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National Aeronautics and Space Administration

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NASA-STD-8709.2
August 1998

NASA SAFETY AND MISSION ASSURANCE ROLES AND RESPONSIBILITIES FOR EXPENDABLE LAUNCH VEHICLE SERVICES

NASA TECHNICAL STANDARD

FOREWORD

Effective Date: August 21, 1998

This document was prepared by the NASA Expendable Launch Vehicle (ELV) Safety and Mission Assurance (SMA)Working Group with representatives from Kennedy Space Center, Goddard Space Flight Center, Lewis Research Center, Marshall Space Flight Center, and NASA Headquarters. This document serves as a guide for determining SMA functional support to NASA ELV Spacecraft customers by delineating the baseline roles and responsibilities for ELV SMA functions, as well as, optional NASA SMA services that may be selected. The document should not be interpreted as assigning organizational responsibilities.

Any questions, comments, or suggested revisions concerning this document should be directed to the Office of Safety and Mission Assurance, NASA Headquarters, Washington, DC 20546.

Frederick D. Gregory
Associate Administrator for
Safety and Mission Assurance

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CHAPTER 1 - SCOPE

1.1 SCOPE

This document defines the NASA Safety and Mission Assurance (SMA) roles and responsibilities as they apply to the various commercial launch service procurement methodologies. The document addresses the NASA SMA functions required for each mission phase from procurement through design, production, launch vehicle integration, spacecraft integration, system test, pre-launch operations, launch operations, post launch activities and mishap investigations. The document is not meant to assign SMA Roles and Responsibilities to a particular organizational unit.

1.2 Purpose

This document establishes a common baseline of NASA SMA roles and responsibilities for expendable launch vehicle (ELV) missions involving NASA payloads and/or NASA facilities. The document is intended to define the ELV SMA services that are necessary to fulfill NASA's fiduciary responsibilities. In addition, the document includes optional SMA services that may be negotiated by an ELV launch services user on a case by case basis.

1.3 Applicability

This document is for the use of NASA Headquarters, NASA Field Centers, NASA spacecraft and payload developers, and associated contractors that are involved in the oversight, insight, or use of NASA provided ELV launch services.

CHAPTER 2 - APPLICABLE DOCUMENTS

NMI 8610.23	Technical Oversight of Expendable Launch Vehicle Launch Services (Reference only)
NMI 8610.24	Expendable Launch Vehicle Launch Services Prelaunch Reviews (Reference only)
EWR 127-1	Eastern and Western Range 127-1 Range Safety Requirements
GMI 1771.1	Range Safety Policies and Criteria for Goddard Space Flight Center/ Wallops Flight Facility
RSM-93	Range Safety Manual for Goddard Space Flight Center/Wallops Flight Facility

CHAPTER 3 - DEFINITIONS AND ACRONYMS

3.1 Definitions

The following definitions apply to terms used in this document.

Situation 1 ELV launch services procured directly by NASA. This includes any launch services where NASA has a contract for launch services directly with the commercial launch services contractor. Examples include the Small Expendable Launch Vehicles (SELV's), Medium Expendable Launch Vehicles (MELV's), Medlite, etc.

Situation 2 United States Air Force (USAF) procured launch services used to launch a NASA mission. In this case the USAF has a direct contract with the launch services contractor. NASA does not have a direct contract with the launch services provider but instead has an agreement with the USAF by which the USAF is compensated for the launch services.

Situation 3 Commercial launch services procured by a commercial entity that is developing a NASA payload under contract to NASA. This is also referred to as indirect procurement. In this situation NASA does not have a direct contract with the launch services contractor.

Situation 4 Commercial launch services using a NASA facility to launch a non-NASA payload. In this circumstance NASA only has responsibility for resource protection of the NASA facilities be used by the commercial entity.

Situation 5 Commercial launch vehicle services paid for by a NASA grant.

Situation 6 Foreign launch vehicle services with a NASA payload. Since current policy requires that U.S. Government sponsored missions use U.S. commercial launch services, this needs to be handled on a case by case basis. This type of arrangement is normally done via a special agreement between the U.S. and the country providing the launch service. Any NASA provided SMA oversight and insight requirements will have to be negotiated on a case specific basis.

