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| DocCoverBackground | CORE FLIGHT SYSTEM  MEMORY MANAGER  BUILD 2.4.1.0  FLIGHT SOFTWARE BUILD VERIFICATON  TEST REPORT  Flight Software Branch – Code 582  Version 1.0 |

Signatures

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Table of Contents

1 Introduction 1

1.1 Document Purpose 1

1.2 Applicable Documents 1

1.3 Document Organization 1

1.4 Definitions 2

2 OVERVIEW 3

2.1 Flight Data System Context 3

2.2 Test History 4

2.3 Testing Overview 5

2.4 Version Information 8

3 Build Verification Test Preparation 9

3.1 Scenerio Development 9

3.2 Procedure Development and Execution 9

3.3 Test Products 9

4 Build Verification Test Execution 10

4.1 Testbed Overview 10

4.2 Requirements Verification Matrix 11

4.3 Requirements Partially Tested 11

4.4 Requirements/Functionality Deferred 12

4.5 Requirements/Functionality Deferred to Mission Testing 12

5 Build Verficiaton Test Results 13

5.1 Overall Assessment 13

5.2 Procedure Description 13

5.3 Analysis/Inspection Requirements Verification 14

5.4 Failed Requirements 15

5.5 DCRs 16

5.5.1 DCRs Verified 16

5.5.2 Outstanding DCRs 17

5.6 Notes 17

Appendix A - RTTM 19

Appendix B - Command, Telemetry, and Events Verification Matrix 20

# Introduction

## Document Purpose

This Test Report describes the test results from the Core Flight System (cFS) Memory Manager (MM) Flight Software (FSW) Test Team build 2.4.1.0 verification testing. It is used to verify that the MM FSW has been tested in a manner that validates that it satisfies the functional and performance requirements defined within the cFS MM Requirements Document. This Test Report summarizes the FSW test history, the build verification process, the build test configuration, and the test execution and results.

## Applicable Documents

Unless otherwise stated, these documents refer to the latest version.

**Parent Documents** (Mission and FSW)

* 582-2007-031 cFS Memory Manager Requirements Document, Version 1.3
* 582-2008-012 cFS Deployment Guide

**Reference Documents**

All of the references below can be found on the Code 582 internal website at <http://fsw.gsfc.nasa.gov/>

* 582-2003-001 FSB FSW Test Plan Template
* 582-2004-001 FSB FSW Test Description Template
* 582-2004-002 FSB FSW Test Scenario Template
* 582-2004-003 FSB FSW Test Procedure Template
* 582-2004-004 FSB FSW Test Execution Summary Template
* 582-2004-005 FSB Test Product Peer Review Form
* 582-2000-002 FSB FSW Unit Test Standard

## Document Organization

Section 1 of this document presents some introductory material.

Section 2 provides a flight software overview and context along with the test history and testing overview.

Section 3 describes the build verification process including procedure development and execution and test products produced.

Section 4 describes the build test configuration which includes an overview of the testbed and the requirements verification matrix.

Section 5 describes the test execution and results by subsystem.

Appendix A - provides the Requirements Traceability Matrix

Appendix B - provides the Command, Telemetry, and Events Verification Matrix

## Definitions

There were 3 verifications methods used during build verification testing. They were:

* Demonstration: Show compliance with system requirement by exhibiting the required capability (e.g. by demonstrating interactive capability, display capability, print capability, etc.
* Inspection: Show compliance with a system requirement by visual verification of the software (e.g. verifying preparation for delivery, proper interfacing)
* Analysis: Perform detailed analysis of code, generated data (both intermediate data and final output data), etc., to determine compliance with system requirements.

The fields in the Requirements Verification Matrix in Section 4.3 are defined as follows:

* Requirements Tested Passed: Requirement was fully tested in a build test procedure and passed all tests.
* Requirements Tested Failed: Requirement was fully tested in a build test procedure and failed one or more aspect of the testing.
* Requirements Tested Partially: Requirement was tested partially in a build test procedure. To be fully tested, the partially tested requirement must be tested additionally in one or more other test procedures within the same build. The aspects of a partially tested requirement that were not tested in the current build were either tested in an earlier build and no longer need to be retested **and/or** there were capabilities not present required to complete the test.
* Total Tested: Total number of requirements fully tested in a build test procedure. Includes total passed and total failed, but does **not** include requirements tested partially, **unless** (included as a separate entry) testing in multiple procedures within the same build constitutes total testing of a particular requirement. Total Requirements Tested is computed this way in order to avoid multiple counting of individual requirements that are tested partially in more than one procedure.
* Deferred: Number of requirements that were planned to be tested in current build, but were not tested due to some FSW capability or necessary system component not being present.
* Total: Total Requirements Tested + Number of Requirements Deferred

In each software test section in Section 5 there is a table of DCR’s. The state definitions are as follows:

* Opened: The DCR is currently being addressed
* Assigned: The DCR was accepted and the modification is being addressed
* InTest: The DCR was corrected and is currently in test
* Validated: The DCR was corrected and tested and have been validated, needs to have a CCB to close the DCR
* Closed: The DCR is closed and have been resolved and tested to satisfaction
* Closed with Defect: The DCR is closed and the defect is most likely assigned a differed DCR number associated with another subsystem.

