

Core Flight Software System (cFS)

checksum (Cs) Application

Build: 2.4.0.0

FSW Version Description Document

Release Date: 5/3/2017

Signatures

Approved by:



1.0 FSW Version Description

1.1 purpose and summary

The purpose of this build is to continue to refine the cFS Checksum (CS) application product. This build provides various bug fixes and enhancements, adds missing requirements and new initialization requirements, as well as, new assert based unit tests. The enhancements include:

* An update to the One Shot command to allow users to specify the background checksum rate
* New platform configuration parameters to allow users to:
  + Specify the enable/disable state of checksum regions following a reset
  + Specify whether or not to preserve the enable/disable state of checksum regions following a processor reset.

This document serves as the notification of the Build 2.4.0.0 release of the cFS CS application.

Checksum (CS) version 2.4.0.0 is compatible with cFE builds 6.5.0 and above and OSAL builds 4.2.0 and above.

1.2 new 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 | Functionality or Change Description |
| --- | --- | --- | --- |
| 1 | 45926 | N/A | Implement UT-Assert Unit Tests for the CS application |

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 N/A ) | Requirements | High Level Description of Functionality |
| --- | --- | --- | --- |
| 1 | 4126 | CS8002  CS8002.3  CS9000 | Updated the One Shot command to operate at a command specified rate. Command specified rates of zero will default to the platform configured default background checksum rate. Added “LastOneShotMaxBytesPerCycle” to housekeeping telemetry packet. |
| 2 | 4176 | CS9002  CS9003  CS9004  CS9005  CS9006  CS9007  CS9008  CS9009  CS9010  CS9011  CS9011.1  CS9011.2  CS9012  CS9013  CS9013.1  CS9014  CS9014.1  CS9015  CS9015.1  CS9015.2 | Previously the CS application, following a reset, would unconditionally enable global checksumming of the OS and cFE core segments, as well as, the table specified areas of memory (if the table loads are successful).  The CS application has been updated to allow users to specify the enable/disable state of each checksum region following a reset and whether or not to preserve the enable/disable state of each checksum region following a processor reset. |
| 3 | 146120 | N/A | When the CS application exits out of its main processing loop, CS performed the following check and issued an error event message.  if (Result != CFE\_SUCCESS || CS\_AppData.RunStatus != CFE\_ES\_APP\_RUN )  The RunStatus however, may not equal CFE\_ES\_APP\_RUN in several nominal cases when the application is terminated via ES commanding. CS has been updated to check for the two possible RunStatus error conditions and send a proper error event message. Otherwise an informational event message is sent. In either case (error or nominal) the system log is written to. |
| 4 | 146106 | N/A | The CS application had not been checking the return value when registering for Event Services. This check has been added. An error return code will write the error and return code to the system log and exit the initialization function with the error return code. |

1.3 MISSING Planned FEATURES AND KNOWN PROBLEMS

Table 1.3-1 identifies the functions and known discrepancies that are absent from CS Build 2.4.0.0. Any workarounds that may apply are identified.

Information on currently open DCRs is available at:

<http://gs580v-fsbmks10.ndc.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 CS DCR 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](mailto:susie.strege@nasa.gov).

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

Trac ticket references are proceeded with a ‘#’ character.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **FSB DCR or Trac #** | **Description** | **Reason for Absence** | **Affected Requirement or Component** | **Workaround** | **Planned Delivery** |
| 1 | 145976 | CS Unit Tests: Delete Local Copies of UT-Assert Files After Changes In Those Files Are Released in Actual UT-Assert Library. Local copies of certain UT-Assert library files are being added to the CS unit test directory, because required stub functions were missing. This is a workaround while waiting for a new version release of UT-Assert library where these missing stub functions will eventually be added to the library. | Implementation is dependent on UT-Assert Library release. | UT-Assert Library | None | Not Determined |
| 2 | 4111 | CS - Add Trick Simulation Support (JSC Request) | Implementation is dependent on customer needs. Community input is needed. | Trick | None | Not Determined |
| 3 | 3879 | Expand CS to compute CRC for each bank of EEPROM | Implementation is dependent on customer needs. | CS App | None | Not Determined |
| 4 | 4075 | The overall EEPROM checksum is in housekeeping telemetry. Add the overall checksums for the other table specified areas: tables, applications, and memory regions. | Implementation is dependent on customer needs. | CS App | 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:

