to identify effective acquisition and formulation strategies and will improve collaborative analysis with other mission directorates and OCFO. This internal process supports already-existing reporting structures within HEOMD and the Agency and is designed to enable an increase in information quality for internal and external communication.

Recent Accomplishments
- Establishment of ESD/Programmatic and Strategic Integration (PSI) Monthly Integrated Performance Review (October 2017)
- Establishment of HEOMD RMO Special Assessments and Analysis Branch (July 2018)

Planned Next Steps
- Synthesis of data reports from existing monthly and quarterly reviews and reporting (Initial: Q1 FY19)
- Synthesis of performance tracking metrics (Initial: Q2 FY19)
- Portfolio-level schedule overview with depicted interdependencies including major program and procurement milestones (Initial: Q3 FY19)
- Portfolio-level analysis assessing portfolio health and risk-exposure (Initial: Q3 FY19)

- Communication of enhanced portfolio assessment capability through internal and external reporting forums (Initial: Q4 FY19)
- Initiation of biannual discussion between GAO and HEOMD leadership on portfolio status (Initial: FY20)
- Sustainment and enhancement of overall process (Ongoing)

Output and Outcome Metrics
- Internal output of enhanced HEOMD integrated products
- Integration of best practices and data impact into program execution and management cycle
- External output of communication of enhanced processes through existing communication paths to OCFO and external stakeholders
- Outcome of increased speed of decision making and response time to emerging issues
- Outcome of increased agency and external stakeholder confidence in HEOMD program and project management due to increase in management effectiveness

Interdependencies
- HEOMD internal interdependencies between program PP&C managers, HEOMD RMO, and HEOMD leadership team
- Coordination of HEOMD analysis and assessment work with ongoing OCFO SID oversight and analysis

Impediments & Challenges

There are no major impediments to the process of enhancing HEOMD portfolio analysis. Challenges exist in unifying data into a coherent reporting format due to the diverse nature of HEOMD programs between formulation, development, operations, and closeout and due to the various formats in which data is collected and analyzed.

Required Resources

Resource impact on programs due to time related to information gathering and synthesis for requests from integration team. Resource impact on integration team to appropriately support scale of data gathering and analysis.

Implement Programmatic (PP&C) Training Curriculum

Lead Executive/Organization

OCFO SID

Supporting Organization(s)

The training lead coordinates with subject matter experts (SMEs) from Agency Centers and from each programmatic function to ensure that all NASA best practices and processes are reflected in the skillsets captured in the competency model matrices.

Initiative Description

The purpose of the Programmatic Training Curriculum is to help bridge the gap between the current-state workforce and future-state workforce of highly trained analysts. Establishing a training curriculum where courses are reflective of the Agency's best practices and methods is necessary to grow and strengthen the Agency's programmatic capabilities.

Background/Current State

The Budget and Management Business Services Assessment (BSA) core team conducted a study to evaluate the health of the Agency's PP&C functions, specifically Integration, Resource Management, Schedule Management, and Cost Estimation and Assessment (CE&A). The outcome of this study revealed that, within the PP&C (herein referred to as *Programmatic*) workforce, there is an inadequate number of advanced, proficient analysts. In addition, there are limited resources describing how a programmatic analyst develops into a programmatic SME.

Expected Benefits

The approach to address the concern for the low number of advanced-level programmatic analysts is two-fold: to refine the Agency hiring process to recruit ideal candidates, and to establish a Programmatic Career Development and Progression Framework to provide training and guidance to those candidates and other programmatic employees. The hiring and interview processes should be strategic to attract candidates who possess an inherent analytical and technical aptitude to support programmatic work. The Programmatic Career Development and Progression Framework will offer a roadmap of how to enhance or develop programmatic skills. It will include tiered competency matrices of entry-level to advanced-level programmatic analysts that is reinforced with a common, centralized Programmatic Training Curriculum. The establishment of the Programmatic Training Curriculum will increase the Agency's programmatic proficiency level and encourage adherence to Agency best practices and processes. This will also promote the consistent application of analytical methods and techniques, which will produce more coherent, reliable work products. Although a robust training program lays a foundation for acquiring certain programmatic skills, it is important to note that on-the-job experiences and mentoring is also needed to develop programmatic SMEs. Taking concepts learned in formalized classroom settings and applying them in day-to-day job functions will enable an analyst to grow in their discipline, strengthen any weak programmatic areas, and continue their progression to an advanced-level programmatic analyst.

Recent Accomplishments

- Identified subject matter experts for each programmatic function and from different Centers to participate in training working groups

- Established training working groups for each programmatic function. Working groups met biweekly to monthly to:
    - Define the skill sets of proficient and advanced analysts for each function for the creation of competency matrices
    - Assess whether existing training courses support the development of the key skill sets previously identified and notate when these skill sets are not supported by current training offerings. This is considered a training gap.
    - Outline the learning objectives, prerequisites, and target audiences of any newly identified training course that addresses a potential training gap.
- Defined and integrated the training courses (existing and newly identified) from each working group to create the initial draft of the synergistic Programmatic Training Curriculum

Planned Next Steps

The planned next steps are to:

- Coordinate with Training Working Group members to peer review course content to ensure that information is consistent and addresses all known gaps
    - Update the training curriculum document to reflect the working group inputs (1st quarter of FY2019)
- Present the Programmatic Training Curriculum draft to the PP&C Steering Committee for concurrence to begin course development and deployment (1st quarter of FY19)
    - Address any changes to the training curriculum based on PP&C Steering Group recommendations (2nd quarter FY19)
    - Identify the required number of dedicated resources to support course development (2nd quarter of FY19)
    - Establish a course development plan/timeline based on resource availability (2nd quarter of FY19)
- Socialize the curriculum to Mission Directorates and AA's so that senior leadership is aware of potentially new and/or updated courses for their employee's development. Incorporate any recommendations/suggestions (2nd quarter of FY19)
- Coordinate with Office of Human Capital to discuss career path development as it relates to competency models. Reflect guidance within the curriculum where applicable (2nd quarter of FY19)
- Begin update of existing and development of new courses (3rd quarter of FY2019 – 3rd quarter FY20)
- Deploy new training courses (4th quarter of FY20)

Output and Outcome Metrics
- A percent increase on the number of proficient analysts within the Agency. Similar to the BSA study, assess the proficiency levels of the Programmatic community within a year of course deployment.
- Common Competency Models exist for each PP&C discipline and are used toward Career Planning and 100% of programmatic job announcements reflect competencies listed within models

- o Supervisors and hiring officials refer to competency models to assess the proficiency levels of programmatic analysts and to gauge their ability to support advanced programmatic analysis
- Development and deployment of training courses
  - o Courses are being developed according the planned timeline. 100% of plan deviations are documented and communicated to the Programmatic Portfolio lead.
  - o Each PP&C professional has taken at least one programmatic course from the curriculum and/or have identified courses within the Individual Development Plan (IDP). Supervisors reinforce the training needs at mid-year and annual performance discussions
  - o New hires and early career programmatic professionals have taken at least two courses within one year of activity within the PP&C community

Interdependencies

An interdependency exists with the GAO Corrective Action Plan initiative for a PP&C NASA Procedural Requirement (NPR) document and other Agency efforts that involve updating programmatic guidance documents and handbooks (e.g., Schedule Management Handbook, EVM handbook, Cost Estimating Handbook, Risk Management Handbook). The guidance and requirements outlined in related programmatic material will be reinforced within the training courses.

There are similar training initiatives that exist within the Agency that are interdependent with the Programmatic Training Curriculum efforts. NASA's Chief Financial Officer University (CFOU) has an established curriculum that caters to the job functions related to the finance and resource management domains as well as the management of risk used for programmatic and institutional decision-making. Some of these courses can be expanded or amended to include the proper programmatic context to ensure that concepts are properly reflected in related training material. Additionally, OCFO's Professional Development Framework (PDF) has created a career path website that enables employees to view the competency matrices of OCFO job functions. The competency levels of the Programmatic functions can also be added to this website so that information is provided uniformly and consistent to other related technical and programmatic fields.

