|  |
| --- |
| Investigation: FIELDS |
| Progress accomplished this period: | October 2014 Reporting Period |
| 1. | Project Management and Product Assurance |
|  | a. | Project Management* Addressing requests for additional information regarding the July 2013 FIELDS cost change proposal.
* Supported the following PERs and associated TRRs
	+ None
* Supported the following FRBs
	+ None
* Supported the following PSRs
	+ EDI GDU FMs 2-8
	+ MMS PSR, including pre-PSR instrument presentations for SDP and EDI GDU.
* Received delivery of the following hardware items at UNH
	+ EDI EM GDE (from IWF) for HVOC exchange practice
	+ EDI FM Gun4/GDE9 (from IWF) for GDU FM9 I&T
	+ DFG flight spare sensor and electronics
* Delivery of the following flight hardware items from UNH to GSFC
	+ None
* Supported processing of NCRs and risks
 |
|  | b. | Product Assurance |
|  |  | Turco / Salwen* Practiced HVOC swap in the EM GDE in preparation for rework of GDE9. Prepared activity sheet.
* Conducted inspection of Gun4/GDE9 at IWF. Hand carried these units from IWF to UNH for GDU FM9 I&T.
* EIDP uploading
 |
| 2. | Systems Engineering  |
|  |  | Rau, Dors, Needell* Supported GDU SN09 (flight spare) test program planning
* Supported EDI GDU "Super" PSR for all delivered units
* Prepared for and supported Mission PSR and SWG/SWT
* Prepared for and supported Commissioning Mtg and FIELDS Team Mtg
* Received delivery of DFG flight spare sensor and electronics
* Released AFG Sensor Temperature Calibration Report
* Finished submitting FIELDS verification material for FM units
 |
| 3. | Post-Delivery Support (UNH) |
|  |  | Observatory Support (FIELDS)* Supported EDI FSW loads
* Finished supporting OBS-3 Pre-Ship CPT
* Performed final ADP RE inspections for OBS1 +Z, OBS2 -Z
* Performed walk down of SDP and EDI MLI and FOV on OBS-1 and OBS-2
* Supported EDI FSW loads on OBS1 and OBS4
* Supported MRT17 SOC led BDM runs on OBS
* Supported MRT17 SOC led FIELDS run on Flatsat and Table top discussion
* Released Observatory level SDP Sensor Safety Removal procedure
* Attended Launch Site Familiarization Training at GSFC
* Performed analysis of OBS power measurements requested by MMS
* Attended discussions on SDP deployment spin rates and ADP max bending moment with GNC personnel
* Continued supporting commissioning planning discussions with SOC
* Continued I&T planning for FIELDS at the OBS level for Cape Ops
* Continued reviewing all test data from previous OBS tests
 |
|  |  |
| 4. | Science and Science Data Processing  |
|  |  | SWT and SWG * Participation at SWT and SWG meetings at GSFC
* Participation in all science planning discussions.

Science data processing activities (Compiled by Chutter)* ALL
	+ Participated to MMS SWT and Fields meeting in GSFC. Important decisions have been taken and subsequent actions have been decided regarding interfacing software within the team, data and CDF format
	+ Continued working through coordinate system requirements
	+ Continued working on software to run at SDC
* UNH
	+ Continued work on EDI E Field interfaces
	+ Continued review of science and engineering telemetry from observatory level testing
	+ Worked on scripting to control batch science processing
	+ Sample CDF test files submitted to SPDF team for review; SPDF approved
	+ Continued development of FIELDS real time displays
	+ Worked on combined B product software (with Cluster data)
	+ Worked on combined E product software (with Cluster data)
* LPP
	+ SCM CDF test file has been submitted to SPDF team for review.
	+ Automatic increment of CDF data file version number now includes latest product version (Z number).
	+ Log messages extended + log file completed.
	+ Minor bug fixes.
* UCLA
	+ Continued bi-weekly mag team telecons to develop calibration data flow, and magnetic conference procedures
	+ Work continues on magnetic field data processing - emphasis on timing
	+ Developing inflight calibration procedures
	+ Work continues on inflight calibration and procedures
* GSFC
	+ Created MMS-style Attitude, Ephemeris and Sun Pulse Time (hk 101) files, using actual Cluster data as input
	+ Delivered latest software, including coordinate transformation library, to SDC
	+ Ran experiments with compression with the help of SPDF staff
* IRFU
	+ Switched to a new version of NASA CDF patch for Matlab which improved writing CDF files containing TT2000 time variables
	+ Reworked structure of the SDP files to align with the data processing concept which was decided at the data processing meeting in September
* LASP
	+ Working on ADP software
 |
|  |  |  |
| 5. | Magnetometers |
|  | a. | DFG  |  |
|  |  |  | * Flight spare sensor and electronics delivered to UNH.
	+ Acceptance test complete (early Nov).
 |
|  | b. | AFG |  |
|  |  |  | Pre-launch Preparations* Louise Lee converting analysis software to Python.
* Continued bi-weekly mag team telecons to develop calibration data flow, and magnetic conference procedures
* Continued to evaluate data processing activities - with emphasis on timing corrections.
* Attended Mag team meeting on October 19th (Attendees: C. T. Russell, R. J. Strangeway, H. K. Leinweber, I. Dors, O. Le Contel, D. Fischer, F. Plaschke, W. Magnes, R. Nakamura, M. Chutter, L. Mirioni, K. Bromund, G. Le. L. Avanov, L. Kepko, B. J. Anderson, J. Slavin).
* Developed list of “Requests for Action” to document the magnetometer data reduction processes, including calibration data.
* Most of the magnetometer team also attended the MMS SWT, and the associated splinter meetings, including Science Data Center splinter, commissioning splinter and FIELDS meeting.

