CORE FLIGHT SOFTWARE

VERSION DESCRIPTION DOCUMENT

CORE FLIGHT EXECUTIVE (CFE)

BUILD: 6.5.0

JUNE 7, 2016

SIGNATURES

Submitted by:

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1.0 FSW VERSION DESCRIPTION

1.1 PURPOSE AND SUMMARY

The purpose of this build is to continue to refine the cFE FSW product. This build provides various bug fixes, as well as, new features and enhancements including:

- Class A safety-critical MISRA 2004 and cppcheck static analysis updates
- Class A safety-critical black box unit test updates
- New File Services standard file header initialization API function
- Enhanced cmake build system (in addition to classic build)
- Configurable priority for Executive Services child task
- 64-bit architecture support
- Assert Based unit test library

There were some minor API changes to this build that may result in compiler warnings with applications/tasks built via previous cFE releases. These API changes were made to correct and improve the function input parameter types. The changes include:

1. CFE_ES_CreateChildTask: stack pointer is `const`
2. CFE_ES_ProcessCoreException: context data pointer is `const` and string argument is now ‘const char * instead of ‘uint8 *’
3. CFE_ES_CalculateCRC: source data pointer is `const`
4. All name arguments are now `const char*` instead of `char*` for all API calls

In addition, this build was updated to comply with the minor API changes that were made in OSAL version 4.2.0 and PSP version 1.3.0. Backward compatibility is not supported with older versions of the OSAL and PSP libraries.

Unit testing has been completed and baselined on cFE build 6.5.0 using the updated 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 cFE 6.5.0 on a PPC/mcp750 running VxWorks 6.9. Results are included in the release package under:

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

Functional testing was performed on a variety of platforms. See section 1.5, Tested Platforms, for a listing of the platforms on which functional testing was performed.

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 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 and the Trac tickets associated with these changes.

Table 1.2-1 – New Functionality in this Version

No.	Trac Ticket #	High Level Description of Functionality	Component	Type	Priority
1	#1	Enhanced build system for cFS. The alternate build system uses CMake and offers several enhancements: • Completely isolated build tree - No mixing of source files and generated files • Dynamic application search path, supports "app-store" concept by keeping app repos separate from cFS repos • Supports multiple different build configurations from the same source tree • Includes mechanisms for electronic data sheets (data dictionary) support and Lua functional testing support in the future	build	enhancement	major
2	#6	Added InitHeader API function in cFE FS to initialize standard cFE file header.	fs	enhancement	minor
3	#48	CMake support for elf2cfetbl usage	build	enhancement	major
4	#84	CMake build support for statically linked CFS applications. Some platforms (RTEMS, for example) do not natively support the concept of dynamic module loading. Even on platforms that perform dynamic loading, it is sometimes beneficial to statically link since there is some extra runtime overhead when using a dynamically linked library vs. a statically linked library. Also adds the necessary hooks to include statically linked modules into the PSP as well as CFS applications and libraries.	other	enhancement	minor
5	#109	ES Performance Child Task Priority is now configurable via platform configuration macro.	other	defect	major
6	#163	Add cFE ITOS Record Files	other	enhancement	minor

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

Table 1.2-2 – Changes to Previously Delivered Functionality and Bug Fixes

No.	Trac Ticket #	High Level Description of Functionality/Bug Report	Component	Type	Priority
1	#2	Compiler errors/warnings on EVS_SendEvent() calls on some architectures	evs	defect	major

