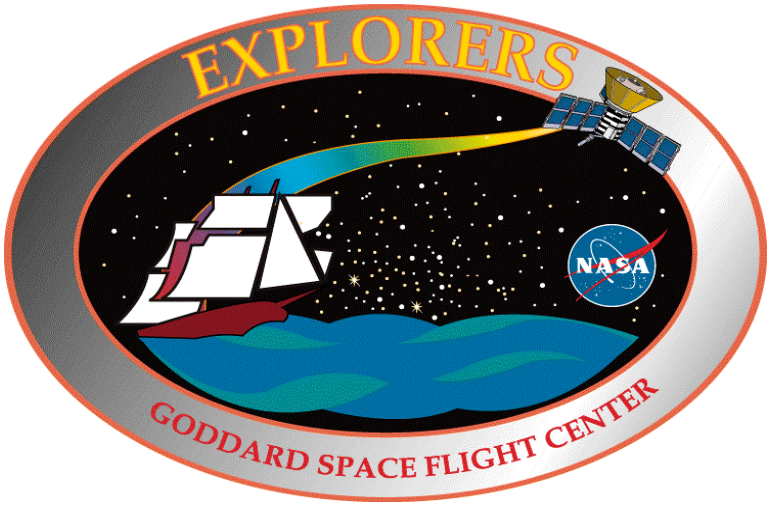
SMEX GENERAL PROJECT PLAN

AO #6 Missions – October, 2007



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SMEX General Project Plan

Science Mission Directorate Associate Administrator	***Date***
Director, Heliophysics Division	***Date***
Director, Goddard Space Flight Center	***Date***
Director, Flight Programs and Projects	***Date***
Explorers Program Manager	***Date***

PI Mission Implementation Plan (MIP)

Principal Investigator	***Date***
Director, Heliophysics Division	***Date***
Explorers Program Manager	***Date***
SMEX Mission Manager	***Date***

1.0 PROJECT OVERVIEW

1.1 INTRODUCTION

The Explorers Program is the oldest continuous program in NASA. It is comprised of a long-standing series of space science missions that are independent, but share a common funding and NASA oversight/insight management structure. Initiated with the Explorer 1 launch in 1958 and including the Nobel Prize winning COBE Mission, the Explorer program has launched over 90 missions, 11 of which have been SMEX class missions. SMEX missions are single PI, focused science investigations historically characterized by full mission costs in the $100M-$150M range, selection being via an AO process, and relatively short mission lifecycles. Though historically not always this way, the program currently administers only PI-led science investigations for SMD's Heliophysics and Astrophysics Divisions. This project plan is for the Small Explorers (SMEX) missions that are planned to be selected from the 6th SMEX AO released in October, 2007. This document is designed to accommodate the unique aspects of a PI led mission and the two step mission selection process. Specific mission details will be initially defined via the proposal at mission selection and fully defined at Mission Confirmation. This document, when appended with the PI developed Mission Implementation Plan (MIP), will be the controlling Project Plan for the mission. The MIP will contain the mission specific details of sections 2 and 3 of this project plan.

These missions will be PI led. The Goddard Procedural Requirement, "Management of Principal Investigator Mode Missions," GPR 7120.3B, will form the foundation of how the missions are managed by the Explorer Program Office. They will be implemented as Category 3 (per NPR 7120.5D) tailored Class D (per NPR 8705.4) payloads. This risk classification has been approved by the SMD AA (ref: Approval of the Reclassification of Small Explorer (SMEX) Mission, 7-10-07). The applicable elements of this mission classification are as follows:

1. Agency priority/acceptable level of risk is low/high respectively.
2. National significance is low to medium.
3. Complexity is medium to low
4. Mission lifetime is short, less than 2 years.
5. Cost is low.
6. Launch constraints are few to none.
7. No in flight maintenance
8. Re-flight opportunities are some or few.
9. Medium or significant risk of not achieving mission success permitted.

1.2 OBJECTIVES

The SMEX and MO missions are space science missions intended to address NASA's heliophysics and astrophysics goals to understand the Sun and its effects on Earth and the solar system, and to discover the origin, structure, evolution, and destiny of the universe, and search for Earth-like planets. The specific mission

objectives are defined by the PIs in their proposal and will be approved by NASA through the Mission Confirmation process.

These missions seek to conduct scientific investigations of modest and focused programmatic scope that can be developed relatively quickly, generally in 36 months or less, and executed on-orbit in less than 2 years.

1.3 MISSION DESCRIPTION AND TECHNICAL APPROACH

The specific mission objective and technical approach is defined by the PIs in their proposal and will be approved by NASA through the Mission Selection and Confirmation processes.

Single string design approaches are acceptable and likely commonplace. Implementation will largely be protoflight with the limited use of engineering models and limited flight spare hardware. In order to offset these risks, the PI is required to implement a strong formal test program, use level 3 parts or better, and provide an appropriate software test bed. The mission systems approach must be compliant with the GSFC Gold Rules Class D Appendix and the test program shall be based on GSFC-STD-7000, General Environmental Verification Standard (GEVS).

1.4 PROJECT AUTHORITY, GOVERNANCE STRUCTURE, MANAGEMENT STRUCTURE AND IMPLEMENTATION APPROACH

Explorer Program authority is delegated from the Associate Administrator for the Science Missions Directorate through the GSFC Center Director to the Explorer Program Manager within the Flight Projects Directorate at GSFC. The Principal Investigator (PI) for each SMEX mission is responsible for the overall success of the mission and is accountable to the AA/SMD for the scientific success and to the GSFC Center Director, through the Explorer Program Office, for the programmatic success. The GSFC Center Management Council (CMC) is the governing CMC for all missions overseen by the Explorer Program.

The Explorer Program Office is responsible for the oversight/insight of all Explorer missions. The Explorer Program Office will assign a Mission Manager to oversee the development of each mission and act as the principal POC for the PI. The Program Office develops the integrated budgetary requirements and recommendations for SMD based on NASA budgetary guidelines. The Program Office establishes operational policies for the Explorer Program, assures appropriate independent review of Explorer missions, monitors the progress of each mission, reports mission and program status to GSFC and NASA management, recommends necessary corrective and preventative actions, and provides access to GSFC and NASA expertise and support for the Pls.

The PI is expected to be in charge of each investigation, with full responsibility for its scientific integrity, safety, and success. The PI team will have a large degree of freedom to accomplish its proposed objectives within the stated constraints with only essential NASA oversight. The Project Management for each SMEX Mission is determined by the

PI's proposal. It could be a NASA Center or it could be a wholly external organization such as a university or private lab. As a PI-led Class D mission, it is expected that the PIs will manage the development of the mission in accordance with the best practices and standards of their parent organization and principal suppliers. The Explorer Program Office will assign a GSFC Mission Manager to each mission to ensure that NASA's interests, requirements, responsibilities, and obligations are fulfilled. The roles and responsibilities of the SMD, Goddard, Explorer Program Office, Mission Manager, and the PI are defined in GPR 7120.3B, "Management of Principal Investigator Mode Missions"

It is NASA's intent to allow the successful proposers to implement their missions utilizing the standards, practices, and processes that they best determine supports their team, provided that they are comprehensive and proven as suitable for spaceflight systems development. NASA will rely heavily on the PI to develop and execute a comprehensive development plan for the mission. Initially, the PI's proposal will provide the basis of such a plan. In support of Mission Confirmation process, the PI will submit a written Mission Implementation Plan (MIP) that will, upon approval, be the detailed basis upon which the project will be executed. The MIP is intended to be the explicit agreement between NASA and the PI on the terms and conditions under which the PI will execute the mission.

For a SMEX, the PI mission cost is limited to $105 million in FY2008 dollars, including funding for all phases and all elements (e.g., Phase A through Phase F, any GFE except standard launch services, implementation of the E/PO program, mission operations and data analysis, safety reliability and quality assurance activities, and reserves).

NASA will fund directly the costs for any non-contributed standard launch services outside of the PI mission cost with the exception of the mission unique and special launch services beyond those standard services offered in the *SMEX ELV Launch Services Information Summary* document.

Total mission cost is defined as all costs that are necessary to complete an investigation beginning with selection through Phase F, including PI mission costs, contributed non-NASA Civil Servant costs, and contributions from U.S. (including non-SMD) and non-U.S. entities

The Explorer Program does not maintain a budget reserve to which investigations exceeding their cost commitments may have access for cost overruns. If, at any time, the cost, schedule, or scientific performance commitments appear to be in peril, the investigation will be subject to cancellation.