# OVERVIEW

## Flight Data System Context

Figure 2-1 illustrates the cFS system context. The cFE interfaces to five external systems: an [Operating System](#Operating_System) (OS), a [Hardware Platform](#Hardware_Platform) (HP), an [Operational Interface](file:///C:\Users\sstrege\Users\sstrege\AppData\Roaming\Microsoft\MM%202.0.0.0\Operational_Interface) (OI), [Applications](#Application) (APP), and other cFE-based systems.



**Figure 2-1 cFS System Context**

The Memory Manager (MM) application of the Core Flight System (cFS) is responsible for the loading and dumping of flight system memory. MM is basically the operator interface for the Operating System Application Layer (OSAL) memory manipulation. MM provides the ability to load and dump memory via commands as well as from files. If the operating system supports symbolic addressing, MM supports specifying the memory address using a symbolic address.

CI

SCH

RAM

cFS

Memory

Manager

(MM)

Dump

and

Load

Files

Dump

and

Load

Files

Open/Close

Read/Write

Load/Dump

Memory

Mapped

Hardware

OS

API

Load/Dump

Read/Write

Commands

HK Requests

HK Packets

MM Events

Peek Events

Poke Events

Dump Words Events

EEPROM

HK, TO, DS

Figure 2.2 – cFS MM Context

Memory Manager makes use of the OSAL when interfacing to memory. Memory Manager assumes that the OSAL will provide routines to access processor memory as well as memory that is not directly accessible (i.e. requires address translation). Address checking is performed using the OSAL. Any addresses specified outside of the valid address range will be considered invalid.

MM performs data transfers between memory and files, but does not handle file dumps or loads. That function must be done with a file transfer application such as the cFS CCSDS File Delivery Protocol (CFDP) application.

Some of the Memory Manager requirements relate to the use of files. MM is responsible for file management operations or directory manipulations. That function is allocated to the cFS File Manager (FM) application. It should be noted that Memory Manager assumes that the files are binary.

There are 4 types of memory that are referred to in Memory Manager:

* RAM – processor memory. Generic term for RAM including DRAM, and SRAM
* EEPROM – Generic term used for non-volatile memory including EEPROM, Flash, PROM, etc.
* Memory Mapped I/O - Addressable Memory that must be read from and written to in 8, 16 or 32 bits at a time

Note that for the Memory Mapped I/O that is byte addressable and requires no special code to support will be accessed as RAM.

## Test History

MM 1.0.0.0 – Build Verification Testing completed 09/22/2008 by Walt Moleski

MM 2.0.0.0 – Build Verification Testing completed 08/26/2009 by Walt Moleski

MM 2.1.1.0 – Build Verification Testing completed 01/10/2010 by Walt Moleski

MM 2.2.0.0 – Build Verification Testing completed 07/26/2011 by Walt Moleski

MM 2.3.0.0 – Build Verification Testing completed 01/09/2012 by Walt Moleski

MM 2.4.0.0 – Build Verification Testing completed 04/16/2015 by Walt Moleski

MM 2.4.1.0 – Build Verification Testing completed 11/15/2016 by Walt Moleski

## Testing Overview

The cFS test procedures assume that the cFS application and its corresponding test application are not executing before the start of the test. If this is the case, the test procedures will need to be modified to handle this situation.

The MM application was tested during Build Verification testing using the following:

* 1 test application: tst\_mm
* 5 test procedures: mm\_cmds.prc, mm\_eeprom.prc, mm\_memmap.prc, mm\_ram.prc, mm\_symtab.prc

The tst\_mm test application is used to send schedule requests for the output of MM’s housekeeping data to the MM application. This was useful when performing build verification testing since it provided great control over the sequence of steps. In addition, having the test application eliminated the need to modify the SCH\_LAB application and rebuild. When deployed for a mission, the Scheduler Application would provide this request. In addition, the test application also provides the ability to get the Cyclic Redundancy Check (CRC) value for an array of data and create files. TST\_MM has 3 ground commands that are used by the MM test procedures:

