NASA Science Mission Directorate (SMD)
Class-D Tailoring/Streamlining
Decision Memorandum

## Summary

Class-D missions are a crucial part of the Science Mission Directorate's mission portfolio, even though they are typically at lower cost than other missions and a lower national priority. However, they provide an ideal platform for technological and architecture innovation and are a training ground for a diverse set of scientists and engineers. Class-D missions are also well-suited for novel partnership models between NASA and the commercial sector. These missions are thus a critical part of the SMD mission portfolio, but only if their management processes are aligned with their overall goals.

For that reason, SMD has been pursuing a streamlined process for implementing Class-D missions that recognizes their unique and important role in SMD's mission portfolio, which can only occur if management processes traditionally applied to other mission classes don't inadvertently suffocate the innovative potential of these missions. We note that previous attempts for such management changes were not specific enough to drive this thought process.

An overall SMD approach to managing Class-D science missions has been developed to describe the principles and approach that will guide the implementation of Class-D missions going forward. This new approach is a tailoring/streamlining of how we execute per NPR 8705.4, Risk Classification for NASA Payloads (Updated w/change 3); NPR 7120.5, NASA Space Flight Program and Project Management Requirements w/Changes 1-15; and the SMD Management Handbook.

## Decision

The new approach, as described below, was approved by SMD leadership to guide the implementation of Class-D missions. The implementation approach was briefed to representatives from NASA's Office of the Chief Financial Officer (OCFO), Office of the Chief Engineer (OCE), Office of Safety and Mission Assurance (OSMA), Office of Procurement, Space Technology Mission Directorate (STMD), select NASA Centers, and SMD Program Offices.

This policy applies to all SMD Class-D missions under $150M, not including launch cost. It is effective January 1, 2018 for all applicable projects that have not reached Key Decision Point-C (KDP-C) as of that date. Other related NASA and SMD policies and guidance will be updated to reflect these changes, as appropriate.

**Approval:**

Signature on file

12/7/17

SMD Associate Administrator — Date

## Overview

The purpose of this paper is to describe the principles and approach governing the implementation of the new SMD policy on Class-D projects for the purpose of making them a more effective tool of innovation in technology, architecture, and partnerships. Some of the primary tenants of Class-D missions are low cost, short development and operations lifecycle, and higher risk posture. This policy is a natural progression of SMD's recent approach to develop a tailored/streamlined process for implementing Class-D missions. SMD's mission portfolio already includes several Class-D science missions (RapidScat, LIS, CYGNSS, NICER, ECOSTRESS, CLARREO-PF, TROPICS, SET, and GeoCARB) in formulation, development, or operations. SMD plans to continue leveraging Class-D missions to maximize science opportunities to augment our vast and robust science portfolio by increasing the cadence, and increasing innovation. The focus of this discussion is on Class-D missions up to $150M, not including launch cost.

In April 2017, SMD hosted an all-day Class-D Summit to explore ways to streamline requirements to contain cost and ensure short development lifecycles. The Summit participants included Program Managers from multiple NASA Centers, contractors, and academic institutions that develop Class-D missions. The discussions included many areas, such as technical execution, reviews, documentation, financial management/earned value management (EVM), electrical, electronic, and electromechanical (EEE) parts, redundancy, testing, and engineering units. Based on the feedback received, SMD's policy focuses on a few key areas that can have major impact without increasing mission risk, namely reviews, documentation, and financial management/EVM.

## Class-D Mission Risk in SMD's Science Portfolio

NPR 8705.4, Appendix B defines Class-D as missions with the following characteristics: low priority to the Agency strategic plan, low-to-medium National significance, medium-to-low complexity, short lifetime (< 2 years), low cost, few launch constraints, and significant alternative launch or re-flight opportunities.

SMD Class-D projects are undertaken to carry out science investigations in the context of a larger portfolio of science investigations composed of projects of different risk classifications, from Class A (high priority/high cost/low risk) through Class D (low priority/low cost/high risk). The inclusion of higher technical risk missions is acceptable because it broadens the science output of the portfolio while not relying too heavily on any individual mission.