At the investigation's Phase B/C Confirmation Review, the PI will be required to demonstrate a minimum unencumbered cost reserve (including adequate funded schedule reserve) against the cost to complete of 30% for Phases C/D/E/F.

The nominal limit for any mission's spending prior to the entry into Phase C is 25% of the total mission cost commitment for Phases A/B/C/D. Exceptions will be granted on a case-by-case basis in order to allow timely purchase of long lead items.

The Explorer Program is required to report to senior NASA management on a regular basis the status of all mission activities.

GSFC CMC	Technical Progress, Cost, Schedule	Monthly
OSS Weekly Status Report	Electronic Weekly Progress Report	Weekly

SMD has agreed to participate in the GSFC CMC Reviews in lieu of separate presentations to NASA Headquarters. In addition, the Explorer program Office electronically transmits a copy of its GSFC CMC report to the designated SMD monthly report web site.

1.5 STAKEHOLDER DEFINITION

The stakeholders of the project are solely determined by the PI via the content of the mission and the methods and organizations involved in the investigation.

2.0 PROJECT BASELINE

2.1 REQUIREMENTS BASELINE

The Program level requirements such as cost limits, needed reserves, and launch dates for the SMEX projects are set forth by SMD in the AO. The mission level 1 science requirements are defined in the proposal by the PI for approval by SMD at confirmation. Design Level 2 requirements are confirmed at the System Requirements Review (SRR). Level 3 and 4 requirements are confirmed at PDR/CDR by the Explorer Program Office. A requirements traceability and verification matrix will be used to confirm that the mission system has met all requirements and is ready for launch. Section 9, Design assurance, of the SMEX MAR describes how design and test requirements verification is to be conducted.

2.2 WBS BASELINE

The PI will define the work required for the mission using the NASA standard WBS format and dictionary shown in NPR 7120.5D, Appendix G. This information to the Level 2 elements will be in the proposal and updated at the Confirmation Review.

2.3 SCHEDULE BASELINE

The schedule baseline is defined in the proposal by the PI. It will show the project's integrated master schedule (IMS), critical milestones, major events, and Agency and project-level reviews. The schedule data should show the logical relationships (interdependencies) for the critical milestones, major events, project reviews, and critical paths, as appropriate.

2.4 RESOURCE BASELINE

The resource baseline is defined in the proposal by the PI. The baseline will show the project funding requirements by fiscal year and state the NOA in real-year dollars for all years - prior, current, and remaining. The funding requirements are linked to the project WBS and include funding for all cost elements down to the Level 2. It will also show the project's workforce requirements by fiscal year, consistent with the project funding requirements and WBS.

3.0 PROJECT CONTROL PLANS

The project control plans (described below) are initially defined in the proposal by the PI and provided in detail as part of the Mission Implementation Plan (MIP) which is required to be submitted for approval at Confirmation.

As referenced in the SMEX Mission Assurance Requirements Document (MAR), a Quality Management System Plan is required which is to include a Product Assurance Implementation Plan (PAIP) specific for the proposed payload/project. The PAIP will describe the developer's approach in implementing the requirements contained in the MAR. The PAIP shall address the developers Configuration Management Plan and is to include a Configuration Control Board, for the control of project related documentation. The PAIP shall be submitted by the developer for approval at mission confirmation.

3.1 TECHNICAL, SCHEDULE, AND COST CONTROL PLAN

Monthly technical, schedule, and cost information is collected analyzed, acted upon, and reported to Goddard's CMC and NASA headquarters to assure that project requirements are being met. The Explorer Mission Manager and his team will work with the PI and his team and participate in Project Reviews, FRB's, CCB's, and schedule, and cost sessions. Risk management will be applied following the guidelines of GPR 7120.4A .The basic risk management tools that will be used are schedule and financial reserves, risk mitigation starting early in the program, PRA, FMEA, Fault Tree Analysis, engineering models, and use of descope options. The Explorer Program Office will perform the PRA, FMEA, and Fault Tree Analysis for the mission using the relevant design data provided by the PI.

Technical status will be tracked via requirements shown in the Level 1 to Level 4 Requirements Traceability and Test Verification matrix and follow processes and requirements specified in the SMEX Class D Mission Assurance Requirements

document as well as the PI's System Engineering Management Plan and Risk Management Plan. Design margins will be established and the reserves tracked and reported.

Schedules will be generated for all elements of the mission using appropriate scheduling tools and methodology. They will identify the project critical path for management and control, contain all critical milestones for internal and external activities, show schedule reserves, and provide schedule integration and traceability.

Cost control will incorporate monthly tracking metrics such as reserve status, liens and encumbrances, reserve percentage of cost to go, obligations and cost – plan vs. actual forecast, and labor – plan vs. actual forecast.

Consistent with NPR 7120.5D Appendix F Section 3.1.6 (c), all contracts and subcontracts that the PI project awards must apply an Earned Value Management System (EVMS). The required EVM system will be scaled to the PI Institution's capability, consistent with the NASA FAR supplement clause 1852.234.-2 as prescribed in 1834.203.70(b).

In summary:

1. EVM reporting begins after the Confirmation Review
2. EVM applies to individual contracts awarded by the PI greater than $20M
3. The required EVM system is tailorable to the PI Institution's capability.

A copy of all EVMS reports shall be provided to the Explorer Mission Manager as part of the monthly project status reporting process.

3.2 SAFETY AND MISSION ASSURANCE PLAN

A System Safety Implementation Plan will be submitted as a part of the MIP. Safety and Mission assurance requirements are defined in the Explorers SMEX Class D Mission Assurance Requirements (MAR) document. The SMEX CLASS D missions will meet all NASA safety standards.

3.3 RISK MANAGEMENT PLAN

The risk management plan is defined in the proposal by the PI. The plan will describe the risk management process adequate for the mission and include the initial significant risk list showing the appropriate actions to mitigate each risk. Risk information will be provided to the Explorer mission manager for inclusion in Goddard monthly reviews. NPR 8000.4 Risk Management Procedural Requirements document will be used as a guide for this plan. Requirements are shown in Section 7 of the SMEX Mission Assurance Requirements (MAR) document.

3.4 ACQUISITION PLAN

The acquisition plan is defined in the proposal by the PI. The plan documents the overall acquisition strategy for the major deliverables and support contracts and documents all NASA and non-NASA agreements and relationships.

3.5 TECHNOLOGY DEVELOPMENT PLAN

Because of the nature of the SMEX missions with their relatively lower cost and shorter completion cycle, no technology development plan is required.

3.6 SYSTEMS ENGINEERING MANAGEMENT PLAN

The systems engineering management plan is defined in the proposal by the PI. It will describe the overall approach for systems engineering from early design to product realization. The plan will describe how performance verification is done as well as the technical management process. The proposed plan shall follow NPR 7123.1, *NASA Systems Engineering Processes and Requirements* as applicable to a SMEX Class D mission.

3.7 SOFTWARE MANAGEMENT PLAN

Formal NASA software IV&V is not required, but PI managed S/W assurance is required. Consistent with the Explorer Program emphasis on extensive system testing, a relevant software test bed shall be used for software development as well as post launch software up-loads. A Software Assurance Plan, which defined how the software development process will be managed, will be provided as specified in the MAR for approval at confirmation. NPR 7150.2 and NASA Standard 8739.8 shall be followed as appropriate for a SMEX Class D mission. Also see Section 5 of the SMEX MAR.

3.8 REVIEW PLAN

Per NPR 8705.4, Appendix B, the Explorer Program Office will specify an independent review program consistent with NPR 7120.5D and NPR 7123.1 to review each mission throughout its development lifecycle. The review panel and pass/fail gates for each review will be determined by the Program Office in conjunction with the GSFC Office of Mission Assurance, Code 300.

In an AO-driven project, the proposing teams are doing formal project formulation (e.g., putting together a detailed WBS, schedules, cost estimates, detailed designs, and implementation plan) during the funded Phase A concept studies. From the point of view of the Program, formulation has already begun. Per 7120.5D, the first KDP is the down select process. Following selection, the process becomes conventional. Due to the less complex nature of the SMEX mission designs, the relatively short development schedule, and the work already accomplished in the AO process by the time the mission

selection takes place, these teams are expected to be already approaching PDR maturity. For these reasons, but primarily because of the short development schedule, the Program Office will have the Standing Review Board (SRB) conduct some system reviews concurrently (see fig. 1.4.1 - SMEX Class D Reference Mission Timeline and Reviews), beginning with a combined PDR/CDR to be held just prior to the Mission Confirmation Review. This is intended to align the technical basis, management, and resource plans into a comprehensive Review and Approval gate for NASA and the PI to commit to execution of the mission.