**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 |
| OSAL | Operating System Abstraction Layer | 4.2.0.0 |

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 | 2.4.0.0 | Not application. Executables must be created for the specific mission/platform |
| Installation Procedures & Special Instructions **(See Section 3.0)** | No | 3.1 | See cFS Deployment Guide    babelfish.arc.nasa.gov (in git system TOOLS master branch)  and  <http://sourceforge.net/projects/coreflightexec> |
| Source Code of this FSW Build | Yes | 2.4.0.0 | gs580v-fsbmks10.ndc.nasa.gov. MKS label CS-ALL-Build2.4.0.0\_MAY3-2017  babelfish.arc.nasa.gov (in git system cs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs-cs> |
| 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 | Yes | 2.4.0.0 | gs580v-fsbmks10.ndc.nasa.gov. MKS label CS-ALL-Build2.4.0.0\_MAY3-2017  babelfish.arc.nasa.gov (in git system cs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs-cs> |
| Ground System Scripts developed by FSB | Yes | 2.4.0.0 | gs580v-fsbmks10.ndc.nasa.gov. MKS label CS-ALL-Build2.4.0.0\_MAY3-2017  babelfish.arc.nasa.gov (in git system cs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs-cs> |
| 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 | Yes | 2.4.0.0 | gs580v-fsbmks10.ndc.nasa.gov. MKS label CS-ALL-Build2.4.0.0\_MAY3-2017  babelfish.arc.nasa.gov (in git system cs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs-cs> |
| Unit Test Data | Yes | 2.4.0.0 | gs580v-fsbmks10.ndc.nasa.gov. MKS label CS-ALL-Build2.4.0.0\_MAY3-2017  babelfish.arc.nasa.gov (in git system cs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs-cs> |
| Unit Test Results | Yes | 2017/03/29 | gs580v-fsbmks10.ndc.nasa.gov. MKS label CS-ALL-Build2.4.0.0\_MAY3-2017  babelfish.arc.nasa.gov (in git system cs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs-cs> |
| FSW Make Files | No | 2.4.0.0 | gs580v-fsbmks10.ndc.nasa.gov. MKS label CS-ALL-Build2.4.0.0\_MAY3-2017  babelfish.arc.nasa.gov (in git system cs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs-cs> |
| Linker & Compiler Configuration Files | No | 2.4.0.0 | gs580v-fsbmks10.ndc.nasa.gov. MKS label CS-ALL-Build2.4.0.0\_MAY3-2017  babelfish.arc.nasa.gov (in git system cs\_app\_master branch)  and  <http://sourceforge.net/projects/cfs-cs> |
| Requirements version (from MKS) | Yes | 1.3 | MKS label – version 1.3 |

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 3.1 | Available with cFE open source release:  <http://sourceforge.net/projects/coreflightexec/>  babelfish.arc.nasa.gov (in git system TOOLS master branch)  and on gs580v-fsbmks10.ndc.nasa.gov |

4.0 Configuration summary and version identification

CS Build 2.4.0.0 can be found on gs580v-fsbmks10.ndc.nasa.gov, sourceforge: <http://sourceforge.net/projects/cfs-cs>, and babelfish.arc.nasa.gov (in git system cs\_app\_master branch). Verification of the version can be done by sending a CS NOOP command which produces an event message containing the version information. In addition, the initialization event message generated during the application startup provides the version information.

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

CS…………………………………………………………………………………………….Checksum Application

DCR Discrepancy/Change Request

ETU Engineering Test Unit

FSB Flight Software Branch

FSW Flight Software

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 Checksum build 2.4.0.0 DCRs/Trac Tickets

Trac ticket references are proceeded with a ‘#’ character.