2	#4	Split message definitions from headers. All of the cFS messages are currently defined in C structures. As a first step toward moving to "electronic data sheets" to describe the external data format, these need to be slightly modified to better separate the header portion of the structure from the payload portion of the structure. Currently, message structures are typically defined by reserving a block of space for the header as a uint8 array of size CFE_SB_CMD_HDR_SIZE or CFE_SB_TLM_HDR_SIZE. This approach has several issues: 1. Using a fixed-size block assumes only a single type of encapsulation (CCSDS) will ever occur. This may not be the case, as other non-CCSDS encapsulations may be a requirement for some missions 2. The fixed size block is not guaranteed to be properly aligned for a CCSDS header. Since it is declared as a uint8 array, the compiler will not ensure any alignment this structure. It is technically not valid to cast this as a CCSDS header since that contains uint16's 3. This is unlikely to be compatible with electronic data sheets (EDS) no matter what specific implementation is used. Since the definition of the message content (payload) and the message header (CCSDS or other format) will come from different data sheets, it becomes very problematic to have them mixed together like this. To solve this problem requires a bit of restructuring: instead of declaring the format of the payload directly within the message structure, declare a separate "Payload" structure and define it in there. This adds one extra layer to the structure tree but will improve flexibility going forward, and it will NOT change the external data format, so compatibility with ground systems is unaffected. It only affects the syntax of code accessing members of the payload structure.	other	enhancement	major
3	#5	Reentrant version of decompress routine in CFE FS. The decompression routine keeps its internal state in global variables which makes it non-reentrant. To protect against concurrent usage a mutex is used but this has a major performance impact. The global variables have been replaced with a state structure so that it can be multithreaded like all other parts of CFS. A global state object has been implemented in order to preserve API compatibility.	fs	enhancement	minor
4	#7	Fix use of uint32 to store a memory address: In many places a uint32 is used to store a memory address which breaks horribly on 64-bit architectures. The new version of OSAL (version 4.2.0) "common_types.h" introduced a "cpuaddr" type to address this -- it is defined as an integer type large enough to store a memory address on the local processor. All uses of a uint32 to store a memory address have been replaced with the cpuaddr type for better portability. This is a requirement for a native 64-bit build to work.	other	defect	major

5	#8	Clean up "extern" declarations at the top of C files: In the cFE core apps, many files reference functions and data structures defined in other files. However, the function prototypes or "extern" declarations are not in common header files, but simply put at the top of the C file that uses it. While this does build, it defeats the type checking done by the compiler. It is far from ideal because if the real variable type or function prototype ever changes, the linker will still happily link it together even though they might be completely incompatible (or worse, incompatible in a really subtle way). The only reason to NOT put a declaration in a header file is if it should not be called or referenced by CFS apps. This has been solved by creating a private cFE core shared header file.	other	defect	major
6	#10	CFE ES makes assumptions about OSAL opaque objects: The OSAL returns object identifiers which are defined as uint32 values. In the current implementation of OSAL they happen to be zero-based but this should not be a requirement; in fact there are several advantages to making these identifiers non-zero-based. The primary offender is the ES core application using the task ID from OSAL directly as an array index. To ensure future compatibility with OSAL updates, the OSAL object IDs are treated as opaque integers of undefined range.	es	defect	minor
7	#11	cFE enumeration names: In order to reduce the chance of name space conflicts, enumerated names now follow the general form, with the value prefixed by the group name and the app name: <APPNAME>_<GROUPNAME>_<VALUEID_1> <APPNAME>_<GROUPNAME>_<VALUEID_2> .... <APPNAME>_<GROUPNAME>_<VALUEID_N> This ensures that even if two enums use the same value name(s) they will not conflict with each other.	other	defect	major
8	#13	Display extended version information from the build: git and Cmake offer additional build information where the current git commit id and most recent tag name are built into a global object that is accessible at runtime. When it is available, this extended build information will be displayed along with the official four digit version number.	build	enhancement	major
9	#16	Removed cfe_es_devsrvr code: cfe_es_devsrvr.c and .h appear to be stale/obsolete and not being called or referenced by anything else in cFE. Furthermore, it should be deprecated anyway since device-support code logically fits better within the PSP. At the cFE layer it should be all hardware-independent code. These two files have been removed from the build.	other	defect	minor