The required technical maturity of the mission elements at the combined PDR/CDR is expected to be somewhat less than traditionally required at a CDR, with the residual details to be covered within the PI's peer review process. However, the mission system must be well defined. In order to facilitate this accelerated system review process, the Program Office will hold a Systems Requirements Review (SRR) four months after mission selection. The combined PDR/CDR will be held 16 months after mission selection. Mission peer reviews will be conducted consistent with GPR 8700.6A, Engineering Peer Reviews. The Explorer Program Office will rely on thorough and robust peer reviews to help mitigate development risk. The complete details of the systems review strategy is described in Appendix C, Explorers Program, SMEX Class D System Review Plan. The details of the peer review strategy will be defined in the MIP.

Circumstances such as the anticipated inability of the mission to meet its technical or programmatic commitments may be instrumental in triggering a Termination Review. The Explorer Program will recommend and notify the Decision Authority (SMD AA) of the Termination Review. The program and the project will present status including any material requested by the Decision Authority at the Termination Review.

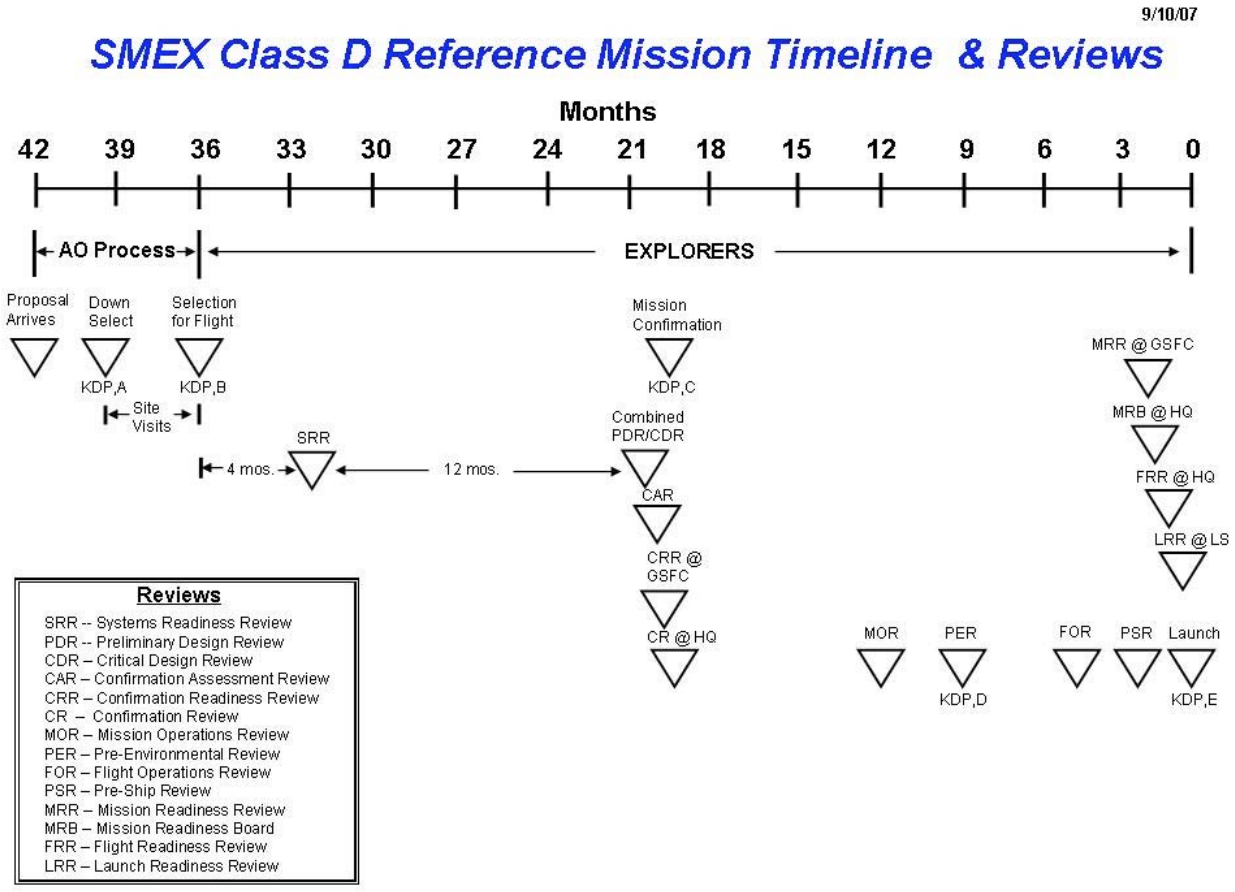


Figure 1.4.1 – SMEX Class D Explorer Mission Timeline and Reviews

3.9 MISSION OPERATIONS PLAN

The mission's operation plan is provided with the proposal by the PI. The plan will describe the activities required to perform the mission, describe how the project will implement the associated facilities, hardware, software, and procedures required to complete the mission, describe mission operations plans, rules, and constraints, and describe the Mission Operations System (MOS) and Ground Data System (GDS).

3.10 ENVIRONMENTAL MANAGEMENT PLAN

The Explorer Program Office shall support the PI in the development of this plan. Products and processes having environmental issues shall be identified in the proposal for inclusion in the plan. Usually corporations, manufacturing facilities, and other institutions already have the plans in place for such items. These existing plans will be reviewed for their acceptability.

3.11 LOGISTICS PLAN

SMEX missions are usually built in only a few locations, one for the instrument, one for the bus, and then all are shipped to the launch site as an integrated unit. Therefore no formal logistics plan is required.

3.12 SCIENCE DATA MANAGEMENT PLAN

The P.I. shall provide this plan with his proposal. The plan will describe how the project will manage the scientific data generated and captured by the operational mission and describe how data will be generated, processed, distributed, analyzed, and archived. Refer to AO paragraph 4.3.1 General Data Policies and NPD2200.1 Management of NASA Scientific and Technical Information.

3.13 INFORMATION AND CONFIGURATION PLAN

The PI shall describe the configuration management plan (See SMEX MAR DID 2.1D) that will be used for configuration identification, configuration control, interface management, records traceability, and document status. It will include how important information records are created, maintained, and retained. The NASA EXP Project Manager will be responsible for determining lessons learned and entering them into the NASA database after launch.

3.14 SECURITY PLAN

The PI shall provide this plan consistent with a SMEX low priority high risk class D mission. The plan shall address security of personnel, information, technology, and protection of the on-orbit assets. It will consider appropriate emergency response plans for the personnel and mission assets in the facility. (Reference SMEX MAR DID 6.3D)

3.15 EXPORT CONTROL PLAN

The PI shall provide this plan consistent with requirements of NPR 2190.1, NASA Export Control Plan, should any export elements exist.

3.16 ORBITAL DEBRIS PLAN

The Explorer Program Office shall support the PI in the development of this plan which will comply with NPR 8715.6 “NASA Procedural Requirements for Limiting Orbital Debris”. Also refer to SMEX MAR paragraph 3.4, Orbital Debris Assessment, and DID 3.7.

4.0 WAIVER LOG

No waiver log will be developed to NPR 7120.5D as the SMEX AO two step process results in formal acceptance of the requirements of the mission upon confirmation. Any requirements deviations will be approved at that time.

5.0 CHANGE LOG

The Goddard Explorers Program Office shall provide a log for changes to this Project Plan.

6.0 APPENDICES

Appendix A Acronyms

Appendix B Definitions

Appendix C Explorers Program, SMEX CLASS D System Review Plan

Appendix D Explorers Program, GSFC Gold Rules Application to SMEX Class D Missions

Appendix E Contract Delivery Requirements List (CDRL), CDRL Descriptions, and reference documents list.

