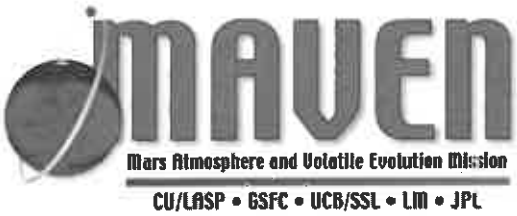
NNG09EK34C
Attachment I

Mars Atmosphere and Volatile Evolution (MAVEN) Mission

Contract Data Requirements List (CDRL) and Schedule for Risk Reduction Phase and Phase B

Revision (3)

Revision Date: March 26, 2009



Goddard Space Flight Center
Greenbelt, Maryland

MAVEN Mission

The Mars Atmosphere and Volatile EvolutioN (MAVEN) mission has developed this baseline Contract Data Requirements List and Schedule (CDRL) which provides more specific information on the deliverable items, listed in the Contract Statement of Work (SOW). The CDRL covers the Risk Reduction Phase and Phase B. Some CDRL IDs are reserved for future use in the event a follow on activity is conducted.

The table below provides a listing of all contract deliverables with the following information:

ID: A sequential numerical identifier for each item.

Title: Provides the Title of the deliverable item.

Schedule: Provides the fixed or relative date or time that the deliverable is required.

Action Required:

A = Approval - Documents in this category require Government review and approval prior to final acceptance. The Government will adhere to a controlled schedule for review of the initial submittal and subsequent changes. Documents shall meet specific format requirements, as specified in the Discovery Mission Configuration Management Procedures, and the content requirements, as defined in the Data Requirements Document. Deviations from the controlled schedule or format will be considered on a case by case basis.

R= Review - Documents in this category do not require formal Government approval. They must be received within a specified time period and are subject to evaluation. The Government reserves the time-limited right of disapproval for each submission. No prescribed format is specified although a recommended format may be found in the Data Requirements Document.

I = Information - Documents in this category are informal and are for information only.

CM Control: Documents in this category will be controlled by Government Configuration Management. (This category is intended to include all documents that affect segments, elements, subsystems and interfaces that are not completely under the Contractor's control.)

Quantity: This provides the required number of hardcopies for the deliverable. All data is required to be submitted electronically (reference the DRD for the electronic format).

Deliverable and Schedule

ID (LM-ID)	Title	Schedule	Action Required	CM Control	Quantity/Distribution
Project Management (PM)					
PM-01	Communications and Information Exchange Plan	Due thirty (30) days after contract award Update as required.	A		Electronic Distribution
PM-02	Monthly Status Reports	Report to be provided before the presentation and submitted electronically 1 day before the review or as directed by the Contracting Officer (CO).	I		Hardcopies provided before the presentation. Deliver electronically to distribution list provided by CO
PM-03	Monthly Contractor Financial Management Reports (533M)	Due monthly on the 10th working day following the close of the contractor's monthly accounting period.	R		Electronic Distribution
PM-04	Quarterly Contractor Financial Management Reports (533Q)	Due quarterly on the 15th of the month following the quarter being reported.	R		Electronic Distribution
PM-05	Work Breakdown Structure and Dictionary, and Cost Account Structure Reports	Due thirty (30) days after contract award Update as required.	A		Electronic Distribution
PM-06	*Reserved*				
PM-07	Earned Value Management System Implementation Plan	Due ninety (90) days after SRR Update as required.	A		Electronic Distribution
PM-08	*Reserved*				
PM-09	*Reserved*				

ID (LM-ID)	Title	Schedule	Action Required	CM Control	Quantity/Distribution
PM-10	Contributions to Project Baseline Review Package	Baseline Review due sixty(60) days before PDR	R		Electronic Distribution
PM-11	Project Schedules	Due monthly as required to support monthly status revuews.	R		Electronic Distribution
PM-12	Configuration Management Plan	Preliminary at SRR Baselined at PDR	A		Electronic Distribution
PM-13	Inputs to System Requirements Review (SRR)/System Concept Review (SCR) Package	Draft due 20 working days prior to the review. Final due at review. Follow-up action item response plan due 5 working days after conclusion of review.	R		Draft-Distribute Electronically Final - Electronic Distribution Follow up -Distribute Electronically
PM-14	Spacecraft Preliminary Design Review (PDR) Data Package	Draft due 10 working days prior to the review. Final due at review. Follow-up action item response plan due 5 working days after conclusion of review.	R		Draft-Distribute Electronically Final - Electronic Distribution and 100 Hard copies Follow up -Distribute Electronically
PM-15	Inputs to Preliminary Design Review (PDR) Data Package	Draft due 20 working days prior to the review. Final due at review. Follow-up action item response plan due 5 working days after conclusion of review.	R		Draft-Distribute Electronically Final - Electronic Distribution Follow up -Distribute Electronically
PM-16	*Reserved*				

PM-17	*Reserved*				
PM-18	*Reserved*				

ID (LM-ID)	Title	Schedule	Action Required	CM Control	Quantity/Distribution
PM-19	*Reserved*				
PM-20	*Reserved*				
PM-21	*Reserved*				
PM-22	*Reserved*				
PM-23	*Reserved*				
PM-24	*Reserved*				

ID (LM-ID)	Title	Schedule	Action Required	CM Control	Quantity/Distribution
PM-25	*Reserved*				
PM-26	*Reserved*				
PM-27	*Reserved*				
PM-28	Risk Management Plan	Preliminary at SRR Baseline at PDR Risk Status reported monthly in MMR	R		Electronic Distribution
PM-29	Phase C/D Implementation Plan	Due one hundred twenty (120) days after SRR	A		Electronic Distribution
PM-30	Phase E Implementation Plan	Due one hundred twenty (120)) days after SRR	A		Electronic Distribution
PM-31	Review Plan	Due ninety (90) days after SRR	R		Electronic Distribution

Systems Engineering (SE)					
SE-01	Systems Engineering Management Plan	Baselined at SRR Update as needed.	R		Electronic Distribution
SE-02	Inputs to Environmental Requirements Document - mission unique	Initial input sixty (60) before SRR Update sixty (60) days after SRR Update as needed.	A		Electronic Distribution
SE-03	Electromagnetic Interference/Electromagnetic Compatibility (EMI/EMC) Control Plan	Preliminary version due at SRR. Baselined at PDR Update as required.	A		Electronic Distribution
SE-04	Flight System Fault Protection Design Specification	Due at PDR. Update as required.	A		Electronic Distribution
SE-05	Integrated Structural and Thermal Math Models	Model files due prior to PDR	A		Electronic
SE-06	Flight System/ Payload Interface Control Documents (ICD)	Preliminary at SRR Released by PDR.	A	YES	Signed before PDR Updates - Electronic Distribution
SE-07	Contribution to Orbit Determination Document	Preliminary at SRR Update as needed.	R	YES	Electronic Distribution
SE-08	Mass Properties Report	Due thirty (30) days after Phase B contract award, Update every two (2) months and as required.	R		Electronic Distribution
SE-09	Spacecraft Subsystems Hardware Specifications	Preliminary at PDR Update as needed. Final at CDR	R		Electronic Distribution

SE-10	Inputs to Trajectory Analysis and Maneuver Planning Document - mission unique	Due sixty (60) days after SRR Update as needed.	R	YES	Electronic Distribution
SE-11	Inputs to Orbit Determination Performance Analysis - mission unique	Preliminary at PDR	R		Electronic Distribution
SE-12	*Reserved*				
SE-13	Plume Impingement Analysis	Preliminary due one hundred twenty (120) days before PDR	A		Electronic Distribution
SE-14	Flight System Performance Specification	Preliminary at SRR Updates by PDR.	A	YES	Electronic Distribution
SE-15	*Reserved*				
SE-16	Flight System Verification Plan	Preliminary at PDR	A		Electronic Distribution
SE-17	Spacecraft Test Laboratory (STL) Implementation Plan	Preliminary at PDR	A		Electronic Distribution
SE-18	*Deleted*				
SE-19	*Reserved*				
Software (SW)					
SW-01	Software Management Plan	Due thirty (30) days after SRR Update at SWRR	A		Electronic Distribution