Situation 7 Commercial launch services where the primary payload is not a NASA payload but NASA has a secondary payload on the mission.

3.2 Acronyms

The following Acronyms apply to terms used in this document.

CDR Critical Design Review

COFR Certificate of Flight Readiness

DCR Design Certification Review

ELV Expendable Launch Vehicles

ERB Engineering Review Board

FRR Flight Readiness Review

GOES Geo-stationary Operational Environmental Satellite

GOWG Ground Operations Working Group

LRR	Launch site Readiness Review
LSRR	Launch Site Readiness Review
MELVs	Medium (Class) Expendable Launch Vehicles
MRB	Material Review Board
MRR	Mission Readiness Review
NASA	National Aeronautics and Space Administration
PDR	Preliminary Design Review
PR	Problem Report
PRB	Problem Review Board
Pre-VOS	Pre-Vehicle On Stand
RFP	Request for Proposal
SEB	Source Evaluation Board
SELVs	Small (Class) Expendable Launch Vehicles
SEPP	Systems Effectiveness Program Plan
SIM Flight	Simulated Flight
S&MA	Safety and Mission Assurance
SOW	Statement of Work
SR&QA	Safety Reliability and Quality Assurance
TIM	Technical Interchange Meeting
USAF	United State Air Force
VAFB	Vandenberg Air Force Base
VOS	Vehicle on Stand

CHAPTER 4 - GENERAL

4.1 Format

The NASA SMA roles and responsibilities are presented in a matrix format. The matrix is organized by the launch vehicle procurement type (situation) and mission life-cycle phase.

Baseline NASA SMA roles and responsibilities are indicated by an “X” in the corresponding box under each procurement situation. The baseline roles and responsibilities are items that are necessary to fulfill NASA’s fiduciary responsibilities. These items are nonnegotiable and are required unless a special exemption is granted by the NASA Associate Administrator for SMA.

Optional services are indicated by a blank box. These services will not be performed unless they are specifically requested by an ELV launch services customer. These are the types of services that a spacecraft customer may want NASA SMA to perform on a case by case basis.

The third category of services are those items that do not normally fit into either of the other categories. These are services that are not a part of the baseline roles and responsibilities but would normally be elected by the ELV launch services user as part of an assurance program. These items are indicated by an “R”. It is highly recommended that a launch services user elect to have these services performed unless mitigating circumstances are identified.

4.2 Range Safety

Range Safety roles and responsibilities are not included in this document. The Range Safety related roles and responsibilities are documented in the applicable range safety requirements documentation.

CHAPTER 5 - ROLES AND RESPONSIBILITIES MATRIX

The following is a matrix of the NASA SMA roles and responsibilities for ELV launch services.

NASA Safety and Mission Assurance Roles and Responsibilities for Expendable Launch Vehicle Services

KEY **X** = **Baseline NASA Safety and Mission Assurance Roles and Responsibility** *(Necessary to fulfill NASA fiduciary responsibility)* **R** = **Highly Recommended Optional Service** *(Should be performed unless mitigating circumstances identified)* **Blank** = **Optional Service** *(Not performed unless customer requested (negotiated) to meet unique needs)*	**Situation 1** **NASA Procured Commercial Launch Service / Any Payload** *(NASA or Foreign or Non-NASA payload)*	**Situation 2** **USAF Procured Launch Vehicle / NASA Payload** *(Examples: Titan IV/Cassini)*	**Situation 3** **(Indirect /Turn-key Procurement) Commercial Launch Service procured by the Commercial NASA Payload Developer** *(Examples: LMLV/Lewis, GOES)*	**Situation 4** **Commercial Launch Service using a NASA facility / Non-NASA Payload** *(Examples: Iridium from VAFB)*	**Situation 5** **Commercial Launch Vehicle paid for by NASA grant / NASA sponsored Payload** *(Examples: Connestoga)*	**Situation 6** **Foreign Launch Service / NASA Payload** *(Examples: Topex/Ariane)*	**Situation 7** **Commercial Launch Service / Primary Payload is non-NASA Secondary Payload is a NASA Payload** *(Examples: Pegasus/OrbView/ SeaStar/SeaWifs)*
I. Procurement							
1. Participate in the NASA Launch services acquisition strategy development to assure proper S&MA considerations *Primary Benefit: Proactive, early S&MA involvement allows for assessment of NASA insight opportunities or deficiencies associated with a procurement strategy while remedial action is still simple and inexpensive.*	X	X	X		X		X
2. Participate in the Source Evaluation Board (SEB) and Source Selection Board activities to verify that adequate SR&QA requirements (guidelines) are incorporated into the Request for Proposal (RFP) Statement of Work (SOW). **(FAR clause requirements, ISO-9000 requirements, Preaward/Postaward surveys, etc.)** **a. Develop, assess, and/or tailor the RFP/SOW S&MA requirements as appropriate** **b. Review / verify appropriate data item requirements "flow down" to the suppliers** **c. Verify that lessons learned and best practices are incorporated (or required)** **d. Review / verify appropriate "Flow Down" requirements for test, and reliability, nonconforming material reporting and availability** **e. Assure appropriate S&MA metrics are included for performance based contracts.**	X						