Post-launch Preparations* Continuing to assess effort requirements to develop and maintain calibration system.

Engineering: Post-delivery Activity* Watching over activities in assessing LM6142.
 |
|  |  |  |  |
|  | c. | SCM | * FMS EIDP sent to UNH for review. =
 |
|  |  |  |  |
| 6. | EDI |
|  |  | * Prepared and conducted the PSR for GDU FMs 2-8

GDE – UNH efforts* Practiced optocoupler replacement on EQM GDE
* Received GDE SN9 from IWF; incoming test successful

GDE - IWF efforts* Shipped EQM GDE to UNH to allow practicing of optocoupler replacement
* Shipped GDE SN9 to UNH

Gun - IWF efforts* Gun SN4
	+ Completed assembly; performed gun calibration
	+ Shipped to UNH, together with GDE SN9

Flight Software* Generated load scripts for Observatories 1 and 4
* Loaded FSW build 06 and associated tables on Observatories 1 and 4
 |
|  |  |  |
| 7. | SDP (KTH, UNH) |

|  |  |  |
| --- | --- | --- |
|  |  | * Supported commissioning planning activities.
* Provided EM SDP hardware to the FIELDS SE team for FIELDS FlatSat test bed in the room 420 lab at UNH.
 |

|  |  |
| --- | --- |
| 8. | ADP |
|  |  | LASP ADP Post-Delivery Support Activities * Participation with Project in discussion, simulation and analysis activities to address negative margin predictions for ADP boom bending strength during formation maintenance maneuvers. See Issues and Concerns below
* ADP WOA closure review
* Supported MMS IS I&T planning teleconferences
 |
|  |  |  |
| 9. | Commissioning and Mission Operations (Needell) |
|  |  | * Supported MRT17 @ LASP
* Continued to support Commissioning planning
* Updated FIELDS CDPU Users Manual
* Participated in PSR/SWT/Commissioning TIM/FIELDS Team Meeting @ GSFC
* Reviewed/updated IS Flight Ops Wiki Pages @ LASP
* Prepared and Delivered slides for FORR as requested by ISSE
* Submitted revised Command/Telemetry Spreadsheets for CTDB7.0 release
 |
|  |
| 10. Problems encountered and updates this period |