* TST\_MM\_GetCRC
  + This command is used to determine the CRC calculated on the supplied array of data. The arguments to this command are DataSize (uint32) and dataArray[256] (uint8). Thus, the CRC is calculated on the data contained in the dataArray for DataSize bytes.
* TST\_MM\_CreateFile
  + This command is used to create a Memory Manager load file. The arguments to this command are DataSize (uint32), Address (uint32), Pattern (uint8), MemType (uint8, SymbolName (char) and FileName (char). This command creates an onboard file to use with the MM\_Load command. The file will contain DataSize bytes of the Pattern specified. The Address where the data will be loaded depends upon whether the SymbolName argument is specified. If the SymbolName is not null, the MM will attempt to resolve the symbol to an address and then add the Address argument as an offset. Otherwise, the Address argument is used as the absolute address to load the data. The MemType argument specifies the type of memory that this file will be loading.
* TST\_MM\_CreateErrorFiles
  + This command is used to generate 3 onboard Memory Manager load files that contain errors. The files are created in RAM with the following names:
    - overmaxload.dat – A file that contains data that is larger than the maximum amount of data allowed for the supplied memory type.
    - toomuchdata.dat – A file that contains more data in the file than indicated by the size in the file header.
    - notenoughdata.dat – A file that contains less data in the file than indicated by the size in the file header.

These 5 MM test procedures do the following:

| **Procedure** | **Description** |
| --- | --- |
| MM\_Cmds | The purpose of this test is to verify that the Memory Manager (MM) general commands function properly. The MM\_NOOP and MM\_Reset commands will be tested as well as invalid commands to see if the MM application handles these appropriately. It should be noted that this procedure uses the RAW command with hard-coded MsgIds to send invalid commands to the MM Application. |
| MM \_EEPROM | The purpose of this test is to verify the Memory Manager (MM) EEPROM commands of the Core Flight System (cFS). This test verifies that the EEPROM commands function properly and that the MM application handles anomalies appropriately. |
| MM\_MemMap | The purpose of this test is to verify the Memory Manager (MM) Memory Mapped I/O commands of the Core Flight System (cFS). This test verifies that the Memory Mapped I/O commands function properly and that the MM application handles anomalies appropriately. Also, these commands are optional in the cFS. If the mission using the MM application does not support Memory Mapped I/O, this test can be eliminated from the test plan. |
| MM\_RAM | The purpose of this test is to verify the Memory Manager (MM) Random Access Memory (RAM) commands of the Core Flight System (cFS). This test verifies that the RAM commands function properly and that the MM application handles anomalies appropriately |
| MM\_SymbolTable | The purpose of this test is to verify the Memory Manager (MM) Symbol Table functionality of the Core Flight System (cFS). Symbol Table support is optional and thus provided in a separate test. If the mission provides Symbol Table support, this test can be used to verify its functionality. |

The cFS Deployment Guide contains the instruction for how to set up both the cFS Flight and Ground test environment. The testers use a cFS Test Account for each build test. This account runs the Advanced Spacecraft Integration and System Test (ASIST) software and is setup to contain all the files needed to test the application. These files are extracted from MKS, the source repository tool. Included in these files are test utilities. These utilities can be located in 2 places depending upon whether they are “local” or “global” utilities. The local utilities are extracted into the working prc directory ($WORK/prc). The global utilities are pointed to by ASIST in the global area defined on the test system. Additional tools utilized by the test procedures are located in the $TOOLS directory. It is assumed that test procedures and the ASIST telemetry database used for testing is built using procedure and database templates

The following utilities were used during testing:

|  |  |
| --- | --- |
| **Name** | **Description** |
| close\_data\_center | Directive that closes the command port from the ASIST machine to the flight cpu. |
| cfe\_startup | Directive combines the "start\_data\_center", "open\_tlm", and "open cmd <cpu>" ASIST startup commands. |
| load\_start\_app | Procedure to load and start a user application from the /s/opr/accounts/cfebx/apps/cpux directory. |
| ut\_pfindicate | Directive to print the pass fail status of a particular requirement number. |
| ut\_runproc | Directive to formally run the procedure and capture the log file. |
| ut\_sendcmd | Directive to send EVS commands Verifies command processed and command error counters. |
| ut\_sendrawcmd | Send raw commands to the spacecraft. Verifies command processed and command error counters. |
| ut\_setrequirements | A directive to set the status of the cFE requirements array. |
| ut\_setupevents | Directive to look for multiple events and increment a value for each event to indicate receipt. |
| ut\_tlmwait | Directive that waits for the specified telemetry condition to be met |
| ftp\_file | To ftp a file to/from the FSW/GSW. |
| get\_mm\_file\_to\_cvt | Directive that issues the MM\_Dump2File command and downloads the file to the ground and inserts it in the MM\_data telemetry item. |
| create\_mm\_file\_from\_cvt | Directive that creates a Memory Manager load file from the MM\_data telemetry item. |
| load\_memory | Directive that transfers the supplied file to the specified cpu and issues the MM\_LoadFile command. |

## Version Information

|  |  |
| --- | --- |
| Item | Version |
| MM Requirements | 1.3 |
| MM Application | 2.4.1.0 |
| TST\_MM Application | 2.4.1.0 |
| CFE | 6.5.0.0 |
| OSAL | 4.2.0.0 |
| ASIST | 20.2 |
| VxWorks | 6.9 |

# Build Verification Test Preparation

## Scenerio Development

No new scenarios developed for build verification test 2.4.1.0. All scenarios are stored on the MKS server, in cFS-Repository MM test-and-ground directory within the test-review-packages subdirectory in the Scenarios folder. It should be noted that as MM requirement evolve these scenarios are not updated to reflect any changes made.