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I. Procurement (cont.)							
a. Evaluate the adequacy of the proposed S&MA (Product Assurance) Plan **i.) Verify that lessons learned and best practices are incorporated** **ii.) Review / verify appropriate data item requirements "flow down" to the suppliers** **iii.) Review vender (previous) performance** *Primary Benefit: Assures that appropriate Safety, Reliability and Quality Assurance requirements and guidelines are incorporated into the RFP and SOW. Assures that recent S&MA lessons learned are considered and incorporated.*							
3. Evaluate the adequacy of the Proposed Risk Management Plan *Primary Benefit: Identifies deficiencies and shortcomings associated with proposed risk management plan while corrective action is still simple and inexpensive.*	X	X	X		X		
4. Assess adequacy of the proposed System Effectiveness Program Plan (or equivalent) *Primary Benefit: Identifies deficiencies and shortcomings associated with proposed System Effectiveness Program Plan while corrective action is still simple and inexpensive. A thorough Systems Effectiveness Program is a good indicator of a systematic, logical, Systems Engineering process. Systems effectiveness metrics can provide some of the S&MA metrics for performance based contracts.*	X	X					

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II. Design							
1. Participate in design review activities (Preliminary Design Review (PDR), Critical Design Review (CDR), Design Certification Reviews (DCR)) for new Launch Vehicle Designs and for redesign of major components and systems. Note: S&MA organization chairs (or co-chairs) the Design Certification Reviews *Primary Benefit: Insight and evaluation of the contractors application of S&MA methodologies / processes during the design phase.*	X	X (DCR only)	X (DCR only)		X (DCR only)		
2. Participate in design review activities for NASA mission unique vehicle modifications *Primary Benefit: Insight of the contractor's application of S&MA methodologies / processes during the design phase.*	X	X	X		X		
3. Participate in qualification reviews *Primary Benefit: S&MA assessment of qualification related issues and judgments.*	X	X	X	X	X		
4. Participate in Launch Vehicle prime contractor System Effectiveness Reviews (critical sub-contractor System Effectiveness Reviews) *Primary Benefit: Provides metrics for demonstrating stable, capable processes. Insight of contractor process weaknesses, long term corrective actions, and, their effectiveness. Provides opportunity for assessment of performance based metrics.*	X	R (by invitation)	R (by invitation)		R (by invitation)		
5. Participate in change boards / Material Review Board (MRB) / Problem Review Board (PRB). As a minimum, review all class 1 changes, deviations, waivers and verify appropriate categorization of lower class changes *Primary Benefit: Independent S&MA assessment of critical offnominal situations that could adversely affect mission success.*	X	X[1]					

