Core Flight Software



Version Description Document

Platform Support Package (PSP)

Build: 1.3.0.0

MaY 24, 2016

Signatures

Submitted by:



Approved by:



Signatures – continued

Approved by:



1.0 FSW Version Description

1.1 purpose and summary

The purpose of this build is to continue to refine and enhance the core Flight System (cFS) Platform Support Package (PSP) library. This build provides various bug fixes, as well as, new features and enhancements including:

* Class A safety-critical instantiation of the library package for the SPARC LEON3 processor
* Instantiation for a PC-RTEMS environment
* Instantiation for the Aitech SP0 3U CompactPCI PPC-VxWorks6.9 environment
* Enhanced cmake build system (in addition to classic build)
* 64-bit Processor Support

This build also cleans out obsolete PSP implementations that had not been maintained in past releases (see ticket #59 for details).

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

1. All memory functions accept memory addresses of type ‘cpuaddr’ instead of ‘uint32’
2. All name arguments are now `const char\*` instead of `char\*` for all API calls

This version of the cFE\_PSP is compatible with the latest versions of the OS Abstraction Layer (OSAL) versions 4.2.0 or later and cFE versions 6.5.0 or later. It is highly recommended to use this version of the cFE\_PSP with the latest versions of the OSAL and cFE. This version of the cFE\_PSP is not backward compatible with earlier versions of the OSAL and cFE components.

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

This document serves to formally release cFE\_PSP Build 1.3.0.0.

1.2 new/Changed functionality in this VERSION

Table 1.2-1 identifies new PSP functionality that has been implemented and is integrated into this version.

**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 | #9 | Added pc-rtems PSP for running the cFS on standard PC hardware using the RTEMS OS. This package is targeted at debugging or proof-of-concept validation using QEMU as an emulator to provide a virtual PC hardware. | other | enhancement | major |
| 3 | #28 | Added SP0 PSP for running the cFS in an Aitech SP0 3U CompactPCI PPC-VxWorks6.9 environment | unspecified | enhancement | major |
| 4 | #49 | New Volume Table macro to prevent need for direct modification to private volume table source code | pc-linux | defect | major |

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

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No.** | **Trac Ticket #** | **High Level Description of Functionality/Bug Report** | **Component** | **Type** | **Priority** |
| 1 | #3 | PSP modular build enhancements | shared | enhancement | major |
| 2 | #5 | Fix all PSP Memory functions that use a uint32 for memory addresses | shared | defect | major |
| 3 | #6 | Remove references to "cfe\_platform\_cfg.h" from PSP | other | defect | major |
| 4 | #15 | PSP modifications for const-correct CFE API | build | defect | major |
| 5 | #17 | Clean up "-D" compile time macros used in pc-linux build | pc-linux | defect | major |
| 6 | #19 | Fix inclusion of PSP internal headers from within public headers | build | defect | minor |
| 7 | #21 | Fix pc-linux PSP for the latest OSAL | pc-linux | defect | minor |
| 8 | #22 | Small Fixes pc-rtems BSP | pc-rtems | defect | minor |
| 9 | #34 | CFE\_PSP\_MemRangeSet() description error. CFE\_PSP\_MemRangeSet() function defined in cfe\_psp\_memrange.c has a comment error on the MemoryType argument that could be misleading. Comments were updated to clearly indicate that any valid CFE\_PSP\_MEM\_ enumeration can be used for the cfe\_psp\_memrange.c functions. | shared | defect | trivial |
| 10 | #49 | Volume Table Requires User Modification | pc-linux | defect | major |
| 11 | #52 | PSP build fails for GRUT699 | unspecified | defect | major |
| 12 | #48 | Allow C99 code in PSP | build | defect | major |
| 13 | #54 | Class A safety-critical updates to the GRUT699 PSP:   * Updated all ut699 PSP source files to comply with “most” MISRA rules and cppcheck static analysis errors * Updated all ut699 PSP source files to remove compiler warnings | other | task | major |
| 14 | #57 | PSP build fails for MCP750 | mcp750-vxworks6.4 | defect | major |
| 15 | #58 | printf format codes vs. argument types | grut699-vxworks6 | defect | minor |
| 16 | #59 | Remove obsolete PSPs. The following PSPs have not been maintained and will be removed:   * mac-osx * mcf5235-rtems * pc-cygwin   Note: The obsolete PSP implementations listed above are available in older releases and in the babelfish git repository archives. With the changes made to this release (PSP version 1.3), it is recommended to use the maintained PSPs delivered in this release as a starting point vs. using the retired PSPs from older releases. | unspecified | task | major |
| 17 | #61 | MCP750-VxWorks Memory Variables Should be “cpuaddr” Type | mcp750-vxworks6.4 | defect | major |
| 18 | #63 | PC\_RTEMS fixes from psp-1.3/cfe-6.5 testing | pc-rtems | defect | major |

1.3 MISSING Planned FEATURES AND KNOWN PROBLEMS

Table 1.3-1 identifies functions and known discrepancies that are absent from this release.