APPENDIX A

AA	Associate Administrator
AO	Announcement of Opportunity
CDR	Critical Design Review
CE	Chief Engineer
CMC	Center Management Council
EVM	Earned Value Management
EVMS	Earned Value Management System
FAR	Federal Acquisition Regulation
FRR	Flight Readiness Review
GDS	Ground Data System
IMS	Integrated Master Schedule
KDP	Key Decision Point
LRR	Launch Readiness Review
MD	Mission Directorate
MOS	Mission Operations System
MSPSP	Missile System Pre-Launch Safety Package
NOA	New Obligational Authority
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
PI	Principal Investigator
PSR	Program Status Review
SMSR	Safety and Mission Success Review
SRB	Standing Review Board
SRR	System Requirements Review
TBD	To Be Determined
V&V	Verification and Validation
WBS	Work Breakdown Structure

APPENDIX B

Acquisition. The acquiring by contract with appropriated funds of supplies or services (including construction) by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated. Acquisition begins at the point when Agency needs are established and includes the description of requirements to satisfy Agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling Agency needs by contract. (Note: A broader view of the term *acquisition* is taken at the ASP meeting and ASM.)

Approval (for Implementation). The acknowledgment by the Decision Authority that the program/project has met stakeholder expectations and formulation requirements, and is ready to proceed to implementation. By approving a program/project, the Decision Authority commits the budget resources necessary to continue into implementation. Approval (for Implementation) must be documented.

Approval. Authorization by a required management official to proceed with a proposed course of action. Approvals must be documented.

Baseline (Document Context). Implies the expectation of a finished product, though updates may be needed as circumstances warrant. All approvals required by Center policies and procedures have been obtained.

Baseline Science Requirements. The mission performance requirements necessary to achieve the full science objectives of the mission. (Also see Threshold Science Requirements.)

Center Management Council (CMC). The council at a Center that performs oversight of programs and projects by evaluating all program and project work executed at that Center.

Concurrence. A documented agreement by a management official that a proposed course of action is acceptable.

Configuration Management. A management discipline applied over the product's life cycle to provide visibility into and to control changes to performance, functional, and physical characteristics.

Contract. A mutually binding legal relationship obligating the seller to furnish the supplies or services (including construction) and the buyer to pay for them. It includes all types of commitments that obligate the Government to an expenditure of appropriated funds and that, except as otherwise authorized, are in writing. In addition to bilateral instruments, contracts include (but are not limited to) awards and notices of awards; job orders or task letters issued under basic ordering agreements; letter contracts; orders, such as purchase orders, under which the contract becomes effective by written acceptance or performance; and bilateral contract modifications. Contracts do not include grants and cooperative agreements.

Decision Authority. The Agency's responsible individual who authorizes the transition of a program/project to the next life-cycle phase.

Earned Value Management (EVM). A tool for measuring and assessing project performance through the integration of technical scope with schedule and cost objectives during the execution of the project. EVM provides quantification of technical progress, enabling

management to gain insight into project status and project completion costs and schedules. Two essential characteristics of successful EVM are EVM system data integrity and carefully targeted monthly EVM data analyses (i.e., risky WBS elements).

Engineering Requirements. Requirements defined to achieve programmatic requirements and relating to the application of engineering principles, applied science, or industrial techniques.

Environmental Impact. The direct, indirect, or cumulative beneficial or adverse effect of an action on the environment.

Environmental Management. The activity of ensuring that program and project actions and decisions that potentially impact or damage the environment are assessed/evaluated during the formulation/planning phase and reevaluated throughout implementation. This activity must be performed according to all NASA policy and Federal, state, and local environmental laws and regulations.

Evaluation. The continual, independent (i.e., outside the advocacy chain of the program/project) evaluation of the performance of a program or project and incorporation of the evaluation findings to ensure adequacy of planning and execution according to plan.

Final (Document Context). Implies the expectation of a finished product. All approvals required by Center policies and procedures have been obtained.

Formulation. The identification of how the program or project supports the Agency's strategic needs, goals, and objectives; the assessment of feasibility, technology and concepts; risk assessment, team building, development of operations concepts and acquisition strategies; establishment of high-level requirements and success criteria; the preparation of plans, budgets, and schedules essential to the success of a program or project; and the establishment of control systems to ensure performance to those plans and alignment with current Agency strategies.

Implementation. The execution of approved plans for the development and operation of the program/project, and the use of control systems to ensure performance to approved plans and continued alignment with the Agency's strategic needs, goals, and objectives.

Information Technology. Any equipment, or interconnected system(s) of subsystem(s) of equipment, that is used in the automatic acquisition, storage, analysis, evaluation, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the Agency.

Key Decision Point (KDP). The event at which the Decision Authority determines the readiness of a program/project to progress to the next phase of the life cycle (or to the next KDP).

Logistics. The management, engineering activities, and analysis associated with design requirements definition, material procurement and distribution, maintenance, supply replacement, transportation, and disposal that are identified by space flight and ground systems supportability objectives.

Management Requirements. Requirements that focus on how NASA does business that are independent of the particular program or project. There are four types: engineering, program/project management, safety and mission assurance, and Mission Support Office functional requirements.

Metric. A measurement taken over a period of time that communicates vital information about the status or performance of a system, process, or activity. A metric should drive appropriate action.

Mission. A major activity required to accomplish an Agency goal or to effectively pursue a scientific, technological, or engineering opportunity directly related to an Agency goal. Mission needs are independent of any particular system or technological solution.

Preliminary (Document Context). Implies that the product has received initial review in accordance with Center best practices. The content is considered correct, though some TBDs may remain. All approvals required by Center policies and procedures have been obtained. Major changes are expected.

Principal Investigator (PI). A person who conceives an investigation and is responsible for carrying it out and reporting its results. In some cases, PIs from industry and academia act as Project Managers for smaller development efforts with NASA personnel providing oversight.

Program. A strategic investment by a Mission Directorate or Mission Support Office that has a defined architecture and/or technical approach, requirements, funding level, and a management structure that initiates and directs one or more projects. A program defines a strategic direction that the Agency has identified as critical.

Program Plan. The document that establishes the Programs' baseline for implementation, signed by the MDAA, Center Director(s), and Program Manager.

Program (Project) Team. All participants in program (project) formulation and implementation. This includes all direct reports and others that support meeting program (project) responsibilities.

Program/Project Management Requirements. Requirements that focus on how NASA and Centers perform program and project management activities.

Project. A specific investment identified in a *Program Plan*having defined requirements, a life-cycle cost, a beginning, and an end. A project yields new or revised products that directly address NASA's strategic needs.

Project Plan. The document that establishes the Project's baseline for implementation, signed by the cognizant Program Manager, Center Director, Project Manager, and the MDAA, if required.

Risk. The combination of the probability that a program or project will experience an undesired event and the consequences, impact, or severity of the undesired event, were it to occur. The undesired event may come from technical or programmatic sources (e.g., a cost overrun, schedule slippage, safety mishap, health problem, malicious activities, environmental impact, failure to achieve a needed scientific or technological objective, or success criterion). Both the probability and consequences may have associated uncertainties.

Risk Assessment. An evaluation of a risk item that determines (1) what can go wrong, (2) how likely is it to occur, (3) what the consequences are, and (4) what are the uncertainties associated with the likelihood and consequences.

Risk Management. An organized, systematic decision-making process that efficiently identifies, analyzes, plans, tracks, controls, communicates, and documents risk and establishes mitigation approaches and plans to increase the likelihood of achieving program/project goals.

Safety. Freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment.

Safety and Mission Assurance Requirements. Requirements defined by the SMA organization related to safety and mission assurance.

Security. Protection of people, property, and information assets owned by NASA, which covers physical assets, personnel, IT, communications, and operations.

Stakeholder. An individual or organization having an interest (or stake) in the outcome or deliverable of a program or project.

Standing Review Board (SRB). The entity responsible for conducting independent reviews of the program/project per the life-cycle requirements. The SRB is advisory and is chartered to objectively assess the material presented by the program/project at a specific review.

System. The combination of elements that function together to produce the capability required to meet a need. The elements include all hardware, software, equipment, facilities, personnel, processes, and procedures needed for this purpose.

Systems Engineering. A disciplined approach for the definition, implementation, integration, and operation of a system (product or service).The emphasis is on achieving stakeholder functional, physical, and operational performance requirements in the intended use environments over its planned life within cost and schedule constraints. Systems engineering includes the engineering processes and technical management processes that consider the interface relationships across all elements of the system, other systems, or as a part of a larger system.

Validation. Proof that the product accomplishes the intended purpose based on stakeholder expectations. May be determined by a combination of test, analysis, demonstration, and inspection.

Verification. Proof of compliance with design solution specifications and descriptive documents. May be determined by a combination of test, analysis, demonstration, and inspection.