SW-02	Software Integration and Test Plan	Preliminary at Subsystem SWPDR	A		Electronic Distribution
SW-03	Software Requirements Specification (SRS)	a) Draft 150 days before PDR b) Baseline prior to PDR c) Updates through life cycle	I		Electronic Distribution
SW-04	Algorithms Design Document(s) (ADD)	Preliminary at Subsystem SWPDR	R		Electronic Distribution
SW-05	Suitcase Simulator User Training Manual *(if applicable)*	Preliminary at Subsystem SWCDR	A		Electronic Distribution
Integration and Test					
IT-01	*Reserved*				
IT-02	Flight System Integration, Test and Launch Operations Plan	Prelim at SRR			Electronic Distribution
IT-03	*Reserved*				
Launch Vehicle (LV)					
LV-01	*Deleted*				
LV-02	Inputs to Launch System Requirements Document	As needed	R	YES	Electronic Distribution

LV-03	Input to the LSSP and LV ICD	As needed.			
LV-04	Deleted				
		Operations (OPS)			
OPS-01	*Reserved*				
OPS-02	*Reserved*				
OPS-03	*Reserved*				
OPS-04	*Reserved*				
OPS-05	*Reserved*				

OPS-06	Mission Support Areas to DSN ICD	Preliminary version at PDR.	A	YES	Electronic Distribution

OPS-07	MSA to NAV facility ICD - mission unique	Preliminary version at PDR.	A	YES	Electronic Distribution
OPS-08	Flight Software Post Launch Maintenance Plan	Preliminary version at SWPDR.	A		Electronic Distribution
OPS-09	*Reserved*				
OPS-10	*Reserved*				
OPS-1 I	*Reserved*				
OPS-12	*Reserved*				
OPS-13	*Reserved*				

Planetary Mission Assurance Requirements (MA)					
ID	Title	Schedule	Action Required	CM Control	Quantity / Dis tribution
MA 1-1	Heritage Hardware Matrix or Report	a) Initial 30 days prior to PDR b) Updates as developed	a) R & A b) R & A		Electronic
MA 2-1	Quality Manual / Mission Assurance Implementation Plan	a) at SRR b) Updates prior to implementa-tion	a) R & A b) R & A		Electronic
MA 2-2	Problem Failure Reports (PFRs)	a) Within 24 hours of occurrence b) Immediately after developer closure	a) I b) A		Electronic
MA 2-3	*Reserved*				
MA 3-1	System Safety Program Plan	a) Draft SSPP at SSR or first program review. b) Final SSP prior to PDR	a) R & A b) R & A		Electronic
MA 3-2	Safety Requirements Compliance Checklist	a) Instr. and subsystems, 30 days prior to PDR with SAR b) Spacecraft with SDP or MSPSP 30 days prior to PDR	a) A b) A		Electronic
MA 3-3	Preliminary Hazard Analysis	a) 30 days prior to PDR	a) A		Electronic
MA 3-4	*Reserved*				
MA 3-5	Safety Assessment Report	a) Preliminary 30 days after PDR	a) A		Electronic
MA 3-6	Missile System Pre-Launch Safety Package	a) Preliminary 30 days after PDR	a) R & A		Electronic
MA 3-7	Verification Tracking Log	a) Submit with Preliminary MSPSP b) Updated with each consecu-tive submittal c) All open hazard control verifi cation items at the delivery of final MSPSP, closed in accor dance with applicable launch site range safety requirements before first operational use	a) R b) R c) R		Electronic

MA 3-8	Ground Operations Procedures	Launch Range Procedures: a) 60 days prior to PDR GSFC Facilities Procedures: d) 7 days prior to first operational use Note: GSFC will approve all hazard operational procedures	a) R & A d) R & A		Electronic
MA 3-9	Safety Waivers	a) As identified	a) A		Electronic
MA 4-1	Reliability Program Plan	a)Draft 30 days after contract award b) Final 30 days prior to SDR c) Updates as required	a) R b) R & A c) R & A		Electronic
MA 4-2	Inputs to Probabilistic Risk Assessment Plan and Report	a) Draft preliminary 90 days prior to PDR b) Preliminary 30 days prior to PDR e) Updates as changes are made	a) R b) R e) A		Electronic
MA 4-3	Failure Mode and Effects Analysis, Critical Items List, and Critical Items Control Plan	a) Preliminary 30 days prior to PDR c) Updates as required	a) R c) R		Electronic
MA 4-4	Fault Tree Analysis	a) Preliminary 30 days prior to PDR d) Updates as required	a) R d) R		Electronic
MA 4-5	*Reserved*				
MA 4-6	*Reserved*				
MA 4-7	Reliability Assessments and Predictions	a) Preliminary 30 days prior to PDR c) Updates as required	a) R c) R		Electronic
MA 4-8	*Reserved*				
MA 4-9	Limited Life Items List	a) Preliminary 30 days prior to PDR c) Updates as required	a) R c) A		Electronic

MA 5-1	Software Assurance Plan	a) 60 days prior to SRR b) Baseline two weeks prior to SRR c) Updates as required	a) R b) A c) A		Electronic

MA 5-2	Software Management Plan	a) Draft 60 days prior to SRR b) Baseline two weeks prior to SRR c) Updated as required	a) R b) A c) A		Electronic
MA 5-3	Software Configuration Management Plan	a) Draft 60 days prior to SRR b) Baseline two weeks prior to SRR c) Updated as required	a) R b) A c) A		Electronic
MA 9-1	System Performance Verification Plan	a) Preliminary at SRR c) Updates as required	a) R c) A		Electronic
MA 9-2	*Reserved*				
MA 9-3	*Reserved*				
MA 10-1	Printed Wiring Coupons	a) Prior to population of flight PWBs	a) A		Electronic
MA 11-1	Materials and Processes Control Plan	a) MPCP delivered at SRR	a) R & A		Electronic
MA 11-2	As-Designed Materials and Processes List	a) Ten days prior to meetings b) 30 days prior to PDR e) Updates as required	a) I b) A e) A		Electronic
MA 11-3	Materials Usage Agreement	a) Provided as applicable (ref DID)	a) A		Electronic
MA 11-4	Stress Corrosion Evaluation Form	a) Provided with DID 11-3, as applicable.	a) A		Electronic
MA 11-5	Polymeric Materials List	a) 30 days prior to PDR	a) R		Electronic
MA 11-6	Materials Waiver	a) 15 days prior to use	a) A		Electronic
MA 11-7	Inorganic Materials List	a) 30 days prior to PDR	a) R		Electronic
MA 11-8	Fastener Control Plan	a) With at SRR b) 30 days prior to PDR	a) R b) A		Electronic
MA 11-9	Lubrication Materials List	a) 30 days prior to PDR c) 30 days before acceptance	a) R c) A		Electronic
MA 11-10	Life Test Plan for Lubricated Mechanisms	a) 30 days prior to PDR c) 30 days before acceptance	a) R c) A		Electronic

MA 11-11	Materials Process List	a) 30 days prior to PDR c) 30 days before acceptance d) Copy of any process submitted upon request	a) R c) A d) I		Electronic
MA 11-12	Certificate of Raw Material Compliance	a) Within 15 days of request	a) I		Electronic
MA 12-1	Parts Control Plan	a) Part of MAIP or delivered with b) Subsequent revisions	a) R & A b) A		Electronic
MA 12-2	Parts Control Board	a) Reports within 5 working days of each PCB	a) R		Electronic
MA 12-3	Parts Identification List	a) 30 days prior to PDR c) Changes d) ABPL 60 days prior to delivery	a) A c) A d) R		Electronic
MA 13-1	Contamination Control Plan	a) 30 days prior to PDR	a) R		Electronic
MA 14-1	Electrostatic Discharge Control Plan	a) 30 days prior to PDR	a) R		Electronic
MA 15-1	Alert / Advisory Disposition and Preparation	a) Response 25 days of Alert/Advisory receipt b) Developer-prepared alerts and advisories within 60 days in coordination with GSFC	a) R b) R		Electronic

DID Number: PM-01

Title: Communications and Information Exchange Plan

Description: The Contractor shall establish, within his organization, responsibility for implementing the communications and information exchange requirements specified in this Contract. The responsibilities and methods needed to meet these requirements, plus any additional procedures the Contractor deems necessary to adequately manage the communications and information exchange, shall be documented in a Communications and Information Exchange Plan. As an alternative, the Contractor may submit his organization's existing Plan for GSFC approval if it meets the intent of the requirements herein.

Content Requirements: The Contractor shall address the following specific requirements:

a. Where possible, submit documents, data, and reports in formats consistent with GSFC Standard Document Template. Templates are available on the Management Information System (MIS).
b. Provide electronic access to documents, drawings, photographs, data, and reports or upload documentation to the Management Information System (MIS).
c. Provide and use video conferencing capabilities to the extent practicable with GSFC for communications and information exchange.