## Procedure Development and Execution

This build test was completed by running 5 test procedures. All test procedures were written using the STOL scripting language. The naming convention for files created by the test procedures was: scx\_cpu<#>\_<procedure name>\_GMT.<ext>.

## Test Products

Four log files were generated for every procedure that was run. They are defined as follows:

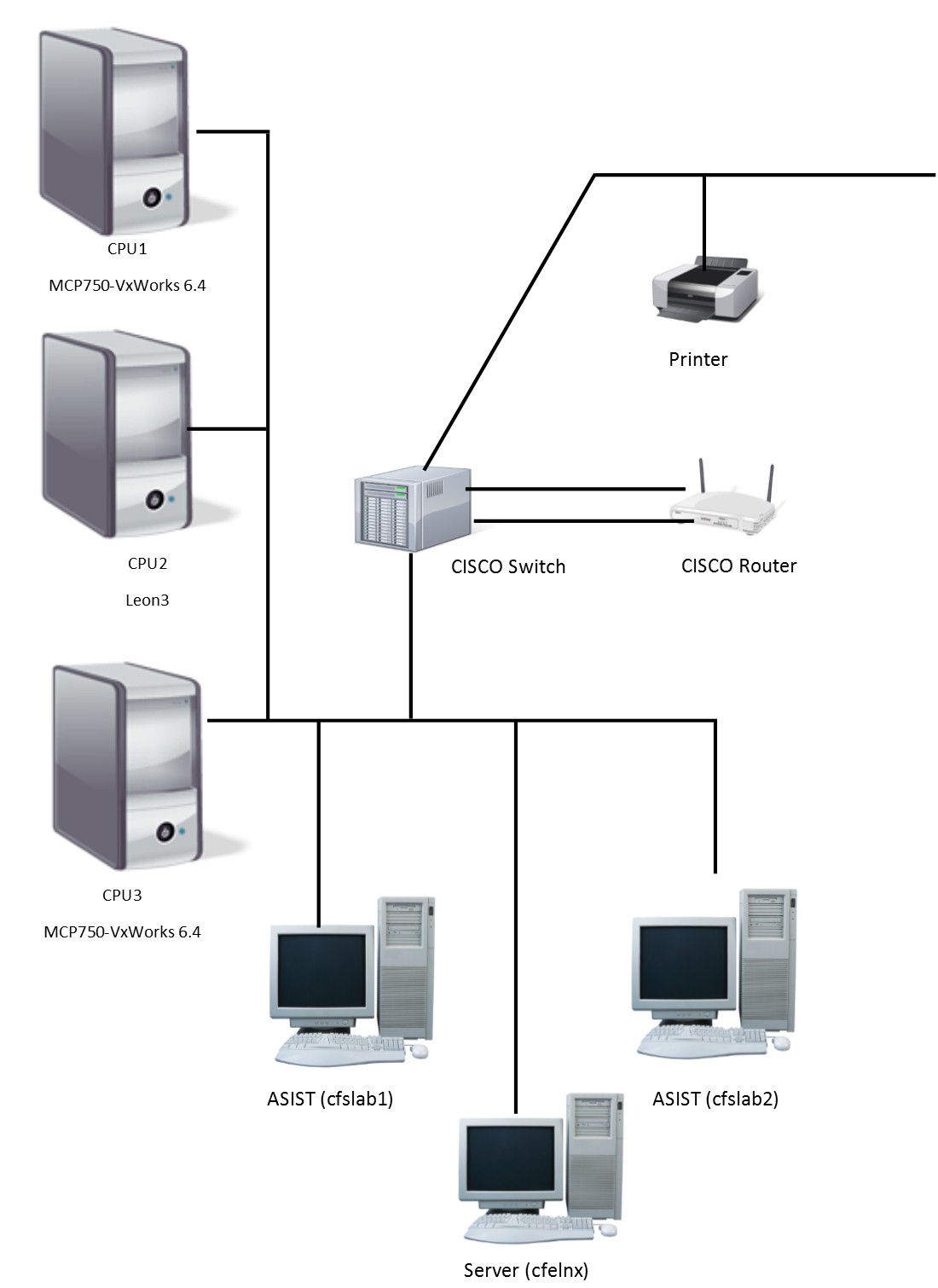
* Logs with the .loge extension list all events sent by the flight software
* Logs with the .logr extension list all requirements that passed validation by demonstration
* Logs with the .logp extension lists all prints that are generated by the test procedure
* Logs with the .logf extension lists everything from the other logs along with the steps in the test procedure
* Logs with the .logs extension lists the SFDU information (if applicable) contained in the full log.

