National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

July 10, 2007

Reply to Attn of: SMD/Heliophysics Division

TO: Goddard Space Flight Center
Attn: 100/Director

FROM: Associate Administrator for Science Mission Directorate

SUBJECT: Approval of the Reclassification of Small Explorer (SMEX) Mission

Based on the Explorer Program Office's presentation on June 8, 2007, to the Science Mission Directorate (SMD) Program Management Council, I approve the reclassification of Class C to a tailored Class D mission for SMEX missions. The SMEX Announcement of Opportunity (AO) wording will reflect SMD's decision to change the classification of the SMEX missions.

We appreciate the efforts of the Explorer Program Office in putting together a recommendation for reclassification of all future SMEX missions. We look forward to implementing the proposed reclassification to tailored Class D for the Directorate's upcoming release of the SMEX AO.

I have enclosed a copy of the minutes and presentation. If you have any questions, please call Mr. Willis Jenkins at 202-358-1285.

S. Alan Stern

2 Enclosures

cc:
Science Mission Directorate/Dr. Colleen Hartman

- Mr. Todd May
- Dr. John Mather
- Dr. Paul Hertz
- Dr. Richard Fisher
- Ms. Victoria Elsbernd
- Mr. Willis Jenkins
- Dr. Jon Morse
- Mr. Rick Howard
- Dr. Hashima Hassan
- Dr. James Green
- Mr. Chuck Miller

Office of Chief Engineer/Mr. Chris Scolese

- Mr. Ken Ledbetter

Office of Safety Mission Assurance/Mr. Bryan O'Connor

- Mr. Patrick Martin

Office of Space Operations Mission Directorate/Dr. William Wrobel

- Dr. J.D. Kelley
- Ms. Anne Sweet

GSFC/100/Mr. Mike Ryschkewitsch

- 100/Ms. Dolly Perkins
- 300/Mr. Marcus Watkins
- 400/Mr. Arthur Obenschain
- 410/Mr. James Watzin
- 410/Mr. Joseph Dezio

June 8, 2007

NASA Headquarters

SMEX Mission Classification Recommendation

Attendees

Dr. S. Alan Stern
Mr. Todd May
Dr. Paul Hertz
Mr. Charles Gay
Mr. Roy Maizel
Mr. Willis Jenkins
Ms. Hashima Hasan
Mr. Ken Ledbetter
Mr. Stan Wojnar
Mr. Rick Howard
Mr. Gary Rawitscher
Mr. Joseph Dezio
Mr. James Watzin
Mr. Chuck Miller
Mr. J.D. Kelley
Mr. G.S. Krishnan

Science Mission Directorate Program Management Council Meeting
NASA Headquarters
June 8, 2007

Meeting Minutes

Purpose:	Re-classification of Class C to tailored Class D for the Small Explorer (SMEX) class missions
Time:	1400-1530
Location:	MIC 3, NASA HQ

Alan Stern	Associate Administrator for the Science Mission Directorate (SMD)

Program Management Council Chair

Todd May	Deputy Associate Administrator for Programs, Science Mission Directorate (SMD)

Program Management Council Members

Chuck Gay	Representing the Director, Heliophysics Division (SMD)
Rick Howard	Representing the Director, Astrophysics Division (SMD)
Stan Wojnar	Representing the Director, Planetary Science Division (SMD)
Roy Maizel	Director, Management & Policy Division (SMD)
Ken Ledbetter	Chief Engineer for Science (SMD)
Paul Hertz	Science Advisor for Science Process and Ethics, Science Mission Directorate (SMD)

Ex-Officio Members:

G.S. Krishnan	Representing the Chief Engineer's Office
J.D. Kelley	Representing the AAA Launch Vehicles, Operations Mission Directorate

Senior Attendees

Willis Jenkins	Explorer Program Executive, Heliophysics Division
Hashima Hasan	Explorer Program Science, Astrophysics Division

Presenter:

James Watzin	Explorer Program Manager, GSFC

Other Attendees:

Joe Dezio	Explorers Program Office, GSFC
Gary Rawitscher	Management & Policy Division, SMD
Chuck Miller	Management & Policy Division, SMD