DID Number: PM-02

Title: Monthly Status Reports

Description: The monthly status reports shall provide a project assessment of contract technical accomplishments, summary of program cost, schedule, and performance, as well as the status of key technical issues and near-term milestones. These reports shall provide a summary of the activities for the month, highlight issues/problems/concerns, and briefly summarize plans for the following month. Detailed supporting technical data should only be provided on an as requested basis.

The Contractor shall use the standard GSFC schedule milestone chart for any related schedule charts. In addition, any changes to the baseline schedule needs to be highlighted on these charts in a manner that shows the original baseline and the new modified baseline, with an explanation for the change.

Content Requirements:

1. Schedule Status Reports
2. Technical Status Reports
3. Risk Mitigation Status
4. Performance Assurance Status
5. Contingency Release Status including Lien List (Cost, Schedule etc)
6. Action Item Status
7. One Month Look-ahead
8. One page fever chart summarizing critical status of above elements

DID Number: PM-03

Title: Monthly Contractor Financial Management Reports (533M)

Description: The monthly Contractor financial management reports (533M) provide contractual expenditure data of cost incurred and estimates costs to complete. This information is necessary for the financial control and reporting required of this contract.

Content: Contract Clause(s) will define required content and format.

DID Number: PM-04

Title: Quarterly Contractor Financial Management Reports (533Q)

Description: The quarterly contractor financial management reports (533Q) provide contractual expenditure data of cost incurred and estimates costs to complete. This information is necessary for the financial control and reporting required of this contract and should include financial management on all subcontracts to the same level as for internal Contractor efforts.

Content: Contract Clause(s) will define required content and format.

DID Number: PM-05

Title: Work Breakdown Structure, Dictionary and Cost Account Structure Reports

Description: The Work Breakdown Structure (WBS) and Dictionary establishes the basic framework within which all effort necessary to meet the requirements of the Contract is identified and defined. It provides the logical structure for planning and controlling costs.

Content: The lowest level of the WBS shall correspond to at least the lowest level at which work scheduled and actual costs can be compared. This level shall be agreed upon during contract negotiations. The WBS shall be coded to establish the relationship among all of its levels. The established coding shall be used to identify each particular WBS item on all program budgets, schedules and financial reports. The WBS shall indicate which items require monthly financial reporting.

A WBS Dictionary shall be prepared to define each item of the WBS. These definitions shall describe the work to be performed, the criteria for completing the work, the organization responsible for the work and the major deliverable(s) involved (if applicable).

DID Number: PM-07

Title: Earned Value Management System Implementation Plan

Description: The Earned Value Management System (EVMS) implementation procedures shall describe the implementation of the EVMS system on the contract.

Content: The EVMS Implementation Procedures shall clearly document the integrated project management processes for the project. These procedures shall include but not be limited to the areas of organizing work, planning, budgeting, scheduling, work authorization, cost accumulation, measurement and reporting of cost and schedule performance, materials and subcontract handling, variance analysis and baseline control. These procedures shall flow down to major subcontracts as identified.

DID Number: PM-10

Title: Contributions to Project Baseline Review Package

Description:

The Project Baseline Review is a joint assessment to verify the technical content and the realism of the related performance budgets, resources, and schedules. It should provide a mutual understanding of the inherent risks in Project's performance plans and the underlying management control systems, and it should formulate a plan to handle these risks.

Content:

The contractor shall provide input into this review reflecting spacecraft, ground segment and operations technical content and the realism of the related performance budgets, resources, risks and risk mitigation, and schedules.

DID Number: PM-11

Title: Project Schedules

Description: Project schedules are used for planning, controlling, modeling and specifying work activities throughout the project life cycle.

Content Requirements: Detailed network diagrams shall be developed, delivered, and maintained containing each subsystem. These networks shall reflect the significant activities in sufficient detail to permit adequate monitoring of work progress. A log of all changes to the logic flow will be maintained and reported monthly for both baseline and current schedules.

Scheduling Tool/Process: The Contractor shall use an application that is compatible to Microsoft Project Professional. The Contractor tool must support data transfer and integration.

Content: The following status and analysis reports will be provided to the Scheduling Office:

Master Level Logic Network: A logic network summarizing the Intermediate/Detailed networks using Microsoft Professional Planning Software

Top Level Master Schedule: A Top Level schedule (chart) utilizing graphics software (Milestone Professional) that summarizes the Intermediate Level logic networks. This schedule must be suitable for a formal presentation.

Detailed Level Logic Network: Detailed logic networks utilizing MS Project Professional software will be provided to the Project Office.

Intermediate Level Summary Chart: An Intermediate level (Summary) schedule (chart) utilizing graphics software (Milestone Professional) that summarizes the detailed level logic networks. This schedule must be suitable for a formal presentation.

Tabular Reports: Tabular reports sorted by subsystem and WBS that will reflect the same data as the detailed logic networks.

60-Day Window Report: A report sorted by subsystem and dates, which list all activities expected to start or complete within sixty (60) days of the end of the month under review.

End-Item Window Report: A monthly report, which reflects the float/slack for deliverable items and major milestones PCM as determined by the Project. This report shall provide a comparison of the current float to the baseline and prior three (3) months float. The contractor shall also supply an explanatory analysis for all changes that exceed the established Stoplight threshold.

Monthly Analysis: Each monthly submittal shall begin with narrative sections for each major subsystem. This shall be followed by a float summary of all major elements showing three (3) months prior float status along with the current float position. Each section should address a brief description of current status and any existing or potential problems. A final section shall address the overall primary critical path status, as indicated by the detailed logic networks, and any work-around techniques being implemented or proposed to maintain schedule integrity.

Manufacturing Schedules: Manufacturing schedules and status obtained from subcontractors and vendors are not required to be submitted with the monthly schedule submittal, however, they shall be supplied to the Project Office upon request.

Top Ten Critical Items: The contractor shall submit monthly a list of the top ten critical items or milestones.

DID Number: PM-12
Title: Configuration Management Plan

Description: The Plan describes the methods and procedures used to manage the functional and physical characteristics of configuration items, and their interfaces and identification documents, during design, fabrication, assembly, and testing.

Content Requirements:

a. The plan shall describe the Contractor's configuration management organization and personnel responsibilities.
b. The plan shall describe the Contractor's configuration identification system, including drawing and specification standards.
c. The plan shall accommodate the requirements of the Contract relative to technical direction and approvals.
d. The plan shall describe the Contractor's change control system and shall include sample change documents and/or forms.
e. The plan shall define the interfaces between the Contractor's change control system and GSFC CM Office.
e. The plan shall describe which types of changes will be submitted to GSFC for approval.
f. The plan shall define the Contractor's engineering data management activities (including archiving process), documentation approvals, release procedures, and categories of release.
g. The plan shall describe the Contractor's configuration status accounting system including samples of lists and reports used.
h. The plan shall describe the Contractor's approach to verification and configuration audit to ensure that performance and functional requirements have been achieved by the design.
i. The plan shall describe Contractor's approach for using photographs as part of the Configuration Management/documentation process

DID Number: PM-13
Title: Inputs to the Mission System Requirements Review (SRR)/System Concept Review (SCR) Package

Description: The SRR/SCR is held to assure that the objectives and requirements of the item being designed are understood and that the proposed approach will meet these requirements. The emphasis should be on the requirements, how they flow down, the proposed design concept and the definition of the major system interfaces. Detailed interfaces are to be presented at later reviews.

Content: The SCR should address the following items:

- Mission/Object Design Objective
- Science Requirements
- Constraints Technical / Performance Requirements
- Organizational Interfaces
- Technical Interface
- System Drivers
- Safety Considerations
- Risk Area
- Proposed Design Approach
    - System Design
    - Mechanical
    - Electrical
    - Thermal
    - Software
- Ground Support Equipment (GSE)
- Operations
- Planned Test Program

DID Number: PM-14

Title: Spacecraft Preliminary Design Review (PDR) Data Package

Description: A PDR is held when the design is advanced sufficiently to begin some bread board testing and /or the fabrication of design models. Detail designs are not expected at this time, but system engineering, resource allocations and design analyses are required to demonstrate compliance with requirements. A presentation of the design and interfaces by means of block diagrams, signal flow diagrams, schematics, logic diagrams, error budgets, link margins, first interface circuits, packaging plans, configuration and layout sketches, analyses, modeling and any early results are required. Estimates of weight, power, volume and the basis for the estimates of these parameters are required. Supporting data and analyses for mechanical, power, thermal, and electronic design: load, stress, margins, reliability assessments, should be shown. Software requirements, design, structure, logic flow diagrams, Central Processing Unit (CPU) loading, design language and development systems need to be specified. Parts selection, de-rating criteria, and radiation hardness, is an important part of the PDR.

