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Gravity Probe B Relativity Mission

C&DH ADP Review – Final Issue Close Out

(Command & Telemetry Unit, Interface Unit, Flight Computer / Command & Control Computer Assembly, Solid State Recorder)

S0839, Rev. -

March 27, 2003

Close Out Certification

The C&DH data package* has been reviewed by Stanford University. MSFC and the IRT have been requested to identify any flight risks from any review to the Stanford University review chairman. The chairman, having assessed all inputs received as of the review date of 27 March 2003, finds the C&DH components reviewed acceptable for the GP-B flight mission contingent on the acceptable closure of the action items and acceptable system level testing.

* the following items were reviewed: Command & Telemetry Unit, Interface Unit, Flight Computer / Command & Control Computer Assembly, Solid State Recorder

ADP Review Chairman:

31 MAR 03

Bill Bencze **Date**

GP-B Program Manager:

1 Apr 03

Gaylord Green **Date**

Concurrence:

Systems Engineering **Date**

Concurrence:

4/1/03

Quality Assurance **Date**

ITAR Assessment Performed

3/3/03

Tom Langerstein

ITAR Control Req'd? ☐ Yes ☒ No

C&DH ADP Data Review (telecon) and Issues Resolution Meeting Minutes:

Location: Lockheed Martin, Building 255 Room OA235, 1 pm, March 27, 2003
Minutes prepared by: Steve Young

References:

LM EM SYS 277, Response to MSFC issues for SPRU, PDU, Battery and SSR, Rich Whelan, March 27, 2003
[note: references are ITAR / U.S. Export Controlled documents]

Attendees:

MSFC: ..... Charlie Dischinger, Howard Estes, Albert Froelich, Terry Koelbl, Jim Looney
SU: ..... Bill Bencze, Dorrene Ross, Steve Young
LM: ..... Rich Whelan, Lim Mar, Roy Morishige, Mike Sisley, Mike Miranda, Dave Steele

Background:

Acceptance Data Packages for all Spacecraft and Space Vehicle components were sent to Marshall Space Flight Center for review. MSFC responded with questions and issues raised by the ADPs. A series of Issues Resolution Meetings were scheduled to address those questions and achieve issue closure based on appropriate discussions, clarifications, or actions. The issue closure process began when several ATC component issues were addressed in January 2003. Meetings scheduled for March and April (2003) will address other subsystems and their components.

The March 27, 2003 meeting focused on the Command & Data Handling (C&DH) subsystem, including the Command & Telemetry Unit (CTU), Interface Unit (IU), Flight Computer (FC) / Command & Control Computer Assembly (CCCA), and Solid State Recorder (SSR).

Overview / Summary:

Review of the MSFC questions regarding the C&DH component ADPs was divided into two sections. First, those issues not included in EM SYS 277 were discussed and brought to closure pending appropriate clarifications and/or provisions. All issues reviewed and further discussion regarding these items are included below. Next, the C&DH component questions included in EM SYS 277 were discussed, along with the "Standard Questions" listed in the referenced document. The complete results of this discussion are not included below. However, several clarifications of the issue resolutions were added and are noted in this document. The remainder of the C&DH component issues were closed as stated in the EM.

C&DH Questions / Issues from MSFC:

	Sybsystem	MSFC Reviewer	Findings/issues	Finding resolution
1	Cmd & Telem Unit (CTU)	Feltner	. A verification requirements compliance matrix (VRCM) was expected. Table 5.5-1, Cross Reference Matrix (CRM), in the Acceptance Test Procedure (ATP) includes some of the data typically provided in a VRCM. The CRM traces specification requirements to the ATP and lists verification references for most (not all) requirements verified by test. However, no verification document references are provided for requirements verified by analysis or inspection.	See EM SYS 277
2	Cmd & Telem Unit (CTU)	Feltner	No analysis documentation is provided for the requirements to be verified by analysis	Analysis contained in CDR (reliability, worst case, thermal) and all known information is on the VRC. CLOSED
3	Cmd & Telem Unit (CTU)	Feltner	The ADP does not include a discussion of how the burn-in requirement (4.1.2.4 of LMMS P063118F) is met. Reviewing the Operating Time Log shows that TLM Side A was operated for only 269.4 hours. How does that meet the 300-hour requirement (is the requirement for each side or cumulative for both)? The last 100 hours failure free requirement appears to have been met if one assumes the last CTU failure is 6041F-006 (dated 1/28/98).	Roy Morishige (3/18/03) 300 hour Burn-In is accumulated by both primary and redundant (A & B) Burn-In hours. CLOSED
4	Cmd & Telem Unit (CTU)	Feltner	No drawings are provided in the ADP. Drawings are available on the VRC, but they do not appear to be a complete set. A drawing list/tree is not provided, so the missing drawings cannot be determined.	B size drawings exist on paper in data center -- can be provided if necessary. CLOSED
5	Cmd & Telem Unit (CTU)	Feltner	The only log book provided is the Unit Time Log. I expected to see a connector mate/demate log but did not find one.	Roy Morishige (3/24/03) Mate/demate log not required by SOW. CLOSED
6	Cmd & Telem Unit (CTU)/Interface Unit	Feltner	A verification requirements compliance matrix (VRCM) was expected. Table 5.6, Cross Reference Matrix (CRM), in the Acceptance Test Procedure (ATP) includes some of the data typically provided in a VRCM. The CRM traces specification requirements to the ATP and lists verification references for most (not all) requirements verified by test. However, no verification document references are provided for requirements verified by analysis or inspection.	See EM SYS 277
7	Cmd & Telem Unit (CTU)/Interface Unit	Feltner	No analysis documentation is provided for the requirements to be verified by analysis.	Analysis contained in CDR (reliability, worst case, thermal) and all known information is on the VRC. CLOSED

8	Cmd & Telem Unit (CTU)/Interface Unit	Feltner	No penalty vibration was performed after replacement of a cracked connector J17 (see failure report 6041F-39). Typically, a penalty vibe would be performed to verify workmanship to replace components and/or if the box was opened. (Note: Failure was considered a part manufacturing defect – not a design problem).	Rework and testing handled internally by vendor and approved by DCMA representative. See clarification of J17 connector function(1). CLOSED
9	Cmd & Telem Unit (CTU)/Interface Unit	Feltner	The ADP does not include a discussion of how the burn-in requirement (4.1.2.4 of LMMS P063118F) is met. Reviewing the Operating Time Log shows that IU Side A was operated for only 239.6 hours. How does that meet the 300-hour requirement (is the requirement for each side or cumulative for both)? The last 100 hours failure free requirement appears to have been met if one assumes the last IU failure is 6041F-039 (dated 5/26/98).	Roy Morishige (3/18/03) 300 hour Burn-In is accumulated by both primary and redundant (A & B) Burn-In hours. CLOSED
10	Cmd & Telem Unit (CTU)/Interface Unit	Feltner	. No drawings are provided in the ADP. Drawings are available on the VRC, but they do not appear to be a complete set. A drawing list/tree is not provided, so the missing drawings cannot be determined.	B size drawings exist on paper in data center -- can be provided if necessary. CLOSED
11	Cmd & Telem Unit (CTU)/Interface Unit	Feltner	A connector mate/demate log is not provided.	Roy Morishige (3/24/03) Mate/demate log not required by SOW. CLOSED
12	Flt computer (FC)/ Cmd & Ctrl Comp Ass'y (CCCA)	Cobb	None	
13	Flt computer (FC)/ Cmd & Ctrl Comp Ass'y (CCCA)	Feltner	The "original" ADP data is not loaded on the VRC. As a result, no data is available prior to October 1998. The missing data includes any problem reports, deviations, waivers, MRB actions, on/off cycles, connector mate/demate cycles, etc prior to October 1998. Action: . Provide data for the original ADP.	Hard copy of vendor data package at SU CLOSED
14	Flt computer (FC)/ Cmd & Ctrl Comp Ass'y (CCCA)	Feltner	A verification requirements compliance matrix is not provided. The matrix is needed to show the mapping of requirements to the verification documentation (test data and/or analysis documents). The CCCA specification lists several requirements that are verified by analysis. No analysis documentation is provided in the ADP. Action: Provide a VRCM. Provide the missing analyses or point to the data that verifies the requirements.	See EM SYS 277
15	Flt computer (FC)/ Cmd & Ctrl Comp Ass'y (CCCA)	Feltner	The only drawing provided is the Backplane Schematic. A drawing list/tree is not provided, so the missing drawings cannot be determined. Action:. Provide a drawing tree and the missing drawings	See EM SYS 277
16	Sol St Recorder (SSR)	Feltner	none of the analyses mentioned in the VRCM are included.	Mike Miranda (3/5/03) Found in CDR, scanned (electrical, thermal, structural, reliability, radiation, worst case, m/p list) -- CLOSED