Information on currently open Trac tickets is available at <https://babelfish.arc.nasa.gov/trac/cfs_psp>. Note that this is a restricted website that requires a server account. Additional Trac tickets may have been submitted after preparation of this VDD. A PSP Trac ticket report containing a listing of open tickets is available on request for customers who do not have access to the babelfish server. Please contact Susanne Strege, susie.strege@nasa.gov.

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Trac Ticket #** | **Description** | **Component** | **Status** | **Planned Delivery** | **Type** | **Priority** |
| 1 | #4 | Clean up shared EEPROM read/write implementation | shared | new | Not Determined | enhancement | major |
| 2 | #7 | PSP memory, port, and EEPROM functions assume direct-mapped access | other | review | Not Determined | defect | major |
| 3 | #8 | PSP needs unit tests | tests | closed | Not Determined | defect | major |
| 4 | #10 | Add PSP unit tests | other | assigned | Not Determined | enhancement | major |
| 5 | #11 | provide grut699-vxworks6 PSP updates | grut699-vxworks6 | new | Not Determined | defect | major |
| 6 | #12 | consider adding PSPs developed at JSC | other | new | Not Determined | enhancement | minor |
| 7 | #14 | Implement Bamboo builds of cFS PSP tree | bamboo | new | Not Determined | task | major |
| 8 | #18 | Add Xenomai BBB PSP | xenomai | new | Not Determined | enhancement | minor |
| 9 | #20 | Enforce Strict ASCII | other | new | Not Determined | defect | minor |
| 10 | #23 | Race condition: PSP timer callbacks are set up and started before CFE\_TIME is running | other | work\_complete | Not Determined | defect | major |
| 11 | #24 | PSP startup code should confirm that OS\_API\_Init worked | other | new | Not Determined | defect | minor |
| 12 | #26 | Update "beaglebone-linux" PSP. This PSP does not yet have the following updates to bring it up to match the development versions of the other PSPs:   * enhanced build script * change uint32 to cpuaddr * dependency management * compatibility with CFE "const" API * clean up build macros | other | review | Not Determined | enhancement | minor |
| 13 | #27 | Fix "utbsp.h" not found failure when building on some platforms | build | closed | Not Determined | defect | major |
| 14 | #29 | PSP API for onboard devices. PSP needs to define some common API/framework for communication with onboard devices. This would present a consistent API so CFS code can be better abstracted from the hardware implementation details.  For instance, if a serial controller device is present on the board, it would speak the same protocol regardless of whether the physical devices is connected over RS232, RS485, an LVDS link, or some other link. However the configuration API and the means to communicate over these different types of interfaces differs. Some boards might have dedicated hardware channels, others might "bit bang" with GPIO, etc.  The PSP should abstract this difference and present a similar API so the CFS code that talks to these devices can be portable. The standardization work being performed by the CCSDS SOIS working group may be relevant here as well. | shared | new | Not Determined | enhancement | minor |
| 15 | #30 | CFE\_PSP\_MemRead/Write() not checking for NULL pointer args | shared | review | psp\_next | defect | major |
| 16 | #31 | CFE\_PSP\_MemCpy/Set not checking for NULL pointer args | shared | review | psp\_next | defect | major |
| 17 | #32 | CFE\_PSP\_MemCpy doesn't handle overlapping ranges | grut699-vxworks6 | new | Not Determined | defect | minor |
| 18 | #33 | Update grut699-vxworks6 cfe\_psp\_memory.c per white box unit testing results | grut699-vxworks6 | new | Not Determined | defect | minor |
| 19 | #35 | Limit the calculated results in CFE\_PSP\_WatchdogSet.  CFE\_PSP\_WatchdogSet computes a new value to set the watchdog timer to, but does not limit the results to the specified min and max values (CFE\_PSP\_WATCHDOG\_MIN and CFE\_PSP\_WATCHDOG\_MAX).  The calculation is also not protected from overflowing the possible range, so it is possible to get a much different result than expected. | grut699-vxworks6 | new | Not Determined | defect | minor |
| 20 | #36 | Update grut699-vxworks6 cfe\_psp\_timer.c per white box unit testing results | grut699-vxworks6 | new | Not Determined | defect | minor |
| 21 | #37 | Update grut699-vxworks6 cfe\_psp\_start.c per white box unit testing results | grut699-vxworks6 | new | Not Determined | defect | minor |
| 22 | #38 | unld PSP core unit test causes a processor exception | unspecified | new | Not Determined | defect | minor |
| 23 | #39 | Use more accurate return codes | unspecified | new | Not Determined | defect | major |
| 24 | #40 | change \* to \*\* in cfe\_psp\_memory.c. For improved efficiency consider changing 1st argument to be a double pointer of type void, and not a single pointer of type void. Then a straight assignment can be used in place of memcpy(used to copy 4 bytes). This will be an API change. | unspecified | new | Not Determined | defect | major |
| 25 | #41 | SPARC Leon3 memory alignment sensitivity and handling | grut699-vxworks6 | new | Not Determined | enhancement | major |
| 26 | #42 | Simplify Function Pointer Manipulations | other | new | Not Determined | task | major |
| 27 | #43 | Should PSP have byte-swapping utilities for endian conversions? | unspecified | new | Not Determined | enhancement | minor |
| 28 | #44 | Rename "mcp750-vxworks6.4" Folder | unspecified | new | Not Determined | defect | major |
| 29 | #45 | Update mcp750-vxworks6.4 cfeSupport.c to Enforce CF Name | unspecified | new | Not Determined | defect | major |
| 30 | #46 | Standardize Version Numbering (in PSP) | other | new | Not Determined | defect | major |
| 31 | #48 | Allow C99 code in PSP | build | new | psp\_next | defect | major |
| 32 | #50 | ApexSim for Arinc653 Posix simulator | other | new | Not Determined | enhancement | minor |
| 33 | #51 | Trick PSP. There is growing interest in being able to use the Trick OSAL/PSP so that a CFS build can be executed within a Trick simulation basically allowing developers to fly unmodified FSW within an all SW simulation environment on their desktop. | unspecified | new | Not Determined | enhancement | major |