|  |  |  |
| --- | --- | --- |
|  |  | EDI* [UPDATE] Unacceptable LED current trend in FM9 GDE Lower Injector during FM9 GDU TV test (PFR-10160.53-147-IP)
	+ The useful life of GDU SN9, including the operational factor of 4 (500 eV and no slow survey), is less than 2 years. ESTIMATE: Remaining life (full performance, continuous operation of gun at 1keV) at +5&#730;C": 131 days.
	+ Unlike the Gun Deflectors we can only claim a factor of 2 in life time (for operation at 500eV) since the Lower Injector is in use in electric field mode and ambient mode. Assumption is 10 deg C in the GDE. Another factor of 2 may be gained by not operating this GDU in slow survey periods. Some additional lifetime may be gained by restricting ambient mode operation to 250 eV.
	+ Cause: Defective HVOC in the FM9 GDE.
	+ Action:
		- For GDU FM4: Replace the FM9 GDE with the FM4 GDE. Reintegrate and retest the GDU FM4.
		- For GDU FM9: Rework the FM9 GDE: replace the problematic HVOC and retest.
	+ UPDATE: The defective HVOC was replaced in GDE9 at UNH with UNH-built HVOC #613. Subsequent bench test was successful. Test in vacuum underway.
* [STATUS UNCHANGED] Low Beam Current at 500 eV (EDI GDU FM9) (PFR-10160.53-136-OP)
	+ During the first functional test in vacuum (room 105 chamber) of GDU SN9 we did not get enough beam current out at 500 eV. At 1keV things were just fine.
	+ FFT retest in room 145 chamber, per FRB recommendation, showed situation at 500 eV was unchanged, and that we now had the same problem at 1keV.
	+ Corrective action: FRB recommended replacement of the BGS with the available spare (BGS SN13) and conduct of measurements to assess the impact on calibration.
	+ Test of the Gun/GDE SN9 with the new BGS showed adequate beams but a discrepancy of ~3 degrees in the pointing. Subsequent checks of the alignment in the test setup and beam tracing calculations provided evidence that MGSE alignment and the effect of magnetic field could account for the discrepancy. The decision was made to proceed with GDU reintegration and retest.
	+ The GDU 9 FFT in vacuum (room 105 TV chamber) showed nominal results except that the azimuthal scan across the hole in the Maheu hat revealed a change of about 2 degrees in azimuth from the test performed with the previous BGS. Approximately 1.5 degree of this change remains after accounting the effects of the magnetic field differences in the 2 chambers.
	+ The GDU9 PER recommended proceed at risk. Accept this amount of deviation from IWF calibration and develop an algorithm for in-flight corrections. A separate NCR (PFR-10160.53-139) was initiated and a residual risk (PIMS ID 125) defined.
	+ [Cause/STATUS}: Awaits inspection of the removed BGS. Retest found higher than expected beam current. Inspection is pending. NCR to remain open pending this investigation
* [CLOSED] Upper Injector +140V offset (EDI Gun FM4) (PFR-10160.53-137-OP)
	+ During the functional test of the reintegrated FM4 Gun, IWF measured a+140V offset in Upper Injector. The+140V offset is linear over the full range from 0...2000V. This appears to be a fixed offset, not a gain error. This voltage is provided by a channel in the Gun Optics board (the half board). The test was performed on 12 May and repeated on 13 May with the same result.
	+ The SN 4 EDI Gun was disassembled at IWF to investigate the voltage offset on the Optics board UI channel found during Gun stack testing. The offset was not observed in subsequent board level testing.
	+ [CLOSED]:
		- IWF identified and corrected the problem. A missing screw in the assembly prevented proper grounding.
		- Gun 4 assembly and testing has resumed.
* [UPDATE] Lower than expected impedance measurement during safe to mate (EDI GUN FM8) (PFR-10160.53-133-IP)
	+ During the safe to mate incoming receiving inspection test at UNH, a lower than usual impedance measurement was seen across the +5V line (P5V2) to ground: (800 Ohm versus ~4M Ohm for earlier units). IWF reported also that their incoming test at UNH showed a higher than previously measured and out of family supply current at the P5V2 line. The Gun performance is otherwise nominal
	+ Tests at UNH by UNH and IWF to investigate the cause of the anomaly, including tests in vacuum, have identified possible sources of the problem. Partial disassembly is required to further isolate the problem. The Gun/GDE were returned to IWF for further investigation, rework and recalibration.
	+ IWF has isolated the problem to the Beam Board. IWF will replace the beam board with a new one assembled at UNH.
	+ Gun 8 has been reassembled and tested using the new beam board. The FM8 Gun/GDE calibration and the subsequent integration with GDU8 are complete. GDU8 environmental testing and detector characterization were successful
	+ [UPDATE] The NCR remains open pending determination of root cause with the beam board that was removed.
 |

|  |  |  |
| --- | --- | --- |
|  |  |  |
| 11. Issues and Concerns |
|  |  | From FIELDS PM* Eight EDI GDUs are now delivered and integrated on the Observatories, some with residual risk. The EDI team is now preparing a flight spare (FM9) in an effort to have it ready in time for a swap out with one GDU on Obs 4 in January.
	+ The replacement of a HVOC in the GDE (SN9) for GDU FM9 was completed successfully. The EM GDE provided by IWF proved valuable for rework practice and activity sheet preparation.
	+ The GDU FM9 I&T activities have so far run smoothly at UNH.

ADP boom bending loads* Monte Carlo simulations of the MMS formation maintenance maneuver are predicting ADP loads that result in negative margin for ADP Boom bending strength. Two changes have been made to the formation maintenance maneuver since requirements were provided. (1) Instead of radially thrusting once per spin, we are now thrusting twice per spin. (2) Attitude control is being interleaved inside of the maneuver. Approximately every two seconds, attitude control is performed by “off-pulsing”. This approach avoids having to reorient the spin axis after the maneuver. The downside is that this ~2 second period is very close to the period of oscillation for ADP. The cases that predicted high ADP loads were examined. These cases included more attitude control thrusting than other cases due to thruster performance variability and mass properties uncertainty.