Impediments & Challenges

The challenges associated with this effort are as follows:

- Dedicated resources
  - o Although many individuals were involved in the development of the Programmatic Training Curriculum, this initiative does not have any dedicated resources. Members of the Programmatic Training Working Groups participate on a voluntarily basis. The only dedicated staff member of this effort is the Training Lead. Not having a dedicated set of

individuals to carry out the development and deployment of training materials will impede the establishment of a beneficial training program.

- Establishing a common terminology standard for certain analysis processes
    - o Centers use slightly different processes and terminologies to execute their analyses. With a centralized training curriculum, Centers will be encouraged to adhere to the processes and terminology adopted within the Agency-developed curriculum, thus potentially abandoning some prior processes.

Required Resources

The resources required to execute the establishment of the Programmatic Training Curriculum include a group of dedicated SMEs that are given the time to develop courses and teach the material. The intent is not to solicit assistance from outside the Agency, but to use programmatic SMEs who are familiar with NASA's best practices and processes. However, full-time dedication is not the requirement; depending how often a course is taught, an instructor will need a budget to develop course material, prepare for a class, travel to the class site (if applicable), and teach the course. Portions of the budget will also help ensure that there is a central repository where all related materials of the Programmatic Training Curriculum can reside.

Include Original Agency Baseline Commitments for Performance-Driven Re-baselined Projects

Lead Executive/Organization
Office of the Chief Financial Officer

Supporting Organization(s)
N/A

Initiative Description
For projects that have been re-baselined due to performance (vice scope change), NASA will begin to include original cost and schedule Agency Baseline Commitments (ABC) in our quarterly, semi-annual, and annual external cost and schedule reports. OCFO will report these data alongside the current reporting structure for transparency purposes.

Background/Current State
NASA collects cost and schedule data to satisfy a number of purposes and customers, both internal and external to NASA. In 2004, the GAO published a study[1] stating that a lack of disciplined project cost estimating processes was resulting in project management problems, schedule slippage, and cost growth. Soon after, Congress passed the NASA Authorization Act of 2005, which created the first external reporting requirements to Congress, the Major Program Annual Report (MPAR)[2]. The MPAR, which requires NASA to report on projects in development with an estimated life cycle cost exceeding $250 million, is the nexus for all external reporting. All other requirements for cost and schedule reporting stem from the MPAR.

Baseline control is the basis for external reporting, which is tied to project lifecycle cost (LCC). For projects with a LCC of at least $250 million, NASA externally commits to a cost and schedule baseline for LCC, development cost (Phases C and D), and launch readiness date (or alternate key schedule milestone) established at KDP-C. Per NPR 7120.5[3], programs or projects shall be re-baselined when:

1. The estimated development cost[4] exceeds the Agency Baseline Commitment development cost by 30 percent or more (for projects over $250 million, also that Congress has reauthorized the project)[5];
2. The NASA AA judges that events external to the Agency make a re-baseline appropriate; or
3. The NASA AA judges that the program or project scope defined in the ABC has been changed or the tightly coupled program or project has been interrupted.

Project ABCs are not re-baselined to reflect cost or schedule growth that does not meet one or more of these criteria.

NASA reports cost and schedule variance against ABCs on a quarterly, semi-annual, and annual basis. Quarterly, NASA's OCFO submits cost and schedule reports to OMB. Semi-annually, OCFO submits cost

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[1] NASA: Lack of Disciplined Cost Estimating Processes Hinders Effective Program Management [GAO-04-642]
[2] Public Law 109-155 Section 103 Baselines and Cost Controls (codified at 51 U.S.C §30104)
[3] NPR 7120.5E, Paragraph 2.4.1.7
[4] "Development cost" includes all project costs from authorization to proceed to Implementation (Phase C) through operational readiness at the end of Phase D.
[5] 51 U.S.C §30104(f)

and schedule reports to GAO. Annually, NASA submits cost and schedule reports to Congress in the President's Budget Request (PBR) Congressional Justification (CJ). In all of these reports, for projects that have been re-baselined, cost and schedule variations are reported against the re-baselined figures and not the original ABC. GAO has recommended that, for re-baselined projects, NASA report cost and schedule growth from original baselines in order to provide stakeholders and Congress with a more accurate view of project performance and to enhance accountability.[6]

In certain cases, re-baselines occur for reasons beyond the control of NASA (e.g., weather-related events, international partnerships, etc.). To fairly represent NASA-driven cost and schedule performance, original baselines will only be reported for re-baselined projects that have been re-baselined primarily due to NASA performance issues. As with other elements of the Corrective Action Plan, the NASA AA may, in future iterations of the Plan, make changes to the implementation of this initiative as challenges or opportunities are encountered.

Expected Benefits
The majority of NASA's major projects proceed through the development phases within original baseline cost and schedule commitments. In the event that a project is re-baselined, NASA reports future cost and schedule variation from the newly established Reporting Baseline. This is a valuable metric because it tracks cost and schedule variation from the newly authorized commitment, which is thoroughly reviewed and approved by all levels of the Agency, OMB, and Congress. NASA will continue to emphasize that once a project is re-baselined, it is appropriate to measure success against the most recent baseline commitments and not the original commitments.

However, in the spirit of transparency, NASA will begin to include the original baseline figures (for projects that have been re-baselined) in external cost and schedule reports alongside the current reporting structure. NASA has long recognized the value in tracking cost and schedule variation against original baseline commitments, including such variation in many internal analyses. The Agency's external partners and the public will benefit from this added transparency in our cost and schedule reports, as they have benefitted from knowledge of other cost and schedule variation across NASA major projects absent a re-baseline.

Recent Accomplishments
N/A

Planned Next Steps
- In FY19, NASA will review and determine the best way to present the original ABC information in its routine external cost and schedule reports in such a way that it is clear to all parties why the project was re-baselined, and why future measurements of growth should be measured against the re-baselined figures.
- Beginning in FY20 (or earlier if possible), for projects that have been re-baselined due to performance, NASA will include original cost and schedule baselines in external reports (quarterly to OMB, semi-annually to GAO, annually in PBR/CJ). Projects that have been re-baselined due to a scope change will be excluded.

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[6] GAO High Risk Series [GAO-17-317] Page 473

Output and Outcome Metrics
N/A

Interdependencies
N/A

Impediments & Challenges
N/A

Required Resources
N/A

Enhance Annual Strategic Review Process

Lead Executive/Organization
Performance Improvement Officer (PIO) and Program Management Improvement Officer (PMIO)

Supporting Organization(s)
OCFO/Mission Directorates/Mission Support Offices

Initiative Description
Enhance the Agency's existing annual Strategic Review process to leverage the program portfolio reviews required by the Program Management Improvement and Accountability Act (PMIAA) aligned with OMB guidance. The portfolio reviews will provide additional information for Agency senior leadership to assess the effectiveness of an Agency program's management and performance, identify opportunities for improvement, and serve as a basis to enable additional external stakeholder communication regarding the outputs of the review.

Background/Current State
NASA currently conducts an annual assessment of progress made against its strategic objectives identified in the 2018 Strategic Plan (NPD 1001.0C). This Strategic Review is mandated within the [Government Performance Results Act Modernization Act of 2010](#) (GPRAMA), with specific requirements for each exercise codified in annual updates to OMB Circular A-11, Part 6, as well as additional requirements communicated via standalone Strategic Review Guidance memoranda (e.g., M-18-15).

Per GPRAMA, the Strategic Review is conducted under the authority of the Chief Operating Officer (COO) (NASA Associate Administrator) and managed by the Performance Improvement Officer (SID Division Director). The Strategic Planning, Performance Management, and Reporting Branch within OCFO SID is responsible for the coordination of the review. The BPR is used as the forum for the Agency meeting that concludes the internal portion of the review. The annual Strategic Review cycle officially concludes with a Principals meeting held at OMB, where the results of the internal review are discussed with representatives of the Administration.