Content: A PDR should cover the following items:

- Science/Technical Objectives, Requirements, General Specification
- Closure of Actions from Previous Review/Changes since the last review
- Performance Requirements
- Error budget determination
- Weight, Power, Data rate, Commands, EMI/EMC
- Interface Requirements
- Mechanical/structural design, analyses, and life tests
- Electrical, thermal, optical/radiometric design and analyses
- Software requirements and design
- Ground Support Equipment design
- System Performance budgets
- Design verification, test flow and calibration/test plans
- Mission and ground system operations
- Launch Vehicle interfaces and drivers
- Parts selection, qualification, and Failure Mode and Effects Analysis (FMEA) plans
    1. EEE Parts Checklist
- Contamination requirements and control plan
- Quality Control, Reliability and redundancy
- Materials and Processes
- Acronyms and abbreviations
- Safety hazards identified for flight, range, ground hardware and operations
- Orbital Debris Assessment

DID Number: PM-15

Title: Inputs to Mission Preliminary Design Review (PDR) Data Package

Description: A PDR is held when the design is advanced sufficiently to begin some bread board testing and /or the fabrication of design models. Detail designs are not expected at this time, but system engineering, resource allocations and design analyses are required to demonstrate compliance with requirements. A presentation of the design and interfaces by means of block diagrams, signal flow diagrams, schematics, logic diagrams, error budgets, link margins, first interface circuits, packaging plans, configuration and layout sketches, analyses, modeling and any early results are required. Estimates of weight, power, volume and the basis for the estimates of these parameters are required. Supporting data and analyses for mechanical, power, thermal, and electronic design: load, stress, margins, reliability assessments, should be shown. Software requirements, design, structure, logic flow diagrams, Central Processing Unit (CPU) loading, design language and development systems need to be specified. Parts selection, de-rating criteria, and radiation hardness, is an important part of the PDR.

Content: A PDR should cover the following items:

- Science/Technical Objectives, Requirements, General Specification
- Closure of Actions from Previous Review/Changes since the last review
- Performance Requirements
- Error budget determination
- Weight, Power, Data rate, Commands, EMI/EMC
- Interface Requirements
- Mechanical/structural design, analyses, and life tests
- Electrical, thermal, optical/radiometric design and analyses
- Software requirements and design
- Ground Support Equipment design
- System Performance budgets
- Design verification, test flow and calibration/test plans
- Mission and ground system operations
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- Contamination requirements and control plan
- Quality Control, Reliability and redundancy
- Materials and Processes
- Acronyms and abbreviations
- Safety hazards identified for flight, range, ground hardware and operations
- Orbital Debris Assessment

DID Number: PM-28

Title: Risk Management Plan

Description: The Risk Management Plan summarizes how the contractor will implement the NASA continuous Risk management process. Include the initial Significant Risk List and appropriate actions to mitigate each risk. Projects with international or other U.S. Government agency contributions must plan for, assess, and report on risks due to international or other government partners and plan for contingencies.

Content:

Develop a stand-alone Risk Management Plan that includes the content required by NPR 8000.4, Risk Management Procedural Requirements or develop an input to the Project-level risk Management Plan.

The risk management plan should clearly describe:

- Risk identification approach
- Risk mitigation philosophy
- Risk mitigation plan
- How the contractor's risk management process supports the Project risk management process.

DID Number: PM-29

Title: Phase C/D Implementation Plan

Description: The Plan provides the basis for Contractor's delta cost proposal for Phase C/D

Content: The Contractor shall prepare a Phase C/D Implementation Plan that describes the Contractor's approach to completing Flight System design, fabricating and verifying the Flight System, integrating the science and engineering payload and completing Flight System acceptance testing and subsequent launch operations and post-launch checkout.

The implementation plan shall be correlated to the WBS and shall identify cost and schedule plans, plus deltas, with rationale from the initial baseline for Phase C/D.

The Plan shall include as a minimum the following:

(1) Technical and programmatic changes in Phase B that impact Phase C/D cost and schedule (identify each change and its impact on cost and schedule).
(2) Flight System summary description, including key or driving requirements
(3) Key open issues and plan for resolution, including payload accommodation
(4) Plan for completing reliability analyses including schedule, staffing, and phasing with design and implementation activities.
(5) Electronics parts procurement and screening plan, and phasing with implementation activities. In particular, long lead or high-risk parts should be identified and include a discussion of how schedule and technical risk will be managed.
(6) Implementation approach for flight hardware subsystems and assemblies including
    a. Key requirements
    b. Make or buy approach, including Contractor division and facility or subcontractor at which assemblies will be manufactured
    c. Changes to originally planned cost and schedule with rationale and basis
    d. Surveillance provisions, including meetings and reviews, to insure that technical, mission assurance and program requirements and constraints are met
    e. Summary test and verification plan
    f. Summary delivery and end item data package requirements
(7) Implementation approach for flight software, including key requirements and functions, make or buy approach, use of simulators, testbeds and the flight system for test and verification.
(8) Plan for verifying payload interfaces with Flight System using testbeds and/or simulators.
(9) ATLO flow plan and description, facility requirements (including Contractor-provided facilities for payload processing), support equipment development & verification approach.
(10) MOS development and support plan, including MOS and DSN compatibility testing, and end-to-end test.
(11) Plan for initial in-flight checkout of Flight System
(12) Phase C/D organization and staffing plan
(13) Risk items eliminated in Phase B, identified risk items for C/D and mitigation measures
(14) Transition plan from Phase B into Phase C/D

DID Number: PM-30

Title: Phase E Implementation Plan

Description: The Plan provides the basis for Contractor's delta cost proposal for Phase E

Content: The Contractor shall prepare a Phase E Implementation Plan that describes the Contractor's approach to providing post-launch mission operations support.

The implementation plan shall be correlated to the WBS and shall identify cost and schedule plans, plus deltas, with rationale from the previous baseline.

The Plan shall include as a minimum the following:

(1) Technical and programmatic changes that impact Phase E cost (identify each change and its impact on cost and schedule)
(2) Baseline MOS support description, including key or driving requirements
(3) Plan for maintaining testbeds at Contractor's facilities
(4) Plan and approach for monitoring routine in-flight telemetry and assessing Flight System health
(5) Key open issues and plan for resolution
(6) Plan for initial in-flight checkout of Flight System
(7) Phase E organization and staffing plan
(8) Risk items and mitigation measures
(9) Transition plan from Phase C/D into Phase E

DID Number: PM-31

Title: Review Plan

Description: Used to negotiate the specifics for the Contractor's review plans, approach and contents.

Content: A review plan shall be prepared identifying the Contractor and the sub-contracted reviews. The approach shall address system- and subsystem-level reviews for the Flight System and both Contractor-developed and subcontracted-delivered items. The plan shall provide review purpose, scope, convening authority, data contents and data package delivery schedules. Also the plan shall describe the process for creating and closing out action items.

DID Number: SE-01

Title: Systems Engineering Management Plan

Description: The contractor shall provide a SEMP to describe all aspects of the systems engineering effort throughout all phases of MAVEN. The purpose of the SEMP is to document, clarify and communicate the systems engineering effort.

Content: The SEMP shall include descriptions of all system engineering processes and functions, system analysis tasks and the tools to accomplish these tasks, the methodology to monitor technical progress, and how systems engineering supports the time phased activities of the MAVEN project.

The SEMP shall comply with both GPR 7123.1 Systems Engineering, and NPR 7123.1A, NASA Systems Engineering Processes and Requirements.

DID Number: SE-02

Title: Inputs to Environmental Requirements Document – mission unique

Description:

This environmental requirements document shall describe the environmental envelope encountered during the payload's total lifetime considering phases such as ground handling, testing, launch, and in-space operations.

DID Number: SE-03

Title: Electromagnetic Interference/Electromagnetic Compatibility (EMI/EMC) Control Plan

Description/Purpose:

This document shall describe the design and test verification methods that will used to insure that the spacecraft will be compatible with the performance requirements.