10	#18	Modify code that reads or writes memory addresses in external messages to use wrapper: In the current version, some external interface (command/telemetry) messages contain direct CPU memory addresses. This can be very bad for several reasons: Memory addresses can be a different size on different CPUs Since memory addresses are likely to change from run to run (even in the same build) it makes it difficult to script tests The receiver has no way to validate it (other than NULL). If the address value ever gets corrupted or an invalid value is used, the consequence is usually dire (a crash). Ultimately the use of direct memory addresses in messages should be avoided. This ticket modified locations where a memory address performs a read/write from/to an external message to use a wrapper function. The wrapper function does not change any functionality in itself, but it will provide a path going forward such that the wrapper function can be modified to convert the address to/from a safe, verifiable, architecture independent value rather than using the address directly.	other	enhancement	major
11	#19	Fix inclusion of PSP private header files in CFE layer	other	defect	minor
12	#20	Stack pointer parameter to CFE_ES_CreateChildTask should not be marked "const"	es	defect	major
13	#22	Error constants defined in "cfe_error.h" incorrectly use the "L" suffix	build	defect	major
14	#23	Code in CFE TIME fails to compile with strict compiler settings	time	defect	minor
15	#24	Fix duplicate mempool structure definitions in unit test code	es	defect	minor
16	#26	Fix type mismatches and remove unnecessary typecasting	other	defect	minor
17	#27	Clean up unused local variables	other	defect	minor
18	#28	Pointer arguments to functions that are input only should be declared "const"	other	enhancement	minor
19	#29	Ensure that return codes from PSP functions are checked	other	enhancement	minor
20	#31	Fix duplicate structure definitions in table unit test	tbl	defect	minor
21	#32	Unit test stubs need to be kept in sync with their respective real implementations	build	defect	minor
22	#33	Fix "no return" warning on CFE_SB_ReadQueue() function	sb	defect	trivial
23	#34	Update cFE unit tests: Updated to cover cFE version 6.5.0 containing source code updates to all files necessary to pursue a Class A safety-critical classification of the cFE software. Tests were modified and new tests were added to improve the branch path and line coverage.	test	defect	major
24	#52	CFE_TIME fails to build with CFE_TIME_CFG_SRC_MET set to TRUE	time	defect	major
25	#55	Many command processors in CFE do not confirm null-termination of strings within the message	other	defect	major
26	#56	Clean up massive number of warnings in sb_UT.c	sb	defect	minor
27	#60	Fix startup file pathnames in CMake version of the sample configurations	other	defect	minor
28	#65	Some symbols not making it into final core executable file	build	defect	major
29	#66	Minor fixes for cmake unit test build	other	defect	minor
30	#73	CFE ES Mempool code uses "uint32" where it should be "cpuaddr"	es	defect	major
31	#76	CFE is closing file handles that were not opened	other	defect	minor