A test summary reported is developed in MKS for each procedure by the tester after build testing is completed. All test products are maintained on MKS in the cFS-Repository MM test-and-ground directory.

# Build Verification Test Execution

## Testbed Overview

MM FSW testing took place in the cFS FSW Development and Test Facility. A high level view of the cFS FSW Test Bed is shown in Figure 4-1. This facility is located in GSFC Building 23, Room N410. This facility consists of two ASIST workstations running ASIST version 9.7k and three MPC750 CPU boards running VxWorks 6.4. CPU1 is primarily used for development testing while CPU2 and CPU3 are used for build verification testing.

**Figure 4-1 cFS FSW Development and Testing Facility**

## Requirements Verification Matrix

|  |  |
| --- | --- |
|  | Memory Manager (MM) |
| Requirements Tested Passed | 56 |
| Requirements Tested Failed | 0 |
| Requirements Tested Partially | 4 |
| Total Tested | 60 |
| Deferred | 0 |
| Total | 60 |

## Requirements Partially Tested

Four requirements were partially tested. These requirements required a performance analysis data viewing tool that no longer is available.

| **Requirement** | **Description** | **Status** | **Justification** |
| --- | --- | --- | --- |
| MM2500 | When writing data to RAM memory, MM shall write a maximum of <PLATFORM\_DEFINED, TBD> bytes per execution cycle | N/A | To verify this requirement, the ES Performance Analysis Monitor was started before performing a load from file command. After the command completed, the Performance Analysis data capture was stopped and the file transferred to the ground. The analysis of this file requires a Performance Analysis data viewing tool that is no longer available. The MM\_SEGBREAK\_PERF\_ID marker should contain data to verify segmentation was occurring. This tool was last available for MM 2.3.0.0. |
| MM2501 | When writing RAM data to a file, MM shall write a maximum of <PLATFORM\_DEFINED, TBD> bytes per execution cycle | N/A | To verify this requirement, the ES Performance Analysis was started before performing a dump to file command. After the command completed, the Performance Analysis data capture was stopped and the file transferred to the ground. The analysis of this file requires a Performance Analysis data viewing tool that is no longer available. The MM\_SEGBREAK\_PERF\_ID marker should contain data to verify segmentation was occurring. This tool was last available for MM 2.3.0.0. |
| MM3300 | When writing data to EEPROM memory, MM shall write a maximum of <PLATFORM\_DEFINED, TBD> bytes per execution cycle | N/A | To verify this requirement, the ES Performance Analysis Monitor was started before performing a load from file command. After the command completed, the Performance Analysis data capture was stopped and the file transferred to the ground. The analysis of this file requires a Performance Analysis data viewing tool that is no longer available. The MM\_SEGBREAK\_PERF\_ID marker should contain data to verify segmentation was occurring. This tool was last available for MM 2.3.0.0. |
| MM3301 | When writing EEPROM data to a file, MM shall write a maximum of <PLATFORM\_DEFINED, TBD> bytes per execution cycle | N/A | To verify this requirement, the ES Performance Analysis was started before performing a dump to file command. After the command completed, the Performance Analysis data capture was stopped and the file transferred to the ground. The analysis of this file requires a Performance Analysis data viewing tool that is no longer available. The MM\_SEGBREAK\_PERF\_ID marker should contain data to verify segmentation was occurring. This tool was last available for MM 2.3.0.0. |

## Requirements/Functionality Deferred

No requirements were deferred.

## Requirements/Functionality Deferred to Mission Testing

The following functionality was deferred to mission testing:

* RAM was the only physical memory type tested. EEPROM, Compact Flash, SSR not tested. EEPROM testing was done by simulating EEPROM in RAM.
* For the Memory Mapped I/O testing there was no forced aligned memory available for testing. Tested was simulated using RAM.

The tests with interrupts disabled wasn’t actually able to tell if interrupts were truly disabled

# Build Verficiaton Test Results

## Overall Assessment

During this build test of the MM Application the software behaved as expected. Below is a summary of the results:

* 47 requirements passed via demonstration
* 8 requirements were validated by analysis.
* 4 requirements could not be fully verified and were partially tested.
* 1 requirement was verified by inspection.
* 5 DCRs were validated

