

FLIGHT SOFTWARE BRANCH

FSW VERSION DESCRIPTION DOCUMENT

CORE FLIGHT EXECUTIVE (CFE)

BUILD: 6.4.1

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SIGNATURES

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1.0 FSW VERSION DESCRIPTION

1.1 PURPOSE AND SUMMARY

The purpose of this build is to fix an inadvertent change that was made in cFE build 6.4.0. cFE build 6.4.0 had changed the definition of the CCSDS command secondary header. This build reverts that change to the original cFE definition. This build was also used as an opportunity to include two new additional features:

1. A new macro to support the cFE 6.4.0 bug fix that enforced the CCSDS primary header to be in big endian format.
2. Johnson Space Center's (JSC) java based CFS Performance Monitor (CPM) tool was added to the cFE tool set.

There were no API changes or additions to this build. Therefore the transition from cFE 6.4.0 to 6.4.1 should require minor effort. cFE Build 6.4.1 implements the 3 DCRs listed in Attachment 1.

Unit testing has been completed and baselined on cFE build 6.4.0 using the cFE test suite updates delivered by Johnson Space Center (JSC). This test suite was used by JSC's Advanced Exploration Systems (AES) Human Exploration & Operations Mission Directorate for Class A certification of CFS on the Orion platform. Regression testing was performed on both cFE 6.4.0 and this fix/revision build. Results are included in the release package under:

/test-and-ground/test-review-packages/Results

There are some outstanding issues being investigated. Resolutions to these issues may require a new release. The project CCB and community inputs will determine which FSW DCRs to include in the next release.

1.2 NEW/CHANGED FUNCTIONALITY IN THIS VERSION

Table 1.2-1 identifies new FSW functionality that has been implemented and is integrated into this FSW version. Requirement references are included where applicable.

Table 1.2-1 – New Functionality in this Version

No.	FSB DCR # (or N/A)	Requirements	High Level Description of Functionality
1	22795	N/A	Added JSC CPM tool to the cFE tools directory
2	22842	N/A	Added big endian conversion macro to ccstds.h

Table 1.2-2 identifies changes to FSW functionality from previously delivered FSW versions and the DCRs associated with these changes.

Table 1.2-2 – Changes to Previously Delivered Functionality

No.	FSB DCR # (or N/A)	Requirements	High Level Description of Functionality
1	22841	N/A	Revert the CCSDS command secondary header definition to the original cFE definition.

1.3 MISSING PLANNED FEATURES AND KNOWN PROBLEMS

Table 1.3-1 identifies the functions and known discrepancies that are absent from cFE Build 6.4.1. Any workarounds that may apply are identified.

Information on currently open DCRs is available at <http://tlserver3.gsfc.nasa.gov:7001/index.html>. Note that this is a restricted website that requires a server account. Additional DCRs may have been submitted after preparation of this VDD. A cFE DCR report containing a listing of open DCRs is available on request for customers who do not have access to tlserver3. Please contact Susanne Strege, susie.strege@nasa.gov.

Table 1.3-1 – Functions absent from this Release

No.	FSB DCR #	Description	Reason for Absence	Affected Require ment or Compon ent	Workaround	Planned Delivery
1	7641	cFE Executive Services User's Guide has holes	Lower priority than other 6.4 issues	N/A	None	Not Determined
3	9821	cFE Table Validation Request Queue becomes full	Lower priority than other 6.4 issues	ES	None	Not Determined
4	12031	Standardize use of event types (ARC suggestion)	On Hold until event standard and cFE Event code walkthrough has been completed with community members	ES	None	Not Determined
5	12298	Update ES performance functions to communicate w/logic analyzer (MMS request)	It is unknown if a generic solution exists for the cFE. More research is needed.	ES	None	Not Determined

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
6	14483	ES: Invalid memory handle when restarting an application (ARC)	Looks like a Table Manager problem, in the table cleanup for an application. Insufficient time to complete analysis for 6.4	SB	None	Not Determined
7	18573	Consider adding APL message processing API for apps	More analysis is needed. This may be accomplished without making modifications to the cFE and adding additional functions to the CFS library. Lower priority than other 6.4 issues	SB	None	Not Determined
8	18593	CFE_ES_ProcessCoreException and CFE_ES_ResetCFE are not ISR safe	May require a re-write of these functions to make them ISR safe. Insufficient time to complete analysis for 6.4	SB	None	Not Determined
9	19117	cFE Time subsystem has calls to OS functions that do not exist (OS_GetLocalMET and OS_SetLocalMET)	Requires PSP changes in addition to the TIME subsystem function call changes. Insufficient time to complete updates for 6.4	TIME	None	Not Determined
10	19589	TBL: Table Services does not restore LastFileLoaded for critical tables from CDS (MMS Request)	Implementation is dependent on customer needs. Community input is needed.	TBL	None	Not Determined

