SMEX "Tailored D Class"
Organizational Roles and Responsibilities

- NASA responsibility
  - Program administration
  - Moderate insight, Limited oversight
  - Streamlined review process
  - Implementation plan approval (at Confirmation)
    - Reviewed for thoroughness, but PI responsible for content choices
  - Limited NASA verification except for flight safety

- PI responsibility
  - Mission implementation (approach & execution)
  - Performance/Cost/Schedule/Risk management
  - Design guidelines
  - Peer reviews
  - Mission assurance
    - Standards, practice, and accountability

SMEX Class D Features

AO Paragraph 4.4.2 Class D Payload Classification:

SMEX Missions to Class D Missions were initially described in the letter of July 10, 2007, “Approval of the Reclassification of Small Explorer (SMEX) Mission.” Enclosure 2 of the July 10 letter circles the sections of NPR 8705.4 (Appendix B) that apply to and constitute the tailored SMEX “Class D” reclassification.

Tailored Class D, Low Priority, High Risk
NPR 8705.4
Appendix B

	CLASS A	CLASS B	CLASS C	CLASS D
Single Point Failures (SPFs)	Critical SPFs (for Level 1 requirements) are not permitted unless authorized by formal waiver. Waiver approval of critical SPFs requires justification based on risk analysis and implementation of measures to mitigate risk.	Critical SPFs (for Level 1 requirements) may be permitted but are minimized and mitigated by use of high reliability parts and additional testing. Essential spacecraft functions and key instruments are typically fully redundant. Other hardware has partial redundancy and/or provisions for graceful degradation.	Critical SPFs (for Level 1 requirements) may be permitted but are mitigated by use of high reliability parts, additional testing, or by other means. Single string and selectively redundant design approaches may be used.	Same as Class C.
Engineering Model, Prototype, Flight, and Spare Hardware	Engineering model hardware for new or modified designs. Separate prototype and flight model hardware. Full set of assembled and tested "flight spare" replacement units.	Engineering model hardware for new or significantly modified designs. Protoflight hardware (in lieu of separate prototype and flight models) except where extensive qualification testing is anticipated. Spare (or refurbishable prototype) hardware as needed to avoid major program impact.	Engineering model hardware for new designs. Protoflight hardware permitted (in lieu of separate prototype and flight models). Limited flight spare hardware (for long lead flight units).	Limited engineering model and flight spare hardware.
Qualification, Acceptance, and Protoflight Test Program	Full formal qualification and acceptance test programs and integrated end-to-end testing at all hardware and software levels.	Formal qualification and acceptance test programs and integrated end-to-end testing at all hardware levels. May use a combination of qualification and protoflight hardware. Qualified software simulators used to verify software and system.	Limited qualification testing for new aspects of the design plus full acceptance test program. Testing required for verification of safety compliance and interface compatibility.	Testing required only for verification of safety compliance and interface compatibility. Acceptance test program for critical performance parameters.