## Procedure Description

| **Procedure** | **Description** | **Requirements tested** |
| --- | --- | --- |
| MM\_Cmds | The purpose of this test is to verify that the Memory Manager (MM) general commands function properly. The MM\_NOOP and MM\_Reset commands will be tested as well as invalid commands to see if the MM application handles these appropriately | MM1000, MM1001, MM1006, MM1009, MM1010, MM1013, MM7001, MM8000, MM9000 |
| MM \_EEPROM | The purpose of this test is to verify the Memory Manager (MM) EEPROM commands of the Core Flight System (cFS). This test verifies that the EEPROM commands function properly and that the MM application handles anomalies appropriately. | MM1006, MM1007, MM1008, MM1009, MM1010, MM3000, MM3000.1, MM3001, MM3002, MM3002.1, MM3100, MM3100.1, MM3100.2, MM3104, MM3104.1, MM3200, MM3200.1, MM3300, MM3301, MM3400, MM3500, MM8000, MM9000 |
| MM\_MemMap | The purpose of this test is to verify the Memory Manager (MM) Memory Mapped I/O commands of the Core Flight System (cFS). This test verifies that the Memory Mapped I/O commands function properly and that the MM application handles anomalies appropriately. Also, these commands are optional in the cFS. If the mission using the MM application does not support Memory Mapped I/O, this test can be eliminated from the test plan. | MM1006, MM1007, MM1008, MM1009, MM1010, MM5000, MM5000.1, MM5002, MM5004, MM5004.1, MM5100, MM5100.1, MM5100.2, MM5104, MM5104.1, MM5300, MM5300.1, MM8000, MM9000 |
| MM\_RAM | The purpose of this test is to verify the Memory Manager (MM) Random Access Memory (RAM) commands of the Core Flight System (cFS). This test verifies that the RAM commands function properly and that the MM application handles anomalies appropriately | MM1006, MM1007, MM1008, MM1009, MM1010, MM2000, MM2000.1, MM2002, MM2003, MM2003.1, MM2003.2, MM2004, MM2004.1, MM2100, MM2100.1, MM2100.2, MM2104, MM2104.1, MM2300, MM2300.1, MM2500, MM2501, MM8000, MM9000 |
| MM\_SymbolTable | The purpose of this test is to verify the Memory Manager (MM) Symbol Table functionality of the Core Flight System (cFS). Symbol Table support is optional and thus provided in a separate test. If the mission provides Symbol Table support, this test can be used to verify its functionality. | MM1009. MM1010, MM1011, MM1012, MM1013, MM2000, MM2000.1, MM2002, MM2003, MM2003.1, MM2004, MM2100, MM2104, MM2300, MM3000, MM3000.1, MM3001, MM3002, MM3100, MM3104, MM3200, MM3400, MM3500, MM7001, MM7002, MM7004, MM8000, MM9000 |

## Analysis/Inspection Requirements Verification

The following requirements were verified using analysis:

| **Requirement** | **Description** | **Status** | **Justification** |
| --- | --- | --- | --- |
| MM1013 | The MM application shall generate an error event message if symbol table operations are attempted but not supported in the current target environment | Pass | This requirement is set to "U" in mm\_cmds and mm\_symtab test procedures since vxworks implements Symbol Table Operations. |
| MM2004 | Upon receipt of a Read command, MM shall read the command-specified number of consecutive bytes from the command-specified RAM memory address and generate an event message containing the data. | Pass | This requirement is verified by looking in the logp files for the mm\_ram and mm\_symtab test procedures. The event text is printed each time the Dump In Event command is issued. The mm\_ram steps are 2.1; 2.4; 2.5; 2.8; 2.9; 2.12; 3.7; 3.8; 5.2; and 5.7. The mm\_symtab steps are 2.2 and 2.5. |
| MM2104 | |  |  | | --- | --- | | |  | | --- | | Upon receipt of a Dump to File command, MM shall write the data associated with the command-specified RAM address , command-specified number of bytes and calculated <MISSION\_DEFINED> CRC  to the command-specified file. | | | Pass | This requirement is verified by examining the dump files generated and downloaded by the mm\_ram test procedure in Steps 3.2; 4.2; 4.14; 4.15; 5.5; and 6.4. The mm\_symtab test procedure tests this requirement in Step 2.8. |
| MM3002 | Upon receipt of a Read command, MM shall read the command-specified number of consecutive bytes from the command-specified EEPROM memory address and generate an event message containing the data. | Pass | This requirement is verified by looking in the logp files for the mm\_eeprom and mm\_symtab test procedures. The event text is printed each time the Dump In Event command is issued. The mm\_eeprom steps are 2.1; 2.4; 2.5; 2.8; 2.9; 2.12; 3.4; 3.5; 5.2; and 5.7. The mm\_symtab steps are 2.10 and 2.13. |
| MM3104 | |  |  |  | | --- | --- | --- | | |  | | --- | | Upon receipt of a Dump to File command, MM shall write the data associated with the command-specified EEPROM address , command-specified number of bytes and calculated <MISSION\_DEFINED> CRC  to the command-specified file. | |  | | | Pass | This requirement is verified by examining the dump files generated and downloaded by the mm\_eeprom test procedure in Steps 3.2; 4.2; 4.14; 4.15; 5.5; and 6.6. The mm\_symtab test procedure tests this requirement in Step 2.15. |
| MM5002 | |  |  | | --- | --- | | |  | | --- | | Upon receipt of a Peek command,  MM shall read <PLATFORM\_DEFINED> bytes of data from the command-specified Memory Mapped I/O address and generate an event message containing the following data: a) address read b) length of data read c) value of the data read | | | Pass | This requirement is verified by looking in the logp files for the mm\_memmap test procedure. The event text is printed each time the Peek command is issued. The Steps are 2.1; 2.4; 2.5; 2.8; 2.9; and 2.12. |
| MM5004 | |  |  | | --- | --- | | |  | | --- | | Upon receipt of a Read command, MM shall read the command-specified number of consecutive bytes from the command-specified Memory Mapped I/O memory address and generate an event message containing the data. | | | Pass | This requirement is verified by looking in the logp files for the mm\_memmap test procedure. The event text is printed each time the Dump In Event command is issued. The Steps are 3.4; 3.5; 5.2; 5.7; 5.10; 5.15; 5.18; and 5.23. |
| MM5104 | |  |  | | --- | --- | | |  | | --- | | Upon receipt of a Dump to File command, MM shall write the data associated with the command-specified Memory mapped I/O address, command-specified number of bytes and calculated <MISSION\_DEFINED> CRC  to the command-specified file. | | | Pass | This requirement is verified by examining the dump files generated and downloaded by the mm\_memmap test procedure in Steps 3.2; 4.2; 4.11; 4.20; 4.32; 4.33.1; 4.33.2; 4.36; 4.37; 4.40; 4.41.1; 4.41.2; 5.5; 5.13 and 5.21. |
| MM7002 | |  |  | | --- | --- | | |  | | --- | | Upon receipt of a Symbol-to-Address command, MM shall report the resolved address in telemetry for the command-specified symbol name. | | | Pass | This requirement is verified by the mm\_symtab test procedure. Steps 2.6 and 2.17 send the LoadWID and LookupSymbol commands respectively. Each command utilized a symbol name and the event generated returned the actual address. |

