

SET Experiment Mission Assurance Requirements Compliance Matrix

The Mission Assurance Requirements Compliance Matrix shall be filled out by the Experimenter and submitted for each design review with NASA. This will be a working document until delivery of the Experiment. The Final Compliance Matrix shall be a part of the Acceptance Data Package.

The following Matrix lists the section and requirement in the MAR. Definitions for the compliant section are as follows:

Y - Yes, Meets Requirement

N - No, Does not meet Requirement. This requires either a request for Deviation or Waiver form to be submitted/approved by the SET Project. The Deviation or Waiver number should be referenced in the "comments" block.

D - Deviation Required

W- Waiver Required

Section in the MAR	Requirement	Compliant				Comments / How requirement was met
		Y	N	D	W	
1.0	The Experiment Developer shall meet the intent of ANSI/ASQC Q9001-2000, "Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation, and Servicing."					
1.0	The Experiment developer shall be required to meet the requirements of this Mission Assurance document through all phases of activity					
1.0	In addition, the applicable sections of this MAR document shall be flowed down in its entirety to each of subcontractor.					
1.0	The Experiment Developer shall submit a waiver request or deviation to NASA/GSFC for consideration and approval for any requirement herein, which will not be met.					
2.0	The Experiment developer's shall conduct reviews of their experiment development.					
2.0	Review team participants shall include independent experts from the experiment developer's institution and SET project personnel.					
2.0	Each experiment shall have the following set of reviews and provide documentation (if applicable) listed below for each review: 1. Experiment Requirements Review (RR) 2. Experiment Design Review (DR) 3. Experiment Pre-Environmental Review (PER) 4. Experiment Pre Ship Review (PSR)					DATES REQUIRED:

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2.1	The Experiment developer shall produce a Qualification and Acceptance Test Plan/Procedure (Q/ATP) for the Engineering and Flight Experiment models in accordance with the design, test and environmental requirements.					
2.1	The Q/ATP shall be made available to GSFC for review.					
2.2	The Experiment developer shall deliver a data package that captures the “as built” configuration and test of the delivered flight units.					
2.2	The Flight Experiment Data Package shall contain the following as a minimum: <ul style="list-style-type: none"> - Unit identification data, part/serial numbers - As-built configuration list and copies of applicable drawings - List of parts/devices used in the hardware, with traceability information - List of materials and processes used in the hardware - Software version - Assembly and Test Log Book. “As run” test procedures with test results including total operating time and cycle records, summary information relating to discrepancies (component removal and replacement), anomalies, failures, and their disposition at first power, summary information listing functional and performance data, inspection history - Experiment level photographs - List of open items with reasons for their open status and proposed closure dates 					
3.0	Deliverable investigation flight products shall be stored, preserved, marked, labeled, packaged, and packed to prevent loss of marking, deterioration, contamination, or damage during all phases of the program.					
3.1	The Experiment developer shall ship flight hardware items only after inspection and/or written authorization from the GSFC Contracting Officer Technical Representative (COTR).					
3.1	The Experiment developer shall provide appropriate environmentally controlled shipping containers for all deliverable hardware.					
3.1	The Experiment developer shall be responsible for the protection of the deliverable investigation flight items and associated Ground Support Equipment (GSE) during handling, transporting and delivery.					

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3.1	The Experiment developer shall provide all materials and personnel required to design, fabricate, and test the necessary handling fixtures, shipping containers, packaging material, and labeling to protect the completed carrier flight units, GSE and Test Equipment against contamination, excessive condensation and moisture, and damage during handling, transportation, and delivery.					
3.1	The shipping containers shall include temperature, and humidity indicators.					
31	<p>Prior to shipping, the Experiment developer's quality assurance personnel shall ensure that:</p> <ul style="list-style-type: none"> - Fabrication, inspection, and test operations have been completed and accepted. - All deliverable products are identified and marked in accordance with requirements. Shipping containers carrying flight hardware are clearly labeled as such. - The accompanying documentation (Experiment Developer's Shipping and Property Form and Experiment Final Acceptance Data Package) has been reviewed for completeness, identification, and quality approvals. - Packaging and marking of deliverable products are adequate to ensure safe arrival and ready identification at their destinations. - The loading and transporting methods are in compliance with those designated in the shipping documents. - Integrity seals are on shipping containers. 					
3.1	The experiment developer shall provide special handling instructions for receiving activities are provided where appropriate, including proper labeling of containers and related documents to provide evidence of this verification.					
3.2	Marking of the assembled flight hardware shall, as a minimum, contain part number, serial number, and revision level.					
3.2	All connectors shall be uniquely identified and the marking of the part shall does not induce any stresses; i.e., steel stamp or etch ink stamp or equivalent, which meets outgassing and contamination requirements, is acceptable.					
3.2	The Experiment flight units shall be permanently labeled with the required information (this information can be silk screened or rubber stamped) and individually packaged in sealed ESD protective bags which shall be tagged with the unit's identification and marking.					