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
11	21087	cFE Application Developers Guide is Outdated	Lower priority than other 6.4 issues	N/A	None	Not Determined
12	21293	cFE: Executive Services always creates tasks with floating point enabled	Implementation is dependent on customer needs. Community input is needed.	ES	None	Not Determined
13	21552	cFE Multicore Support: Modify cFE ES to support multicore cpus/operating systems	Lower priority than other 6.4 issues	ES	None	Not Determined
14	21554	cFE ES: Add a mechanism to serialize the initialization of the cFE Core apps	OSAL 4.1 updates may have fixed this issue. Further analysis is needed.	ES	None	Not Determined
15	21557	cFE Core: Make ccstds.h endian neutral	Long term issue. Violates CCSDS standard. Resolution requires executive/community decision.	cFE	None	Not Determined
16	21558	cFE Core SB: Prevent message looping in applications such as SBN	This has been fixed in the SBN prototype code.	SB	None	Not Determined
17	21594	ES - Add Ability to Recreate the RAM Disk via Command	Nice to have feature. RAM disk can be recreated via shell commanding. Not many applications require use of the RAM disk (only CF).	ES	None	Not Determined

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
13	21771	ES - RegisteredTasks Counter Does Not Decrement When Child Tasks are Exited	Needs test time, code seems to be correct - But also NumChildTasks for each app is not decremented. Insufficient time to complete analysis for 6.4	ES	None	Not Determined
19	21934	Table Services CRC Tool Displays Output in Hexadecimal Only	Easy to implement however there is not a high need for fix.	N/A	None	Not Determined
20	22063	Add support to allow SBN to pass sender information across the network	Analysis is needed to determine the best solution. Insufficient time to complete analysis for 6.4	SB	None	Not Determined
21	22080	EVS - Add Configuration To Output Events Upon Command Message vs. Function Call (MMS Request)	May change the design of EVS. Analysis is needed to determine the best solution for the cFE. Insufficient time to complete analysis for 6.4	EVS	None	Not Determined

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
22	22081	SB - Add Last Pipe ID and Message ID to Routine Telemetry for Diagnosing Message Limit Error and Buffer Overrun Errors	Needs more discussion. What problem are we trying to solve? Event filtering may solve this issue. Implementation is dependent on customer needs. Community input is needed.	SB	None	Not Determined
23	22150	TIME Services Complexity Requires Extra User Guide Documentation	Lower priority than other 6.4 issues	N/A	None	Not Determined
24	22242	TABLE load may not work if file read is fragmented (affects PikeOS)	Analysis is needed to determine if the solution requires a cFE change or OSAL. Insufficient time to complete analysis for 6.4	TBL	None	Not Determined
25	22313	CFE ES: Check exception handling code for potential exception conditions and ISR safety	Insufficient time to complete analysis for 6.4	ES	None	Not Determined
26	22622	TBL - Update Table Services to Send Messages to Notify Applications of Pending Table Updates	Update will require an additional message ID for each application using a table. Implementation is costly. Implementation is dependent on customer needs. Community input is needed.	TBL	None	Not Determined

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
27	22629	Consider adding option for 8 bit subseconds field in the telemetry secondary header	Implementation is dependent on customer needs. Community input is needed.	cFE	None	Not Determined
28	22684	Update CFE_ES_SYSTEM_LOG_SIZE verify to allow larger sys log files	Lower priority than other 6.4 issues	ES	None	Not Determined
29	22685	Why is CFE_SB_MAX_MSG_IDS limited to 1024 in the verify header file?	Lower priority than other 6.4 issues	SB	None	Not Determined
30	22686	Why does the CFE_SB_DEFAULT_MSG_LIMIT have a lower limit of 4 in the verify.h?	Lower priority than other 6.4 issues	SB	None	Not Determined
31	22703	TBL - Modified Table Notification issue	Insufficient time to complete for 6.4	TBL	None	Not Determined
32	22741	Consider adding EVS command to send event with text specified in command parameter	Implementation is dependent on customer needs. Community input is needed.	EVS	None	Not Determined

