

**FLIGHT SOFTWARE BRANCH**

**FSW VERSION DESCRIPTION DOCUMENT**

**CORE FLIGHT EXECUTIVE (CFE)**

**BUILD: 6.4.2**

**JUNE 29, 2015**



## **SIGNATURES**

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## 1.0 FSW VERSION DESCRIPTION

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### 1.1 PURPOSE AND SUMMARY

The purpose of this build is to fix a series of startup race conditions that were found in cFE build 6.4.1. This build also includes two fixes in the unit test suite.

There were no API changes or additions to this build. Therefore the transition from cFE 6.4.1 to 6.4.2 should require minor effort. cFE Build 6.4.2 implements the 5 Trac Tickets listed in Attachment 1.

Unit testing has been completed and baselined on cFE build 6.4.2 using the cFE test suite. Results are included in the release package in the “Results” directories included under:

/fsw/cfe-core/unit-test/

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/Trac Tickets 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 /Trac # (or N/A )	Requirements	High Level Description of Functionality
N/A	None	N/A	N/A

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

**Table 1.2-2 – Changes to Previously Delivered Functionality**

<b>No.</b>	<b>FSB DCR # (or N/A )</b>	<b>Requirements</b>	<b>High Level Description of Functionality</b>
1	Trac #40	N/A	<p>The CFE_ES_WaitForStartupSync() API has been modified to use a simpler polling loop (with delay) rather than a semaphore. This may cause some extra scheduling delays as the waiting tasks will be performing a delay rather than pending on a semaphore, but it will be reliable. Any such delays will be confined to start up, and typically less than 50ms (the delay time).</p> <p>The core applications were updated to make a call to the CFE_ES_WaitForStartupSync API during initialization. This forces each core application to reach its respective main loop before the next core application will be started regardless of the platform's priority settings.</p>
2	Trac #41	N/A	<p>When starting an application, cFE ES had called the CFE_ES_UnlockSharedData function before making a call to OS_TaskCreate, then called CFE_ES_LockSharedData again to perform several more updates to the global table after the task ID is obtained.</p> <p>This unlock-relock opens up an opportunity for the child thread to read the shared table data before it is fully populated. This can cause many problems. One specific issue is the call to CFE_ES_GetAppID (which many tasks call very early in their init procedures) will fail, which can have a serious snowball effect.</p> <p>The unlock-relock code has been removed and updated to be the same as other areas where tasks are spawned.</p>
3	Trac #42	N/A	<p>The EVS_SendEvent function was modified to confirm the global "EVS_AppID" value is within range before calling EVS_IsFiltered. Otherwise do nothing.</p> <p>The CFE_EVS_TaskInit function was modified to set the EVS_AppID value last. This will assure that all other initialization is done before the AppID is valid.</p>

### 1.3 MISSING PLANNED FEATURES AND KNOWN PROBLEMS

Table 1.3-1 identifies the functions and known discrepancies that are absent from cFE Build 6.4.2. Any workarounds that may apply are identified.

Information on currently open DCRs is available at <http://tlserver3.gsfc.nasa.gov:7001/index.html> and [https://babelfish.arc.nasa.gov/trac/cfs\\_cfe/report/1](https://babelfish.arc.nasa.gov/trac/cfs_cfe/report/1). Note that these are restricted websites that requires a server account. Additional DCRs/Trac Tickets may have been submitted after preparation of this VDD. A cFE DCR and/or Trac Ticket report containing a listing of open DCRs/Trac Tickets is available on request for customers who do not

have access to the above servers. Please contact Susanne Strege, [susie.strege@nasa.gov](mailto:susie.strege@nasa.gov). Table 1.3-1 below only contains a listing of the open DCRs on the MKS tserver3 server. Open trac tickets are not listed.

**Table 1.3-1 – Functions absent from this Release**

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	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
2	8310	ES: add the ability to ignore comment lines (per ARC wish list).	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	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
5	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
6	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

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
7	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
8	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
9	21087	cFE Application Developers Guide is Outdated	Lower priority than other 6.4 issues	N/A	None	Not Determined
10	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
11	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
12	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



No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
13	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
14	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
15	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
16	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

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
17	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
18	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
19	22150	TIME Services Complexity Requires Extra User Guide Documentation	Lower priority than other 6.4 issues	N/A	None	Not Determined
20	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
21	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