32	#77	Remove dependencies on SOFTWARE_BIG/LITTLE_BIT_ORDER	other	enhancement	major
33	#79	Fix build failures on RTEMS	other	defect	major
34	#80	Integrate CFE_TIME with OSAL timebase API	time	enhancement	minor
35	#103	Remove "cpu" directories from fsw/platform_inc	common	defect	major
36	#106	CCSDS header file macro CCSDS_INC_SEQ generates a compiler warning when referenced (GSFC DCR 22932)	common	defect	major
37	#113	Copies to/from message payloads should use the sizeof() operator where possible	other	enhancement	major
38	#114	ES unit test failing on x86_64 due to uint32 memory handle	es	defect	major
39	#120	resolve "-m32" CFE classic build issues	build	defect	major
40	#122	Add missing ".Payload" structure member designations	time	defect	major
41	#123	JSC: Remove unnecessary cast on OS_write	es	defect	minor
42	#124	JSC: Update code constructs to MISRA recommendations	other	defect	major
43	#125	JSC: change uint8 to char for strings in interface structures	other	defect	major
44	#126	Fix potential issues in ES_CleanUpApp()	es	defect	major
45	#127	Fix size check in CFE_ES_InitializeCDS()	es	defect	major
46	#128	JSC: Type correctness fixes	other	defect	major
47	#132	Add explicit "return" after functions that are not supposed to return	other	defect	major
48	#139	Remove unused "StackPtr" variable in ES startup object table	es	enhancement	minor
49	#149	Hush cppcheck warnings. There are some specific places in the code where we want cppcheck to not produce warnings, without generalizing in any way to other code. This involves inserting comments like: /* cppcheck-suppress unsignedPositive */	cppcheck	defect	major
50	#150	Redundant Initializations. When a variable is declared and initialized during the declaration and then a value is immediately stored in it, a cppcheck warning is produced. The redundant initializer does not need to be added. These redundant initializers are being removed.	cppcheck	defect	minor
51	#151	cppcheck - Strncpy-fills May Not Be Null Terminated. addressing the following cppcheck warnings: E-JA/cfe/fsw/cfe-core/src/es/cfe_es_apps.c:502: warning: The buffer 'RamDiskPath' may not be null-terminated after the call to strncpy(). /home/bamboo-remote-agent/bamboo-agent-home/xml-data/build-dir/CFS-CFSCFE-JA/cfe/fsw/cfe-core/src/es/cfe_es_apps.c:807: warning: The buffer 'RamDiskPath' may not be null-terminated after the call to strncpy(). /home/bamboo-remote-agent/bamboo-agent-home/xml-data/build-dir/CFS-CFSCFE-JA/cfe/fsw/cfe-core/src/es/cfe_es_shell.c:122: warning: The buffer 'Cmd' may not be null-terminated after the call to strncpy(). /home/bamboo-remote-agent/bamboo-agent-home/xml-data/build-dir/CFS-CFSCFE-JA/cfe/fsw/cfe-core/src/es/cfe_es_shell.c:96: warning: The buffer 'OutputFilename' may not be null-terminated after the call to strncpy(). 4-8-16 - CCB meeting discussed solution to replace strncpy call with CFE_SB_MessageStringGet	other	defect	major
52	#153	Fix git version strings built into executable. The cmake build system includes version information acquired by running git describe in various source trees being used by the build.	build	defect	minor

		These version strings are then linked directly into the output executable. In testing the CFE 6.5 release it was observed that this wasn't quite working correctly. The git revs were OK but it in some cases was referencing the wrong base tag or no base tag at all.			
53	#154	SB Timeout Receive Unit Test Failure. When running the SB unit tests via the "classic build", the SB is failing due to an unexpected return: Unexpected return in timeout receive test, exp=-905969663, act=-905969662 The failure appears to be due to the unit test not setting the proper return value before the call to CFE_SB_RcvMsg. In the sb_UT.c source code file in the Test_RcvMsg_Timeout function there is an #ifndef statement around the UT_SetRtnCode function that is blocking the return code from being set properly.	other	defect	major
54	#155	Enhanced build version.h collisions. The CMAKE build system CFE/cmake/version.cmake code generates a version.h file that overrides the version.h required to build for VxWorks. T fix changed the generated filename to cmake_version.h, and make the change to CFE/cmake/target/src/target_config.c to include the new filename	build	defect	minor
55	#157	EVS - CFE_EVS_WriteAppDataCmd References Incorrect Variable in Call to OS_creat	evs	defect	major
56	#160	CFE_ES_ReloadAppCmd References Incorrect Data in Call to CFE_ES_ReloadApp	es	defect	major
57	#162	CFE_ES_ShellOutputCommand is Truncating Output Filename	es	defect	major

1.3 MISSING PLANNED FEATURES AND KNOWN PROBLEMS

Table 1.3-1 identifies the functions and known discrepancies that are absent from cFE Build 6.5.0. 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. 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. Table 1.3-1 below only contains a listing of the open DCRs on the MKS tlserver3 server. Open trac tickets are not listed.