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
33	22742	SB - Sequence Count Reset Issue (APL found)	Analysis is needed to determine if this is an issue that should be fixed in the Software Bus or worked around as was done by the RBSP FSW team. Insufficient time to complete analysis for 6.4	SB	Create a library routine that will manage the sequence counters so that when the message is sent on the software bus, the packet is complete. Replace the calls to CFE_SB_MsgSend with CFE_SB_ZeroCopySend, which is the API that does not increment and update the sequence counter.	
34	22767	Update String Functions to Use "strn" Version (ARC wish list)	Lower priority than other 6.4 issues	cFE	None	
35	22768	cFE ES: Do not create syslog entries for each ER log entry	Lower priority than other 6.4 issues	ES	None	
36	22780	cFE ES : Fix ES AppCreate Command parameter validation	Lower priority than other 6.4 issues	ES	None	
37	22789	Edit SB Unit test to cover zero copy functions	Lower priority than other 6.4 issues	N/A	None	

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
38	22791	The SB unit test driver needs to be changed to increase the coverage of the SB source code	Lower priority than other 6.4 issues	N/A	None	Not Determined
39	22792	The EVS unit test driver needs to be changed to increase the coverage of the EVS source code	Lower priority than other 6.4 issues	N/A	None	Not Determined
40	22793	The TBL unit test driver needs to be changed to increase the coverage of the TBL source code	Lower priority than other 6.4 issues	N/A	None	Not Determined
41	22807	ES unit test crashes on Ubuntu 14.04	Lower priority than other 6.4 issues	N/A	None	Not Determined
42	22812	Remove "cpu" directories from fsw/platform_inc	Lower priority than other 6.4 issues	N/A	None	Not Determined
43	22813	cFE does not allow FSW to meet double floating point alignment requirements on PPC440x5 Book E architecture	Insufficient time to complete analysis for 6.4	N/A	None	Not Determined
44	22814	Allow for arbitrary build/cpu directory names in makefile	Lower priority than other 6.4 issues	N/A	None	Not Determined
45	22819	ES application startup race condition when startup task is at a low priority	Insufficient time to complete analysis for 6.4	N/A	None	Not Determined
46	22830	SB – Update to verify HK command packet length	Lower priority than other 6.4 issues	N/A	None	Not Determined
47	22831	EVS – Update to verify HK command packet length	Lower priority than other 6.4 issues	N/A	None	Not Determined
48	22832	ES – Update to verify HK command packet length	Lower priority than other 6.4 issues	N/A	None	Not Determined

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
49	22833	TIME – Update to verify HK command packet length	Lower priority than other 6.4 issues	N/A	None	Not Determined

1.4 DEVELOPMENT TOOL VERSIONS ASSOCIATED WITH THIS FSW VERSION

Table 1.4-1 identifies the versions of development tools used to generate this FSW version:

- Note that since the cFE uses the Operating System Abstraction Layer (OSAL), multiple operating systems are supported. Build Testing of cFE Build 6.4.1 has been done on a PPC/mcp750 using the RTOS and compiler specified in Table 1.4-1 below. In addition to the build tests executed on a Big Endian platform, cFE 6.4.1.0 was tested on an X86/PC running Linux (Little Endian platform). The little endian test started the CFS Scheduler (SCH) and Stored Command (SC) applications and verified by inspection that the “patched” default tables for these applications loaded and executed properly. The “patched” tables had been updated to include use of the conversion macro that was added via DCR 22842. The “patched” table files will be supplied outside of the cFE 6.4.1.0 release. In addition, cFE Build 6.4.1 has been integrated with the following hardware/software platforms:

Tested Platforms

- PPC/mcp750 running VxWorks 6.4
- X86/PC running Linux

Supported Platforms

- PPC/RAD750 running VxWorks 6.4
- Coldfire/MMS flight board running RTEMS 4.10
- Coldfire/MCF5235 running RTEMS 4.10
- SPARC/LEON3 running RTEMS 4.10

Table 1.4-1 – Development Tool Versions Associated with this FSW Version

Tool Type.	Tool Name	Version Used
RTOS	VxWorks	6.4
Compiler	GNU (ccppc)	3.3.2
CFS PSP	CFS Platform Support Package	1.2.0.0
OSAL	Operating System Abstraction Layer	4.1.1
Ground System	ASIST	20.2

2.0 DELIVERED PRODUCTS

Table 2-1 identifies the locations of FSW products relevant to this FSW Build. The version or date of the Build and where the product can be located are provided. Changes from a previous VDD are identified.