If the success of a particular project is absolutely necessary to the success of the portfolio, the project should not be Class-D no matter how low its cost.

SMD acknowledged that there is a risk that Class-D projects may not be successfully developed within its allocated resources. If a Class-D project overruns, SMD should consider whether the portfolio's science return is better served by (a) increasing the budget required for the Class-D project at the expense of future projects in that portfolio (typically delays or eliminates a future project in the portfolio), or by (b) terminating the Class-D project so there is no impact on other projects in that portfolio. Thus, terminations and an increased risk for failure are accepted as part of this

implementation.

**Tailoring/Streamlining Implementation Principles**

**Reviews:**
NPR 7120.5 requires the traditional development lifecycle reviews (LCRs), and associated Key Decision Points (KDPs) reviews for all projects, regardless of risk class. The objective of this tailoring/streamlining process is to execute the necessary reviews at the appropriate levels, while not reducing the lifecycle rigor for Class-D missions. Reviews for Class-D missions should be conducted, as follows:

- LCRs, peer reviews, table tops, etc. shall be conducted by the Implementing Project Institutions. Program Office and SMD personnel are expected to attend.

- Key Decision Points. – Projects shall only have two (2) KDPs during the Project development lifecycle. The KDP shall occur no later than 30 days after the lifecycle review.
    - Reviews associated with KDP's shall be conducted by NASA SMD chartered Standing Review Boards (SRBs).
    - KDP-C (the first KDP in the lifecycle) is required for all SMD missions to establish the Agency Baseline Commitment (ABC) with OMB and Congress and the Management Agreement (MA) with the implementing Project. The SMD AA is the Decision Authority (DA) for KDP-C.
    - One additional KDP (KDP-D or KDP-E) is required, which will be determined at KDP-C. The Division Director is the DA for the subsequent KDP.
    - The SMD AA reserves the authority to add KDPs and to retain DA for other KDPs normally assigned to DDs.
    - A NASA chartered Standing Review Board (SRB) will lead the two LCR's that support the two KDPs, and will be coordinated with the Institution's internal review team.
- Standing Review Board – The SRB size shall be as small as practical, with a goal of no more than six (6) members, not including the Review Manager. The Chair shall approve SMEs/consultants.
    - The Convening Authorities are the Division Director and Center Director.
- Office of Safety and Mission Assurance (OSMA)/Office of the Chief Engineer (OCE) Safety and Success Review (SMSR) is not required, but may be scheduled on a case-by-case basis. This decision shall be coordinated with OSMA, OCE, and the Division Director.

**Documentation:**
Although documentation is critical for project planning, execution, and project control, the objective of Class-D tailoring is to reduce the total overall documentation requirements, and with it the number of separate document submittals, the number of reviewers and approvers, and the configuration management burden. Below is a list of documents that are impacted by this new policy:

- The Implementing Institution is responsible for review and approval of Formulation (prior to PDR/KDP-C) documentation identified as "draft" or "preliminary" state of readiness in 7120.5. NASA HQ approval of "draft" or "preliminary" documentation prior to PDR/KDP-C is not required. The Project documentation shall always be available for the Program Office and SMD review upon request.

- Approval of final versions of documentation, such as the Formulation Agreement, is still required at the specified time in the lifecycle, in accordance with 7120.5.
- Final Project documentation, such as the Project Plan, shall be approved by the Division Director (DD) per the milestones defined in 7120.5. The SMD AA generally is not required to review and approve project documentation, but can retain the approval process.
- SMD encourages merging of documentation – The Project, and/or the Implementing Institution decides which documents to merge. For example, the Project Plan may include Risk Management Plan, V&V Plan, and Project Control Plan.[1]

**Performance Management:**

As SMD is willing to assume more risk with Class-D missions, and in the spirit of streamlining the management oversight of these missions, performance management of these missions should be done as follows:

- In the spirit of Category-3/Class-D missions, NASA shall develop only one NASA ICE/ISE, which is generally part of the responsibility by the SRB. The Center Director retains the authority to develop one ICE/ISE as she/he deems necessary for a project implemented at their Center.
- For Class-D missions, the KDP-C decision will be made based on 60% confidence levels, and not based on the usual 70%, reflecting the enhanced risk stance of this mission-class.
- Although Earned Value Management (EVM) is not required, performance measurement basic best practices are necessary as defined per performance measurement[2] shown in the Appendix below. This reflects sound accounting practices that rely on a detailed understanding of the overall work to be performed, its breakdown into measureable pieces, a well-formed understanding on how hardware and services are acquired, and a financial system that detects that expenditures and progress towards completion of the proposed hardware are consistent and verifiable.