No.	FSB DCR #	Description	Reason for Absence	Affected Requirement or Component	Workaround	Planned Delivery
22	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
23	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
24	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
25	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
26	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
27	22703	TBL - Modified Table Notification Issue	Insufficient time to complete for 6.4	TBL	None	Not Determined
28	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
29	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.	
30	22767	Update String Functions to Use "strn" Version (ARC wish list)	Lower priority than other 6.4 issues	cFE	None	
31	22768	cFE ES: Do not create syslog entries for each ER log entry	Lower priority than other 6.4 issues	ES	None	
32	22780	cFE ES : Fix ES AppCreate Command parameter validation	Lower priority than other 6.4 issues	ES	None	
33	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
34	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
35	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
36	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
37	22807	ES unit test crashes on Ubuntu 14.04	Lower priority than other 6.4 issues	N/A	None	Not Determined
38	22812	Remove “cpu” directories from fsw/platform_inc	Lower priority than other 6.4 issues	N/A	None	Not Determined
39	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
40	22830	SB – Update to verify HK command packet length	Lower priority than other 6.4 issues	N/A	None	Not Determined
41	22831	EVS – Update to verify HK command packet length	Lower priority than other 6.4 issues	N/A	None	Not Determined
42	22832	ES – Update to verify HK command packet length	Lower priority than other 6.4 issues	N/A	None	Not Determined
43	22833	TIME – Update to verify HK command packet length	Lower priority than other 6.4 issues	N/A	None	Not Determined
44	22838	MMS-IVV-013 (OBS-1238) - Static Code Analysis: Possible Buffer Underrun in cfe_fs_decompress.c	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
45	22843	SB - Allow the Endianness of the Command Secondary Header to be Configurable	Lower priority than other 6.4 issues	N/A	None	Not Determined
46	22846	Elf2CfeTbl tool can be different for different processors and the tool can require recompilation when osconfig.h changes	Lower priority than other 6.4 issues	N/A	None	Not Determined
47	22932	CCSDS header file macro CCSDS_INC_SEQ generates a compiler warning when referenced	Lower priority than other 6.4 issues	N/A	None	Not Determined
48	22934	SB - Duplicate Pipe Creation Causes Failure to Delete Pipe	Lower priority than other 6.4 issues	N/A	None	Not Determined
49	22950	SB - The CFE_SB_MAX_DEST_PER_PKT Configuration Parameter Purpose is Not Clearly Documented	Lower priority than other 6.4 issues	N/A	None	Not Determined
50	23031	TBL - Dump table registry data command hogs CPU if too many tables	Lower priority than other 6.4 issues	N/A	None	Not Determined
51	23032	Put ES Perf Child Task Priority in global cfe_platform (or mission) config.	Lower priority than other 6.4 issues	N/A	None	Not Determined
52	23035	ES - Exit Application Error	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 6.4.2 has been done on a PPC/mcp750 using the RTOS and compiler specified in Table 1.4-1 below. In addition, cFE Build 6.4.2 has been integrated with the following hardware/software platforms:

**Tested Platforms**

- PPC/mcp750 running VxWorks 6.4

**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
- X86/PC running Linux

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

<b>Tool Type.</b>	<b>Tool Name</b>	<b>Version Used</b>
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	6.4.2	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	6.4.2	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	6.4.2	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

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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)**

<b>Destination (Target System)</b>	<b>Filename</b>	<b>Version and Date</b>	<b>Location</b>
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**

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cFE Build 6.4.2 can be found on t1server3.gsfc.nasa.gov and is provided as open source on sourceforge.net:

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

Telemetry is available to indicate cFE Build 6.4.2 and is documented in the following source file:  
/fsw/cfe/core/src/inc/cfe\_version.h.

## ACRONYMS

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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 – 6.4.2 DCRS/TRAC TICKETS**

<b><u>Ticket</u></b>	<b><u>Summary</u></b>	<b><u>Type</u></b>	<b><u>Milestone</u></b>	<b><u>Component</u></b>
<b><u>#40</u></b>	<b><u>CFE ES "StartupSyncSemaphore" subject to multiple race conditions</u></b>	defect	<b><u>6.4.2</u></b>	es
<b><u>#41</u></b>	<b><u>Race condition within CFE ES AppCreate</u></b>	defect	<b><u>6.4.2</u></b>	es
<b><u>#42</u></b>	<b><u>Race conditions / dependencies between CFE core apps</u></b>	defect	<b><u>6.4.2</u></b>	other
<b><u>#51</u></b>	<b><u>Buffer overrun in stub implementation of CFE TIME Print</u></b>	defect	<b><u>6.4.2</u></b>	time
<b><u>#59</u></b>	<b><u>Unit            Test            Stub            Function UT_GetActualCmdCodeField Not Restored with CCSDS Secondary Header (GSFC DCR 23036)</u></b>	defect	<b><u>6.4.2</u></b>	other