[1] not done for Titan IVB/ Cassini

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III. Production							
1. (Resident) In plant Quality Assurance surveillance of manufacturing, fabrication, vehicle systems test and checkout, PR investigation and corrective action adequacy. Resident staff plus support group for technical analysis of non-conforming material related activities (MRB, PRB, etc.) *Primary Benefit: NASA surveillance and assessment (confidence sampling, verification and validation) of contractor production activities.*	X		X				
2. Participate / support of the Preship Reviews /Pre-Vehicle on Stand Reviews (Pre-VOS). *Primary Benefit: S&MA assessment of vehicle readiness for shipment and assembly. S&MA assessment of significant production related issues and corrective actions.*	X	X	X		X		
3. Participate / support of the Hardware Acceptance Reviews *Primary Benefit: S&MA assessment of significant hardware issues and corrective actions.*	X						
4. Participate / support of the contractor programmatic System Effectiveness Reviews **(Fleetwide / Generic)** *Primary Benefit: Provides metrics for demonstrating stable, capable processes. Insight of contractor process weaknesses, long term corrective actions, and, their effectiveness. Provides opportunity for assessment of performance based metrics.*	X						
5. Participate in change boards / Material Review Board (MRB) / Problem Review Board (PRB). As a minimum, review all class 1 changes, deviations, waivers and verify appropriate categorization of lower class changes *Primary Benefit: Independent S&MA assessment of critical offnominal situations that could adversely affect mission success.*	X	X					

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III. Production (cont.)							
6. Assess problem investigation and corrective action identification and implementation activity adequacy. Review Engineering Review Board (ERB) activities and impacts to test modifications/deletions. **(Mission Specific)** *Primary Benefit: Independent S&MA assessment of critical offnominal situations that could adversely affect mission success. Note: Mission specific assessments and evaluations also serve as input to lessons learned, recurrence control, and continuous improvement initiatives for other current and upcoming missions and programs.*	X	X	X	X Only items with potential facility impacts	X		
7. Perform SR&QA compliance and spot audits *Primary Benefit: Assurance that the contractor is using the processes they defined in their Assurance Plans. Verifies contract compliance.*	X						
8. Participate in Ground Operations Working Group (GOWG) and Technical Interchange Meetings (TIMS) *Primary Benefit: Early identification and resolution of potential issues involving integration and operations. Provides independent S&MA assessment of critical offnominal situations that could adversely affect mission success.*	X	X	X		X		
9. Perform NASA independent review of problems that occur on other vehicle flows to assess potential generic impacts. Maintain trend analysis, data base management, and access to contractors non-conforming/corrective action database. (continuous on-going function) *Primary Benefit: Assurance that issues and concerns that occur on other vehicles and missions are prevented from affecting any NASA missions. Assurance that generic causes are identified and corrected. Assurance that adverse trends are recognized and remedial actions are identified and implemented.*	X	X.	R				

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III. Production (cont.)							
10. Develop verification checklists/procedures for S&MA execution during vehicle integration activities. Identify problems and areas of concern for special action items to be verified. *Primary Benefit: Assurance that known critical verifications and special issues are appropriately identified and dispositioned.*	X	X					

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IV. Launch Vehicle Integration							
1. Participate in process evaluations and validations **a. Perform Quality Assurance surveillance of Integrated Systems Test & Checkout** **b. Problem Review Boards** **c. Perform Insight/Oversight of problem trending** **Perform Insight/Oversight of special issue testing** **d. Participate in change boards / MRB / PRB** **As a minimum, review all class 1 changes, deviations, waivers and verify appropriate categorization of lower class changes** **Perform S&MA review & assessment of MRB actions** **e. Perform Quality Assurance surveillance of vehicle erection process** **f. Participation in integration validation process review activities** **g. Verify serial numbers of installed critical hardware.** *Primary Benefit: NASA surveillance and assessment (confidence sampling) of contractor integration, test and checkout activities.* *Independent S&MA assessment of critical offnominal situations that could adversely affect mission success.* *Provides NASA independent assessment of integration validation process.* *Independent verification of critical hardware serial numbers. (Used to assure pedigree and build history.)*	X	X	R	X			

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IV. Launch Vehicle Integration (cont.)							
2. Perform SR&QA Compliance and spot audits *Primary Benefit: Assurance that the contractor is performing in accordance with the processes defined in their Assurance Plans*	X						
3. Maintain a status of open problems and failed hardware, provide status at the Mission Readiness Review (MRR), Launch Site Readiness Review (LSRR), Launch Readiness Review (LRR), Flight Readiness Review (FRR). *Primary Benefit: Assurance that known critical issues and problems are appropriately dispositioned prior to each critical milestone.*	X	X	R [2]	X	X		