Tactically, the review begins with each MD or Mission Support Office (MSO) developing an assessment of their ongoing and planned activities in support of each strategic objective assigned to their organization. In addition, OCFO SID develops an independent assessment of the progress the Agency has made, or committed to, in support of each strategic objective. The results of both assessments are presented to the NASA AA, who in turn determines a final "rating" for each strategic objective. The ratings, along with a high-level summary of the considerations for each rating, are provided to OMB in a "Summary of Findings" report, which in turn is utilized to develop the agenda for the Principals Meeting that concludes the review cycle. Guidance for ratings and specific requirements for the Summary of Findings deliverable are variable and dependent on annual guidance from OMB.

The PMIAA will be implemented in a phased approach over several years per OMB guidance memorandum M-18-19, with the provision of incremental OMB guidance as the agencies implement it. Aligned with OMB guidance, in 2019 NASA will integrate a pilot portfolio-level review component into its existing Strategic Review framework, and incrementally expand on the portfolio reviews in the future. The initial portfolio reviews will include non-IT major programs, and IT major projects will be added in the future. OMB will also conduct portfolio reviews of the most at-risk agency programs designated as high risk by GAO, however, plans for these reviews are pending future OMB guidance. This Corrective

Action Plan initiative captures the Agency's strategy to implement the portfolio-level review, to include expanding beyond the requirements of the PMIAA legislation to incorporate additional external stakeholder access of the review's outputs.

Expected Benefits

The current Strategic Review, per OMB requirements, narrowly focuses on the Agency's annual progress made against its 13 long-term strategic objectives established in its 2018 Strategic Plan. The measures described in this initiative will enhance the value of this exercise as follows:

- An additional layer of review at the portfolio level will enable additional insight into the challenges affecting the Agency's Mission Directorates.
- Additional acquisition-specific data sets will be collected during the review (starting in 2019).
- Major non-IT investments will be included in the review for the first time starting in Phase II[7] of PMIAA implementation (expected NLT 2021).
- Assessment of the Agency's larger grant programs to be included in the review for the first time starting in Phase III (expected NLT 2023).

In addition to the enhanced data collection and consideration that will occur during the review as a result of this initiative, NASA will implement a process to discuss the findings of its review with the GAO, starting with the 2020 assessment cycle. This will ensure additional stakeholder communication regarding the outputs of the review.

Recent Accomplishments

An annual review of the Agency's strategic objectives was first conducted in 2013, per GPRAMA and OMB guidelines. That initial exercise included an assessment of the Agency's strategic objectives previously established in its 2011 Strategic Plan. The COO decisional meeting that concluded the review occurred within a stand-alone internal stakeholder meeting, outside of a recognized management council, and utilized a uniform set of success criteria. NASA has successfully implemented improvements to this process over the subsequent 5 assessment cycles, to include:

- Increased integration with the Agency's nascent Enterprise Risk Management (ERM) framework.
- Full integration with the Agency's existing monthly Baseline Performance Review (BPR), which has greatly increased the audience of the assessment, as well as the availability of the data to senior decision makers across the Agency.
- Development of success criteria unique to each strategic objective, established in tandem with the development of each objective during the formation of the Agency's 2018 Strategic Plan.
- Continued refinement of the templates utilized to collect inputs into both the independent and stakeholder assessments, as well as additional templates used to summarize assessment findings for NASA AA/COO consideration.

In addition, the Agency has made impressive strides to integrate the outputs of the review within its ongoing strategic planning efforts.

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[7] M-18-19 mandates that CFO Act agencies follow an incremental 3 phase approach to implementing PMIAA legislative requires. All 3 phases are to be completed within a 5 year window, beginning in December 2018.

Planned Next Steps

The Agency will utilize the upcoming 2019 review cycle as a pilot year prior to consider a permanent format for the portfolio review component of the exercise. The pilot will also seek to inform what subsequent phases of PMIAA implementation may include.

During the pilot exercise, the 2019 Strategic Review will be modified as follows:

- One portfolio[8] will be selected to participate in this initial exercise
- Selection will be made by the COO/NASA AA
- The Mission Directorate Associate Administrator (or their designee) for the selected organization will provide a high-level assessment of their portfolio's strengths and weakness at the beginning of the annual Strategic Review meeting held at the April BPR
- A template developed by the PMIO will be provided to the selected portfolio owner that will include the following considerations:
  - The performance of the non-IT major programs and projects in their portfolio (life cycle cost greater than $250 million)
  - Opportunities for improvement, as well as identification of any barriers to achieving program outcomes
  - Identification of 2-3 major acquisitions that have demonstrated particular success in the last two years
  - Identification of 2-3 major acquisitions that have encountered challenges in the last two years
  - Any additional lines of inquiry deemed necessary by the Program Management Improvement Officer
- The NASA AA will provide feedback/guidance to the selected portfolio manager (NASA MDAA), as necessary. In addition, corrective actions or follow-on investigations may be assigned during the Strategic Review meeting
- A high-level synopsis of these discussions, as well as any follow-up actions, will be included in the Summary of Findings report provided to OMB (expected May 21, 2019)
- An agenda item will be added to the Principals Meeting at the conclusion of the 2019 review cycle (expected NLT June 28, 2019), to ensure a dialogue between OMB and the Agency in regards to the selected portfolio's successes and/or challenges

The portfolio level review component of the broader 2019 Strategic Review will be overseen by the PMIO and will incorporate a set of broadly applicable program management principles, practices, and standards associated with successful program outcomes, in addition to more specific standards based on the type of program being reviewed. Agency managers will be held accountable for addressing areas identified for improvement during the portfolio level component of the review. The PIO will remain responsible for all other components and activities associated with the 2019 Strategic Review.

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[8] For the purposes of PMIAA implementation, NASA's major acquisition portfolios will be broadly defined utilizing the organizational structure authorized within NPD 1000.3E. This includes 4 Mission Directorates (Aeronautics Research, Human Exploration and Operations, Science and Space Technology)

NASA and OMB will evaluate the results of the portfolio review pilot prior to initiating the 2020 Strategic Review. The results of that analysis, along with any additional guidance communicated in future iterations of OMB Circular A-11, Part 6, will be used to enhance the portfolio review process starting in 2020. The GAO's 2019 High Risk Report (expected February 2019) may introduce additional considerations. Any process adjustments to the portfolio review process will be codified in future updates to the Agency's 5-year implementation plan for PMIAA.

Integrated Strategic Review/Portfolio Review Pilot Schedule:

Key Milestones	FY2019					
	January	February	March	April	May	June
Pre-Brief with COO (NLT) (selection for Pilot Portfolio Review)	1/11 △					
Strategic Review Kickoff (NLT)		1/31 △				
Enterprise Risk Management Coordination		1/31 △				5/21 △
Independent Strategic Review Assessments (OCFO Strategic Investments Division)		1/31 △	3/4 △			
Strategic Objective Owners Self Assessments		1/31 △	3/4 △			
Portflio Owner Self Assessment		1/31 △	3/4 △			
Reconciliation Discussions (where necessary)			3/4 △	4/4 △		
PIO Decisional Briefing (NLT)				4/11 △		
NASA Strategic Review with COO (Baseline Performance Review)				4/25 △		
Deliver Summary of Findings to OMB					5/21 △	
OMB/NASA Strategic Review Meeting (NLT) (to include Portfolio Review discussion)						6/28 △

Output and Outcome Metrics
- *Specific metric TBD* – Likely to consider additional performance information that will be provided in the FY 2021 Volume of Integrated Performance, which will be published in February 2020.
- *Specific metric TBD* – Likely to consider additional agenda topics included in the Principals Meeting held with OMB and/or potentially GAO every summer.
- *Specific metric TBD* – Likely to consider growth in number of data elements included in the assessment templates year over year, starting in 2019.

