

APPENDIX 5: SOFTWARE MANAGEMENT REQUIREMENTS

1 SCOPE

The scope of this appendix is to cover all flight software managed and developed for the DV (including subsystems such as propulsion) and the Adapter.

In addition, this appendix covers the software managed and developed for Ground Test Equipment (GTE), Ground Support Equipment (GSE), and Simulations/Models.

2 FLIGHT SOFTWARE DEVELOPMENT, OPERATIONS, AND MAINTENANCE

The Contractor shall be responsible for the development, operation, and maintenance of DV/Adapter software.

2.1 Constraints

2.1.1 Flight software shall be developed, operated, and maintained in accordance with IEEE/EIA 12207.0, “*Standard for Information Technology – Software Life Cycle Processes*” as tailored in the table below. Engineering data shall be developed and delivered in accordance with Appendix 8.

Project Tailoring Decisions

For the Implementation of IEEE/EIA Standard 12207.0 –1996

| IEEE/EIA 12207.0 Processes | IEEE/EIA 12207.0 Activities: Contractor is responsible for all activities unless otherwise noted in the “Responsibility Column” | Responsibility |
|----------------------------|--|----------------|
| Acquisition Process | | |
| | 5.1 | Not applicable |
| Supply Process | | |
| | 5.2.1-5.2.3 | Not applicable |
| | 5.2.4-5.2.7 | Contractor |
| Development Process | | |
| | 5.3 | Contractor |
| Operation Process | | |
| | 5.4 | Contractor |
| Maintenance Process | | |
| | 5.5 | Contractor |

| | | |
|---------------------------------|--|-----------------------------------|
| IEEE/EIA 12207.0 Processes | IEEE/EIA 12207.0 Activities: Contractor is responsible for all activities unless otherwise noted in the "Responsibility Column" | Responsibility |
| Supporting Processes | | |
| | 6.1-6.4, 6.6-6.8 | Contractor |
| | 6.5 | NASA (with Contractor SW Support) |
| Organizational Processes | | |
| | 7.1 | Contractor |
| | 7.2-7.4 | Not applicable |

2.1.2 Flight software shall be developed using an industry-standard High Level Language.

2.1.3 Flight software shall be developed using Commercial Off-The-Shelf (COTS) for the following:

- Real Time Operating System
- Development Environments
- Support Applications

2.2 Functional Requirements

2.2.1 Flight software shall provide a deterministic executive for the scheduling of flight software tasks.

2.2.2 Flight software shall detect and provide graceful degradation for active control system anomalies and provide (or relay) a signal for transmission to the ground indicating that condition.

2.2.3 Flight software shall detect and provide graceful degradation for time overflows, data validity failures, transient off-nominal (outside of specifications) data inputs, and software exceptions and provide (or relay) a signal for transmission to the ground indicating that condition.

2.2.4 Flight software shall be re-programmable via the DV GSE interface.

2.2.5 Flight software shall interface with GSE/GTE, including the Vehicle System Demonstrator (VSD), via the GSE interface.

3 SOFTWARE DEVELOPMENT PLANNING

3.1 Software Development Plan

3.1.1 The Contractor shall develop a Software Development Plan (SDP) for the development, operation, and maintenance of the DV/Adapter SW (and associated GTE/GSE).

3.1.2 The Contractor shall perform the development, operation, and maintenance activities as documented in the SDP.

3.2 *Managing Subcontractors*

If Subcontractors are used, the Contractor shall include all contractual requirements necessary to ensure that software products are developed in accordance with prime contract requirements.

3.3 *Software Independent Verification & Validation*

The Contractor shall support the NASA Software Independent Verification and Validation (IV&V) Facility process. The efforts will be limited in scope to:

- FMU Software Requirements
- FMU Software Design/Code
- FMU Software Integration, Test, and Verification Plan
- FMU Software Verification Test Matrix
- FMU Software Verification Test Procedures
- FMU Software Verification Test Results

These efforts exclude the Propulsion System, GTE, and GSE software.

3.4 *Software Data Distribution System (DDS)*

3.4.1 The Contractor shall provide an on-line Software DDS as an extension of their current information technology (IT) infrastructure.

3.4.2 The Contractor shall manage and maintain the system.

3.4.3 The Contractor shall grant access to authorized users.

3.4.4 The Contractor shall insure that data posted to the Software DDS is current, accurate, and complete.

4 SOFTWARE MEETINGS

4.1 *Weekly Communications (Tag-up Meetings)*

A standard form of weekly communication with the X-43C SW Manager shall be established. This may consist of a teleconference, e-mail, visits or videoconferences. Teleconference should last less than one hour each. Data for the meeting should be generated using Contractor processes and internal formats.

4.2 *Technical Interchange Meetings*

4.2.1 Contractor shall conduct (or support) Software Technical Interchange Meetings (TIMs) as required by either the Contractor's SW Manager or the X-43C SW Manager. Software TIMs shall be conducted to provide technical status and review of problems with respect to software engineering, quality assurance, system effectiveness, safety,

and test activities.

4.2.2 SW Technical Meetings shall be held at either the Contractor's Facility or an alternate facility as mutually agreed upon. The Contractor should plan for one TIM per quarter.

4.3 Software Status Reviews (SSR)

4.3.1 The Contractor shall conduct monthly Software Status Reviews (SSRs) with the X-43C SW Manager. The monthly SSR will be held in place of the weekly Tag-up meeting.

4.3.2 The Contractor shall post presentation material on the Contractor's Software DDS at least two days prior to the review.

4.3.3 SW SSRs shall be held at either the Contractor's Facility or an alternate facility as mutually agreed upon.

4.3.4 Report of meeting results shall be prepared by the Contractor, reviewed by the X-43C SW Manager, and posted on the Contractor's Software DDS.

4.4 Software Reviews

4.4.1 Prior to each DV and Adapter Review identified in the SOW (Section 9.4, as per LMS CP-5505), the Contractor shall conduct (or support) a SW review.

4.4.2 The Contractor shall post presentation material on the Contractor's Software DDS at least two days prior to the review.

4.4.3 SW Reviews shall be held at either the Contractor's Facility or an alternate facility as mutually agreed upon.

4.4.4 Report of meeting results shall be prepared by the Contractor, reviewed by the X-43C SW Manager, and posted on the Contractor's Software DDS.

5 SOFTWARE TEST PLANNING

5.1 Software Integration, Test, and Verification Plan

5.1.1 The Contractor shall develop a SW Integration, Test, and Verification Plan for the development, operation, and maintenance of the DV/Adapter SW.

5.1.2 The Contractor shall perform software integration, test, and verification testing activities as documented in the Software Integration, Test, and Verification Plan.

5.2 SW Verification Test Procedures

The Contractor shall develop SW Verification Test Procedures.

5.3 SW Verification Test Report

After the completion of SW Verification Testing, the Contractor shall compile the results in a SW Verification Test Results Report.

5.4 Ground Test Equipment and Ground Support Equipment

The Contractor shall design, develop, test, operate, and maintain all necessary GTE and GSE for the development, integration, integration test, verification test, functional testing (pre & post shipment), preflight checkouts, operations, and maintenance of the DV/Adapter SW.

5.5 Test Support

The Contractor shall continue SW support after the DV and Adapter have been delivered to the Government RTO.