Table 1.3-1 – Functions absent from this Release

No.	Trac Ticket #	Description	Component	Status	Planned Delivery	Type	Priority
1	#14	CFE_TIME_GetTime() should not return a structure	other	new	Not Determined	enhance ment	minor
2	#15	CFE_TIME_GetReference() has insufficient protection against update while reading	time	new	Not Determined	defect	major

3	#17	Implement "bootstrap" script	build	new	Not Determined	enhancement	major
4	#25	Consolidate CDS and generic/ram mempool code into single implementation	es	on_hold	Not Determined	enhancement	minor
5	#30	Review use of CFE_PSP_MemCpy/CFE_PSP_MemSet	other	review	Not Determined	task	minor
6	#34	update cFE unit tests	test	assigned	Not Determined	defect	major
7	#38	Update CFE_FS_InitHeader to to Handle Error/Invalid Length Conditions	fs	new	Not Determined	enhancement	major
8	#39	Enforce Strict ASCII	other	new	Not Determined	defect	minor
9	#43	CFE TIME uses OSAL IntLock/IntUnlock for mutual exclusion	time	review	Not Determined	defect	major
10	#44	CFE_ES_WriteToSyslog() is not multi-thread safe	es	review	Not Determined	defect	major
11	#45	CFE_ES_ProcessCoreException() is not interrupt-safe	other	review	Not Determined	defect	major
12	#46	Application Startup Race Conditions (GSFC DCR 22819)	es	new	Not Determined	defect	major
13	#47	CFE TIME fails to build when CFE_TIME_CFG_SIGNAL set to TRUE	time	review	Not Determined	defect	minor
14	#49	Extend CMake app search path	build	new	Not Determined	enhancement	minor
15	#53	File operations in CFE_ES_ShellOutputCommand() need cleanup	es	review	Not Determined	defect	minor
16	#54	Pre-CMake fallback build script needs updating.	build	in_work	Not Determined	task	minor
17	#58	Exiting an Application Creates an Application with an Unknown State (GSFC DCR 23035)	es	new	Not Determined	defect	major
18	#61	CFE_SB_GetMsgTime() and CFE_SB_TimeStampMsg() do not handle byte-swapping on _EL platforms	sb	new	Not Determined	defect	major
19	#62	Clean up EVS_SendViaPorts() function	evs	new	Not Determined	enhancement	minor
20	#63	EVS "output ports" should be a function of the PSP	evs	review	Not Determined	enhancement	minor
21	#64	Suspicious implementation of SHORT_FORMAT mode in EVS_SendPacket()	other	review	Not Determined	defect	major
22	#69	SB Pipes are not protected.	sb	review	Not Determined	defect	major
23	#70	SB Only Increments Message Sequence Count Where There are Subscribers	other	new	Not Determined	defect	major
24	#78	cFE TIME unit tests break when different configuration options are used	time	new	Not Determined	defect	major
25	#83	Default Configuration Setting for CFE_ES_STARTUP_SCRIPT_TIMEOUT_MSEC is Too Big	other	new	Not Determined	enhancement	major