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3.2	<p>The tag and label shall contain the following information as a minimum:</p> <ul style="list-style-type: none"> • Manufacturer's Name • Manufacturer's Part Number and latest revision letter • Date of Manufacture • Unique Serial Number • Nomenclature of the unit 					
4.0	The Experiment developer shall develop and implement an appropriate Mission Assurance Program for the flight hardware, software, and ground support equipment.					
4.0	The Experiment developer shall contact the GSFC Systems Assurance Manager (SAM) concerning any Quality related issues throughout all phases of activity.					
4.0	During Reviews, the Experiment developer shall demonstrate how the experiment is in compliance with its stated Proposal objective(s) and provide sufficient details to illustrate the experiment's capability to meet or exceed the Proposal's stated mission success levels.					

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4.1	<p>The Experiment developer shall use the following NASA workmanship processes on flight hardware:</p> <ul style="list-style-type: none"> • NASA-STD-8739.3, Soldered Electrical Connections • NASA-STD-8739.4, Crimping, Interconnecting Cables, Harnesses, and Wiring • NASA-STD-8739.1, Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies, • ANSI/ESD S20.20-1999, Standard for Electrostatic Discharge Control (Excluding Electrically Initiated Explosive Devices) • NASA-STD-8739.2, Workmanship Requirements for Surface Mount Technology, • 561-PG-8700.2.1, Flight Field Programmable Gate Array Design Guidelines • IPC-2221, Generic Standard on Printed Board Design • IPC-6011, Generic Performance Specification for Rigid Printed Boards • IPC-6012, Qualification and Performance Specification for Rigid Printed Boards – Supplemented with GSFC/S-312-P-003, Procurement Specification for Rigid Printed Boards for Space Applications and Other High Reliability Uses. 					
4.1	The Experiment developer shall provide the SET project with printed wiring board (PWB) coupons and associated test reports for evaluation and approval by the GSFC coupon test laboratory personnel.					
4.1	Coupon acceptance shall be obtained from GSFC prior to board population.					

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4.1	<p>The experiment developer personnel working on flight hardware shall be certified as having successfully completed the required training courses, prior to handling any flight hardware.</p> <ul style="list-style-type: none"> • NASA-STD-8739.3, Soldered Electrical Connections • NASA-STD-8739.4, Crimping, Interconnecting Cables, Harnesses, and Wiring • NASA-STD-8739.1, Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies, • ANSI/ESD S20.20-1999, Standard for Electrostatic Discharge Control (Excluding Electrically Initiated Explosive Devices) • NASA-STD-8739.2, Workmanship Requirements for Surface Mount Technology, 					
5.0	The experiment developers shall interface with the SET Parts Engineer for assistance with the Guidelines in Appendix A.					
5.1	The experiment developer shall submit a Parts List (PL) for their flight hardware prior to their Design Review					
5.1	An As-Built Parts List (ABPL) shall be maintained and submitted to the GSFC for inspection as part of the Final Acceptance Data Package.					
5.1	<p>The PL shall be a composite of the parts selection for each circuit design, including EEE parts, and should include, as a minimum, the following information:</p> <ul style="list-style-type: none"> • Complete Procured part number • Generic Part Number • Part name or functional description • Serial number, if applicable • Manufacturer • Lot Date Code (“as built” list only) • Part specification control drawing number • Need Quantities • Part use locations to the subassembly level • Radiation Tolerance 					
6.0	NASA Reference Publication 1124, Rev. 4 entitled “Outgassing Data for Selecting Spacecraft Materials” shall be used as a guide for materials selection.					

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6.0	The experiment developer shall maintain a list of materials, processes, and appropriate usage records prior to and during the hardware development for review by the GSFC.					
6.0	This "as-built" list shall be maintained and delivered as part of the Final Acceptance Data Package.					
6.1	The experiment developer shall use compliant materials in the fabrication of flight hardware to the extent practicable.					
6.1	<p>Material must be used in a conventional application and meet the applicable selection criteria identified as follows:</p> <ul style="list-style-type: none"> • Hazardous materials requirements, including flammability, toxicity and compatibility as specified in Eastern and Western Range 127-1 Range Safety Requirements. • Vacuum Outgassing requirements as defined in NASA Reference Publication 1124, Rev. 4. A list of material outgassing data shall be established, and reviewed and approved by the GSFC. Only materials that have a total mass loss (TML) <1.00% and a collected volatile condensable mass (CVCM) <0.10% shall be used unless a waiver request or deviation is submitted and granted by the GSFC. • Stress corrosion cracking requirements as defined in MSFC-STD-3029. Conventional applications or usage of materials is the use of compliant materials in a like manner for which there is extensive satisfactory aerospace heritage. 					
6.2	Materials that do not meet the requirements of the applicable selection criteria, or used in an unconventional application shall be considered to be a non-compliant material. The proposed use of a non-compliant material requires approval by the GSFC SET Project personnel prior to use.					
6.3	Materials that have a limited shelf life shall be controlled and documented by the developer. At a minimum, the records shall identify the start date (manufacturer's processing, shipment date, or date of receipt, etc.), the storage conditions associated with a specified shelf life, and expiration date.					