Tailored Class D, Low Priority, High Risk
NPR 8705.4
Appendix B

	CLASS A	CLASS B	CLASS C	CLASS D
EEE Parts 'http: // nepp .nasa .gov/ index_nasa .cfm/ 641	NASA Parts Selection List (NPSL)* Level 1, Level 1 equivalent Source Control Drawings (SCDs), and/or requirements per Center Parts Management Plan.	Class A requirements or NPSL Level 2, Level 2 equivalent SCDs, and/or requirements per Center Parts Management Plan.	Class A, Class B or NPSL Level 3, Level 3 equivalent SCDs, and/or requirements per Center Parts Management Plan.	Class A, Class B, or Class C requirements, and/or requirements per Center Parts Management Plan.
Reviews	Full formal review program.Either IPAO external independent reviews or independent reviews managed at the Center level with Enterprise Office participation. Include formal inspections of software requirements, design, verification documents, and code.	Full formal review program.Either IPAO external independent reviews or independent reviews managed at the Center level with Enterprise Office participation. Include formal inspections of software requirements, design, verification documents, and peer reviews of code.	Full formal review program. Independent reviews managed at Center level with Enterprise Office participation. Include formal inspections of software requirements, peer reviews of design and code.	Center level reviews with participation of all applicable directorates. May be delegated to Projects. Peer reviews of software requirements and code.
Safety' NPD 8700.1	Per all applicable NASA safety standards.	Same as Class A.	Same as Class A.	Same as Class A.
Materials	Verify heritage of previously used materials and qualify all new or changed materials and applications/configurations. Use source controls on procured materials and acceptance test each lot/batch.	Use previously tested/flown materials or qualify new materials and applications/configurations. Acceptance test each lot of procured materials.	Use previously tested/flown materials or characterize new materials. Acceptance test sample lots of procured materials.	Requirements are based on applicable safety standards. Materials should be assessed for application and life limits.
Mishap Investigation Board Requirements 'NPR 8621.1	Initiated and conducted per NPR 8621.1.	Initiated and conducted per NPR 8621.1.	Initiated and conducted per NPR 8621.1.	Initiated and conducted per NPR 8621.1.

Tailored Class D, Low Priority, High Risk
NPR 8705.4
Appendix B

	CLASS A	CLASS B	CLASS C	CLASS D
Reliability 'NPD 8720.1	Failure mode and effects analysis/critical items list (FMEA/CIL), worst-case performance, and parts electrical stress analysis for all parts and circuits. Mechanical reliability, human, and other reliability analysis where appropriate.	FMEA/CIL at black box (or circuit block diagram) level as a minimum. Worst-case performance and parts electrical stress analysis for all parts and circuits.	FMEA/CIL scope determined at the project level. Analysis of interfaces. Parts electrical stress analysis for all parts and circuits.	Analysis requirements based on applicable safety requirements. Analysis of interface.
Reliability 'NPD 8720.1	Failure mode and effects analysis/critical items list (FMEA/CIL), worst-case performance, and parts electrical stress analysis for all parts and circuits. Mechanical reliability, human, and other reliability analysis where appropriate.	FMEA/CIL at black box (or circuit block diagram) level as a minimum. Worst-case performance and parts electrical stress analysis for all parts and circuits.	FMEA/CIL scope determined at the project level. Analysis of interfaces. Parts electrical stress analysis for all parts and circuits.	Analysis requirements based on applicable safety requirements. Analysis of interface.
Fault Tree Analysis	System level qualitative fault tree analysis.	Same as Class A.	Same as Class A.	Fault tree analysis required for safety critical functions.
Probabilistic Risk Assessment 'NPR 8705.xx	Full Scope, addressing all applicable end states per NPR 8705.xx.	Limited Scope, focusing on mission-related end-states of specific decision making interest per NPR 8705.xx.	Simplified, identifying major mission risk contributors.Other discretionary applications.	Safety only.Other discretionary applications.
Maintainability[1] 'NPD 8720.1	As required by NPD 8720.1	Application of NPD 8720.1 determined by program. (Typically ground elements only.)	Maintainability considered during design if applicable.	Requirements based on applicable safety standards.

Tailored Class D, Low Priority, High Risk
NPR 8705.4
Appendix B

	CLASS A	CLASS B	CLASS C	CLASS D
Quality Assurance **'NPD 8730.3** **' NPR 8735.2** **' NPD 1280.1** **(NPR 8735.1A)**	Formal quality assurance program including closed-loop problem reporting and corrective action, configuration management, performance trending, and stringent surveillance. GIDEP failure experience data and NASA Advisory process.	Formal quality assurance program including closed-loop problem reporting and corrective action, configuration management, performance trending, moderate surveillance. GIDEP failure experience data and NASA Advisory process.	Formal quality assurance program including closed-loop problem reporting and corrective action, configuration management, tailored surveillance. GIDEP failure experience data and NASA Advisory process.	Closed-loop problem reporting and corrective action, configuration management, GIDEP failure experience data and NASA Advisory process. Other requirements based on applicable safety standards.
Software **'NPD 8730.4**	Formal project software assurance program. Independent Verification and Validation (IV&V) as determined by AA OSMA.	Formal project software assurance program. IV&V as determined by AA OSMA.	Formal project software assurance program. IV&V as determined by AA OSMA.	Formal project software assurance insight. IV&V as determined by AA OSMA.
Risk Management **'NPR 7120.5**	Risk Management Program. Risk reporting to GPMC.	Same as Class A.	Same as Class A.	Same as Class A.
Telemetry Coverage	During all mission critical events to assure data is available for critical anomaly investigations to prevent future recurrence.	Same as Class A.	Same as Class A.	Same as Class A.