26	#85	Add UT assert stubs to CFE	test	on_hold	Not Determined	enhancement	major
27	#86	Correction of an infinite loop in cfe_sb_task.c	sb	new	Not Determined	defect	minor
28	#89	ES Does Not Check CFE_PSP_MemRead8 Return Code	es	new	Not Determined	defect	major
29	#90	ES - Invalid Memory Handle When Restarting/Deleting an Application with Tables (GSFC DCR 14483)	tbl	new	Not Determined	defect	major
30	#92	cFE Time subsystem has calls to OS functions that do not exist	time	new	Not Determined	defect	major
31	#93	Executive Services always creates tasks with floating point enabled (GSFC DCR 21293)	es	new	Not Determined	defect	major
32	#94	ES - Add Ability to Recreate the RAM Disk via Command (GSFC DCR 21594)	es	new	Not Determined	defect	major
33	#95	ES - Registered Tasks Counter Does Not Decrement When Child Tasks are Exited (GSFC DCR 21771)	es	new	Not Determined	defect	major
34	#96	Add support to allow SBN to pass sender information across the network (GSFC DCR 22063)	other	new	Not Determined	defect	major
35	#97	EVS - Add Configuration To Output Events Upon Command Message vs. Function Call (GSFC DCR 22080)	evs	new	Not Determined	defect	major
36	#98	SB - Add Last Pipe ID and Msg ID to Routine Telemetry for Diagnosing Message Limit Error and Buffer Overrun Errors (GSFC DCR 22081)	sb	new	Not Determined	defect	major
37	#99	TBL - Update Table Services to Send Messages to Notify Applications of Pending Table Updates (GSFC DCR 22622)	tbl	new	Not Determined	defect	major
38	#100	Update CFE_ES_SYSTEM_LOG_SIZE Verify to Allow Larger Sys Log Files (GSFC DCR 22684)	es	new	cfe_next	defect	major
39	#101	Table Services Name Buffer Overflow	tbl	new	Not Determined	defect	major
40	#102	ES Creates Redundant Sys Log Entries When Creating ER Log Entries (GSFC DCR 22768)	es	new	Not Determined	defect	major
41	#104	MMS-IVV-013 (OBS-1238) - Static Code Analysis: Possible Buffer Underrun in cfe_fs_decompress.c (GSFC DCR 22838)	fs	new	Not Determined	defect	major
42	#105	cFE Does Not Meet Double Floating Point Alignment Requirements on PPC440x5 BookE Architecture (GSFC DCR 22813)	common	new	Not Determined	defect	major
43	#107	SB - Duplicate Pipe Creation Causes Failure to Delete Pipe (GSFC DCR 22934)	sb	new	Not Determined	defect	major
44	#108	TBL - Dump Table Registry Data Command Can Hog CPU (GSFC DCR 23031)	tbl	new	Not Determined	defect	major
45	#110	ES - Recursive Exit Application Error Message	es	new	Not Determined	defect	major

46	#111	Naming convention for macros in cfe_mission_cfg and cfe_platform_cfg	other	new	Not Determined	enhancement	major
47	#112	Simplify Function Pointer Manipulations	other	new	Not Determined	task	minor
48	#115	Standardize Version Numbering (in CFE)	other	new	Not Determined	defect	major
49	#116	printf format specs need to be cleaned up	other	new	Not Determined	defect	minor
50	#117	CFE_ES_GetAppName() undefined output when failure occurs	es	new	cfe_next	defect	major
51	#118	Improve cppcheck configuration for CFE	cppcheck	new	Not Determined	enhancement	major
52	#119	cppcheck a vxworks build	cppcheck	in_work	Not Determined	task	major
53	#133	CFE_ES_AppCreate does not unload an object file if the entry point is not found	other	new	cfe_next	defect	major
54	#135	SB: "cfe_sb.h" should not depend on cfe_platform_cfg.h	sb	new	cfe_next	defect	minor
55	#137	Possible buffer overrun in format strings used for scanf	es	new	cfe_next	defect	major
56	#138	FS - ExtractFilenameFromPath Function Needs Revision	other	new	cfe_next	enhancement	major
57	#140	The ES "LoadLibrary()" call - avoid duplicates and pass ID	es	new	cfe_next	enhancement	minor
58	#141	Macro Parameters need Parens	common	new	cfe_next	defect	minor
59	#142	Refactor CFE_ES_AppCreate and CFE_ES_LoadLibrary	es	new	cfe_next	enhancement	minor
60	#143	ES does not check target file existence before attempting to reload an application (GSFC DCR 145460)	other	new	cfe_next	defect	major
61	#144	Thread safety issues in CFE_TIME around the Sync Callbacks	time	new	cfe_next	defect	major
62	#145	use the OSAL configuration file loader library	es	new	cfe_next	enhancement	minor
63	#147	ES - CreateChildTask API Function Does Not Use "Flags" Input Parameter	es	new	Not Determined	defect	major
64	#152	Redundant Assignments and Unread Variables	other	new	Not Determined	defect	minor
65	#156	Incorrect leap seconds in docs	time	new	Not Determined	defect	minor
66	#158	EVS Unit Test Code Coverage Incomplete in Task.c (GSFC DCR 8492)	evs	new	Not Determined	enhancement	minor
67	#159	ES Unit Test Code Coverage Incomplete in apps.c	es	new	Not Determined	enhancement	minor
68	#161	CFE_ES_DeleteChildTask SysLog Message/Comments are Misleading	es	new	cfe_next	defect	minor
69	#164	cFE cES1702.3 and cES1703.3 Requirement Failures	es	new	cfe_next	defect	major
70	#168	cFE cES1515.1 Requirement Failure	es	new	cfe_next	defect	major