Waiver. A documented authorization intentionally releasing a program or project from meeting a requirement.

Work Agreement. The Center form (or equivalent), prepared for each program/project cost account and used to document agreements and commitments for the work to be performed, including scope of work, receivables/deliverables, schedule, budget, and assumptions.

Work Breakdown Structure (WBS). A product-oriented hierarchical division of the hardware, software, services, and data required to produce the program/project's end product(s), structured according to the way the work will be performed, and reflective of the way in which program/project costs, schedule, technical and risk data are to be accumulated, summarized, and reported.

APPENDIX C

Explorers Program, SMEX Class D General System Review Plan

Original Signed by: _____
Chief, Systems Review Office Date

Original Signed by: _____
Explorers Program Manager Date

Introduction- These missions will be PI led. The Goddard Procedural Requirement, "Management of Principal Investigator Mode Missions," GPR 7120.3B, will form the foundation of how the missions are managed by the Explorer Program Office. They will be implemented as Category 3 (per NPR 7120.5D) tailored Class D (per NPR 8705.4) payloads. This risk classification has been approved by the SMD AA (ref: Approval of the Reclassification of Small Explorer (SMEX) Mission, 7-10-07). The applicable elements of this mission classification are as follows:

1. Agency priority/acceptable level of risk is low/high respectively.
2. National significance is low to medium.
3. Complexity is medium to low
4. Mission lifetime is short, less than 2 years.
5. Cost is low.
6. Launch constraints are few to none.
7. No in flight maintenance
8. Re-flight opportunities are some or few.
9. Medium or significant risk of not achieving mission success permitted.

These missions seek to conduct scientific investigations of modest and focused programmatic scope that can be developed relatively quickly, generally in 36 months or less, and executed on-orbit in less than 2 years.

NPR 8705.4, Appendix B, does not require a full formal review program, but rather calls for Center level reviews that may be delegated to the Project and that software requirements and code assessment is by peer review. The Center has delegated responsibility for establishing the review plan to the Explorers Program Office. The Explorers Program Manager will select the mission review team chairman with the concurrence of Code 300. The review team chairman and the project Mission Manager will select the Standing Review Board (SRB) team members with the concurrence of the System Review Manager (SRM) in accordance with GPR 8700.4. The Goddard System review Office will provide the System Review Manager (SRM). In some cases the SRM may be appointed as the SRB chair by the Program Manager with the concurrence of Code 300. The role of the SRM is to:

1. To ensure that all SRB reviews are conducted in a manner consistent with GPR 8700.4, Integrated Independent Reviews as modified here-in and provide access to GRMS for use in tracking RFA's.
2. Support the chair in developing a Flight Readiness Report (aka "Redbook") that documents the level of accomplishment and subjectively quantifies the residual risk remaining in the project.

This report is submitted to the GSFC center director for approval prior to the Flight Readiness Review.

The SRB will follow the mission development to launch.

Major Reviews:

The SMEX system review process will be supported by a robust independent peer review program that will assess the technical adequacy of mission element designs and remaining technical risks. The review process will include six (6) major system reviews identified below and referenced in appendix G of NPR 7123.1, NASA Systems Engineering Processes and Requirements as modified here-in.

- **G4, System Requirements Review (SRR)**
- **G7 and G8, Combined PDR/CDR**
- **Mission Operations Review (MOR)**
- **G11, Pre-Environmental Review (PER)/or Test readiness review (TRR)**
- **Flight Operations Review (FOR)**
- **G12, Pre-Ship Review (PSR)/ or System Acceptance Review(SAR)**
  -G13, Operational Readiness Review

Each review is explained below along with the entrance criteria for starting the review and the success criteria.

G4, System Requirements Review (SRR) – The SRR examines the functional and performance requirements defined for the system and ensures that the requirements and the selected concept will satisfy the mission. The SRR will be held approximately four months after the start of Phase B. The SRR establishes that system requirements are clearly understood, that the allocation of requirements to each independent subsystem element and their respective subsystems is complete and verifiable, and that those lower level requirements are traceable to the mission level. Technical content at this review may be limited to that necessary for a reasonable evaluation of the requirements flow and to clearly demonstrate that the design meets those requirements.

Table G-4 SRR Entrance and Success Criteria

System Requirements Review	
Entrance Criteria	**Success Criteria**
1. A preliminary SRR agenda, success criteria, and charge to the board have been agreed to by the technical team, project manager, and review chair prior to the SRR. 2. The following technical topics shall be addressed at the review: a. System requirements b. System software functionality description c. Updated Concept of Operations d. Mission Requirements e. Baseline System Engineering Management Plan(SEMP) f. Risk Management Plan g. Preliminary system requirements allocation to the next lower level system h. Risk assessment and mitigations. i. Configuration Management System as defined in the MAR j. Initial document tree k. Verification and Validation approach l. Preliminary system safety assessment m. Gold Rules application	1. The project utilizes a sound process for the allocation and control of requirements throughout all levels, and a plan has been defined to complete the definition activity within schedule constraints. 2. Requirements definition is complete with respect to top-level mission and science requirements, and interfaces with external entities and between major internal elements have been defined. 3. Requirements allocation and flow down of key driving requirements have been defined down to subsystems. 4. Preliminary approaches have been determined for how requirements will be verified and validated down to the subsystem level. 5. Major risks have been identified and technically assessed, and viable mitigation strategies have been defined.

G7 and G8, Combined PDR/CDR – The combined Instrument, Spacecraft, Mission PDR/CDR demonstrates that the design is clearly beyond PDR maturity level and of sufficiently maturity to support proceeding with full-scale fabrication, assembly, integration, and test. The combined Instrument, Spacecraft, Mission PDR/CDR will be held approximately sixteen months after the start of Phase B (selection for flight). At this review the project establishes that it is on track to complete flight and ground system development and will perform mission operations, meeting mission performance requirements within identified cost and schedule constraints. It is anticipated that most of the detailed designs will be complete at this review.

Table G-7/8 Combined PDR/CDR Entrance and Success Criteria

Combined PDR/CDR	
Entrance Criteria	**Success Criteria**
1. Successful completion of the SRR and responses made to all SRR RFAs and RIDs, or a timely closure plan exists for those remaining open. 2. A preliminary review agenda, success criteria, and charge to the board have been agreed to by the PI, project manager, and review chair prior to the review. 3. Technical topics listed below for both hardware and software system elements shall be addressed at the review: a. Subsystem design specifications for each configuration item (hardware and software), with supporting trade-off analyses and data, as required. The software design specification should include a completed definition of the software architecture and a database design description. b. Subsystem and component product build-to specifications for each hardware and software configuration item c. Fabrication, assembly, integration, and test plans and procedures d. Technical data information (e.g., integrated schematics, spares provisioning list, interface control documents, engineering analyses, and specifications) e. Operational limits and constraints f. Engineering drawing tree g. Contamination control plan h. Command and telemetry list	1. The detailed design is expected to meet the requirements with adequate margins at an acceptable level of risk. 2. The flow down of verifiable requirements is complete and requirements are traceable to mission goals and objectives. 3. Interface control documents are sufficiently matured to proceed with fabrication, assembly, integration, and test, and plans are in place to manage any open items. 4. High confidence exists in the product baseline, and adequate documentation exists or will exist in a timely manner to allow proceeding with fabrication, assembly, integration, and test. 5. The product verification and product validation requirements and plans are complete. 6. The testing approach is comprehensive, and the planning for system assembly, integration, test, and launch site and mission operations is sufficient to progress into the next phase. 7. Adequate technical and programmatic margins and

Combined PDR/CDR	
Entrance Criteria	**Success Criteria**
i. Updated Requirements verification matrix / validation plan j. Updated risk assessment and mitigation k. Reliability analyses and assessments (NASA will assist with the PRA, FTA and the FMEA based on information supplied by the developer) l. Updated Limited Life Items List (LLIL) m. System safety analysis with associated verifications n. Gold Rules application	resources exist to complete the development within budget, schedule, and risk constraints. 8. The operational concept is technically sound and includes the flow down of requirements for execution. 9. Risks to mission success are understood and credibly assessed, and plans and resources exist to effectively manage them. 10. Safety and mission assurance (e.g., safety, reliability, maintainability, quality, and EEE parts) have been adequately addressed in system and operational designs, and any applicable S&MA products (e.g., PRA, system safety analysis and failure modes and effects analysis) have been approved.