Classification Overview:

The Explorer Program manager, James Watzin was introduced to the PMC board members. Mr. Watzin presented a recommendation to change the classification of the Small Explorer mission form Class C to a tailored Class D. He showed how changing the classification would improve program implementation by defining the Principle Investigator's (PI) roll and responsibilities. A chart displaying the Explorer Program office's assessment was shown, in an effort to compare Class D to Classes A-C. This same Self assessment chart showed categories that were pertinent for creating the tailored D classification. Mr. Watzin also presented a historical perspective of the evolution of key requirements, NMI 8010.1 and NPR8705.4 for Class C to Class D.

Recommended Organizational Roles and Responsibilities

- **NASA under the guidance of the Explorer Program Office**

Responsibility for the Explorer Office is to have moderate insight with limited oversight. The office would conduct the administration under a streamline review process. NASA would provide implementation plan approval at confirmation

- **PI management**

The PI is responsible for mission implementation approach and execution. Performance, cost, schedule and risk management are a key responsibility of the PI. The PI will also design guidelines, conduct peer reviews and ensure mission assurance via practices, standards and accountability.

Risk and Benefits

Risks continue to be a single string implementation. The implementation of the tailored Class D would streamline the review process. There was much discussion because of the implication that less review would jeopardize the success of the mission. The Explorer's Program Office was concerned that missions would be over reviewed by Independent review teams such as those placed on the AIM mission. It was thought peer reviews were helpful. Another risk would be that NASA would have to rely on the provider design standards and mission assurance.

Some benefits gained by a tailored Class D class are greater team empowerment, improved cost performance and quicker development timeline. There is also an opportunity to utilize alternate launch vehicles

Summary:

The meeting came to order at 1400 and ended at 1530 on June 8, 2007. The Explorer Program manager (Jim Watzin) presented a case for SMD to consider changing from Class C to a tailored Class D. The recommendation from the Explorer's Office to reclassify the SMEX mission was thought that tailoring would emphasize good parts, robust test program and acceptance of provider standard and processes. It was also felt that minimum classification allows for trades. Mr. Watzin also committed to getting supporting library documentation developed this summer, in time for the final AO release

EXECUTIVE SESSION

The consensus was that SMD should move to Change the classification of SMEX mission to a tailored classification. Ken Ledbetter reminded the group that all missions are Class A at the launch pad. Todd May added that, "we are accepting risk with this decision and can't forget that when we go to the launch pad". Mr. Ledbetter agreed with Mr. Watzin's description of the classification creep in part due to failures on MPL, MCO, Wire and Terriors. Gary Rawitscher commented that it is important to do due diligence up front- the PI's experience is important

Action Items:

1. The Explorer program manager and his team need to provide more information concerning the execution of the proposed plan such as mission review requirements and gain the appropriate concurrence of his implementation plan to detail schedules which support the final AO release. Provide an insight level matrix
2. The Deputy Program Associate Administrator for Programs, Science Mission Directorate will provide a copy of an insight level matrix as a guide needed for the SMEX planning.

Attendee contact information:

Dr. Alan Stern	NASA/HQ	202-358-3889	alan.stern@nasa.gov
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Mr. Joseph Dezio	NASA/GSFC	301-286-8416	joseph.a.dezio@nasa.gov
Mr. James Watzin	NASA/GSFC	301-286-1169	james.g.watzin@nasa.gov
Mr. Chuck Miller	NASA/HQ	202-358-0715	chuck.miller@nasa.gov
Mr. J.D. Kelley	NASA/HQ	202-358-0197	jkelley@nasa.gov
Mr. G.S. Krishnan	NASA/HQ	202-358-0955	g.s.krishnan@nasa.gov

SMEX Mission Classification

-2007 AO Recommendation –

-Jim Watzin-
-Explorer Program Manager-
-GSFC-

Improving Program Implementation

1. Proper scaling of NASA design requirements, oversight and approval, and the basis for review is essential for PI mode missions
2. Clear delineation of organizational roles and responsibilities allows ownership to be properly established
3. Risk classification is key !
   - Provides the basis, or foundation, upon which the entire mission implementation is framed
   - Defines the PI's freedom to manage
   - Defines the Program's responsibility