Content:

The EMC/EMI Compatibility Plan shall include the following minimum material.

a. Description of how the spacecraft will be designed to ensure compatibility between the various subsystems, the launch vehicle, and payloads.
b. Design and test plans that will be used at the system, subsystem and component levels.
c. EMC/EMI test matrix that describes which components, and/or subsystems will be tested for Conducted Emissions, Conducted Susceptibility, Radiated Emissions, Radiated Susceptibility and Electrostatic Discharge.
d. Description of the EMC/EMI and ESD Test Plans.
e. Description of the proposed accept/reject test criteria that will be used at the system, subsystem and component levels of assembly.
f. Description of proposed design guidelines that will be employed to ensure that the EMC/EMI requirements will be met, such as bonding, grounding and isolation, wiring harnesses design, EED circuits, shielding, etc.
g. Describe the plan for providing the predicted and measured values of the S/C radiation interference levels at GFE instrument locations such as the optical apertures of the Imager, Sounder and SXI and the Imager and Sounder cooler apertures.

Special Preparation Instructions:

The scope of this document shall include the satellite, instruments, and associated ground support equipment.

DID Number: SE-04

Title: Flight System Fault Protection Design Specification

Description:

Provide the specifications for the flight system fault protection design for all in-flight phases of the MAVEN mission. Include fault protection for the spacecraft and the instruments.

DID Number: SE-05

Title: Integrated Structural and Thermal Math Models

Description/Purpose:

To provide test verified mathematical models that represent the static and dynamic structural characteristics of the spacecraft and can be utilized with other data to predict structural accelerations, deflections, and internal loads. Also, to provide the dynamic model for use by the launch vehicle contractor in the performance of the flight loads analyses.

Item D (below) shall be used by NASA to evaluate the on-orbit structural accelerations and dynamic interactions. This model will be quite different than the model for launch condition.

To provide for the comprehensive, detailed review and validation of the thermal design and to predict the thermal performance of the spacecraft and instruments in all modes of operation.

Content:

A. STRUCTURAL AND DYNAMIC MATHEMATICAL MODELS AND DOCUMENTATION

The contractor shall develop and document test-verified mathematical structural models of the spacecraft in the launch configuration. These shall include a structural finite element model and a dynamic model in Craig-Bampton form, developed, verified, and documented as described below. The finite element model shall represent the structural and dynamic characteristics of the spacecraft. Interface degrees of freedom shall be compatible with corresponding attachment degrees of freedom on the model of the launch vehicle. The dynamics model shall be based on the finite element structural model using standard reduction techniques such as Craig-Bampton reduction.

The test verified structural finite element models and dynamic models shall be provided on electronic medium in a format acceptable to the launch vehicle contractor for the performance of the verification loads cycle analysis.

The dynamic models shall:

a. Include the overall system (spacecraft and components),
b. Be in Craig-Bampton form with modes that represent the dynamic characteristics of the spacecraft to at least 100 Hz,
c. Define dynamic degrees of freedom to allow calculation of acceleration levels and relative deflections at critical points, and
d. Include Load Transformation Matrices (LTM) described in the next section.

The finite element model documentation shall include the following:

a. A listing of the input data for the model,
b. Model definition plots, coordinate system definition, mass properties, and any other pertinent model definition information, along with documentation of the correlation between the modeled properties and the spacecraft design (GFE instrument models will be provided by their subcontractors),
c. Mode shapes, frequencies, modal damping, modal participation factors, modal effective weights, correlation between analytical and test modes, and all data required to demonstrate test-verification of the models
d. Characterization of all significant frequencies and mode shapes for the spacecraft constrained at the launch vehicle boundary points.

B. LOAD TRANSFORMATION MATRICES (LTM's)

The Load Transformation Matrices shall be fully documented and provided on electronic medium in a format acceptable to the launch vehicle contractor. The LTMs shall:

a. Consist of influence coefficients relating selected output variables to the associated dynamics

model response variable,

b. Include launch vehicle interface reaction forces, component/spacecraft interface reaction forces, and reaction force at support locations for deployables,
c. Include force, shear, and moment coefficients for determining internal loads in critical structural members, and
d. Include coefficients for determining absolute and relative deflections of spacecraft internal elements.

The LTM documentation shall provide:

a. A description of the model(s) from which the LTMs were generated,
b. A description of each row of the LTM,
c. Instructions for use of the LTM, including discussion of the equations used for computing internal transient loads, and
d. Results of standard checks performed for verification of the LTM (e.g., response to 1g accelerations and unit displacements at the interface).

C. STRUCTURAL MODEL VERIFICATION PLAN

In support of the development of the test-verified structural models, the contractor shall develop a verification plan which includes:

a. Identification of the modeling techniques and analysis programs to be utilized,
b. Analytical and testing techniques to be used to verify the analytical models and, where required, plans for revising models and repeating analyses based on verification results,
c. A description of analyses to be performed, along with the objective, scope, and output of each analyses, and description of testing which will be used for model verification, and
d. A compilation of required loads interface data (e.g., loads to components or deployables, or loads from launch vehicle(s), etc.), and a schedule of need dates.

D. ON-ORBIT INTERACTIONS

Repeat item "A" above for fully deployed, on orbit operating conditions and milli-g level vibrations.

The requirements and guidelines for the Combined Comprehensive S/C- Instrument Analytical Thermal Model is described below:

The Combined Comprehensive S/C-Instrument thermal model is a mathematical representation of the heat transfer between the s/c, the instruments and the environment. This model shall accurately predict the heat flows and the resulting temperature changes for any alteration in the environment, internal power dissipation, or any other thermal model parameter. The mathematical representation shall consist of a geometric math model (GMM), with which radiation couplings and environmental heat fluxes are calculated, and a thermal math model (TMM), which calculates the heat transfer and resultant temperatures.

The requirements for the Geometric and Thermal Math Model are described below:

Provide a list of all nodes with nodal descriptions. Sketches showing how nodes correspond to s/c Instrument components shall be included. Describe each node of the TMM, its correspondence to a surface or surfaces of the GMM, and discuss the nodalization rationale and how accurately the nodalization thermally represents the actual s/c Instrument hardware.

Special Preparation Instructions:

For items A thru C, all models, simulations, and/or databases required by this DID shall be delivered on electronically compatible with the hardware platform on which it is to execute and include everything necessary to provide a fully functioning computer model whose execution requires only commercially available hardware and software.

For item D, all analysis, simulations, and/or databases for this report shall be available for review at the

contractor's facilities.

The instrument structural models shall be incorporated in the spacecraft model and all analyses shall include the instruments.

Part 1 is to be provided at subsystem PDR and Part 2 one month after submittal of PLAC model to the launch vehicle contractor.

The instrument thermal models shall be incorporated into the spacecraft model by the contractor. All S/C thermal analyses shall include the instrument model.

DID Number: SE-06

Title: Flight System/Payload Interface Control Documents (ICD)

Description/Purpose

This document will be used to define the Spacecraft contractor's electrical, mechanical and thermal interface to the GFE instruments.

Content

The contractor shall prepare the Flight System/Payload Interface Documentation for each instrument that contains the following minimum material.

a. Provide a document that describes the circuits that are used by the spacecraft contractor and the instrument contractor for all electrical signals between the spacecraft and instruments.
b. The interface document shall also describe all the power grounds and signal return compatibility between the S/C and the instruments.
c. Define the mechanical, thermal, and INR interface with each Instrument.
d. Define the ESD protection and radiation shielding provisions for the instruments.
e. Define the contamination environment the spacecraft generates in the vicinity of the instrument thermal and optical surfaces.
f. Any other ICD relevant information.
g. Definition of the spacecraft to instrument interface for all GSE components.

DID Number: SE-07

Title: Contribution to Orbit Determination Document

Description:

Provide flight system input into the Project-level Orbit Determination Document.

Content:

As required for the development of the document

DID Number: SE-08

Title: Mass Properties Report

Description/Purpose:

To document all physical mass properties of the spacecraft, its subsystems and components from preliminary design through final assembly, launch and throughout all phases of the mission up to End of Life (EOL).

Content:

This document shall provide a mass properties database for each spacecraft including the GFE instruments. Mass properties shall include mass, center of gravity, moments of inertia and products of inertia. The reports shall be based upon calculated values and shall be updated as calculations are revised and actual measured data becomes available. Following environmental testing and prior to the spacecraft shipment, the report shall contain a complete mass properties summary of the final spacecraft mass properties as measured. The report shall also include the appropriate mass contingency for the current stage of hardware development, along with the allocated mass allowable.

Delivery of this CDRL may be accomplished by posting the latest version of the mass properties report to MIS.