Interdependencies
- OCFO SID Director
  - Acts as NASA's designated Performance Improvement Officer (PIO), responsible for ensuring Agency compliance with all GPRAMA commitments
- Program Management Improvement Officer (PMIO)
  - Acts as NASA's responsible party for ensuring compliance with all PMIAA commitments
- OCFO SID Strategic Planning, Performance Management, and Reporting Branch (SPPM&R)

- - o Leads coordination for all Strategic Review requirements embedded within GPRAMA and OMB Circular A-11, Part 6
  - OCFO SID Portfolio Intelligence and Assessment Branch
    - o Independent assessment team
  - Mission Directorates (HEOMD, ARMD, SMD, and STMD) and Mission Support Directorate (MSD)
    - o Each Mission Directorate has responsibility for implementing activities in support of at least 1 strategic objective established in the 2018 Strategic Plan
    - o HEOMD, ARMD, SMD, and STMD have responsibility for portfolios included in 2019 pilot
  - Chief Operating Officer (COO)/Associate Administrator (AA)

Impediments & Challenges
- The OMB PMIAA guidance is based on a phased approach over several years with additional OMB guidance that will be provided as the agencies implement in parallel. This may cause changes to the agency's implementation approach.
- Assessing strategic objective progress, as well as portfolio-level challenges, simultaneously may introduce confusion that could impair the value of the assessment's findings to senior leadership.
- PMIAA delegated responsibility to OMB to issue annual tactical guidance regarding implementation of the requirements embedded within the legislation. As such, NASA is dependent on to-be-released external guidelines that could complicate its ability to successfully coordinate its Strategic Review and Portfolio Review requirements while maintaining its current value to senior leadership.
- PMIAA delegated aspects of the legislation's oversight to the GAO. Future GAO assessments of OMB's government-wide implementation of PMIAA could impact the mechanics or reporting of NASA's internal assessment activities.

Required Resources
- Input and support from offices identified above as interdependencies
  - o OCFO and MDs/MSOs will continue to provide analytical support
  - o OCFO SID SPPM&R Branch to lead implementation
- NASA COO, PIO, and PMIO approvals
- MD partner for pilot exercise
  - o Identify a portfolio owner to participate in the initial pilot (scheduled to be selected in January 2019)

Create Technology Readiness Assessment (TRA) Best Practices Document

Lead Executive/Organization
Office of the Chief Technologist

Supporting Organization(s)
Office of the Chief Engineer; Various Centers and Mission Directorates

Initiative Description
This initiative is expected to develop a document that will capture the technology readiness assessment (TRA) information that is scattered throughout the Agency, provide links to governing documents, and document best practices across the Agency. The intent is to provide best practice information and governing statements and to document a generic process for how to conduct assessments.

As the Agency continues discussing risk, one element that could help inform decisions is an independent technology readiness assessment, which would provide an independent view of the state of a new technology or system of technologies. The assessment could inform projects and missions about the current technology readiness level (TRL), as well as provide an informed assessment of what will be needed to integrate into a larger system.

Background/Current State
In 2014, a study was conducted by a partnership of the Office of the Chief Technologist and the Office of the Chief Engineer. Concurrently, GAO was developing its Technology Readiness Assessment Guide.

The internal study made several recommendations, one of which was to "develop a TRA Handbook that will consolidate all TRA and TRL processes, guidance, best practices, examples, and other related content into a single reference source." This initiative is in response to that recommendation, in order to gather information regarding best practices into a single source rather than the multiple sources documented by the study team.

Expected Benefits
It is expected that this document, when completed, will gather the information regarding technology readiness and its assessment into a single source. Currently, as the study team found, TRA information is found in multiple NPRs and in the Systems Engineering Handbook, as well as in many Center documents/practices. These governing documents will not be changed. The purpose of this effort is to gather the high-level information into a single document with citations to governing documents. The other intent of the document is to provide information on how to conduct an assessment, based on the expertise of current TRA practitioners across the Agency.

Recent Accomplishments
N/A

Planned Next Steps
NASA will stand up a team of interested and knowledgeable participants to gather best practices across the Agency. Once engaged, the team will compile the best practices into a document for Agency review.

Output and Outcome Metrics
Outputs will include documented best practices for use by Mission Directorates, Offices, and Centers for independently determining the technology readiness level of a given technology or system of

technologies. This information can be used for decision-making by programs and projects to provide additional information regarding the state of a technology prior to incorporating it within the program or project.

Interdependencies

Technology readiness assessments could help inform risk discussions, as well as assist practitioners and projects to respond to the GAO TRA Guide, which is currently in the review process.

Impediments & Challenges

- It will take time to survey, compile, and assess the many practices across the Agency to adequately identify, document, and link best practices.
- Participants will be limited to working on an as-available basis.

Required Resources

The document will be researched and written by TRA practitioners across the Agency on an as-available basis.

Update Probabilistic Programmatic Policy

Lead Executive/Organization
OCFO/SID/APARC

Supporting Organization(s)
Supporting organizations, beyond OCFO and the NASA PP&C communities, will include the Office of the Chief Engineer (OCE) and NASA MDs. Flight projects will be the implementing organizations and NASA Standing Review Boards (SRBs) will conduct assessments based on the requirements. The PP&C Steering Group will provide the needed technical expertise and guidance.

Initiative Description
This initiative readdresses NASA's current probabilistic programmatic policy. NASA will add a requirement for flight projects to conduct a Joint Cost and Schedule Confidence Level (JCL) corresponding with the System Requirements Review (SRR) leading up to KDP-B. NASA will also add a requirement for flight projects to conduct/update a JCL at the Critical Design Review (CDR). Further, flight projects that are not performing to plan will have a requirement to conduct/update a JCL at the System Integration Review (SIR) leading up to KDP-D. These new requirements will apply to all major flight projects with a life cycle cost of at least $1 billion, or otherwise designated by the NASA AA. The existing JCL requirement for the Preliminary Design Review (PDR) leading up to KDP-C will not change.

Background/Current State
NASA currently uses a variety of cost and schedule methodologies to formulate, plan, and implement projects. One of the general methodologies deployed by NASA is the use of probabilistic programmatic analysis. NASA found that budgeting projects to a risk-adjusted estimate that reflects a project's risk exposure, in combination with communicating that risk posture internally and externally, facilitates more realistic budget positions. It also aids in communication of the budgets. NASA currently requires projects to perform probabilistic analysis once at KDP-B and once at KDP-C. At KDP-B, NASA requires all flight projects with lifecycle costs (LCC) over $250 million to provide probabilistic analysis on their cost estimates and their schedule estimates. The intent of KDP-B policy is to position projects to have a healthy programmatic risk posture going into KDP-C. At KDP-C, NASA requires all flight projects with LCC over $250 million to provide a joint cost and schedule confidence level (JCL) analysis. After KDP-C, NASA policy does not require a project to update any probabilistic analysis. However, the Agency uses a variety of performance metrics to assess how well the project is performing against its plan. If these metrics show that a project's performance varies significantly from its plan, the project may need to replan, but Agency policy only encourages updates to the probabilistic programmatic analysis (i.e., JCL analysis) in the event the project requires a re-baseline[9].

NASA probabilistic programmatic policy has been empirically successful as measured by an observable reduction in the number and magnitude of project baseline overruns since the implementation of the policy. Additionally, the JCL policy has assisted in communicating Agency risk posture and quantifying the need for unallocated future expenses[10] (UFE).

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[9] Re-baselined projects are not required, but are encouraged, to do a JCL analysis by NPR 7120.5E.
[10] Per NPR 7120.5E, UFE is "*the portion of estimated cost required to meet specified confidence level that cannot yet be allocated to the specific project WBS sub-elements because the estimate includes probabilistic risks and*

External stakeholders have documented the value of NASA's probabilistic policy and have recommended that the policy be augmented.[11] Furthermore, the probabilistic policy, and specifically the JCL policy, has been a forcing function for projects to consider how their programmatic, technical, and risk products interact, which allows for more traceable programmatic integration.