SMEX Mission Classification
- *Self Assessment* -

Characterization	Class A	Class B	Class C	Class D
Priority (Criticality to Agency Strategic Plan) and Acceptable Risk Level	High priority, very low (minimized) risk	High priority, low risk	Medium priority, medium risk	Low priority, high risk
National significance	Very high	High	Medium	Low to medium
Complexity	Very high to high	High to medium	Medium to low	Medium to low
Mission Lifetime (Primary Baseline Mission	Long, >5years	Medium, 2-5 years	Short, <2 years	Short < 2 years
Cost	High	High to medium	Medium to low	Low
Launch Constraints	Critical	Medium	Few	Few to none
In-Flight Maintenance	N/A	Not feasible or difficult	Maybe feasible	May be feasible and planned
Alternative Research Opportunities or Re-flight Opportunities	No alternative or re-flight opportunities	Few or no alternative or re-flight opportunities	Some or few alternative or re-flight opportunities	Significant alternative or re-flight opportunities
Achievement of Mission Success Criteria	All practical measures are taken to achieve minimum risk to mission success. The highest assurance standards are used.	Stringent assurance standards with only minor compromises in application to maintain a low risk to mission success.	Medium risk of not achieving mission success may be acceptable. Reduced assurance standards are permitted.	Medium or significant risk of not achieving mission success is permitted. Minimal assurance standards are permitted.
Examples	HST, Cassini, JIMO	MER, MRO, Discovery payloads, ISS Facility Class Payloads, Attached ISS payloads	EESP, Explorer Payloads (MIDEX, SMEX), ISS complex subrack payloads	SPARTAN, GAS Can, technology demonstrators, simple ISS, express middeck and subrack payloads

SMEX Mission Class Inflation

- a *Historical Perspective of Key Requirements* -

Class C

NMI 8010.1A (11/90 – 11/94)
(Attachment B)

Medium Priority, Med/High Risk

Single string and partially single string design approaches are commonplace

Limited formal reviews & project level reviews

Formal inspection system including problem reporting

Class C

NPR 8705.4 (6/04 – 6/09)
(Appendix B)

Medium Priority, Medium Risk

Single string and selectively redundant design approaches may be used

Full formal review program

Formal quality assurance program ….. with tailored surveillance

SMEX Mission Class Inflation

Current Class D More Akin to Old Class C

Old Class C

NMI 8010.1A (11/90 – 11/94)
(Attachment B)

Medium Priority, Med/High Risk

Single string and partially single string design approaches are commonplace

Limited formal reviews & project level reviews

Formal inspection system including problem reporting

Current Class D

NPR 8705.4 (6/04 – 6/09)
(Appendix B)

Low Priority, High Risk

Single string and selectively redundant design approaches may be used

Center level reviews .... May be delegated to Project

Closed-loop problem reporting & corrective action, GIDEP, & NASA Advisory process

SMEX "Tailored D Class" Recommended 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
  - No 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 "Tailored D Class" Risk/Benefit Comparison

- Risks
  - Single string implementation
  - Streamlined review process
  - Provider design standards
  - Provider mission assurance
- Mitigations gained through Program tailoring
  - Approved Implementation Plan at Confirmation
  - Class C EEE parts
  - Class B test program
- Benefits
  - Greater team empowerment
  - Improved cost performance
  - Quicker development timeline
  - Opportunity to utilize ALVs

"Tailored D Classification" Could Counter Declining Programmatic Relevance

- SMEX science buying power has been decreasing
  - Increased conservatism
  - Lengthen development schedules
    - 2 step selection
    - Increased review & oversight
    - High launch costs
- PI responsibility has been eroding
  - Increased oversight
  - Emphasis on NASA standards & processes
  - NASA verification & surveillance

Recommendation

- Classify SMEX as Class D for upcoming AO
  - Minimum classification allows for trades
  - Tailoring to emphasize good parts, robust test program, and acceptance of provider standards & processes (see attachment of Appendix B)
- Consider future use of Category 1 ALVs

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.

Appendix B

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.

Appendix B

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.

Appendix B

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.