

Core Flight Software System (cFS)

Health & SafEty (hS) Application

Build: 2.3.0.0

FSW Version Description Document

Release Date: 10/12/2016

1.0 FSW Version Description

1.1 purpose and summary

The purpose of this build is to continue to refine the cFS Health and Safety (HS) application product. This build provides various bug fixes and a few minor user’s guide updates. This build also resolves capability issues with cFE build 6.5.0. This document serves as the notification of the Build 2.3.0.0 release of the cFS HS application.

HS version 2.3.0.0 is compatible with cFE builds 6.5.0.0 and above and OSAL 4.2.0.0 and above.

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.

Table 1.2-1 – New Functionality in this Version

| No. | FSB DCR # (or N/A ) | Requirements | High Level Description of Functionality |
| --- | --- | --- | --- |
| N/A |  |  | None |

Table 1.2-2 identifies changes to FSW functionality from a previously delivered FSW version and the DCRs and Trac Ticket numbers associated with these changes. See attachment 1 for a full listing of the DCRs and Trac Tickets included in this release.

Table 1.2-2 – Changes to Previously Delivered Functionality

| No. | FSB DCR or Trac Ticket # (or N/A ) | Requirements | Functionality or Change Description |
| --- | --- | --- | --- |
| 1 | #40 | HS6010 | HS Hogging configuration error. Health and Safety detects hogging by incrementing a counter within a non-blocking loop running at low priority, periodically extracting the number of increments, and rescaling that count to be within a fixed range. The system is hogging if the resulting scaled value is smaller than a threshold (actually, if a fixed value minus the rescaled value, representing busy time, is over a threshold).  The rescaling is done by multiplying by a Mult1, dividing by Div, then multiplying by Mult2.  Problem 1:  The initialization of the parameters at task startup is done with this code:  HS\_CustomData.UtilMult1 = HS\_UTIL\_CONV\_MULT1;  HS\_CustomData.UtilMult2 = HS\_UTIL\_CONV\_DIV;  HS\_CustomData.UtilDiv = HS\_UTIL\_CONV\_MULT2;  Note the cross-up between DIV and MULT2.  Problem 2:  The default value of MULT1 in the stock configuration file is large enough that the first multiplication of the rescaling may overflow; a safer value (such as 1) should be used to avoid inconsistent behavior in untuned systems: better to have the system declare HOGGING consistently but, at the wrong threshold than to randomly bat it around, as happens on fast targets where count\*2500 overflows. |
| 2 | 4015 | N/A | Fixed the following initialization typos in the custom initialization function defined in fsw/src/hs\_custom.c:  HS\_CustomData.UtilMult2 = HS\_UTIL\_CONV\_DIV;  HS\_CustomData.UtilDiv   = HS\_UTIL\_CONV\_MULT2; |
| 3 | 4053 | N/A | GPM-IVV-1280 - HS - Increments Command Error Counter for Internal Commands. In order to keep consistency between cFS applications it is recommend to remove all code to increment the command error counter for all internal commands. Removed code that incremented the command error counter for the HS\_TEP\_WAKEUP\_MID internal command. |
| 4 | 145570 | N/A | Updated function HS\_CustomGetUtil to protect against Divide-By-Zero |

1.3 MISSING Planned FEATURES AND KNOWN PROBLEMS

Table 1.3-1 identifies the functions and known discrepancies that are absent from HS Build 2.3.0.0. Any workarounds that may apply are identified.

Information on currently open DCRs is available at <http://tlserver3.gsfc.nasa.gov:7001/index.html>. Information on currently open Trac tickets is available at <https://babelfish.arc.nasa.gov/trac/cfs_apps/report/1>. Note that these are restricted websites that requires a server account. Additional DCRs and/or Trac Tickets may have been submitted after preparation of this VDD. A cFS HS DCR/Ticket report containing a listing of open DCRs and Trac tickets is available on request for customers who do not have access to the restricted servers. Please contact Susanne Strege, susie.strege@nasa.gov.

Table 1.3-1 – Functions absent from this Release

| No. | FSB DCR # (or N/A ) | Description | Reason for Absence | Affected Requirement or Component | Workaround | Planned Delivery |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 4150 | Add HS CPU utilization driver for Linux. The HS app has an hs\_custom.c file that implements an idle task and calculates the CPU utilization. When running the cFE on Linux this idle task causes the linux system to use 100% CPU, which is not good for a desktop system. Since Linux already maintains its own CPU utilization stats, a version of hs\_custom.c that works for linux by eliminating the idle task and instead reporting the CPU utilization stats that linux maintains. This can be added to the project source and selected at compile time. | Implementation is dependent on customer needs. | HS6010 | None | Not Determined |
| 2 | 4116 | HS - Add Trick Simulation Support (JSC Request) | Implementation is dependent on customer needs. Community input is needed. | N/A | Add required ifdef statements to header files | 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:

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

| Tool Type. | Tool Name | Version Used |
| --- | --- | --- |
| RTOS | BVTed with VxWorks 6.9, however, OSAL provides ability to use multiple OSes | 6.9 |
| Compiler | GNU | 3.3.2 |
| cFE | Core Flight Executive | 6.5.0.0 |
| cFE-PSP | cFE Platform Support Package | 1.3.0.0 |
| OSAL | Operating System Abstraction Layer | 4.2.0 |

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 | 2.3.0.0 | Not applicable. Executables must be created for the specific mission/platform |
| Installation Procedures & Special Instructions **(See Section 3.0)** | No | N/A | See Deployment Guide    babelfish.arc.nasa.gov (in git system TOOLS master branchs)  and  <http://sourceforge.net/projects/coreflightexec> |
| Source Code of this FSW Build | Yes | 2.3.0.0 | Tlserver3.gsfc.nasa.gov. MKS label HS-ALL-Build2.3.0.0-OCT12-2016  babelfish.arc.nasa.gov (in git system hs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs_hs> |
| FSW Build Plan | N/A | N/A | None |
| Annotated S/W Detailed Design Docs | No | N/A | fsb.gsfc.nasa.gov/cFS |
| Ground System T&C Database | No | N/A | Tlserver3.gsfc.nasa.gov  babelfish.arc.nasa.gov (in git system hs\_app\_master branch)  and  http://sourceforge.net/projects/cfs\_hs |
| Ground System Scripts developed by FSB | No | N/A | Tlserver3.gsfc.nasa.gov  babelfish.arc.nasa.gov (in git system hs\_app\_master branch)  and  http://sourceforge.net/projects/cfs\_hs |
| Simulator and Test Data Generator Software | No | N/A | None |
| Executable - Ground Tools associated with FSW (tools to build stored command loads, etc.) | No | N/A | None |
| Source Code - Ground Tools associated with FSW (tools to build stored command loads, etc.) | No | N/A | Perl scripts to generate ground database and build verification procedures from templates (see cFS Deployment Guide) |
| Unit Test Procedures | No | N/A | Tlserver3.gsfc.nasa.gov |
| Unit Test Data | No | N/A | Tlserver3.gsfc.nasa.gov. MKS label HS-ALL-Build2.3.0.0-OCT12-2016  babelfish.arc.nasa.gov (in git system hs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs_hs> |
| Unit Test Results | No | N/A | Tlserver3.gsfc.nasa.gov. MKS label HS-ALL-Build2.3.0.0-OCT12-2016  babelfish.arc.nasa.gov (in git system hs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs_hs> |
| FSW Make Files | No | N/A | Tlserver3.gsfc.nasa.gov. MKS label HS-ALL-Build2.3.0.0-OCT12-2016  babelfish.arc.nasa.gov (in git system hs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs_hs> |
| Linker & Compiler Configuration Files | No | N/A | Tlserver3.gsfc.nasa.gov |
| Requirements version (from MKS) | No | 1.4 | Tlserver3.gsfc.nasa.gov  babelfish.arc.nasa.gov (in git system hs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs_hs> |

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 |
| --- | --- | --- | --- |
| N/A | See cFS Deployment Guide | Version 3.0 | Available with cFE open source release:  <http://sourceforge.net/projects/coreflightexec/>  babelfish.arc.nasa.gov (in git system TOOLS master branch)  and on Tlserver3.ndc.nasa.gov |

4.0 Configuration summary and version identification

HS Build 2.3.0.0 can be found on tlserver3.gsfc.nasa.gov and babelfish.arc.nasa.gov (in git system hs\_app\_master branch). Note that these are restricted websites that requires a server account. The open source release of HS Build 2.3.0.0 can be found on http://sourceforge.net/projects/cfs\_hs. Verification of the version can be done by sending a HS Noop command which produces an event message containing the version. In addition, the initialization event message generated during the application startup provides the version.