Expected Benefits

Improvements to probabilistic estimating processes for our largest projects at KDP-B, CDR, and KDP-D might further reduce cost and schedule overruns. Producing a JCL at SRR leading up to KDP-B will better inform leadership of the range of potential cost and schedule impacts on the portfolio through Phase B and through the life cycle. Updating the JCL at CDR will capture evolving and emergent risks and provide leadership with an enhanced awareness regarding projections of the project's cost and schedule through Implementation. By the time of SIR and KDP-D, most work-to-go involves "marching army" costs and a JCL will provide diminishing returns. However, for projects that are off plan, updating a JCL will better inform decision-makers at KDP-D of the confidence of hitting cost and schedule targets given evolving risk postures. By focusing these new JCL requirements on the largest projects (LCC of at least $1 billion), NASA is intelligently applying its programmatic resources to mitigate the largest potential impacts to its portfolios.

Recent Accomplishments

N/A

Planned Next Steps

The following milestones have been identified to address augmentation of NASA probabilistic programmatic policy.

- APMC approval of the CAP will serve as approval for the new JCL requirements.
- Upon concurrence of the APMC, NASA will publish an executive memo detailing any new probabilistic programmatic requirements and the expectations on how those requirements will be transitioned in the current Agency manifest. This memo will focus on the implementation details for the KDP-B JCL.
- Language specified in the APMC executive memo will be formal Agency guidance until NASA NPR 7120.5 is updated.

Output and Outcome Metrics

- Objective measurement and communication of changes to cost and schedule risk exposure and performance from the KDP-B, CDR and SIR milestones[12] for the affected projects.

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specific needs that are not known until these risks are realized." It is commonly referred to as "reserves" in industry.

[11] "Ensure that program offices regularly and consistently update their Joint Cost and Schedule Confidence Levels (JCL) across the portfolio. As a project reaches the later stages of development, especially integration and testing, its risk posture may change. An updated project JCL would provide both project and agency management with data on relevant risks that can guide project decisions. " Government Accountability Office. GAO-17-317 "*High-Risk Series*," p. 473. February 2017.

[12] Performance is a function of the risk posture the Agency takes at each milestone. For example, higher risk programmatic postures at KDP-B may result in lower performance – but both metrics should be internally consistent.

Interdependencies

N/A

Impediments & Challenges

The challenges associated with this effort are as follows:

- Dedicated Resources: Additional resources may be needed to implement any new requirement.
- Communication: Communicating expectations and implementation down to projects and up to stakeholders will be a challenge.

Required Resources

- Implementation Resources
  - o Probabilistic programmatic requirements will require more programmatic support to projects. Implementing JCLs at SRR, CDR, and SIR will require projects to produce and communicate a work product that has not been baselined in their current workload and expectations.
  - o Depending on the ultimate policy selected, jumpstart capability may be needed to assist projects and implementing Centers for the first year of the initiative's implementation to ensure the consistency of expectations and products. For example, when the now-disbanded Office of Evaluation's (OoE) Cost Analysis Division did a similar jumpstart activity for JCL implementation, the total cost to OoE for two years of implementation of that jumpstart was approximately $400,000 annually. However, JCLs are no longer new to the Agency, and the Centers (as well as many projects) have developed the capability to do probabilistic analysis; therefore, the cost of implementing any increases to the current JCL requirement should be significantly lower than the initial jumpstart costs paid by OoE.
  - o Jumpstart support would handle the mechanics, but implementation would additionally require projects to dedicate hours of personnel support to produce the proper inputs to any increased probabilistic programmatic requirement.
- Communication
  - o Additional internal and external communication would be needed to support expectations and implementation. Resources for communication can be covered by the current PP&C Community.

Initiative to Pilot

Create a Schedule Repository

Lead Executive/Organization

OCFO/SID/APARC will lead the Schedule Repository effort with direct support of the Agency's PP&C Portfolio Lead and the PP&C Steering Group.

Supporting Organization(s)

OCFO/SID/APARC will coordinate with Center points of contact (primarily the Schedule Community of Practice (SCoPe) POCs), and individual programs and projects on the collection of schedule data to support the Schedule Repository effort.

Initiative Description

A Schedule Repository is a collection of program and project (P/p) schedules for completed and current missions and technology developments. Schedule information is organized and archived in a searchable library. The purpose of the Schedule Repository is to:

- Provide the schedule management community with access to historical and analogous schedules to aid in the planning and development of schedules for future missions.
- Allow for the continuous improvement of schedule management guidance and best practices.

The schedule data collection cadence for the Schedule Repository will be determined by the PP&C Steering Group, which is represented by the Centers and Mission Directorates (MD).

Background/Current State

In 2016, as part of the Agency's Schedule Initiative (SI), information was provided to the schedule management community on SI efforts in order to collect feedback from the community regarding areas of schedule management in need of improvement. The findings, which were presented at the 2017 NASA Cost and Schedule Symposium, highlighted the need for access to past P/p schedules and for schedule management guidance that is more detailed, consistent, and consolidated.

With respect to access to past P/p schedules, currently, detailed schedule information is not collected at the Agency, MD, or Center levels on a routine basis because no requirements or formal processes exist (e.g., Cost Analysis Data Requirement (CADRe) collects only mission-level integrated master schedules (IMS) at lifecycle reviews). Thus, there is no centralized repository of detailed P/p schedule information from which other programs or projects can draw analogous data for schedule planning, development, and analysis purposes. In addition, schedule data is sometimes lost (e.g., during computer refreshes that go wrong or during employee attrition without proper data transition), preventing future programs or projects from locating relevant data. Schedulers then must create schedules from scratch instead being able to use valuable, NASA-specific data that include realized risks and lessons learned to inform planning and potentially to produce more realistic schedule estimates. This limits the efficiency with which schedules are produced and assessed. In many cases, it also constrains the ability to document and support the schedule basis of estimate (BoE) effectively. A Schedule Repository will alleviate these problems by providing an accessible, centralized archive of NASA schedule data.

To address schedule management guidance needs, the Agency decided to update the Schedule Management Handbook. While the draft is almost complete, it is not yet released. Updates will include the identification of NASA-specific best practices to address how NASA conducts schedule management (based on requirements specific to NASA, such as JCL and "risk-informed" schedules). It will incorporate

practices and processes used across various Centers. The handbook will also include significantly more guidance on how to assess and analyze a schedule using different methods and techniques. A Schedule Repository that supports analysis across a variety of schedules will facilitate ongoing handbook updates to ensure the Agency's schedule management guidance stays relevant and addresses current concerns.

Expected Benefits

A Schedule Repository will provide a centralized source for quick and convenient access to schedule data (integrated master schedules, as well as supporting schedules and data) from which schedulers and analysts will be able to research analogous missions and use them as a basis for developing program or project schedules. A Schedule Repository will also allow the Agency to fine-tune best practice guidance for schedule planning, development, assessment, analysis, maintenance, and control. Looking across P/p schedules can inform the Agency regarding how well schedule management best practices are implemented, which in turn can lead to improvements in schedule guidance and training. In addition, having a routine collection of schedules will aid the Agency in understanding how and at what point in project lifecycle schedules typically experience issues. The trending of performance-based indices across a repository of programs and projects can help uncover the critical points in P/p lifecycles when schedule performance issues are more likely to arise. This can also facilitate continuous improvement in guidance and training.

Recent Accomplishments

- Two meetings have been held with Goddard Space Flight Center (GSFC) to understand their Center OCFO-led initiative for the routine collection of schedule data into a consolidated library. Future meetings are planned for further discussion.
- One meeting has been held to explore options for housing the Schedule Repository. Future meetings are planned for further discussion.

Planned Next Steps

- To proceed with the Schedule Repository effort, the OCFO/SID/APARC Lead will work with supporting organizations to identify Center SCoPe and P/p POCs and assign targeted dates for the following next steps:
    - Determine what schedule information (e.g., past or current program and project IMS and supporting schedules) can be collected for past and current programs or projects at each Center.
    - Determine the cadence of schedule information collection.
    - Determine the most effective way to transfer schedule data from the data source to the Schedule Repository, whether as a cloud function, server capability, direct-from-user delivery, or a hybrid approach.
    - Develop a framework for the Schedule Repository to determine where the data will be stored and what organizational structure will be used.
    - Collect and organize P/p schedules for both completed and in-work missions according to the identified framework.