The mass properties report shall contain the following:

a. An overall spacecraft mass summary, including total spacecraft dry mass, spacecraft subsystem dry mass, total spacecraft launch mass (including propellant), total spacecraft orbit insertion mass, and spacecraft mass at EOL
b. A spacecraft mass properties summary for the various phases of the mission, including launch, deployments, separation, through EOL. This summary should also demonstrate mass changes due to propellant utilization throughout the mission through EOL
c. A detailed mass properties summary of all spacecraft hardware organized by subsystem
d. A summary of all mass properties changes incorporated into the spacecraft mass properties database since the last report.

DID Number: SE-09

Title: Spacecraft Subsystems Hardware Specifications

Description/Purpose:

The component and subsystem design specifications shall be used to define the performance, design, and test verification requirements for all spacecraft component and subsystems.

Contents:

The contractor shall provide specifications for each spacecraft component and subsystem in accordance with the specification tree. A specification tree shall be provided that identifies the top level S/C design specification and all lower level design specifications. The subsystem specifications shall include, but not be limited to, the following items:

a. Performance requirements and capabilities (may be provided for informational purposes)
b. Subsystem and/or component mechanical and electrical interfaces.
c. Performance verification requirements
d. Performance assurance requirements
e. Grounding and shielding plan
f. Radiation design requirements
g. Functional and/or block diagram(s)
h. Component specification requirements

Special Preparation Instructions:

The Component and Subsystem Design Specifications shall be in accordance with MIL-STD-490, or the contractor's equivalent format.

DID Number: SE-10

Title: Inputs to Trajectory Analysis and Maneuver Planning Document - mission unique

Description/Purpose:

Provide flight segment inputs into the Project-level Trajectory Analysis and Maneuver Planning Document

Content:

As required for the development of the document.

DID Number: SE-11

Title: Inputs to Orbit Determination Performance Analysis – mission unique

Description/Purpose:

Provide flight segment inputs into the Project-level Orbit Determination Performance Analysis.

Content:

As required for the development of the analyis.

DID Number: SE-13

Title: Plume Impingement Analysis

Description/Purpose:

Plume Impingement Analysis is required to predict contamination and degradation of performance of spacecraft and instrument surfaces and components. Plume impingement can contaminate surfaces, degrade optical properties (including thermal radiation and absorption), and affect instrument performance.

Content:

Provide analysis of thruster firing plume impingement on spacecraft and instrument components, surfaces and fields of view.

DID Number: SE-14

Title: Flight System Performance Specification

Description/Purpose:

The Flight System Performance Specification shall delineate the contractor's design for the MAVEN Spacecraft. It shall establish the top level design and interface specification(s) placed on the Spacecraft in response to the Mission Requirements Document spacecraft requirements, MAVEN-PM-RQMT-005, and the instrument ICD's.

Contents:

In order to assure that the contractor is performing in accordance with the Statement of Work and Specifications, the contractor shall provide a Spacecraft Design specification that will be used by the contractor to direct the development of the entire Spacecraft. The lower level System and Subsystem level specifications shall be directed and controlled by the Spacecraft Design specification. The specification shall divide and allocate the design responsibilities and interfaces between all of the elements of the spacecraft.

Special Preparation Instructions

The contents of the Spacecraft Design Specification should be in accordance with MIL-STD-490, or the contractor's equivalent format.

DID Number: SE-16

Title: Flight System Verification Plan

Description/Purpose:

Provide a description of the system performance and verification test program, and describe the specific tests and/or analysis that will collectively demonstrate that the hardware/software complies with the performance requirement, and the payload ICD's.

Content:

This plan shall identify the test plans and analyses to be performed at each level of assembly in the system, subsystem through fully integrated s/c and SSGS, to demonstrate that the system (hardware and software) meets its performance and environmental requirements. The plan shall identify, where applicable, the combination of tests and analyses to be used to verify each performance and/or environmental requirement and whether verification is conducted on test modules or flight hardware/ software. Included should be descriptions of functional measurements planned at the component, subsystem, integration and system level as well as descriptions of methods planned to make the measurements.

Also, this plan shall include a description of when and how frequently all redundant components and cross-strapped paths will be tested during each environmental test activity. In addition, a list of performance parameters, by subsystem, shall be identified that will be used for monitoring data trends during qualification and acceptance test programs. The plan shall provide the following contents as a minimum:

a. Performance Verification Matrices (PVM) which map performance and design requirements/parameters against the verification methods, to include the level of verification, test procedure reference and, when applicable analysis documents to prove compliance with the system specifications. The Performance Verification Plan (PVM) shall be deliverable in both electronic database and in hardcopy format as a separate volume of the PVP.

   1. A "requirement sort" of the matrices will report all of the verifications attributable to a specific requirement, which can be evaluated for the comprehensiveness of the verification set.
   2. A "verification sort" will report all of the requirements attributable to the verification that will indicate to the verification planner the exact objectives of any specific verification (the requirements to be verified).
   3. Both of these sorts of the matrices will be available within the electronically delivered version of the CDRL. For example, a specific sort of "verification type = test - and - level = system" will list all system level tests. Specific sorts shall be available on request.

b. Detailed test flow sequence charts showing sequence of development and subsystem testing, including integration and qualification/acceptance activities for components, subsystem, spacecraft, GFE instruments, the SEM instruments, and the INR system (i.e., spacecraft and SSGS).

c. Component Life Test Plans that describe the test article configuration and how specification life requirements will be verified. These Plans apply to all component hardware to be life tested and should describe details such as instrumentation monitoring, facility control sequences, test article functions, test parameters, quality control checkpoints, pass/fail criteria, data collection, reporting requirements, and safety and contamination control provisions.

d. Plan for the verification of all previously flown and qualified hardware, including identification of additional verifications required.

e. An environmental test plan that documents the spacecraft contractor's approach for qualification and acceptance tests. It is intended to provide general test philosophy and an overview of the system-level environmental testing to be performed to demonstrate adequacy of the spacecraft for flight (e.g. static loads, vibration, acoustics, shock, etc.) It should include test objectives, unit under test, configuration and general test methods.

f. End-to-End System and Compatibility Test Plans that describe the tests to be performed to verify that the entire spacecraft system (end-to-end) meets performance requirements that are described in Attachment F. This document shall provide details on how the fully integrated system will be tested in an executable system configuration (End-to-End), the sequence and schedule of the test flow, and it shall include a verification matrix. The plan also describes the test facilities and support resources needed for this test.

g. Plan for certification for spacecraft and GFE instrument handling equipment.

h. A list of performance parameters by subsystem shall be identified that will be used for monitoring data trends during the spacecraft qualification and acceptance test programs.

i. Provide the test plan, test sequence, and a description of the tests and activities that will be performed at the launch site.

j. Provide the descriptions for tests that are identified in the performance verification matrix.

k. Describe the proposed ESD qualification test plan that will be used at the component and spacecraft levels of assembly.

l. Provide the post-launch test plan that will be followed prior to spacecraft engineering hand-over (24 days) to the government

m. Provide the recommended test plan that the government will perform during the PLT phase.

1. Describe the recommended test plan for each s/c subsystem that will characterize its baseline in-orbit performance.

2. Describe the recommended plan for testing the primary, redundant and/or cross-strap signal paths and equipment.

3. Provide a recommended post-launch INR test approach describing the tests to be performed by NASA to initialize and/or characterize INR on-orbit performance and the interval required between calibrations. Test groups may be used in lieu of test plans for each required INR calibration and/or initialization procedure to provide a clear overview of the overall procedure. Each test plan/group presented above shall contain the number of times the test is expected to be performed to characterize each calibration and/or the interval required between calibrations, and recommendations for when the test should or be done (e.g., seasonally, time of day).

n. Spacecraft-level thermal balance and thermal test profiles.

DID Number: SE-17

Title: Spacecraft Test Laboratory (STL) Implementation Plan

Description: The Plan provides the basis for Contractor's implementation of the Spacecraft Test Laboratory.

Content: The Contractor shall prepare a Spacecraft Test Laboratory (STL) Implementation Plan that describes the Contractor's approach to developing and using the STL for pre-ATLO activities, during ATLO and for providing post-launch mission operations support.

The Plan shall include as a minimum the following:

- Technical and programmatic plans for implementation
- Baseline MOS support description, including key or driving requirements
- Plan for maintaining testbeds at Contractor's facilities
- Key open issues and plan for resolution
- Risk items and mitigation measures
- Transition plan from Phase C/D into Phase E

DID Number: SW-01

Title: Software Management Plan

Description/Purpose:

To define the offeror's systematic approach to, and processes used in, the management, development, testing (verification, validation, qualification), documentation, configuration management, and quality assurance of the MAVEN Flight, and associated Electrical Ground Support Equipment Software.