[2] not done for LMLV/Lewis

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V. Spacecraft Integration to Launch Vehicle							
1. Participate in integrated Final Walkdowns (Leaks, loose hardware, workmanship, etc.) *Primary Benefit: Independent S&MA evaluation*	X	X	R [2]		X		
2. Perform special issue SR&QA Compliance and spot audits *Primary Benefit: Assurance that contractor is using the appropriate discipline and processes in resolving unique integration issues.*	X						
3. Maintain a status of open problems and failed hardware, provide status at the Mission Readiness Review (MRR), Launch Readiness Review (LRR), Flight Readiness Review (FRR) *Primary Benefit: Assurance that known critical issues and problems are appropriately dispositioned prior to each critical milestone.*	X	X	R [2]				
4. Perform surveillance of Spacecraft to Launch Vehicle integration process *Primary Benefit: NASA surveillance and assessment (confidence sampling) of S/C to L/V integration, test and checkout activities.*	X	X	R [2]				
5. Participate in change boards / Material Review Boards (MRB) / Problem Review Boards (PRB) **As a minimum, review all class 1 changes, deviations, waivers and verify appropriate categorization of lower class changes.** *Primary Benefit: Independent S&MA assessment of critical offnominal situations that could adversely affect mission success.*	X	X	R [2]				

[2] not done for LMLV/Lewis

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VI. Systems Test and SIM Flight							
1. Perform assessments of Operations and procedure discipline **a. Participate in SIM flight activities** **b. Participate in Operations Dress Rehearsal** **c. Participate in Launch Crew Certification Activities** *Primary Benefit: Independent S&MA evaluation of operations and procedures discipline.*	X	X	R [2]		X		
2. Participate in change boards / Material Review Boards (MRB) / Problem Review Boards (PRB) **As a minimum, review all class 1 changes, deviations, waivers and verify appropriate categorization of lower class changes** *Primary Benefit: Independent S&MA assessment of critical offnominal situations that could adversely affect mission success.*	X	X	R [2]	X			

[2] not done for LMLV/Lewis

NASA Safety and Mission Assurance Roles and Responsibilities for Expendable Launch Vehicle Services

KEY **X** = **Baseline NASA Safety and Mission Assurance Roles and Responsibility** *(Necessary to fulfill NASA fiduciary responsibility)* **R** = **Highly Recommended Optional Service** *(Should be performed unless mitigating circumstances identified)* **Blank** = **Optional Service** *(Not performed unless customer requested (negotiated) to meet unique needs)*	**Situation 1** **NASA Procured Commercial Launch Service / Any Payload** *(NASA or Foreign or Non-NASA payload)*	**Situation 2** **USAF Procured Launch Vehicle / NASA Payload** *(Examples: Titan IV/Cassini)*	**Situation 3** **(Indirect /Turn-key Procurement) Commercial Launch Service procured by the Commercial NASA Payload Developer** *(Examples: LMLV/Lewis, GOES)*	**Situation 4** **Commercial Launch Service using a NASA facility / Non-NASA Payload** *(Examples: Iridium from VAFB)*	**Situation 5** **Commercial Launch Vehicle paid for by NASA grant / NASA sponsored Payload** *(Examples: Connestoga)*	**Situation 6** **Foreign Launch Service / NASA Payload** *(Examples: Topex/Ariane)*	**Situation 7** **Commercial Launch Service / Primary Payload is non-NASA Secondary Payload is a NASA Payload** *(Examples: Pegasus/OrbView/ SeaStar/SeaWifs)*
VII. PreLaunch Activities							
1. Maintain a status of open problems and failed hardware, provide status at the Mission Readiness Review (MRR), Flight Readiness Review (FRR) *Primary Benefit: Assurance that known critical issues and problems are appropriately dispositioned prior to each critical milestone.*	X	X	R [2]	X	X		
2. Compile Quality Assessment Report and provide PreLaunch Assessments *Primary Benefit: Report of S&MA completion of assessment activities that result in concurrence that the Vehicle is ready for launch*	X	X	R [2]	X	X		
3. S&MA COFR Signature *Primary Benefit: NASA S&MA approval to launch predicated on the successful accomplishment of the NASA S&MA roles and responsibilities. (assessments, evaluations and verifications)*	X	R *as required	R *as required				
4. S&MA GO/NO-GO input at the Mission Readiness Review (MRR), Launch Readiness Review (LRR), Flight Readiness Review (FRR) *Primary Benefit: NASA S&MA certification of the successful completion of activities necessary to fulfill the specific readiness review criteria.*	X	X	R [2]	X *No MRR participation	X *No MRR participation		
5. Coordinate the Launch Vehicle Contingency Plan **a. Coordinate the appropriate data impoundment Roles and Responsibilities** **b. Coordinate the S&MA Membership on the Contingency Investigation Team** *Primary Benefit: Pre-Mishap (Contingency) planning and coordination to assure that, in the event of a mishap, the critical data is preserved and investigation can begin immediately.*	X	X	X		X		