**Implementation:**

Consistent with the approach outlined above, proposals for Class-D missions will be solicited and evaluated, as follows:

- All applicable Announcements of Opportunity (AOs) and other acquisition approaches will include examples of the above tailoring, and the Technical, Management, and Cost (TMC) evaluation process will assess accordingly.
- Management and documentation processes over and above those described here will not be considered a strength in the proposal evaluation and selection process.
- SMD recognizes the importance of these missions for training purposes and accepts the risks originating from less experienced key personnel, where mentoring and support tools are in place.
- All planned tailoring shall be included in proposals and Project Plans.

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[1] See TROPICS Project Plan as an example, https://soma.larc.nasa.gov/standardao/

[2] Per Robert Lightfoot memo 9/26/14, https://soma.larc.nasa.gov/standardao/

**Appendix 1: Minimum expected practices when implementing any spaceflight science missions.**

- Plan all work scope for the program to completion. The Project Plan will be created and is a narrative description of the authorized project work scope and deliverables for NASA in-house efforts as well as contracted efforts greater than $20M. As part of the planning effort, a Work Breakdown Structure (WBS) will be developed and used as the foundation for planning all authorized work required to complete the project.
- Break down the program work scope into finite pieces that are assigned to a responsible person or organization for control of technical, schedule and cost objectives. The control accounts (CAs) will be identified at meaningful levels within the WBS and are the main juncture for the planning and control of authorized work. A project Acquisition Plan will be created and identify all major proposed acquisitions in relation to the project WBS. The project will create and maintain an Integrated Master Schedule (IMS) in accordance with scheduling best practices.
- The project will integrate work scope, schedule, budget, and funding requirements into a Performance Measurement Baseline (PMB) against which accomplishments can be measured. A change management process should be used to ensure the integrity of the PMB. The project will provide a comprehensive Basis of Estimate (BoE) down to at least the Work Package (WP) level. The project will establish reserves based on an assessment of all known risks and uncertainty in executing the plan.
- Use actual costs incurred and recorded in accomplishing the work performed. Actual costs recorded in the accounting system will be obtained and used. It is essential that all costs be identified down to at least the CA level as work progresses and that the actual costs align to the authorized project budgets. On occasion where actual cost is not recorded in the same time period as work accomplishment, alternate methods of reporting the actual cost such as estimated actuals needs to be considered and implemented.
- Objectively assess accomplishments at the work performance level. All work will be scheduled by WBS, and CAs/WPs, using measurable units or milestones to enable the objective assessment of accomplishments and to obtain earned value (also referred to as Budgeted Cost for Work Performed or BCWP). The most appropriate Performance Management Technique (PMT) will be selected for each work package in order for EVM indicators to provide accurate and meaningful insight. Once a PMT is selected, it will be documented and reviewed by management, including the NASA Program Office, during an Integrated Baseline Review (IBR).
- Analyze significant variances from the plan, forecast impacts, and prepare an estimate at completion based on performance to date and the remaining work to be performed. The project will analyze significant cost and schedule variances on a monthly basis at a minimum, and describe cause, impact and corrective actions. Projects will include EVM metrics in monthly management reviews. The project will prepare and maintain an Estimate at Complete (EAC) based on performance to date, actuals to date, and the estimate of the cost of the work remaining to be performed. The project will calculate an EAC monthly and update the official EAC at least annually.
- Use the Earned Value Management System (EVMS) information in the organization's management processes. The project will use the EV in conjunction with other program control data at all management levels in its decision-making process to gain an understanding of the performance to date and where the project is likely headed in the future based on trending data.

NASA EVM 101 is a good reference for definitions and acronyms. https://evm.nasa.gov/