SMEX Class D Features

AO Paragraph 4.4.2 Class D Payload Classification: (Cont)

The fundamental themes expressed in the July 10 letter are as follows

- Some risk is okay
- Single string is okay
- Space quality parts are required
- Comprehensive test program is required
- Mission tailoring is allowed

Transferred more responsibility to the PI

- PI generates the Mission Integration Plan (MIP) to define the approach to managing the project
- PI generates the Product Assurance Implementation Plan (PAIP) to define the processes and practices which will be used
- PI assumes responsibility for as-built surveillance, compliance auditing, and certification

SMEX Class D Features

Work assumed by NASA

- Probabilistic Risk Assessment (PRA)
- Failure Modes and Effects Analysis (FMEA)
- Fault Tree Analysis
- Launch vehicle interface

Simplified/ Streamlined processes

- Combined system PDR/CDR reducing the development cycle
- Incorporated PI conducted peer reviews per GPR 7120.3B
- Consolidated monthly reporting
- EVM simplification

Reduced

- Fewer contract deliverables (CDRL's) of which only 8 of 58 are for approval
- Gold Rules, a priori mission exceptions list, initially w/o waivers

Eliminated

- No formal software IV and V, however a software test bed is required for development and on-orbit modifications

SMEX General Project Plan Highlights

1.0 PROJECT OVERVIEW

1.1 INTRODUCTION

…..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……

1.4 PROJECT AUTHORITY, GOVERNANCE STRUCTURE,

MANAGEMENT STRUCTURE AND IMPLEMENTATION APPROACH

…..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.

3.0 PROJECT CONTROL PLANS

…….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 be submitted by the developer for approval at mission confirmation.

SMEX General Project Plan Highlights

3.8 REVIEW PLAN

In an AO-driven project, the proposing teams are doing formal project formulation…. during the funded Phase A concept studies…. formulation has already begun…. 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…. approaching PDR maturity. For these reasons, but primarily because of the short development schedule, the Program Office will have …… 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…..