Mission Operations Review (MOR) – The MOR establishes the adequacy of plans and schedules for ground systems and flight operations preparation in order to justify proceeding with implementation. It is typically held subsequent to completion of detailed design and fabrication activities, but prior to initiation of major integration of flight and ground system elements.

G11, Pre-Environmental Review (PER)/or Test readiness review (TRR) - The PER ensures that the test article (hardware/software), test facility, support personnel, and test procedures are ready for testing and data acquisition, reduction, and control. Through a complete and comprehensive evaluation of project status, the PER establishes readiness to proceed with environmental testing of the integrated flight system and to demonstrate that the project is on track to complete flight and ground system development and to perform mission operations within identified cost and schedule resources. The PER is held after completion of the initial successful comprehensive systems test of the fully integrated flight system and prior to initiation of the system level environmental test sequence.

Table G-11 PER Entrance and Success Criteria

Pre-Environmental Review	
Entrance Criteria	**Success Criteria**
1. The objectives of the testing have been clearly defined and documented, and all of the test plans, procedures, environment, and configuration of the test item(s) support those objectives. 2. Configuration of the system under test has been defined and agreed to. All interfaces have been placed under configuration management or have been defined in accordance with an agreed to plan, and a version description document has been made available to TRR participants prior to the review. 3. All applicable functional, unit-level, subsystem, system, and qualification testing has been conducted successfully. 4. All TRR-specific materials, such as test plans, test cases, and procedures, have been available to all participants prior to conducting the review. 5. All known system discrepancies have been identified and disposed in accordance with an agreed-upon plan. 6. All previous design review success criteria and key issues have been satisfied in accordance with an agreed-upon plan. 7. All required test resources people (including a designated test director), facilities, test articles, test instrumentation, and other test enabling products have been identified and are available to support required tests. 8. Roles and responsibilities of all test participants are defined and agreed to. 9. Test contingency planning has been accomplished, and all personnel have been trained.	1. Adequate test plans are completed and approved for the system under test. 2. Adequate identification and coordination of required test resources are completed. 3. Previous component, subsystem, and system test results form a satisfactory basis for proceeding into planned tests. 4. Risk level is identified and accepted by program/competency leadership as required. 5. The objectives of the testing have been clearly defined and documented, and review of all the test plans, as well as the procedures, environment, and configuration of the test item, provide a reasonable expectation that the objectives will be met. 6. The test cases have been reviewed and analyzed for expected results, and the results are consistent with the test plans and objectives. 7. Test personnel have received appropriate training in test operation and safety procedures.

Flight Operations Review (FOR) - The FOR reviews the progress of ground system development and mission operations planning activities and establishes readiness to proceed with final preparations of ground system elements to support successful launch and mission operations. The FOR is held late in the test flow of the flight system but prior to the last major interactive test between the flight and ground system elements. The review is conducted before shipment of flight system elements to the launch site.

G12, Pre-Ship Review (PSR)/ or System Acceptance Review(SAR) – The PSR verifies the completeness of the specific end products in relation to their expected maturity level and assesses compliance to stakeholder expectations. It establishes that all flight and ground system verification activities have been successfully completed. The PSR examines the system, its end products and documentation, and test data and analyses that support verification. It also ensures that the system has sufficient technical maturity to authorize its shipment to the designated operational facility or launch site. The PSR is conducted prior to shipment of flight system elements to the launch site and after successful completion of all verification activities, including environmental and functional performance testing as well as ground system and network compatibility testing.

- G13, Operational Readiness Review (ORR) - The ORR subject matter will be included within the framework of the PSR. The ORR examines the actual system characteristics and procedures used in the operation of the end product. It also determines if all operational supporting facilities, equipment, documents, up-dated data bases necessary for the normal and contingency operations have been tested, delivered, and installed at the sites to support flight activities. It ensures that all system and support (flight and ground) hardware, software, personnel, procedures, and user documentation accurately reflect the deployed state of the system.

Table G-12 PSR Entrance and Success Criteria, and G-13 ORR Entrance and Success Criteria

Pre-Ship Review	
Entrance Criteria	**Success Criteria**
1. A preliminary agenda has been coordinated prior to the PSR. 2. The following technical topics shall be addressed at the review: a. Product verification results; b. Product validation results; c. Documentation that the delivered system complies with the established acceptance criteria; d. Documentation that the system will perform properly in the expected operational environment; e. Technical data package updated to include all test results; f. Certification package; g. Updated risk assessment and mitigation; h. Successfully completed previous milestone reviews.	1. Required tests and analyses are complete and indicate that the system will perform properly in the expected operational environment. 2. Risks are known and manageable. 3. System meets the established acceptance criteria. 4. Required safe shipping, handling, checkout, and operational plans and procedures are complete and ready for use. 5. Technical data package is complete and reflects the delivered system. 6. All applicable lessons learned for organizational improvement and system operations are captured.

Pre-Ship Review	
Entrance Criteria	**Success Criteria**
i. Remaining liens or unclosed actions and plans for closure. 3. Operational Readiness Review, G13 a. All validation testing has been completed. b. Test failures and anomalies from validation testing have been resolved and the results incorporated into all supporting and enabling operational products. c. All operational supporting and enabling products (e.g., facilities, equipment, documents, updated databases) that are necessary for the nominal and contingency operations have been tested and delivered/installed at the site(s) necessary to support operations. d. Operations handbook has been approved. e. Training has been provided to the users and operators on the correct operational procedures for the system. f. Operational contingency planning has been accomplished, and all personnel have been trained.	7. The system, including any enabling products, is determined to be ready to be placed in an operational status. 8. All waivers and anomalies have been closed. 9. Systems hardware, software, personnel, and procedures are in place to support operations.

Other Reviews:

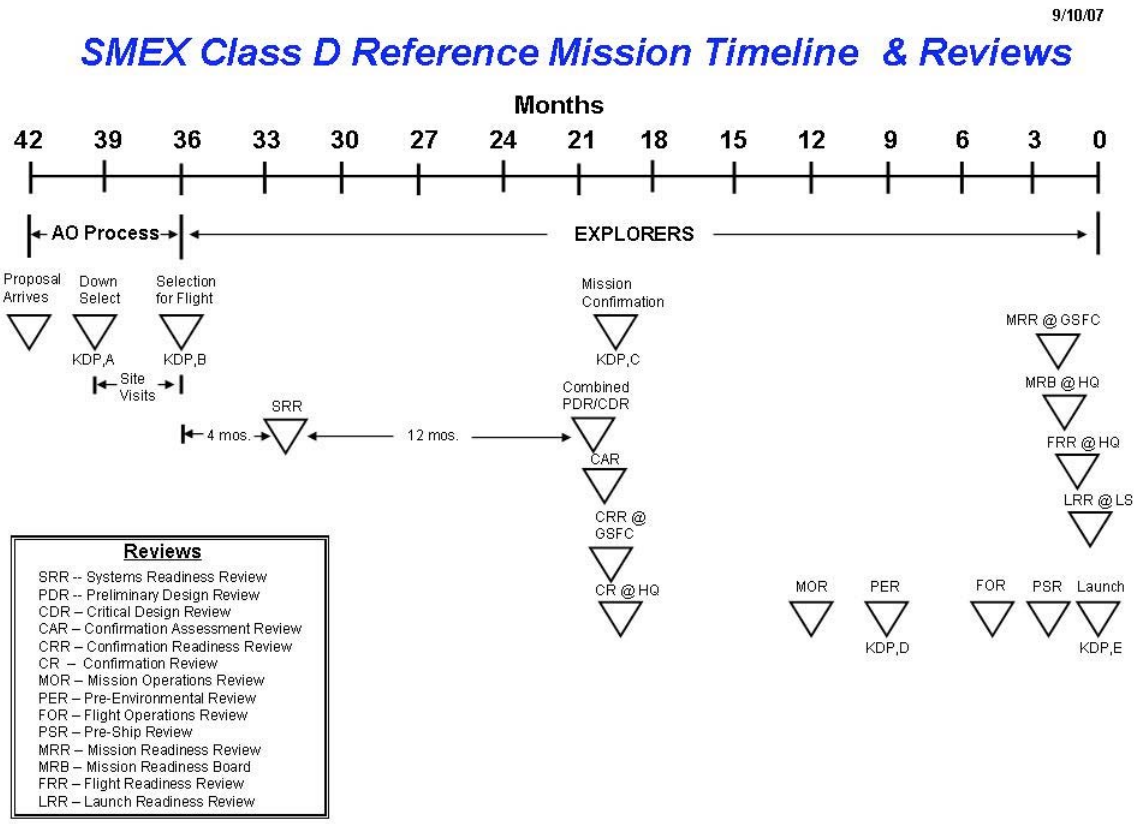
G20, Technical Peer Reviews - Instrument and sub-system level peer reviews are informal reviews defined and implemented by the PI per GPR 8700.6A. The results and the issues raised in these reviews will be summarized in writing by the peer review chair and forwarded through the Mission Manager to the SRB for information prior to the next higher level review. See NPR-7123.1A for complete peer review description.

