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:

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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 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.

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.	Trick	None	Not Determined

			Community input is needed.			
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

Software Element	Changed with this Version?	New Version or Date	Location
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

Software Element	Changed with this Version?	New Version or Date	Location
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

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.	defect	moderate	Test Complete	02/01/2012	2.4.0.0

		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.					
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	defect	moderate	Test Complete	02/14/2012	2.4.0.0

		is tested in gc_us_nvmem.prc specifically against CS2008.					
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