17			Verify that all Mandatory Inspection Points (MIP's) have been performed/stamped.	See EM SYS 277
18			Verify the presence of an as-built configuration list and audit it to the as design documentation.	See EM SYS 277
19			Verify that all contractually required drawings are contained; top ass'y only in pkg	See EM SYS 277
20			Verify that all drawings are approved and released; top ass'y only in pkg.	See EM SYS 277
21			Verify that all redlines or test departures have been approved.	See EM SYS 277
22			Verify that all required Inspection Reports are approved.	See EM SYS 277
23			Verify that all Deviation/Waiver's are approved and closed.	See EM SYS 277
24			Verify that all Open Work/Deferred Work is documented.	See EM SYS 277
25			Verify the presence of a Limited Life Items List .	See EM SYS 277
26			Verify the presence of a Cleanliness Certificate.	See EM SYS 277
27			Verify that all Temporary Installed Items are listed.	See EM SYS 277
28			Verify that all Loose Delivered Items are listed.	See EM SYS 277
29			Verify the presence of an as-built EEE Parts List	See EM SYS 277 SKR97031 on the VRC
30			The inrush requirement was not met. Disposition to VRIC260257 was UAI. The specification was not changed, but this VRIC mentioned in VRCM.	See EM SYS 277
31			VRIC – 2602596:31 PMdocumented two unverified failures – disposition is UAI a. failed to record data b. +28V input current did not decrease as expected in SLEEP mode	See EM SYS 277
32			260384:Per LMMS R14447, error can occur in off-nominal situation in ground base software only. PRF 971035 and attachments detail a patch that can keep error from occurring. Covered by a CARD?	Commands that caused errors were provided for software diagnostics, not required for normal use. See clarification below [(2)]. CLOSED
33			260385: Anomaly attributed to test equipment. PFR 971036 details a sequence of commands from test hardware that can cause the anomaly to occur.	See EM SYS 277 Test set error only -- commands are non-databased and can not be issued in-flight. See clarification below [(3)]. CLOSED

Additional Notes:

(1) Clarification of J17 connector function, Lim Mar (3/27/03)

Interface Unit Connector J17 is the redundant interface between the Interface Unit (IU) and the Command and Telemetry Unit (CTU) and pin 21 is a spare pin. Pin 21 is open and does not interface the ACE.

(2) Clarification of issue #32, Roy Morishige (3/7/03)

S/N: 260384 No Constraints and Restriction Document (CARD) required, since the 2 commands that created the error are not included in the Flight Software Command Set. They were 2 Ground Command Database commands being provided for possible usage in a contingency situation, if required. In addition, the occurrence of this error has be eliminated by a one word patch.

(3) Clarification of issue #33, Roy Morishige (3/7/03)

S/N; 260385 on the first page states "Concur with SEAKR's disposition of Test Set Anomaly, No defect in Flight Hardware." Also SEAKR Memorandum dated 17 November 1997 states "This anomaly is caused by the Test Set occasionally not properly initializing its logic during reset operation." Therefore, PFR 971036 is correctly closed out to SEAKR's test setup/test equipment/procedure and not Flight Hardware.