5.0 Software CopyRight Notice

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Acronyms

ACS Attitude Control System

C&DH Command and Data Handling

cFE…………………………………………………………………………………………..……Core Flight Executive

cFS………………………………………………………………………………………core Flight Software System

CM Configuration Management

COTS Commercial Off-The-Shelf

DCR Discrepancy/Change Request

ETU Engineering Test Unit

FSB Flight Software Branch

FSW Flight Software

HS Health and Safety

I&T Integration & Test

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

RTOS Real-Time Operating System

T&C Telemetry and Command

URL Universal Resource Locator

VDD Version Description Document

ATTACHMENT 1 – cFS Health and Saftey build 2.3.0.0 DCRs

|  | | | |
| --- | --- | --- | --- |
| **No.** | **DCR/Trac Ticket #** | **Description** | **Type** | | **Priority** | **State** | **Date Reported** | **Build Target** |
| 1 | #17 | Update HS app for recent CFE update | defect | | major | Test Complete | 5/18/2015 | 2.3.0.0 |
| 2 | #26 | HS: Fix compiler errors/warnings with strict build settings | defect | | minor | Test Complete | 6/29/2015 | 2.3.0.0 |
| 3 | #40 | HS Hogging configuration error. Health and Safety detects hogging by incrementing a counter within a non-blocking loop running at low priority, periodically extracting the number of increments, and rescaling that count to be within a fixed range. The system is hogging if the resulting scaled value is smaller than a threshold (actually, if a fixed value minus the rescaled value, representing busy time, is over a threshold). The rescaling is done by multiplying by a Mult1, dividing by Div, then multiplying by Mult2.  Problem 1:  The initialization of the parameters at task startup is done with this code:  HS\_CustomData.UtilMult1 = HS\_UTIL\_CONV\_MULT1; HS\_CustomData.UtilMult2 = HS\_UTIL\_CONV\_DIV; HS\_CustomData.UtilDiv = HS\_UTIL\_CONV\_MULT2;  Note the cross-up between DIV and MULT2. Problem 2:  The default value of MULT1 in the stock configuration file is large enough that the first multiplication of the rescaling may overflow; a safer value (such as 1) should be used to avoid inconsistent behavior in untuned systems: better to have the system declare HOGGING consistently but, at the wrong threshold than to randomly bat it around, as happens on fast targets where count\*2500 overflows. | defect | | minor | Test Complete | 2/1/2016 | 2.3.0.0 |
| 4 | 145764 | Fixed the following format warnings from calls to CFE\_EVS\_SendEvent:   fsw/src/hs\_app.c:435: warning: format ‘%08X’ expects type ‘unsigned int’, but argument 4 has type ‘int32’   fsw/src/hs\_monitors.c:570: warning: format ‘%d’ expects type ‘int’, but argument 4 has type ‘uint32’   fsw/src/hs\_custom.c:415: warning: format ‘%i’ expects type ‘int’, but argument 12 has type ‘uint32’   fsw/src/hs\_custom.c:472: warning: format ‘%d’ expects type ‘int’, but argument 6 has type ‘int32’ | defect | | minor | Test Complete | 9/6/2016 | 2.3.0.0 |
| 5 | 4015 | Fixed the following initialization typos in the custom initialization function defined in fsw/src/hs\_custom.c:  HS\_CustomData.UtilMult2 = HS\_UTIL\_CONV\_DIV; HS\_CustomData.UtilDiv   = HS\_UTIL\_CONV\_MULT2; | defect | | minor | Test Complete | 5/21/2012 | 2.3.0.0 |
| 6 | 4053 | GPM-IVV-1280 - HS - Increments Command Error Counter for Internal Commands. In order to keep consistency between cFS applications it is recommend to remove all code to increment the command error counter for all internal commands. Removed code that incremented the command error counter for the HS\_TEP\_WAKEUP\_MID internal command. | defect | | minor | Test Complete | 7/30/2012 | 2.3.0.0 |
| 7 | 4109 | Removed use of the term "Critical" when referencing application and event monitoring. Use of the term "critical", when referring to application and event monitoring, is unnecessary. In theory, all applications are somewhat "critical" or we shouldn't be running them. All applications in the system will need some action taken if they stop running. Of course, some applications are less important than others, but the Application Monitor allows less important applications to have less drastic responses when they fail to check in. Since the monitor can be used for the less critical applications, to avoid any confusion, the term Critical was removed from the source code comments, doxygen users guide, and users guide when referring to Application and Event Monitoring. | Change Request | | minor | Test Complete | 5/8/2013 | 2.3.0.0 |
| 8 | 4133 | Corrected HS\_MAT\_LD\_ERR\_EID Doxygen Information to 'Error Loading MsgActs Table,RC=0x%08X' | defect | | minor | Test Complete | 9/25/2013 | 2.3.0.0 |
| 9 | 145570 | Updated function HS\_CustomGetUtil to protect against Divide-By-Zero | defect | | major | Test Complete | 5/13/2016 | 2.3.0.0 |
| 10 | 145575 | Moved the following function prototypes from hs\_app.c to hs\_app.h:   int32 HS\_AppInit (void); int32 HS\_SbInit (void); int32 HS\_TblInit (void); int32 HS\_ProcessMain (void); int32 HS\_ProcessCommands (void); | Change Request | | minor | Test Complete | 5/16/2016 | 2.3.0.0 |
| 11 | 145738 | HS\_AppInit sets variable that is never used. In hs\_app.c, the variable "Status" is set to CFE\_SUCCESS, immediately after which the code path will always set "Status" to a different value without using the previously-set value. In hs\_app.c:HS\_AppInit , removed assignment Status to CFE\_SUCCESS at declaration. | defect | | minor | Test Complete | 8/5/2016 | 2.3.0.0 |
| 12 | 3284 | Default HS Idle task priority was set to the same prioritoy as the VxWorks UTILITY\_TASK. The default priority has been changed to 252. The Idle task priority should be the lowest priority task on a system. | Change Request | | minor | Test Complete | 8/3/2011 | 2.3.0.0 |