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6.4	Raw materials purchased by the experiment developer shall be accompanied by the results of nondestructive, chemical and physical tests, or a Certificate of Compliance.					
7.0	Reporting of failures shall begin with the first mechanical or electrical test of the item to be delivered. The experiment developer shall contact the GSFC SAM in the event of any failures (within 1 business day) via email or voice mail.					
7.0	If the experiment contains software, the developer shall implement a process for Software Problem Reporting and Corrective Action that address reporting, analyzing and correcting software non-conformances throughout the experiment's life cycle.					
8.0	The Experiment developer shall provide final assembly and sub-assembly photographs of each electronic board of their experiment, clearly showing all critical details.					
8.0	Each photograph shall be identified with assembly number, serial number, description (e.g. name of the assembly) date of photo, and the developer's company name or logo.					
9.0	The Experiment developer should provide, at a minimum, a configuration management system that ensures all applicable drawings and changes to drawings are reviewed in a systematic manner to determine the validity and impact on performance schedule and cost, the final drawing configuration of the Experiment and final versions of all tests performed on hardware.					
9.0	If an experiment contains software, the developer shall develop and implement a Software Configuration Management system that provides baseline management and control of software requirements, design, source code, data, and documentation.					
10.0	The Experiment developer shall support the SET project in performing a Failure Modes and Effects Analysis (FMEA) for the carrier.					

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11.0	The Experiment developer shall make available to the GSFC Systems Assurance representative documents, records, equipment, as well as access to working areas within his facilities that are required by the representative to perform his overview activities. The Experiment developer and their subcontractors and suppliers work activities and operations are subject to evaluation; review, survey and inspection by a GSFC or GSFC designated Systems Assurance representative.					
12.0	The Experiment developer's system safety program shall be initiated in the concept phase of design and continue throughout all phases of the mission.					
12.0	Each experiment developer shall support the carrier developer (GSFC) with all the safety documentation needed to satisfy the requirements for the appropriate launch vehicle.					
12.0	Each developer shall provide technical support to the SET Project for safety working group meetings and technical meetings, as necessary.					
12.0	The GSFC System Safety Engineer shall certify safety compliance prior to the Carrier Pre-Ship Review.					
12.0	<p>The system safety program shall accomplish the following:</p> <ul style="list-style-type: none"> • Provide for the early identification and control of hazards to personnel, facilities, support equipment, and the flight system during all stages of project development including design, fabrication, test, transportation and ground activities. The program shall address hazards in the flight hardware, associated software, ground support equipment, operations, and support facilities, and shall conform to the safety review process requirements of NASA-STD-8719.8, "Expendable Launch Vehicle Payloads Safety Review Process Standard". • Meet the system safety requirements of EWR 127-1 "Range Safety Requirements Eastern and Western Range" and KHB 1710.2, "Kennedy Space Center Safety Practices Handbook" and NPR 8715.3 NASA Safety Manual. • Meet the baseline industrial safety requirements of the institution. 					

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13.0	The SET project is required by NASA to conduct an Orbital Debris Assessment for limiting Orbital Debris to the host spacecraft. The Experiment developer shall work with the GSFC Safety Engineer in order to assure requirements of the safety policy are met.					
14.0	Experimenter requirements for contamination emitted by the Experiment are flight-dependent and shall be negotiated with the Host spacecraft provider. The Experiment developer shall establish the implementation and describe the methods that will be used to measure and maintain the levels of cleanliness required during each of the various phases of the Experiment's lifetime.					
15.0	The Experiment Developer shall identify all risks. All risks shall be documented and reported on in accordance with the SET Project's Risk Management Plan.					
15.0	The Experiment developer shall provide input into the SET Project's Risk Management Program. Risk Management applies to all software and hardware products and processes (flight and ground) in order to identify, analyze, plan mitigation actions, track, control, and communicate risks.					
15.0	The Experiment developer shall participate in teleconferences (as required) with the Risk Manager and Experiment Manager.					
15.0	The Experiment Developer shall report all outstanding risk items at all Management and Design reviews.					
16.0	If the experiment contains software, the experiment developer shall perform software assurance functions for all flight and ground system software.					
16.0	The experiment developer shall ensure that any software safety requirements, identified as part of system safety, are documented, traced, and controlled throughout the life cycle.					
17.0	The developer shall complete the Requirements Compliance Matrix (Verification Matrix) located in Appendix A of the SET Experiment Accommodations & Requirements Specification (SEARS) LWSSET-SPEC-0001.					