Output and Outcome Metrics

The Schedule Repository will consist of past and current schedules (as of the most recent key decision milestone) from each Center collected in a centralized repository. Schedule collection metrics (e.g., percentages of available data collected, percentages of projects with complete or current data sets) will be developed and schedule data that is collected for the repository will be tagged (e.g., by work

breakdown structure, subsystem type, and/or responsible organization) to enable various categorizations as appropriate for Agency analysis and use.

Impediments & Challenges

There are several challenges to implementing a data collection activity to produce a consolidated Schedule Repository:

- Establishing an Agency Framework: to be supportive of all stakeholders from practitioners to decision makers
  - Different schedule file formats (e.g., Primavera versus Microsoft Project files)
  - Schedules may be at different levels of detail for different programs and projects
  - Schedules may be at different levels of integration for different programs and projects (e.g., giver/receiver relationships versus all work captured in one IMS)
- Defining Scope: Mission thresholds (e.g., category) and types (e.g., flight, technology)
  - Implementation Approach for Data Collection
  - Implementation Timeline
  - Data Fidelity
  - Ownership/Access
- Governance: Forcing mechanism (requirements/guidance)
  - Not "adding" product requirements
  - Not "dictating" schedule processes beyond what is already in policy and guidance
  - Guidance on the way the IMS should be set up to facilitate these uploads (e.g., necessary fields, preventing the deletion of tasks once they are complete, putting in the actual achieved duration at completion, use of Microsoft Project or compatible format, etc.)

Required Resources

No additional resources are required, however, FTE/WYE resources will be prioritized for this effort.

Initiative to Research

Enhance Implementation Indicators for Trends and Projections

Lead Executive/Organization
Office of the Chief Engineer (OCE)

Supporting Organization(s)
Office of the Chief Financial Officer; Office of Safety and Mission Assurance; Mission Directorates; Centers

Initiative Description
The intent of this initiative is to establish a cross-Agency working group, including outside experts, led by OCE to identify indicators that will advance NASA's ability to detect emerging issues that may affect a project's implementation. Actions for the working group may include, but are not limited to:

- Review the adequacy of the metrics and leading indicators (e.g., mass margin, power margin, etc.) that are currently used to measure the progress and health of a flight project in development and their effectiveness in forecasting upcoming cost and schedule challenges. This assessment may consider the extent to which these metrics and leading indicators anticipated recent schedule problems in SMD and HEOMD.
- Discuss options and make any recommendations, if warranted, to ensure programs and projects in the Implementation phase achieve an adequate frequency of independent review. For example, are additional mid-course reviews or independent assessments needed? Do entrance/success criteria for reviews need to be updated?
- Review current practices of other agency, industry, or academic procedures for new state-of-the-art practices for monitoring and controlling projects to see if they are useful for NASA projects.
- As part of this effort, examine how program and project managers have responded to the current set of metrics and leading indicators, especially those that are particularly effective in predicting cost and schedule growth. Are program and project managers identifying, in a timely manner, corrective actions or risk mitigation plans in response to predictions of technical maturity and cost and schedule growth? Are they addressing these predictions, tracking the implementation and results of any identified corrective actions and risk mitigation plans, and responding effectively? Are there any corrective actions and risk mitigation plans that have been effective in correcting cost and schedule growth trends?

The working group will present findings and any recommendations to the Associate Administrator for consideration of follow-on action.

Background/Current State
Because each NASA program and project is unique, it is critical that the metrics and leading indicators chosen for any particular project represent true indicators of that project's performance. By monitoring trends in the metrics and leading indicators, program managers, project managers, systems engineers, program analysts, other team members and management can more accurately assess the health, stability, and maturity of the program or project. Consequently, problems can often be mitigated before they become too costly.

Expected Benefits

Program and project personnel expend a significant amount of time and effort to generate and maintain voluminous data and report progress and performance at various levels and meeting venues across the Agency. Agency review of programs and projects at the BPR focuses on key problem areas, but there are still challenges in proactively identifying and addressing emergent issues. It will be valuable to review the current set of metrics, leading indicators, and standards; and make the necessary modifications, updates, and adjustments to ensure that these efforts are effectively supporting identification of emergent issues.

The NPR 7120.5E lifecycle review structure is based on the engineering reviews defined in NPR 7123.1B, which establish the SRR/SDR (System Definition Review), PDR, CDR, SIR, and ORR (Operational Readiness Review) milestones. From design, manufacturing, test, and assembly perspectives, these standard life cycle reviews are reasonable milestones. For projects with long gaps between formal life-cycle reviews, sufficient independent oversight/insight between the formal milestone reviews is critical to provide timely independent reports to Agency and project management. Experienced independent board members can often help a project find or avoid problems and mistakes that the project team is missing by leveraging their past lessons learned and their distance from the daily project management activities. The working group tasked under this initiative will assess and make recommendations as deemed appropriate, and whether there may be a potential benefit of additional independent assessments that do not place undue burden on programs and projects.

Benchmarking and review of other government, industry and academic procedures or studies may reveal new ways of viewing or predicting issues with project cost and schedule performance. This may include development of new indicators, advanced modeling, new display capabilities, or philosophies.

Recent Accomplishments

NASA has implemented a multitude of new and evolved project performance indicators and metrics since the establishment of the previous 2007 Corrective Action Plan. In response to the 2011 GAO report (GAO-11-364R) entitled "Additional Cost Transparency and Design Criteria Needed for NASA Projects," the NASA OCE undertook an effort to determine and implement a set of common metrics or leading indicators to assess project design stability and maturity at key points in a project's life cycle. These leading indicators provide additional insight and enhance NASA's ability to monitor and assess the stability of programs and projects as well as the maturity of their products through the development process.

Based on an OCE-led analysis via the Program and Project Management Board (PPMB), leading indicators and augmented entrance criteria for key lifecycle reviews have been incorporated into NASA policy NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*. In addition, a common set of recommended programmatic and technical indicators to support trending analysis throughout the life cycle have been incorporated into NASA policy NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*.

Tightly coupled programs, single-project programs, and projects develop and track programmatic and technical leading indicators to ensure proper progress and management. A wide range of performance trends are used, including trends in requirements, interfaces, verifications, reviews, software, problem/discrepancy reports, cost, schedule, staffing, and technical measures.

In summary, NASA has been generally successful in identifying and incorporating a wide range of metrics and leading indicators that track performance of programs and projects in the Implementation phase. This has led to pre-emptive corrective action in countless cases across the NASA flight project portfolio.

Planned Next Steps

OCE will convene a cross-Agency working group and plan steps listed in the Initiative Description section leveraging the earlier OCE analysis on leading indicators. The working group will report to the APMC on progress and recommendations by October 2019.

Output and Outcome Metrics

The output metrics are to produce a set of recommended or required indicators/metrics and any proposed changes in existing NPRs, NPDs, or handbooks. The best outcome metric would be reduced cost and schedule growth; however, it will be several years after implementation of any new practices before progress can be measured.

Interdependencies

In response to a 2011 GAO audit, NASA identified three leading indicators required to be reported by all programs and projects. These include mass margin, power margin, and Request for Action (RFA), or other means used by the program/project to track review comments (e.g., Review Item Discrepancies (RIDs) and/or Action Items). These three leading indicators were incorporated into NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*. If NASA is considering changes or alternatives to the three existing required indicators as a result of this study, NASA will need to coordinate with GAO to discuss and come to agreement on any changes.

Impediments & Challenges

Programs and projects will be reluctant to increase the number of metrics they need to gather and analyze, so the working group will have to ensure that selected metrics will truly be useful in determining progress and predicting future issues. It is critical to avoid undue reporting burdens on programs and projects.