Instrument Reviews - Instrument specific reviews (PDR/CDR, PER, Pre-ship) are treated as technical peer reviews. The results and the issues raised in these reviews will be summarized in writing by the peer review chair and forwarded through the Mission Manager to the SRB for information prior to the next higher level review.

Participation of selected SRB members in the instrument and spacecraft peer reviews will be with the concurrence of the PI, Project Manager, and the SRB Chair.

Enterprise Reviews – The following reviews are outside of the formal system review process, but must be supported by the PI, Mission Manager, Project Manager, SRM, and SRB chair:

Confirmation Readiness Reviews (CRR/CR)
Safety and Mission Success review (SMSR) @ HQ
Mission Readiness Review (MRR) @ GSFC CMC
Mission Readiness Board (MRB) @ HQ
Flight Readiness Review (FRR) @ launch site
Launch Readiness Review (LRR) @ launch site



APPENDIX D

Explorers Program, GSFC Gold Rules Application to SMEX Class D Missions

Original Signed by: _____
Director, Applied Engineering and Technology ***Date***

Original Signed by: _____
Explorers Program Manager ***Date***

Goddard Space Flight Center Rules (GSFC-STD-1000), sometimes referred to as GOLD Rules, are a high-level subset of all the design rules required for safety and mission success of all space flight missions. These rules spell out the technical or design requirements that every Goddard project should meet regardless of its implementation approach. GSFC Rules are not intended to serve as a "cookbook" or "how-to" guide, but rather as another tool for assessing overall project risk, assuring mission success, and providing early visibility to senior management where risks are being incurred.

GSFC Rules are high-value principles that establish the methodology necessary to consistently and efficiently achieve safety and mission success, with rationale based on sound engineering practice, systems management principles, or lessons learned. While these principles are valid for the range of NASA payloads, some rules may be more appropriately waived than others for higher risk classification levels. The next set of SMEX missions, having been reclassified as Category 3, Class D missions, are likely near term candidates for this type of waiver.

In order to streamline the formal documentation process, GSFC will evaluate a priori rules waiver/deviation requests in the form of a proposed Mission Exceptions List. This list should include rationale consistent with the SMEX classification and proposed mission specifics. It should also be guided by the SMEX philosophy of a rigorous and disciplined systems engineering program, combined with the prevention of problems by using high quality parts, materials and workmanship, guarded by a strong test program.

Consistent with this AO, proposed exceptions should focus on rules associated with removing additional layers of mission safeguards consistent with increased mission risk tolerance. These proposed exceptions should have a practical resource benefit associated with "not having to do something," as opposed to "not having to do

something well." Proposed exceptions should not include rules that highlight good engineering and management practice, ensure personnel safety, or relax proven engineering design/test requirements. It is anticipated that a proposed exceptions list would be received and negotiated early in Phase B, before the first systems review. Once a Mission Exceptions List is approved, the project would not have to seek waivers or deviations from those rules over the project's lifecycle. Other GOLD Rules beyond the approved Mission Exceptions List would still require formal waiver or deviation for non-compliance.

APPENDIX E

SMEX Class D CDRL LIST

CDRL	Description	FOR	WHEN	MAR DID	Project Plan
1.	Signed Mission Implementation Plan between PI and the Explorer Program Office	A	Draft at SRR Final at Confirmation		1.1
2.	Level 1 Science agreement; signed by NASA HQ, Office of Space Science (OSS) and the Principal Investigator (PI)	A	Confirmation		
3.	Five-level Project WBS & Dictionary, Per 7120.5D	I	Start of phase B		2.2
4.	Weekly Progress reports/Telecom	I	Start of Phase B		1.4
5.	Monthly Progress Reports (Monthly Management Meeting)	I	Start of Phase B		1.4
6.	Inputs to Lessons Learned Information System (LLIS)	I	Launch (+30) days		3.13
7.	Performance Assurance Implementation Plan (PAIP)	A	Preliminary at Phase A Final at Confirmation	2.1D	3.0
8.	Configuration Management Plan	I	PDR/CDR	2.1D	3.0
9.	Software Requirements Assurance, Test, and Verification Plan	R	PDR/CDR	5.1D,5.2 D	3.7
10.	Mission Requirements, Traceability & Verification Doc	R	SRR	9.1D	2.1
11.	Mission System Test and Verification Plan	R	PDR/CDR		
12.	Observatory Integration and Test Plan and Procedure Document Plan	R	PER		
13.	Test and Verification Procedures	I	14 Days Before Use	9.1D	
14.	Operational Hazard Analysis	I	PDR/CDR, Final PDR/CDR + 6 Mo	3.4D	
15.	Inputs to Probabilistic Risk Assessment (PRA)	R	6 Mo prior to PDR/CDR	4.1D, 4.6D	3.1
16.	Inputs to Preliminary Failure Modes and Effects Analysis (FMEA)	R	6 Mo prior to PDR/CDR	4.2D	3.1
17.	Inputs to Fault Tree Analysis	R	6 Mo prior to PDR/CDR	4.3D	3.1
18.	Worst Case Analysis	R	PDR/CDR	4.4D	
19.	Contamination Control Plan	I	PDR/CDR	13.1D	
20.	IT Security Plan	R	Confirmation	6.3D	3.14

CDRL	Description	FOR	WHEN	MAR DID	Project Plan
21.	Inputs to NTIA Spectrum Applications	R	Confirmation		
22.	Inputs to S/C to L/V ICD	R	PDR/CDR		
23.	Failure Notification and Failure Analysis Report	I	Notification immediate, report 1 week after FRB	12.6D	
24.	Inputs Orbital Debris Analysis	R	Preliminary at SRR, Final at PDR/CDR	3.7D	3.16
25.	Systems Requirements Review (SRR) Package	R	Start of Phase B (+4) Months		3.8
26.	Combined Observatory PDR/CDR Package	R	End of Phase B	8.3D	3.8
27.	Confirmation Assessment Review (CAR) Package	A	In conjunction with PDR/CDR		
28.	Instrument PDR and CDR packages(if held separately)	R	2 weeks before reviews		
29.	Instrument Pre-Environmental Review (PER) package	R	PER (- 2) weeks	8.6D	
30.	Observatory Pre-Environmental (PER) package	R	PER (- 2) weeks	8.6D	
31.	Instrument Pre-Ship Review (PSR) package	R	PSR (- 2) weeks	8.8D	
32.	Observatory Pre-Ship Review (PSR) package	R	PSR (- 2) weeks		
33.	Mission Operations Center (MOC) and Science Operations and Data Analysis (SODA) review package	R	MOR		
34.	Mission Operations Review (MOR) package	R	Launch (-16) months	8.5D	
35.	Flight Operations Review (FOR) package	R	Launch (-4) months	8.7D	
36.	Mission Readiness Review (MRR) package	A	Launch (-4) months	8.10D	
37.	Inputs to Safety and Mission success review(SMSR)	R	Launch (-4) months	8.2D TO 8.10D	
38.	Inputs to Flight Readiness Review (FRR)	A	Launch (-3) months		
39.	Inputs to Launch Readiness Review (LRR)	A	LRR (-2) weeks		
40.	Inputs to S/C to GS/RF ICD	R	PDR/CDR		