|  | | | |
| --- | --- | --- | --- |
| **No.** | **DCR/Trac Ticket #** | **Description** | **Type** | | **Priority** | **State** | **Date Reported** | **Build Target** |
| 1 | #30 | CS: Fix compiler error using with the latest build scripts | defect | | minor | Test Complete | 06/29/2015 | 2.4.0.0 |
| 2 | #39 | Allow C99 code in APPS | defect | | minor | Test Complete | 01/28/2016 | 2.4.0.0 |
| 3 | 3905 | CS - Missing Doxygen in Platform Configuration File | defect | | minor | Test Complete | 08/24/2011 | 2.4.0.0 |
| 4 | 3969 | Housekeeping telemetry points indicating that a CS one shot or recompute is in progress are misleading. Also the requirements associated with these telemetry points are missing. | defect | | moderate | Test Complete | 01/24/2012 | 2.4.0.0 |
| 5 | 3981 | GPM-IVV-1356 - CS - Missing requirement to test for invalid non-volatile memory segments.  There is no requirement for the CS app to test for or send an event message for an invalid table-defined non-volatile memory segment.  This test and subsequent event message are implemented during validation of the non-volatile memory checksum table in CS\_ValidateEepromChecksumDefinitionTable() in \apps\cs\fsw\src\cs\_table\_processing.c (build 4.1 version 1.8 2010/05/28 11:14:34EDT).  The relevant error event IDs are CS\_VAL\_EEPROM\_RANGE\_ERR\_EID and CS\_VAL\_EEPROM\_STATE\_ERR\_EID, but these are not tested in any build test procedure.    For other memory, there is a requirement for the CS app to test for and send an event message for invalid table-defined segments.  This is implemented in  CS\_ValidateMemoryChecksumDefinitionTable() in the same file cs\_table\_processing.c.  The relevant error event IDs are CS\_VAL\_MEMORY\_RANGE\_ERR\_EID and CS\_VAL\_MEMORY\_STATE\_ERR\_EID, and these are tested in the build test procedure gc\_cs\_usermem.prc. The requirement for the memory validity test and event message is CS6000.2 which states: “If the table-defined Memory is invalid, CS shall send an event message.”    There is no similar requirement for a non-volatile memory validity test and event message.  Such a requirement might be a sub-requirement to CS2001, which is similar to CS6000. CS6000 and CS2001 are the requirements to perform memory and non-volatile memory, respectively. | defect | | moderate | Test Complete | 01/31/2012 | 2.4.0.0 |
| 6 | 3983 | GPM-IVV-1355 - CS - Missing requirement for event message that reports new non-volatile memory checksum result.  CS2006 states: “Upon receipt of a Recompute Non-volatile Checksum Segment command, CS shall recompute the baseline checksum for the command-specified non-volatile segment”  There is no sub-requirement to report the new baseline once it is computed, but this is reported in CS\_RecomputeEepromMemoryChildTask() in cs\_compute.c (build 4.1 version 1.1 2011/06/07 17:34:43EDT)  The watch for event message CS\_RECOMPUTE\_FINISH\_EEPROM\_MEMORY\_INF\_EID is set up in test procedure gc\_cs\_nvmem.prc but there are no checks and no operator notifications about whether or not it was received, thus there is no indication of the success of the test.  All other recompute functions have a requirement for this message when checksumming other areas:  CS3004.1 for the OS, CS3009.1 for CFE, CS4005.1 for apps, CS5005.1 for tables, and CS6005.1 for memory segments.  For their applicable areas, these requirements all state: “Once the baseline CRC is computed, CS shall generate an event message containing the baseline CRC.”    The similar requirement for this event message in the non-volatile memory recompute function is missing, as is the test for it. | defect | | moderate | Test Complete | 02/01/2012 | 2.4.0.0 |
| 7 | 3984 | GPM-IVV-1352 - CS - Missing requirement for Get Entry ID Memory Command.  There is no requirement for the CS function to retrieve an entry ID based on an address from the Memory table, which is implemented in CS\_GetEntryIDMemoryCmd() in cs\_memory\_cmds.c (build 4.1 version 1.4 2010/03/29 16:57:18EDT) at line 414.  There is a similar function to retrieve an entry ID based on an address from the non-volatile memory table, which is implemented in CS\_GetEntryIDEepromCmd() in cs\_eeprom\_cmds.c (build 4.1 version 1.5 2010/03/29 16:57:26EDT) at line 414 and which is described by requirement CS2008 that states: “Upon receipt of a Get Non-volatile Checksum Segment command, CS shall send an event message containing the segment number for the command-specified non-volatile address", from the L5 requirement set dated 2011/11/2.  The implementation of this ground command is GC\_CS\_GetMemoryEntryID and is used in the test procedure gc\_cs\_usermem.prc but without a specific requirement for it.  The similar command GC\_CS\_GetEepromEntryID is tested in gc\_us\_nvmem.prc specifically against CS2008. | defect | | moderate | Test Complete | 02/14/2012 | 2.4.0.0 |