One of the biggest impediments and challenges is the episodic communication breakdown between different management levels that can lead to miscommunication regarding emergent issues and proposed solutions. Problems identified by metrics and trends need to be accepted as credible, and appropriate corrective actions and mitigations must be implemented in a timely manner and tracked to completion.

NASA needs to prioritize program analysis at all levels of the Agency. More importantly, program analysts must be given responsibility and support from leadership. This will enable them to focus on analysis and develop the necessary expertise, tools and information-gathering networks to produce good analysis and clear recommendations for improvement. Agency, Center and program/project managers need to demand excellent analysis at all levels, and must actively use the analytical products to make decisions.

Required Resources

A team of Subject Matter Experts from across the Agency will have to be established. The time and travel resources for the team will need to be supported by each SME's respective organization. OCE resources will support OCE efforts and leadership for this initiative.

Areas of Emphasis

Area of Emphasis: Improve NASA's Governance of Strategic Acquisitions

Approximately 85% of NASA's budget is procurement. The remaining 15% of in-house work represents a key component of acquisition decisions and NASA Center work allocations. Each year, NASA must consider the acquisition approach for missions entering pre-formulation where make/buy/partner decisions must be made. The aerospace industrial base has become more diverse and complex in recent years, leading to an increase in "blended" acquisition options across international partners, an evolved industrial base via mergers and new entrants, NASA in-house capabilities, and public/private partnerships. Long-term institutional planning largely depends on the acquisition approaches that NASA adopts. Consequently, NASA is strengthening its acquisition strategy governance, helping to create a unified story for leadership on why we make the choices we do, being clear on internal outcomes and messaging, and ensuring consistency in the system. The formation on October 16, 2018 of the NASA Acquisition Strategy Council (ASC) seeks to address acquisition holistically under a single Decision Authority.

Prior to the ASC, acquisition planning and implementation was distributed across seven decision authorities, eight meeting modes, seven support staff structures, and twelve directives owners. Under the new governance structure, the ASC will be responsible for acquisition policy (NPD 1000.5, Policy for NASA Acquisition), integration, and performance; specific acquisition strategy approvals; and associated Agency future work planning. The ASC will be aligned with and complementary to the existing Agency governance architecture that includes the Executive Council, Agency Program Management Council, and Mission Support Council.

There are numerous benefits to the implementation of the ASC. There will be better documentation and communication of acquisition decisions, stronger compliance with acquisition policy, a forum to address strategic contractor and partner management, a forum to develop criteria for make/buy/partner, and a strengthened link between strategy and execution. NASA's renewed emphasis on strategic acquisitions will improve the Agency's efficacy in intelligently moving forward on large (greater than $1 Billion or other high profile) acquisitions and making data-driven decisions, ensuring a holistic view of the aerospace industrial base, international partners, and NASA in-house performance and capacity. Making smarter strategic acquisition decisions in the earliest stages of public dollar investment will better position the Agency to efficiently and effectively manage its portfolio.

Area of Emphasis: Risk Assessment, Requirements, and Concept Definition Early In the Formulation Phase

To achieve our ambitious strategic objectives, NASA needs to be a technical risk-taking agency, but also needs to seek out ways to reduce programmatic (cost and schedule) risk. NASA can reduce its programmatic risk by emphasizing its early formulation phase risk assessment and management capabilities, as well as its processes and practices for defining and controlling requirements and concepts. To improve cost and scheduling estimating, NASA will emphasize the importance of reducing risk and uncertainty earlier in projects and minimizing late changes in requirements and concepts. NASA will also emphasize the adherence to its current formulation-related documentation (e.g., directives, policies, requirements, procedures and handbooks) and practices, and consider whether changes are needed to ensure that project requirements and concepts are developed properly and as early as possible in the formulation phase. NASA can improve its processes so that prior to allocating significant funds, the agency and its stakeholders know what end objectives the project is to achieve, the project has developed the requirements to achieve those ends, and the best possible concept has been selected to meet those requirements. Areas of emphasis will include the following:

- Requirements Definition (e.g., established and flowed down, configuration controlled, clear and concise)
- Concept Development (e.g., assessment and alignment of alternative concepts to requirements, feasibility of concepts to meet requirements within margin)
- Formulation Reviews (e.g., appropriate emphasis, appropriate entrance and exit criteria, adherence to policy)

The issue of cost increases and schedule slips relative to formulation phase estimates is caused primarily by the immaturity of the concept, technical approaches, and design. The immaturity in these areas at this point in the life cycle may result in the use of inaccurate parameters for cost and schedule estimating early in projects. Cost and schedule estimates are more reliable when NASA and its suppliers clearly understand what needs to be procured based on an established design driven by clearly defined requirements.

Given that the purpose of the formulation phase is to mature the concept, technical approaches, and design, it is impossible to eliminate all of the inaccuracy in the parameters early in projects. However, by focusing more of the early formulation efforts on identifying and controlling requirements, and improving the iterative process of requirements and concept definition, NASA can improve the formulation phase and minimize the inaccuracy of cost and schedule estimating.

This area of emphasis is intended to improve NASA's risk management, and its requirements and concept development processes and practices. Any improvements made as a result should enable better cost and schedule estimation, as well as reduce overall costs for the agency.

The areas of emphasis outlined here may yield significant improvements, including:

- Identifying and mitigating technical risks earlier in projects.
- Identifying and mitigating fabrication/production/integration/test risks earlier in projects.
- Mitigating the risk, cost and schedule increases resulting from requirement instability, incompatibility, and scope creep.

- Ensuring the final selected concept meets requirements with margin.
- Ensuring both concepts and requirements can be matured and baselined as early as possible.
- Reducing the time required to move the project past notional cost and schedule estimates.

Area of Emphasis: Contractually Incentivizing High Performance

NASA will emphasize the importance of appropriately structuring contracts, evaluation periods, and incentive fees to adequately encourage high performance on NASA's largest contracts moving forward.

The Office of Procurement will emphasize best practices guidance regarding the duration of contract award fee evaluation periods in the formulation, implementation, and mission operations project lifecycle phases. For example, during formulation (Phases A and B) and operations (Phase E), an award fee evaluation period of 12 months may be sufficient to evaluate contractor performance. However, once the project enters implementation (Phases C and D), it may be more appropriate to limit the defined award fee evaluation period to six months for a more focused evaluation of contractor performance.

The use of award and incentive fees is a critical contract management tool by which the government can incentivize enhanced contractor performance during the execution of a design and development-type contract. As an example, the Performance Evaluation Board (PEB) evaluates contractor performance during the pre-determined award fee evaluation period against a pre-defined set of evaluation criteria, resulting in a score ranging from zero to 100. The PEB then provides the resultant recommended award fee score to the Fee Determination Official (FDO) for consideration. The FDO takes the PEB score under advisement, but retains the authority to freely determine the final award fee score. The award fee score directly corresponds to the level of award fee granted to the contractor.

The FDO is responsible for appointing PEB membership for a contract that uses an award fee incentive. The Office of Procurement considers it a best practice to staff the PEB with individuals who have the technical expertise to accurately evaluate contractor performance and who are organizationally situated such that they are familiar with the ongoing activities of the contractor. The PEB brings a broader management perspective to the evaluation process than exists at the monitor level, and its members accordingly should be at a relatively high management level.

Emphasizing intelligent use of award and incentive fees will lead to improved trust that the award fee contract management tool is being used fairly and accurately to incentivize contractor performance on the Agency's highest visibility contracts.