CDRL	Description	FOR	WHEN	MAR DID	Project Plan
41.	Inputs to Project Service level agreement(PSLA)	R	PDR/CDR		
42.	Science data System ICD	I	MOR		
43.	Ground System ICD	I	MOR		
44.	Ground System Test Plan	I	MOR		
45.	Launch and Early Orbit Operations Plan, Timeline and Script	R	Launch (-18) Months		
46.	FOT Training and Simulation Plans	I	At MOR		
47.	Contingency Operations Plan	I	Preliminary at MOR Final at FOR		
48.	Instrument and Spacecraft Bus Activation and Acceptance Plans	I	Preliminary at MOR Final at FOR		
49.	Instruments, S/C Bus and MOC Users Guides/Handbooks	AFR	FOR		
50.	On-orbit Anomaly Report	R	Notification immediate, report 1 week after FRB	6.1D	
51.	Mission System Pre-Launch Safety Data Package (MSPSP)	A	Preliminary at PDR/CDR, Final at PER	3.5D	
52.	Hazardous Procedures to Range	R	Launch (-4) months	3.5D	
53.	Launch Site Ground Operations Procedures	R	Launch (-4) months	3.6D	
54.	Range Safety Requirements “Tailoring”—EWR127 Chapter 3	R	PDR (-2) months	3.1D	
55.	Parts list (Instrument & S/C)	R/I	Preliminary at PDR/CDR, As built at PER	11.2D TO 11.4D	
56.	Materials list (Instrument & S/C)	R/I	Preliminary PDR/CDR, As-built PER	12.3D	
57.	GIDEP Alert/NASA Advisory Disposition	R	As Released		
58.	Closeout photos of flight printed wiring boards, mechanisms, instruments, bus, and observatory	I	As Close Out Occurs	2.5D	

Note:

R (Review) - Documents in this category are to be reviewed within 10 working days by the GSFC or its designated representatives in order to determine contractor effectiveness in meeting contract

objectives. When Government review reveals inadequacies, the contractor may be requested to correct the inadequacies.

I (Information) - Documents in this category are to be provided to GSFC or its designated representative for information purposes only. No Government response is required.

A (Approve) - Documents in this category require review and approval by GSFC or its designated representative prior to use or implementation. GSFC shall approve/disapprove within 10 working days of receipt. Requirements for resubmission shall be specified in letter(s) of disapproval

AFR (Available For Review) - Documents in this category are to be available at the contractor's facility for review upon GSFC's request.

NLT (No Later Than)

CDRL #:	TITLE:
1	Mission Implimentation Plan (MIP)

DELIVER TO:	FOR:	WHEN:
Explorer Program Office	Approval	Confirmation

DESCRIPTION :

Meets the requirements of SMD, Heliophysics Division Reclassification of SMEX Missions letter of July 10, 2007 and NPR 8705.4 as modified therein.

Summarizes the implementation of the mission and will contain the mission specific details of sections 2 and 3 of the Project Plan. The MIP will also show:

1. Roles and responsibilities of organizations
2. Acquisition Plan including all major contract partners and dollar values
3. Systems Engineering Plan
4. Continious Risks Management Plan
5. Systerm Safety Implementation Plan
6. Mission Operations Plan
7. Reliability Plan
8. Limited Life Plan
9. Review Plan
10. Science Data Management Plan
11. Export Control Plan (if exports exist)
12, Environmental Management Plan
13. IT Security Plan
14. Gold Rules Application to the Mission

REFERENCES:

CDRL #:	TITLE:
5	Monthly Project Management Report

DELIVER TO:	FOR:	WHEN:
Explorer Mission Manager	Information	Start of Phase B

DESCRIPTION :

Contains the following:

1. Progress Report
2. 533M Financial Management Report
3. Schedule status, critical path, days of reserve
4. Cost and obligations planned vs actuals
5. Leins, cost to go, budget reserves
6. Quarterly Financial Reports (533 Q)
7. Risk status via 5x5 matrix
8. EVM chart

REFERENCES:

CDRL #:	TITLE:
7	Performance Assurance Implementation Plan (PAIP)

DELIVER TO:	FOR:	WHEN:
Explorer Program Office	Approval	Confirmation

DESCRIPTION :

The PAIP is the plan that implements the SMEX Mission Assurance Requirements (MAR) to a specific mission. Each topic of the SMEX MAR shall be addressed as to how implemented.

The PAIP is to also include:

- Workmanship Program Plan
- Electrostatic Discharge Program Plan
- Parts Control Plan
- Materials and Processes Control Plan

Note: Parts must meet Class A, Class B or NPSL level 3, level 3 equivalent

REFERENCES:

CDRL #:	TITLE:
9	Software Requirements Assurance, Test, and Verification Plan

DELIVER TO:	FOR:	WHEN:
Explorer Mission Manager	Review	Due at combined PDR/CDR

DESCRIPTION :

NPR 7150.2 and NASA STD-8739.8 shall be followed as appropriate for a SMEX Class D Mission.

REFERENCES:

MAR DIDs: 5.1D Software Assurance Plan, 5.2 Software Requirements Verification Matrix

CDRL #:	TITLE:
10	Mission Requirements, Traceability, and Verification, Level I to Level IV Document

DELIVER TO:	FOR:	WHEN:
Explorer Mission Manager	Review	Due at SDR

DESCRIPTION :

1. Shows how each level I Requirement flows down to Level II, III, and IV requirements.

2. Shows how each requirement is to be measured and verified to meet performance (Test and Test Procedure paragraph)

3. Will be used to confirm that systems meet all performance requirements at completion of test program via matrix check list, down to the test procedure and paragraph in the test procedure.

REFERENCES:

CDRL #:	TITLE:
11	Mission System Test and Verification Plan

DELIVER TO:	FOR:	WHEN:
Explorer Mission Manager	Review	Due at combined PDR/CDR

DESCRIPTION :

1. Describes test to be performed at board, box, and observatory levels

2. Shows environmental test matrix

3. Describes the Qualificaton Plan and qualification methods used for components and systems

4. Meets the requirement of SMD/Heliophysics Division Reclassification of SMEX Missions letter of July 10, 2007, NPR 8705.4 Class B Qualification Acceptance and Protoflight Test Program.

REFERENCES:

GSFC-STD-7000, General Envionmental Verification Standard (GEVS) is the baseline

SMEX Class D Reference Documents

	Document ID	Title	Project Plan Par./Page	MAR DID
1.	SMD AA Letter of 7/10/07	Reclassification of Small Explorer (SMEX) Mission	1.1, 3	1, 1
2.	SMD-TBD	Announcement of Opportunity, Explorer Program, Small Explorers (SMEX) and Missions of Opportunity	2.1, 6 3.12, 12	
3.	NPR-8705.4	Risk Classification for NASA Payloads	1.1, 3 3.8, 9	1, 1
4.	NPR-8000.4	Risk Management Procedural Requirements	3.3, 8	DID 7.1D
5.	NPR 7150.2	Software Engineering Requirements	3.7, 9	5, 14
6.	NPR-7123.1	NASA Systems Engineering Processes and Requirements	3.6, 9	
7.	NPR-7120.5D	NASA Space Flight Program and Project Management Requirements		1, 1 DID 7.1D 3.1D
8.	NPR-2190.1	NASA Export Control Program	3.15, 13	
9.	NPR-8715.6	NASA Procedural Requirements for Limiting Orbital Debris	3.16, 13	
10.	NASA-STD-8739.8	Software Assurance Standard, Software Quality Assurance Plans	3.7, 9	5, 14 DID 5.1D
11.	NASA FAR 1852.234.-2	NASA FAR Supplement Clause regarding EVM as prescribed in 1834.203.70 (b)	3.1, 8	
12.	GPR 8700.4F	Integrated Independent Review		8.2, 24
13.	GPR-8700.6A	Engineering Peer Reviews	3.8, 10	
14.	GPR-7120.4A	Risk Management	3.1, 7	DID 7.1
15.	GPR-7120.3B	Management of Principal Investigator Mode Missions	1.1, 3 3.8, 10	
16.	410-PLAN-0095	SMEX General Project Plan		2.2.2, 5 8.1, 23

	Document ID	Title	Project Plan Par./Page	MAR DID
17.	410-PLAN-0097 (APPENDIX C)	SMEX Class D System Review Plan	3.8, 10	8, 23
18.	410-PLAN-0096 (APPENDIX D)	GSFC Gold Rules Application to SMEX Class D Missions	1.3, 4	
19.	410-RQMT-0036	Small Explorer (SMEX) Program, Low Priority, High Risk Payload (Class D), Mission Assurance Requirements	2.1, 6	
20.	410-PLAN-0068	System Safety Implementation Plan for the Goddard Space Flight Center Explorers Program Office	3.2, 8	3.1, 8
21.	GSFC-STD-7000	General Environmental Verification Standard (GEVS)	1.3, 4	9, 26
22.	GSFC-STD-1000	Gold Rules	1.3, 4	5,14 9, 26