## Failed Requirements

No requirements failed during MM 2.4.1.0 testing.

## DCRs

No new DCRs were generated during MM 2.4.1.0 testing

### DCRs Verified

The following DCRs were verified during testing.

| **DCR** | **Description** | **Test Method** | **Test Approach** |
| --- | --- | --- | --- |
| 4076 | cFS.MM Move MM file subtype from private header file to public platform config header file | Inspection | Viewed the updated files and confirmed that the file subtype was moved as stated. |
| 141142 | Incorrect Error Message in mm\_dump.c | Inspection | Verified the change stated in the DCR was implemented. |
| 145913 | MM: Switch Statement in mm\_dump.c missing default case | Inspection | Verified that the default case was added to this file. |
| 145917 | MM – CFE\_EVS\_SendEvent Format Warnings | Demonstration | The make process did not generate any warnings. |
| 145938 | MM – Integrate and Implement Babelfish Ticket Fixes | Inspection/Test Procedure | The submitted code was inspected and verified that the buffer overruns were fixed. The make process verified the other fixes. |

### Outstanding DCRs

|  |  |  |
| --- | --- | --- |
| **DCR** | **Description** | **State** |
| 4119 | MM – Add Trick Simulation Support (JSC Request) | Submitted |
| 4122 | Consider allowing files to be loaded to an address other than that specified in the file | Submitted |
| 4094 | Add Cache Flushing Support | Submitted |
| 3975 | Add support for reading/writing to registers and hardware I/O | On Hold |
| 3976 | Add EEPROM write enable flag to housekeeping telemetry | On Hold |
| 3816 | Add command to get EEPROM write enable/disable status | On Hold |

## Notes

It should be noted that integration testing is the ultimate verification of the MM applications performance in a system-like scenario.

1. RTTM

The MM Build 2.4.1.0 RTTM can be found on the MKS server, in cFS-Repository MM test-and-ground/results folder.

1. Command, Telemetry, and Events Verification Matrix

|  |  |  |
| --- | --- | --- |
| **Command** | **Test Procedure(s)** | **Notes/Comments** |
| MM\_NOOP | mm\_cmds |  |
| MM\_RESETCTRS | mm\_cmds |  |
| MM\_PEEK | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_POKE | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_LOADWID | mm\_ram |  |
| MM\_LOADFILE | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_DUMP2FILE | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_DUMPINEVENT | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_FILL | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_LookupSymbol | mm\_symtab |  |
| MM\_SymTbl2File | mm\_cmds; mm\_symtab |  |
| MM\_EnableEEWrite | mm\_eeprom; mm\_symtab |  |
| MM\_DisableEEWrite | mm\_eeprom; mm\_symtab |  |

|  |  |  |
| --- | --- | --- |
| **Telemetry** | **Test Procedure(s)** | **Notes/Comments** |
| MM\_CMDPC | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_CMDEC | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_LASTACTN | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_MEMTYPE | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_ADDRESS | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_FILLPATTERN | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_BYTESPROC | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| MM\_LASTFILE | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |

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| --- | --- | --- |
| **File Telemetry** | **Test Procedure(s)** | **Notes/Comments** |
| MM\_data[2048] | mm\_eeprom; mm\_memmap; mm\_ram; |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Event Message Ids** | **Test Procedure(s)** | **Notes/Comments** |
| **1** | MM\_INIT\_INF\_EID | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| **2** | MM\_NOOP\_INF\_EID | mm\_cmds |  |
| **3** | MM\_RESET\_DBG\_EID | mm\_cmds |  |
| **4** | MM\_LOAD\_WID\_INF\_EID | mm\_ram; mm\_symtab |  |
| **5** | MM\_LD\_MEM\_FILE\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| **6** | MM\_FILL\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| **7** | MM\_PEEK\_BYTE\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| **8** | MM\_PEEK\_WORD\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **9** | MM\_PEEK\_DWORD\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **10** | MM\_POKE\_BYTE\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| **11** | MM\_POKE\_WORD\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **12** | MM\_POKE\_DWORD\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **13** | MM\_DMP\_MEM\_FILE\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| **14** | MM\_DUMP\_INEVENT\_INF\_EID | mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| **15** | MM\_PIPE\_ERR\_EID |  |  |
| **16** | MM\_MID\_ERR\_EID |  |  |
| **17** | MM\_CC1\_ERR\_EID | mm\_cmds |  |
| **18** | MM\_LEN\_ERR\_EID | mm\_cmds; mm\_eeprom; mm\_memmap; mm\_ram; mm\_symtab |  |
| **19** | MM\_MEMTYPE\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **20** | MM\_SYMNAME\_ERR\_EID | mm\_symtab |  |
| **21** | MM\_DATA\_SIZE\_BYTES\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **22** | MM\_DATA\_SIZE\_BITS\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **23** | MM\_ALIGN32\_ERR\_EID | mm\_memmap; |  |
| **24** | MM\_ALIGN16\_ERR\_EID | mm\_memmap; |  |
| **25** | MM\_OS\_MEMVALIDATE\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **26** | MM\_LOAD\_FILE\_CRC\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **27** | MM\_LOAD\_WID\_CRC\_ERR\_EID | mm\_ram |  |
| **28** | MM\_OS\_EEPROMWRITE8\_ERR\_EID |  |  |
| **29** | MM\_OS\_EEPROMWRITE16\_ERR\_EID |  |  |
| **30** | MM\_OS\_EEPROMWRITE32\_ERR\_EID |  |  |
| **31** | MM\_OS\_CREAT\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **32** | MM\_OS\_OPEN\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **33** | MM\_OS\_CLOSE\_ERR\_EID |  |  |
| **34** | MM\_OS\_READ\_ERR\_EID |  |  |
| **35** | MM\_OS\_READ\_EXP\_ERR\_EID |  |  |
| **36** | MM\_OS\_WRITE\_EXP\_ERR\_EID |  |  |
| **37** | MM\_OS\_STAT\_ERR\_EID |  |  |
| **38** | MM\_CFS\_COMPUTECRCFROMFILE\_ERR\_EID |  |  |
| **39** | MM\_CMD\_FNAME\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **40** | MM\_LD\_FILE\_SIZE\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **41** | MM\_FILE\_LOAD\_PARAMS\_ERR\_EID | mm\_eeprom; mm\_memmap; mm\_ram |  |
| **42** | MM\_CFE\_FS\_READHDR\_ERR\_EID |  |  |
| **43** | MM\_CFE\_FS\_WRITEHDR\_ERR\_EID |  |  |
| **44** | MM\_HKREQ\_LEN\_ERR\_EID |  |  |
| **45** | MM\_SYM\_LOOKUP\_INF\_EID | mm\_symtab |  |
| **46** | MM\_SYMNAME\_NUL\_ERR\_EID | mm\_symtab |  |
| **47** | MM\_SYMTBL\_TO\_FILE\_INF\_EID | mm\_cmds; mm\_symtab |  |
| **48** | MM\_SYMFILENAME\_NUL\_ERR\_EID | mm\_symtab |  |
| **49** | MM\_SYMTBL\_TO\_FILE\_FAIL\_ERR\_EID | mm\_cmds; mm\_symtab |  |
| **50** | MM\_SYMTBL\_TO\_FILE\_INVALID\_ERR\_EID | mm\_symtab |  |
| **51** | MM\_EEPROM\_WRITE\_ENA\_INF\_EID | mm\_eeprom; mm\_symtab |  |
| **52** | MM\_EEPROM\_WRITE\_ENA\_ERR\_EID |  | Cannot generate since the PSP implementation just returns SUCCESS. |
| **53** | MM\_EEPROM\_WRITE\_DIS\_INF\_EID | mm\_eeprom; mm\_symtab |  |
| **54** | MM\_EEPROM\_WRITE\_DIS\_ERR\_EID |  | Cannot generate since the PSP implementation just returns SUCCESS. |
| **55** | MM\_OS\_ZERO\_READ\_ERR\_EID |  |  |