Appendices

Appendix A: NASA Associate Administrator Memorandum Initiating CAP Effort

National Aeronautics and Space Administration

Office of the Administrator
Washington, DC 20546-0001

September 6, 2018

TO: Officials-in-Charge of the Human Exploration and Operations Mission Directorate, the Science Mission Directorate, the Space Technology Mission Directorate, the Aeronautics Research Mission Directorate, the Office of the Chief Financial Officer, the Office of the Chief Information Officer, the Office of Procurement, the Office of the Chief Engineer, Goddard Space Flight Center, and Johnson Space Center

FROM: Associate Administrator

SUBJECT: Kickoff for Establishing a New Corrective Action Plan

Agency senior leadership has determined that the development of a new Corrective Action Plan (CAP) is necessary, with a final deliverable in place no later than the end of the current calendar year. This decision is in response to recent challenges in cost and schedule growth experienced by several of the Agency's highest profile missions, as well as the continued inclusion of NASA's acquisition practices in the Government Accountability Office's (GAO) biennial High Risk Report. For background, the previous CAP was established in 2008, with all initiatives completed or closed by the end of 2012. This new plan will continue to build on the legacy of programmatic improvements implemented in response to the 2008 CAP. It will encompass enhancements in NASA's policies and processes concerning program and project management, as well as related surveillance of contractors through appropriate insight and oversight. The goal of the CAP is to continue to grow the Agency's cutting-edge program and project management efforts across the board, and improve transparency and accountability for NASA's stakeholders.

The Associate Administrator, in coordination with the Chief Financial Officer, will set top-level direction for this activity. A Corrective Action Plan Working Group (CAPWG) will be convened and responsible for providing the detailed content of the plan. The CAPWG will meet weekly and be comprised of representatives from HEOMD, STMD, ARMD, SMD, OCE, OCFO, OP, and OCIO. The CAPWG will have regular opportunities to receive feedback from senior leadership via a steering committee that will be comprised of the Associate Administrator, the Deputy Associate Administrator, the Chief Financial

Officer, the Mission Directorate Associate Administrators, and the Directors of the Goddard Space Flight Center and the Johnson Space Center (or their designated representatives). In addition to guidance from the steering committee, there will be several iterative touchpoints with GAO held in October and November. Final approval of the CAP will be routed through the Agency Program Management Council (APMC). To that end, an informational briefing will occur at the October 10 APMC, and a decisional briefing will occur at the December 6 APMC.

The Strategic Investments Division, within the Office of the Chief Financial Officer, is leading the development of NASA's 2018 CAP. There will be a kickoff meeting for the CAPWG held on September 19, with subsequent meetings held on a regular basis through the end of December 2018. The first steering committee meeting will occur in early October. I ask each of you to identify who from your organization will be a member of the CAPWG and to supply their name and contact information to Kevin Gilligan (cc David C. Walters) no later than September 13, 2018.

Stephen G. Jurczyk

Appendix B: Working Group and Steering Committee Membership

A-Suite: Steve Jurczyk

A-Suite: Melanie Saunders

OCFO: Jeff DeWit

HEOMD: Bill Gerstenmaier

SMD: Thomas Zurbuchen, Sandra Connelly

ARMD: Jaiwon Shin

STMD: Jim Reuter

OCE: Joe Pellicciotti

GSFC: Steve Shinn

JSC: Debbie Korth

CAPWG Membership

Team Lead: Kevin Gilligan

HEOMD: Scott Martinelli

SMD: Gary Rawitscher

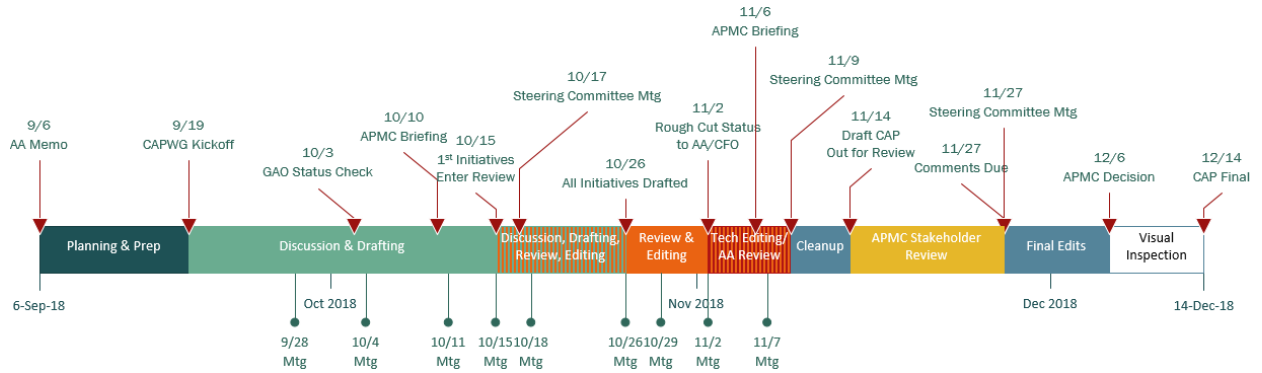**ARMD**: Tony Springer

STMD: Mike Green

OCIO: Dana Mellerio

OP: Jeff Cullen

OCE: Ellen Stigberg

OCFO SID: David Walters, Charley Hunt

Appendix C: Development Timeline

Appendix D: Acronyms List

AA – Associate Administrator
ABC – Agency Baseline Commitment
APARC – Agency Programmatic Analysis & Research Capability
APL – Applied Physics Laboratory
APMC – Agency Program Management Council
ARMD – Aeronautics Research Mission Directorate
ASC – Acquisition Strategy Council
BoE – Basis of Estimate
BPR – Baseline Performance Review
BSA – Business Services Assessment
CADRe – Cost Analysis Data Requirement
CAP – Corrective Action Plan
CAPWG –Corrective Action Plan Working Group
CDR – Critical Design Review
CE&A – Cost Estimation and Assessment
CFO – Chief Financial Officer
CFOU – Chief Financial Officer University
CJ – Congressional Justification
COO – Chief Operating Officer
DCMA – Defense Contract Management Agency
EAC – Estimate at Completion
EGS – Exploration Ground Systems
ERM – Enterprise Risk Management
ESD – Exploration Systems Development
EVM – Earned Value Management
EVMS – Earned Value Management System
FDO – Fee Determination Official
FTE – Full Time Equivalent
GAO – Government Accountability Office
GPRAMA – Government Performance and Results Act Modernization Act
GSFC – Goddard Space Flight Center
HEOMD – Human Exploration and Operations Mission Directorate

IEMP – Integrated Enterprise Management Program
IMS – Integrated Master Schedule
IPMR – Integrated Program Management Report
JCL – Joint Cost and Schedule Confidence Level
JPL – Jet Propulsion Laboratory
JSC – Johnson Space Center
KDP – Key Decision Point
KSC – Kennedy Space Center
LCC – Life-Cycle cost
LOE – Level of Effort
MD – Mission Directorate
MPAR – Major Program Annual Report
MSO – Mission Support Office
MSFC – Marshall Space Flight Center
NASA – National Aeronautics and Space Administration
NPD – NASA Policy Directive
NPR – NASA Procedural Requirements
OCE – Office of the Chief Engineer
OoE – Office of Evaluation
ORR – Operational Readiness Review
P/p – Program/project
PBR – President's Budget Request
PDF – Professional Developmental Framework
PDR – Preliminary Design Review
PEB – Performance Evaluation Board
PIO – Performance Improvement Officer
PMIAA – Program Management Improvement and Accountability Act
PMIO – Program Management Improvement Officer
PP&C – Program Planning and Control
RFA – Request for Action
RFP – Request for Proposal
RMO – Resource Management Office

SCoPe – Schedule Community of Practice
SDR – System Definition Review
SI – Schedule Initiative
SID – Strategic Investments Division
SIR – Systems Integration Review
SLS – Space Launch System
SMD – Science Mission Directorate
SME – Subject Matter Expert
SPPM&R – Strategic Planning, Performance Management, and Reporting Branch
SRB – Standing Review Board
SRR – System Requirements Review
SSME – Space Shuttle Main Engine
STMD – Space Technology Mission Directorate
SwRI – Southwest Research Institute
TRA – Technology Readiness Assessment
TRL – Technology Readiness Level
UFE – Unallocated Future Expenses
WYE – Work Year Equivalent