Content:

The Software Management Plan shall be prepared in accordance with the full, untailored contents of NASA-STD-2100-91, NASA-DID-M000 (including all subsumed DID contents from the MAR, or DOD-STD-2167A and DOD-STD-2168 standards (in which case the contractor shall use, as a minimum, the contents of DID's DI-MCCR-80030A and DI-QCIC-80572).

Special Preparation Instructions

The contractor may tailor this document as appropriate or use alternate guidelines (e.g., MIL-STD-498, IEEE Standards) for its preparation.

DID Number: SW-02

Title: Software Integration and Test Plan

Description/Purpose:

The Software Integration andTest Plan (SITP) defines the total strategy, methodology, and approach for the complete integrations and testing of a particular Computer Software Configuration Item, including informal tests conducted on the Computer Software Component (CSC), Computer Software Unit (CSU), or other applicable divisions of software (object, class, package, etc.), and formal (qualification, acceptance testing) on the fully integrated CSCI. The SITP shall identify and describe the test environment for each phase of testing. Any requirement which shall require the full satellite for its verification shall be identified. The Software Integration and Test Plan shall contain a traceability matrix which traces all test cases, procedures, descriptions to their corresponding SRS requirement.

Content:

The contractor may use DOD-STD-2167A DID DI-MCCR-80014A as a guideline for this document, which shall, as a minimum, contain the following items: Introduction, Scope, Purpose, Organization, Objectives, Applicable Documents, Reference Documents, Informational Documents, Test Environments, Test Management, Test Control, Test Execution, Test Evaluation, Data Collection, Pass/Fail Criteria, Data Reduction Techniques, Results Analysis Techniques, Traceability of Each SRS Requirement to Informal and Formal Tests, Unit Testing, CSC Testing, CSC Integration Testing, CSCI Testing, Informal Test Plans, Formal Test Plans, Plan for Delivery of Software to Satellite Integration and Testing, Required Resources (Flight-like Hardware, Interface and Support Software, Test Equipment, etc.), Facilities, Personnel.

Special Preparation Instructions

The contractor may tailor this document as appropriate or use alternate guidelines (e.g., MIL-STD-498, IEEE standards) for its preparation only with the explicit, prior approval and agreement of the Government.

DID Number: SW-03

Title: Software Requirements Specification (SRS)

Description/Purpose:

The Software Requirements Specification (SRS) specifies in detail all the requirements for a particular Computer Software Configuration Item (CSCI), including functional and performance requirements, interface requirements, data requirements, quality assurance requirements, testing requirements, security and safety requirements. A traceability matrix shall be included in the SRS that traces each software requirement to a performance specification, system, subsystem, or other higher-level requirement from which it is derived as well as the method which will be used to verify the requirement.

Content:

The Software Requirements Specification shall be prepared in accordance with the contents of NASA-STD-2100-91, NASA-DID-P200 or DOD-STD-2167A, DID's DI-MCCR-80025A and DI-MCCR-80026A.

Special Preparation Instructions:

The contractor may tailor this document as appropriate or use alternate guidelines (e.g., MIL-STD-498, IEEE standards) for its preparation only with the explicit, prior approval and agreement of the Government.

DID Number: SW-04

Title: Algorithms Design Document(s) (ADD)

Description/Purpose:

The Software Design Document (SDD) describes in detail the architecture, structure and organization of a particular Computer Software Configuration Item (CSCI), decomposing the top-level CSCI into Computer Software Components (CSC's) and Computer Software Units (CSU's), or other natural division of the software (e.g., objects, classes, packages, etc.), as appropriate. The Software Design Document also describes each unit of software in terms of its interfaces (inputs and outputs), data architectures, processing (e.g., logic, algorithms, etc.), and traces each design feature to its corresponding requirement(s) in the SRS (for which a traceability matrix shall be provided as part of the SDD).

To fully describe all the Electrical Power and Distribution Subsystem (EPDS) algorithms which will be implemented in the flight software. This document provides intermediary information which the EPDS analysts and software engineers will use to write the EPDS software implementation.

Content:

The Software Design Document (SDD) shall be prepared in accordance with the contents of NASA-STD-2100-91, DID's NASA-DID-P300 and NASA-DID-P400, or DOD-STD-2167A, DID's DI-MCCR-80012A and DI-MCCR-80027A.

The Electrical Power and Distribution Subsystem (EPDS) Algorithms Description Document shall fully describe the EPDS algorithms with sufficient detail to be useful to software engineers, design engineers subsystem, and systems engineers. This document shall include textual descriptions of each algorithm and diagrams such as: mode-transition diagrams, data flow diagrams, structure charts, control diagrams, etc. It will define software interfaces and internal variables, execution rates, deadlines, operational constraints and restrictions.

Special Preparation Instructions:

The contractor may tailor this document as appropriate or use alternate guidelines (e.g., MIL-STD-498, IEEE standards) for its preparation only with the explicit, prior approval and agreement of the Government.

DID Number: SW-05

Title: Suitcase Simulator User Training Manual

Description/Purpose:

To Provide documentation which can be used to understand the design and operation of the Spacecraft Emulator.

Contents:

The Spacecraft Emulator Design Document shall describe the detailed design of the spacecraft emulator, including all hardware, software, firmware, and commercial-off-the-shelf (COTS) test equipment used in the emulator. Distinctions shall be made between flight-like components, simulated components, and full-software simulations.

DID Number: IT-02

Title: Flight System Integration, Test and Launch Operations Plan

Description/Purpose

To provide information on how the spacecraft will be tested and how its performance will be verified during Integration and Test.

Provide documentation required to support launch operations. This document will be used as an input document for transmittal of all MAVEN requirements to ER and is the primary document used by ER for the preparation of their Launch Site Support Plan (LSSP) and Payload Requirements Document (PRD).

Provides a plan to obtain approval for use of the launch site facilities and resources and for the safety measures to be employed for spacecraft operations.

Contents:

The contractor shall provide detailed test procedures to be used during Spacecraft Level Testing. These procedures shall be prepared for each test activity defined in the Performance Verification Plan and shall cover all spacecraft test operations, interfaces, and spacecraft performance requirements (i.e., electrical, structural and mechanical, EMC), and shall cover specialized tests such as mechanical function and deployments, environmental exposure tests (i.e., vacuum, vibration), spacecraft calibration, GSE calibration and checkout, and pre-launch end-to-end tests. As a minimum, the procedures shall contain such information as:

a. Test Objectives
b. Test Methods
c. Applicable Documents and Software
d. Required Spacecraft Configuration
e. Test Equipment Configuration
f. Test Equipment Identification
g. Test Instrumentation
h. Safety Provisions and Cautions
i. Program Quality Requirements
j. Test Instructions
k. Data Recording Requirements
l. Data Recording Forms and Tables
m. Accept/Reject Criteria
n. Test Termination Procedure

The Launch Site Integration Plan shall define and document the support activities that are necessary for pre-launch activities and the technical aspects of launch operations. This plan shall describe the pre-launch checkout test plan and integration with the launch vehicle; participation in launch vehicle/spacecraft integrated systems test; and inspection, checkout, and fueling operations. All GFE facilities, services and materials must be specified in this document. This includes facilities required for spacecraft checkout and assembly, power, clean room provisions, office space, and communications.

The contractor shall document compliance with all ER safety training, security and Personal Reliability Program requirements.

This document should describe all aspects of the program while at the launch site. A suggested format for the Launch Site Integration Plan is given below:

1.0 General
- 1.1 Plan Organization
- 1.2 Plan Scope
- 1.3 Applicable documents

1.4 Spacecraft Hazard System Summary

2.0 Pre-launch/Launch Test Operations Summary
- 2.1 Schedule
- 2.2 Layout of Equipment (each facility) including Test Equipment
- 2.3 Description of Events at Launch Site
  - 2.3.1 Spacecraft Delivery Operations
  - 2.3.2 Payload Processing Facility Operations
  - 2.3.3 Hazardous Processing Facility Operations
  - 2.3.4 Launch Complex Operations
- 2.4 Launch Hold Criteria
- 2.5 Environmental Requirements for Facilities During Transport

3.0 Test Facility Activation
- 3.1 Activation Schedule
- 3.2 Logistics Requirements
- 3.3 Equipment Handling
- 3.4 Maintenance

4.0 Administration
- 4.1 Test Operations

5.0 Security Provision for Hardware/Software

6.0 Special Range Support Requirements
- 6.1 Voice Communications
- 6.2 Mission Control Operations

The contractor shall submit a Ground Operations Plan (GOP) for each spacecraft to be launched. Contents shall be in accordance with Eastern and Western Range Safety Requirements 127-1. The GOP generation shall begin in the design phase and continue through the project development production and integration and test phases. The GOP must be approved by the launch range prior to the start of any hazardous operations on the range.