| 8 | 3990 | CS Requirements Specify Unconditional Enabling of Checksumming Following Processor Reset  Currently during a processor reset or power on reset the CFS/CS application will unconditionally enable global checksumming, OS checksumming, and cFE core checksumming. In addition, during a processor reset or power on reset, if the table loads from EEPROM are successful (which they should always be) then EEPROM checksumming, memory checksumming, application checksumming, and table checksumming will unconditionally be enabled.    These 7 items work fine for the power on reset (although one could argue the global enable/disable should be a platform configurable item. For the processor reset these 7 items should be preserved and retain the values they had before the processor reset.  Note: The requirement updates were made in accordance with the decisions made under DCR 4017. | enhancement | | moderate | Test Complete | 03/08/2012 | 2.4.0.0 |
| 9 | 4017 | CS - Does Not Allow Missions to Configure Checksum Regions Following a Reset.  Consider making the enable state for each checksum area a platform configurable item i.e. let the user specify the enable/disable state of each checksum region on a power-on reset.    Consider adding a configuration parameter that will allow the user to specify whether or not to preserve the state of the checksum regions over a processor reset.  Both considerations will be implemented as a solution to this DCR. | enhancement | | moderate | Test Complete | 05/22/2012 | 2.4.0.0 |
| 10 | 4176 | CS - Allow One Shot Command to Operate at a Different Rate than the Configured Background Checksum Rate (MMS Request)  Currently the CS application uses a fixed rate that is specified in the platform configuration file) for all checksumming. | enhancement | | moderate | Test Complete | 12/11/2014 | 2.4.0.0 |
| 11 | 145923 | CS - CFE\_EVS\_SentEvent Format Warnings | defect | | minor | Test Complete | 10/24/2016 | 2.4.0.0 |
| 12 | 145926 | Implement UT-Assert Unit Tests for the CS Application | enhancement | | major | Test Complete | 10/24/2016 | 2.4.0.0 |
| 13 | 146034 | CS - Remove/Replace Copyright Symbol from Comment Blocks and MKS History | cosmetic | | minor | Test Complete | 01/25/2017 | 2.4.0.0 |
| 14 | 146070 | CS Requirements Need to Be Updated To Allow One Shot Command to Operate at Different Rates | enhancement | | moderate | Test Complete | 02/22/2017 | 2.4.0.0 |
| 15 | 146106 | CS Does Not Check Return Value When Registering for Event Services | defect | | minor | Test Complete | 03/05/2017 | 2.4.0.0 |
| 16 | 146109 | CS: The commands that contain an EntryID are not 32-bit aligned | defect | | minor | Test Complete | 03/08/2017 | 2.4.0.0 |
| 17 | 146113 | CS - Command Definitions Should be Defined in cmds.c.  The app.c unit contains definitions for the NOOP, Reset, and Background commands. To keep in sync with other cFS applications and following the cFS Development Standards, these function definitions should be moved to the cmds.c unit. The function prototypes for these functions should also be moved to cmds.h. | defect | | minor | Test Complete | 03/15/2017 | 2.4.0.0 |
| 18 | 146120 | CS Sends Error Event Message On Nominal Application Exit.  When the CS application exits out of its main processing loop, CS will check for a "fatal" process error via the following code:    if (Result != CFE\_SUCCESS || CS\_AppData.RunStatus != CFE\_ES\_APP\_RUN )    In this case an error event message is sent and the system log is written to.    The RunStatus may not equal CFE\_ES\_APP\_RUN in several nominal cases when the application is terminated via ES commanding. CS should be updated to check for the two possible RunStatus error conditions and send a proper error event message. Otherwise an informational event message should be sent. In either case (error or nominal) the system log should be written to. | defect | | moderate | Test Complete | 03/21/2015 | 2.4.0.0 |