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VIII. Launch Operations							
1. S&MA GO/NO-GO input during the launch countdown *Primary Benefit: NASA S&MA concurrence that all identified launch countdown issues have been adequately evaluated and resolved, there are no known unacceptable violations of launch commit criteria, and the launch countdown procedure discipline is acceptable.*	X	X	R [2]	X *For facility only	X		
2. Participate in problem evaluation and make S&MA recommendation to continue launch count *Primary Benefit: Assurance that all launch countdown anomalies and their resolutions are evaluated from an S&MA perspective.*	X	X	R [2]	X *For facility only	X		
3. Verify PreLaunch Close-outs complete / Vehicle Walkdowns / Redtag removal and verification. (Streamer removal, Pegboard verification, close-out photos, etc.) *Primary Benefit: Independent verification that all critical PreLaunch close-outs are complete.*	X	X	X [2]	X	X		

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IX. Post Launch Activities							
1. Perform Pad Walkdowns and damage assessments *Primary Benefit: S&MA assessment of post launch damage to launch facilities. Normally only performed on NASA launch facilities.*				X			
2. Perform Post flight Anomaly corrective action implementation monitoring *Primary Benefit: Assurance that anomalies are investigated, understood and that adequate corrective actions and recurrence controls are implemented.*	X		X	X *Facility only	X		
3. Participate in Anomaly investigation and close-out review *Primary Benefit: Provides S&MA perspective to these investigations and provides potential lessons learned inputs for recurrence control, and continuous improvement initiatives for other, current and upcoming, missions and programs. This type of activity provides the foundation for closed loop continuous improvement.*	X	X	X	X	X		
4. Participate in final review and assessment of problems/issues and potential impact on future missions. *Primary Benefit: Provides S&MA perspective to these reviews and provides potential lessons learned inputs for recurrence control, and continuous improvement initiatives for other, current and upcoming, missions and programs. (i.e. improved S&MA metrics for incorporation into the next procurement cycle.) This type of activity provides the foundation for closed loop continuous improvement.*	X	X	X	X	X		
5. Document appropriate S&MA related Lessons Learned and implement lessons for future missions *Primary Benefit: Lessons learned implementation/ recurrence control.*	X	X	X	X	X		

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X. Mishap Investigation NMI 8621.1F "Mishap Reporting and Investigating" Performed to determine mishap causes and prevent their recurrence.							
1. Impound data/monitor impound activities if required *Primary Benefit: Assures that all critical data is preserved and available for the investigation activities.*	X	X	X	X	X		
2. Participate as a member of mishap board *Primary Benefit: Provides S&MA perspective on mishap boards and provides potential lessons learned inputs for recurrence control, and continuous improvement initiatives for other, current and upcoming, missions and programs. (i.e. improved subcontractor supplier control guidelines for incorporation into the next procurement cycle.) This type of activity provides the foundation for closed loop continuous improvement.*	X	X	X		X		
3. Participate in mishap investigation activities (NASA is not a member of board) *Primary Benefit: Lessons learned implementation/ recurrence control*	X	X	X	X	X	X	X