Each GOP submittal or supplemental submittal shall include addenda and updates required to ensure that the plan is current for each spacecraft launch.

DID Number: LV-02

Title: Inputs to Launch System Requirements (LSRD) Document

Description/Purpose:

The Launch System Requirements Document captures MAVEN requirements on the launch vehicle provider. It is used to support the procurement of launch services.

Contents:

As required to support the Project-level LSRD.

DID Number: LV-03

Title: Input to the LSSP and LV ICD

4. DESCRIPTION/PURPOSE

The spacecraft to launch vehicle interface control document (S/L ICD) is designed to provide the Spacecraft requirements definition, interface details, launch site facilities, and safety data between the launch vehicle and the spacecraft. It defines the mission requirements and interfaces as they are known. It shall also include any other contractor furnished hardware and services required such as transportation, propellants or analytical support services. The S/L ICD will evolve as mission requirements are identified.

Contents:

Spacecraft to Launch Vehicle ICD Format

Following is a sample S/L ICD format of appropriate detail. An S/L ICD format of similar detail shall be provided by the spacecraft Contractor.

S/L ICD

Approvals and Distribution Page

1. Introduction
   - 1.1 Mission Information
   - 1.2 Purpose
   - 1.3 Launch Vehicle Description
     - 1.3.1 Configuration
     - 1.3.2 Non-Standard Service Hardware
   - 1.4 Spacecraft Description
   - 1.5 Definitions, Abbreviations/Acronyms
2. Applicable and Reference Documents
3. Mission Characteristics
   - 3.1 Launch Site
   - 3.2 Launch Vehicle Performance
   - 3.3 Mission Design Requirements
     - 3.3.1 Orbital Parameters
     - 3.3.2 Spacecraft Separation
       - 3.3.2.1 Orientation
       - 3.3.2.2 Translational and Rotational Rates
     - 3.3.3 Collision/Contamination Avoidance Maneuver
   - 3.4 Launch window
     - 3.4.1 Eclipse Constraints
     - 3.4.2 Sun Angle Constraints
     - 3.4.3 Ascending Node Constraints
   - 3.5 Mission Time line
   - 3.6 Launch Date
   - 3.7 Spacecraft Systems Launch Configuration
   - 3.8 Spacecraft Mass and Dynamic Properties
     - 3.8.1 Launch Mass
     - 3.8.2 Reference Coordinates/Drawing
     - 3.8.3 Center of Mass Location and Alignment
     - 3.8.4 Moments of Inertia
     - 3.8.5 Fundamental Frequencies (Axial/Lateral)
     - 3.8.6 Time Constant and Energy Dissipation Sources
   - 3.9 Spacecraft Hazardous Systems
     - 3.9.1 Propulsion
     - 3.9.2 Electrical Explosive Devices (EEDs)

3.9.3 Pressurized Systems
3.9.4 Hazardous Fluids/Materials
3.9.5 RF Systems
3.9.6 Other

4. Spacecraft Interfaces
4.1 Mechanical Interface
4.1.1 Spacecraft Attach Fitting
4.1.2 Spacecraft Dynamic or Static Envelope
4.1.2.1 Envelope Incursions
4.1.2.2 Compatibility Drawing
4.1.3 Separation System
4.1.4 Fairing
4.1.4.1 Access
4.1.4.2 Thermal Insulation
4.1.4.3 Acoustic Blankets
4.1.5 Spacecraft Integration
4.2 Electrical Interface
4.2.1 Spacecraft Telemetry
4.2.1.1 Stations
4.2.1.2 Airborne Telemetry Support
4.2.1.3 Data Rate/Type
4.2.1.4 Special Hardware
4.2.1.4.1 RF Window/Door
4.2.1.4.2 Re-radiator
4.2.1.4.3 Other
4.2.2 Launch Vehicle Provided Electrical Firing Pulses
4.2.3 Launch Vehicle Provided Discrete Commands
4.2.4 Vehicle Interface Connectors/Pin Assignments
4.2.4.1 Launch Vehicle Interface Connectors
4.2.4.2 Spacecraft Interface Connectors
4.2.4.3 Pin Assignments
4.2.5 Separation Switches/Pads
4.2.6 Mission Peculiar Vehicle Telemetry
4.2.6.1 Stations
4.2.6.2 Airborne Telemetry Support
4.2.6.3 Data Rate/Type
4.2.6.4 Special Instrumentation
4.2.7 Special Vehicle Electrical Hardware
4.3 Environmental Interface
4.3.1 Steady State Acceleration
4.3.2 Structural Loads
4.3.3 Vibration
4.3.3.1 Random Vibration
4.3.3.2 Sine Vibration
4.3.3.3 Acoustic Environment
4.3.4 Separation Shock
4.3.5 Thermal and Humidity
4.3.5.1 Fairing Temperature and Emissivity
4.3.5.2 Free Molecular Heating Rate
4.3.5.3 Spacecraft/PAF Thermal Interface
4.3.6 Contamination Control
4.3.7 Pressure
4.3.8 Electromagnetic Compatibility
4.3.8.1 General Requirements
4.3.8.2 Launch Vehicle RF Environment
4.3.8.3 Spacecraft EMI/RFI Environment

5. Ground Handling and Processing Requirements
5.1 Facilities
5.1.1 Operational Areas and Office Support Equipment
5.1.2 Hazardous Processing Areas

5.1.3 Block House
5.1.4 Launch Pad
5.1.5 Communications Requirements
5.1.6 Power Requirements
5.1.7 Spacecraft Handling/Test Equipment
5.1.8 Special Equipment
5.2 Logistics
5.2.1 Transportation
5.2.2 Handling
5.2.3 Storage
5.3 Facilities Environmental Interface
5.3.1 Thermal
5.3.2 Humidity
5.3.3 Contamination Control
5.3.4 Electromagnetic Compatibility
5.3.5 Fairing Airflow
5.3.5.1 Flow Rate
5.3.5.2 Diffuser/Deflector
6. Mission Specific Launch Vehicle Modifications
6.1 Launch Vehicle Configuration
6.2 Special Vehicle Insignia
7. Safety and Security Services
8. Interface Verification/Compatibility Testing
8.1 Analysis
8.1.1 Mission Analysis
8.1.2 SC Separation Analysis
8.1.3 Collision/ Contamination Avoidance Maneuver (C/CAM) Analysis
8.1.4 Coupled Loads Analysis
8.1.5 Integrated Thermal Analysis
8.1.6 EMI/EMC and RF Compatibility Analysis
8.1.7 Acoustic Analysis
8.1.8 Ascent Venting Analysis
8.1.9 RF Link Analysis
8.1.10 Critical Clearance Analysis
8.1.11 Separation System Stress Analysis
8.1.12 Post Launch Evaluation Report
8.2 Testing
8.2.1 Separation Shock Testing
8.2.2 Payload Attach Assembly Fit Check
8.2.3 Launch Site End-to-End Tests
8.2.4 SC/LV Buildup Interface Verification Tests
8.2.5 Combined Electrical Readiness Test (CERT)
8.2.6 SC/LV Launch Rehearsals

9.0 Verification Matrix

DID Number: OPS-06

Title: Mission Support Areas (MSA) to DSN ICD

Description/Purpose

This document will be used to define the Spacecraft contractor's electrical, software and data interface between the Mission Support Area and the Deep Space Network.

Content

The contractor shall prepare the MSA/DSN Interface Documentation.

DID Number: OPS-07

Title: MSA to NAV facility ICD – mission unique

Description/Purpose

This document will be used to define the Spacecraft contractor's electrical, software and data interface between the Mission Support Area and the JPL Navigation Facility.

Content

The contractor shall prepare the MSA/NAV Interface Documentation.

DID Number: OPS-08

Title: Flight Software Post Launch Maintenance Plan

Description/Purpose

This document will be used to define the Spacecraft contractor's plans for Post Launch Flight Software Maintenance.

Content

The contractor shall prepare the Flight Software Post Launch Maintenance Plan.

Mission Assurance Data Item Descriptions

All Mission Assurance Data Item Descriptions (DID Numbers MA1-1 through MA 15-1) are contained in the Mission Assurance Requirements, MAVEN-PM-RQMT-0006.