2.0 Delivered products

Table 2.0-1 identifies the products relevant to this release. The version or date of the release and where the product can be located are also provided. Changes from the previous version 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 | 1.3.0.0 | N/A. Executables are not delivered for the cFE-PSP |
| Installation Procedures & Special Instructions | No | 3.0 | See CFS Deployment Guide. babelfish.arc.nasa.gov (in git system master cfs\_tools branch) and open source at <http://sourceforge.net/projects/coreflightexec/> |
| Source Code of this FSW Build | Yes | 1.3.0.0 | babelfish.arc.nasa.gov (in git system master branch) and open source at <http://sourceforge.net/projects/coreflightexec/> |
| FSW Build Plan | N/A |  | None |
| Annotated S/W Detailed Design Docs | N/A | 5.4 | See cFE Application Developer’s Guide. babelfish.arc.nasa.gov (in git system master cfs\_cfe branch) and open source at <http://sourceforge.net/projects/coreflightexec/> |
| Ground System T&C Database | N/A | N/A | None |
| Ground System Scripts developed by FSB | N/A | N/A | None |
| Simulator and Test Data Generator Software | N/A | N/A | None |
| Executable - Ground Tools associated with FSW (tools to build stored command loads, etc.) | N/A | N/A | Tools are available in babelfish.arc.nasa.gov (in git system master cfs\_tools branch) and open source at <http://sourceforge.net/projects/coreflightexec/> |
| Source Code - Ground Tools associated with FSW (tools to build stored command loads, etc.) | No | N/A | $WORK  Perl scripts to generate ground database and build verification procedures from templates |
| Unit Test Procedures | N/A | N/A | None. There are no existing unit test procedures. |
| Unit Test Data | N/A | N/A | None. See note above. |
| Unit Test Results | N/A | N/A | None. See note above. |
| FSW Make Files | Yes | Tagged in CM | babelfish.arc.nasa.gov (in git system master cfs\_tools branch) and open source at <http://sourceforge.net/projects/coreflightexec/> |
| Linker & Compiler Configuration Files | Yes |  | babelfish.arc.nasa.gov (in git system master cfs\_tools branch) and open source at <http://sourceforge.net/projects/coreflightexec/> |

3.0 INSTALLATION PROCEDURES

Table 3.0-1 identifies the nominal Installation Procedure(s) for this release 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 target CPU | CFS Deployment Guide | 3.0 | babelfish.arc.nasa.gov (in git system master cfs\_tools branch) gsfc\_build/docs/CFS Deployment Guide.doc and open source at <http://sourceforge.net/projects/coreflightexec/> |

4.0 Configuration summary and version identification

cFE\_PSP Build 1.3.0.0 can be found on babelfish.arc.nasa.gov and is provided as open source on sourceforge.net:

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

PSP version information is documented in the psp\_version.h source file included in the /inc directory under each platform implementation.

5.0 Software CopyRight Notice

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Acronyms

AES………………………………………...…………………………………………….Advance Exploration Systems

API………………………………………...…………………………………………….Application Program Interface

cFE Core Flight Executive

C&DH Command and Data Handling

cFS…………………………………………………………..……………………………Core Flight Software System

CM Configuration Management

COTS Commercial Off-The-Shelf

DCR Discrepancy/Change Request

ES Executive Services

ETU Engineering Test Unit

FSB Flight Software Branch

FSW Flight Software

GSFC Goddard Space Flight Center

JSC Johnson Space Center

I&T Integration & Test

OSAL……………………………………………………………………….……Operating System Abstraction Layer

POSIX Portable Operating System Interface

PSP…………………………………………………………………………………….……Platform Support Package

RTOS Real-Time Operating System

SPARC Scalable Processor Architecture

TBL……………………………………………………………………………………………………………..……Table

T&C Telemetry and Command

URL Universal Resource Locator

UTF…………………………………………………………………………………………….….Unit Test Framework

VDD Version Description Document