Table 2-1 – Delivered Products and their Locations

Software Element	Changed with this Version?	New Version or Date	Location
Executable for this build	Yes	6.4.1	N/A. Executables are not delivered for the cFE
Installation Procedures & Special Instructions	No	N/A	See Deployment Guide .Tlserver3.gsfc.nasa.gov (in MKS CM system)
Source Code of this FSW Build	Yes	6.4.1	Tlserver3.gsfc.nasa.gov (in MKS CM system)
FSW Build Plan	No	N/A	None
Annotated S/W Detailed Design Docs	No	N/A	cFE Application Developer's Guide
Ground System T&C Database	Yes	6.4.1	Tlserver3.gsfc.nasa.gov (in MKS CM system under test-and-ground/asist)
Ground System Scripts developed by FSB	No	N/A	Tlserver3.gsfc.nasa.gov (in MKS CM system under test-and-ground/asist)
Simulator and Test Data Generator Software	N/A	N/A	None
Executable - Ground Tools associated with FSW (tools to build stored command loads, etc.)	No	N/A	Tlserver3.gsfc.nasa.gov (in MKS CM system)
Source Code - Ground Tools associated with FSW (tools to build stored command loads, etc.)	Yes	N/A	\$WORK Perl scripts to generate ground database and build verification procedures from templates
Unit Test Procedures	No	N/A	Tlserver3.gsfc.nasa.gov (in MKS CM system)
Unit Test Data	No	N/A	Tlserver3.gsfc.nasa.gov (in MKS CM system)
Unit Test Results	No	N/A	Tlserver3.gsfc.nasa.gov (in MKS CM system)
FSW Make Files	No	N/A	Tlserver3.gsfc.nasa.gov (in MKS CM system)
Linker & Compiler Configuration Files	No	N/A	Tlserver3.gsfc.nasa.gov (in MKS CM system)

3.0 INSTALLATION PROCEDURES

Table 3-1 identifies the nominal FSW Installation Procedure(s) for this FSW Build onto the intended target system (including the commercial applications used and the configuration settings). The procedure version identifier, the date of the procedure and where it can be located are also provided.

Table 3-1 FSW Installation Procedure(s)

Destination (Target System)	Filename	Version and Date	Location
Procedure is generic for each CPU	CFS Deployment Guide	3.0	tlserver.gsfc.nasa.gov cfe-project docs/cFE Deployment Guide

4.0 CONFIGURATION SUMMARY AND VERSION IDENTIFICATION

cFE Build 6.4.1 can be found on tserver3.gsfc.nasa.gov and is provided as open source on sourceforge.net:

<http://sourceforge.net/projects/coreflightexec/>

Telemetry is available to indicate cFE Build 6.4.1 and is documented in the following source file:
`/fsw/cfe/core/src/inc/cfe_version.h`.

ACRONYMS

API.....	Application Program Interface
cFE.....	Core Flight Executive
C&DH.....	Command and Data Handling
CFS.....	Core Flight Software System
CM.....	Configuration Management
CPM.....	CFS Performance Monitor
COTS.....	Commercial Off-The-Shelf
DCR.....	Discrepancy/Change Request
ES.....	Executive Services
ETU.....	Engineering Test Unit
FSB.....	Flight Software Branch
FSW.....	Flight Software
I&T.....	Integration & Test
MMS.....	Magnetospheric Multiscale Mission
OSAL.....	Operating System Abstraction Layer
RTOS.....	Real-Time Operating System
TBL.....	Table
T&C.....	Telemetry and Command
URL.....	Universal Resource Locator
UTF.....	Unit Test Framework
VDD.....	Version Description Document

ATTACHMENT 1 – 6.4.1 DCRS**cFE DCRs Build 6.4.1**

Dec 9, 2014

ID	DCR_Type	DCR_Title	State	DCR_Build Found	DCR_Build Target
22795	Change Request	Add JSC Performance Monitor Tool	Ready For Closure	CFE-6.4.0.0	CFE-6.4.1.0
22841	Defect	SB - CCSDS Command Secondary Header Redefined	Test Completed	CFE-6.4.0.0	CFE-6.4.1.0
22842	Change Request	SB - Add Big Endian Conversion Macro to ccstds.h	Test Completed	CFE-6.4.0.0	CFE-6.4.1.0
22844	Change Request	Tag cFE 6.4.1 for Test	Ready For Closure		CFE-6.4.1.0