SMEX General Project Plan Highlights

3.8 REVIEW PLAN (cont)

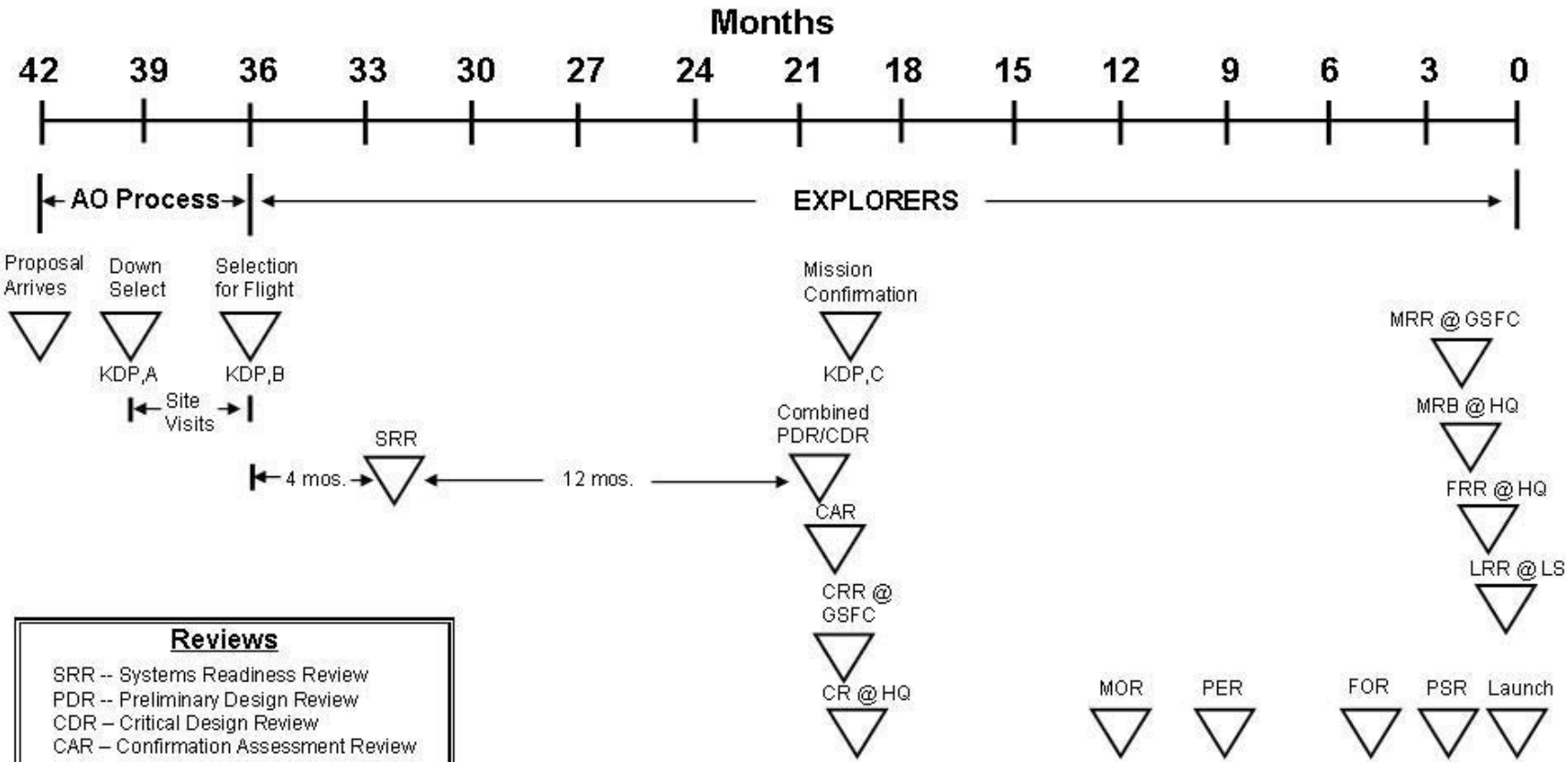
The required technical maturity of the mission elements at the combined PDR/CDR is expected to be somewhat less than traditionally required at a CDR, with the residual details to be covered within the PI's peer review process. However, the mission system must be well defined.

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.

See SMEX General Project Plan, Appendix C, General System Review Plan, page 22 and 23 for the entrance and success criteria for the combined CDR/PDR.

9/10/07

SMEX Class D Reference Mission Timeline & Reviews



Reviews

SRR -- Systems Readiness Review
PDR -- Preliminary Design Review
CDR – Critical Design Review
CAR – Confirmation Assessment Review
CRR – Confirmation Readiness Review
CR – Confirmation Review
MOR – Mission Operations Review
PER – Pre-Environmental Review
FOR – Flight Operations Review
PSR – Pre-Ship Review
MRR – Mission Readiness Review
MRB – Mission Readiness Board
FRR – Flight Readiness Review
LRR – Launch Readiness Review

1.4.1 – SMEX Class D Explorer Mission Timeline and Reviews

THE EXPLORERS PROGRAM OFFICE WISHES YOU ALL GOOD LUCK AND IS LOOKING FORWARD TO WORKING WITH YOU IN THE FUTURE.