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:

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

Tool Type.	Tool Name	Version Used
RTOS	VxWorks	6.9
Compiler	GNU (ccppc)	3.3.2
CFS PSP	CFS Platform Support Package	1.3.0.0
OSAL	Operating System Abstraction Layer	4.2.0
Ground System	ASIST	20.2

1.5 TESTED PLATFORMS

Since the cFE uses the Operating System Abstraction Layer (OSAL), multiple operating systems are supported. Build Testing of cFE Build 6.5.0 has been done on a PPC/mcp750 using the RTOS and compiler specified in Table 1.4-1 above. In addition, cFE Build 6.5.0 has been functionally tested with the hardware/software platforms listed in Table 1.5-1 below (build test platform is included for completeness).

Table 1.5-1 – Functional Test Platforms Associated with this FSW Version

No.	Machine	CPU	Operating System	cFE Build	PSP	Notes
1	Motorola MCP750	PowerPC 750 32-bit microprocessor	VxWorks 6.9	32-bit	mcp750-vxworks6.4	mcp750-vxworks6.4 PSP supports VxWorks 6.x versions Built via classic build in accordance with "Deployment Guide" instructions. Used for build, regression, and requirements verification testing
2	Standard PC	x86-64 / Intel Xeon CPU E5-1650	Ubuntu 14.04.4 LTS 64-bit, kernel version 3.13.0	64-bit	pc-linux	Using "posix-ng" OSAL layer for native 64-bit OSAL support Built via CMake
3	QEMU v2.5.0	i686 / QEMU virtual 32-bit	RTEMS 4.11 (prerelease) + pc686 BSP	32-bit	pc-rtems	Built via CMake and according to "README" file included in pc-rtems PSP
4	Custom Hardware	Xilinx Microblaze / Virtex-5 FPGA	SCLinux, kernel version 3.6.0	32-bit	pc-rtems	PSP extension modules in use to support custom hardware Built via CMake
5	Vadatech AMC516	PowerPC e500mc / Freescale QorIQ (quad-core)	Embedded Linux (customized), kernel version 3.12.19	32-bit	pc-linux	Built via CMake
6	Beaglebone Black	ARMv7 / Texas Instruments AM3359	Debian Wheezy 7.9, kernel version 3.8.13	32-bit	pc-linux	Built via Cmake
7	Linux Workstation	x86_64 / Intel Xeon CPU E5-2640	CentOS 6.8 64-bit	32-bit	pc-linux	Unit test verificaiton and integrated build running test applications Built via classic build

8	Aeroflex Gaisler ut699 developm ent board	SPARC Leon3	VxWorks 6.7	32-bit	grut699-vxw orks6	Built via classic build. Integrated build running test applications.
9	Aitech's SP0 3U CompactP CI SBC	Pow erQUICC-III MPC8548E	VxWorks 6.9	32-bit	sp0-vxw orks6.9	Built via classic build. Integrated build running test applications.
10	VirtualBox VM	single core X86	Debian Jessie, 32-bit x86	32-bit	pc-linux	Build and unit test verification: - Bamboo Job A build uses classic build - BambooJB build uses CMake build - cppcheck is run by both jobs - runs unit tests produced by both jobs
11	Dell Precision Standard PC	2C Core i3-2120,3.3G,3M,1 GT,Dell Precision T1650	RedHatEnter priseClient 5.11 32-bit	32-bit	pc-linux	Built via classic build. Unit test verification only.

2.0 DELIVERED PRODUCTS

Table 2.0-1 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 2.0-1 – Delivered Products and their Locations

Software Element	Changed with this Version?	New Version or Date	Location
Executable for this build	Yes	6.5.0	N/A. Executables are not delivered for the cFE
Installation Procedures & Special Instructions	No	N/A	See Deployment Guide babelfish.arc.nasa.gov (in git system master branchs – cFE and TOOLS) and http://sourceforge.net/projects/coreflightexec
Source Code of this FSW Build	Yes	6.5.0	babelfish.arc.nasa.gov (in git system master branch) and http://sourceforge.net/projects/coreflightexec
FSW Build Plan	No	N/A	None
Annotated S/W Detailed Design Docs	No	N/A	cFE Application Developer's Guide babelfish.arc.nasa.gov (in git system master branch) and http://sourceforge.net/projects/coreflightexec
Ground System T&C Database	Yes	6.5.0	babelfish.arc.nasa.gov (in git system master branch) and http://sourceforge.net/projects/coreflightexec
Ground System Scripts developed by FSB	No	N/A	babelfish.arc.nasa.gov (in git system master branch) and http://sourceforge.net/projects/coreflightexec
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	babelfish.arc.nasa.gov (in git system TOOLS master branch) and http://sourceforge.net/projects/coreflightexec
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	Yes	6.5.0	babelfish.arc.nasa.gov (in git system master branch) and http://sourceforge.net/projects/coreflightexec
Unit Test Data	Yes	6.5.0	babelfish.arc.nasa.gov (in git system master branch) and http://sourceforge.net/projects/coreflightexec
Unit Test Results	Yes	6.5.0	babelfish.arc.nasa.gov (in git system master branch) and http://sourceforge.net/projects/coreflightexec
FSW Make Files	Yes	6.5.0	babelfish.arc.nasa.gov (in git system master TOOLS branch) and http://sourceforge.net/projects/coreflightexec

Software Element	Changed with this Version?	New Version or Date	Location
Linker & Compiler Configuration Files	Yes	6.5.0	babelfish.arc.nasa.gov (in gitsystem master TOOLS branch) and http://sourceforge.net/projects/coreflightexec

3.0 INSTALLATION PROCEDURES

Table 3.0-1 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 3.0-1 FSW Installation Procedure(s)

Destination (Target System)	Filename	Version and Date	Location
Procedure is generic for each CPU	cFS Deployment Guide	3.0	babelfish.arc.nasa.gov (in git system master TOOLS branch) and http://sourceforge.net/projects/coreflightexec

4.0 CONFIGURATION SUMMARY AND VERSION IDENTIFICATION

cFE Build 6.5.0 can be found on babelfish.arc.nasa.gov (in git system master branch) and is provided as open source on sourceforge.net:

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

Telemetry is available to indicate cFE Build 6.5.0 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
EDS.....Electronic Data Sheet
ES.....Executive Services
ETU.....Engineering Test Unit
EVS.....Event Services
FSB.....Flight Software Branch
FSW.....Flight Software
I&T.....Integration & Test
MISRA.....Integration & Test
OSAL.....Operating System Abstraction Layer
PPC.....Power Personal Computer
RTOS.....Real-Time Operating System
SB.....Software Bus Services
TBL.....Table Services
TIME.....Time Services
T&C.....Telemetry and Command
URL.....Universal Resource Locator
UTF.....Unit Test Framework
VDD.....Version Description Document