From FIELDS SE* OBS-3 ADP +Z Boom Canister B-side thermistor is not operational and may be left that way for flight

Science Data Processing Issues (Compiled by Chutter)* GSFC
	+ GSFC is requiring that there be a Software Management Plan (SMP) for Ken Bromund’s task (yes, they know this is Class D software). GSFC is providing help to create the actual document (essentially documenting the informality of our processes in a formal-looking document). The current plan forward is to spend a few more hours, and then see if we are then in a position to get a waiver for anything that is missing
 |

|  |
| --- |
| Activities planned for next reporting period |
|  |  | Management |
|  |  |  | * Continue preparation of additional materials requested regarding the FIELDS July 2013 proposal.
* Process NCRs related to the flight spare EDI GDU. Support FRBs as needed.
* Receive delivery of the following items at UNH
	+ None
* Make or coordinate delivery of the following to the MMS Project
	+ EDI GDU FM9 (flight spare) (to Obs-4 at Asrtotek)
* Prepare and conduct the following PERs and associated TRRs
	+ EDI GDU FM9
* Prepare and conduct the following PSRs.
	+ PSR: EDI GDU FMs 2-8
* CDRL and contract deliverable submissions:
	+ None planned
 |
|  |  | Product Assurance, Configuration Management, Parts, Materials, Facilities |
|  |  |  | Turco/Salwen* Support GDE 9 HVOC exchange rework
* EDI GDU FM9 integration support
* EDI GDU FM9 PER support
 |
|  |  | Systems Engineering & FIELDS I&T |
|  |  |  | Rau, Dors, Needell* Continue supporting GDU SN09 (flight spare) test program
* Perform Acceptance test of DFG Flight Spare
* Review FIELDS Instrument Users Manual
* Continue review of commissioning planning material on SOC website
 |
|  |  | Post-Delivery Support (UNH) |
|  |  |  | Observatory Support (FIELDS)* Perform final ADP RE inspections for OBS3 +Z, OBS4 -Z
* Perform walk down of SDP and EDI MLI and FOV on OBS-3 and OBS-4
* Continue discussions on ADP max bending moment with GNC personnel
* Perform post ship Observatory Functional testing including SDP Motor and HOP testing and ADP Simulator Testing
* Prepare for and attend MMS FORR
* Continue I&T planning for FIELDS at the OBS level with focus on Cape
* Prepare WOAs for FIELDS work at Cape
 |
|  |  | Science |
|  |  |  | SWT and SWG* Support science telecons as needed

Science data processing plans for November 2014* ALL
	+ Work on INITIAL versions of software by end of December
	+ Use SPDF tools to verify CDF and skeleton files follow MMS CDF Guide
	+ Support SODAWG
* UNH
	+ Work on real time data display for EDI and DFG/AFG
	+ Continue working on EDI E Field interfaces
	+ Work on RunEst software (for E Field and mag spin axis calibration)
	+ Continue work on scripting to control processing
	+ Continue L0 to L1 software updates as necessary
	+ Continue working on combined E and B products
	+ Work on error and warning management
* LPP
	+ [in progress] Analyze the results of the MRT9 data test and correct the software where needed.
	+ [in progress]Test further the SCM calibration software with the new SCM L1A
	+ [in progress] Include CDF version number computation (vX.Y.Z)
	+ L1B data will be delivered in both SCM123 and OMB reference frames as decided on the data processing group meeting, Iowa, March 2014
	+ Include coordinate transformation from mechanical frame OMB to GSE in L1BtoL2
	+ [new] Produce and check CDF skeleton files fully ISTP/MMS standard compliant.
	+ [new] Write the software that gives the calibration factor for a given bandwidth in order that Mark Chutter can calibrate SCM spectra.
* UCLA
	+ Continue developing in-flight calibration procedures
	+ Continue converting analysis activities
	+ Continue working on timing corrections
	+ Work on MMS Products Guide
* GSFC
	+ Demonstrate the calibration process (Orthogonalization) as input to Mag Conference and next level of Mag calibration
	+ Continue work with LANL and DSWG to create attitude/ephemeris data product and transformation software.
	+ Test the SDC installation of the LANL software library
	+ Work on fully functional L2pre software: finish DMPA-GSE transformation.
	+ Modify L1B and L2pre software to handle data overlap, fine timing corrections.
	+ Work on coordinate transformation software required for L2 data production.
	+ Implement versioning scheme for the L1B, QL, and L2pre data products
	+ Update Level 2 calibration document to document decisions from the SWT Meeting
* IRFU
	+ Implement initial version of SDP offset files
	+ Release new version of Level-2 files for MRT9
* LASP
	+ Continue improving DCE software
	+ [new] Write the software that gives the calibration factor for a given bandwidth in order that Mark Chutter can calibrate E spectra.
 |
|  |  | Mag Team (UCLA, IWF, LPP) |
|  |  |  | * Continue bi-weekly Mag team telecons.
* Continue developing inflight calibration procedures.
* Continue data analysis software activities.
* Generate responses to the RFAs from the Mag team meeting.
* Expand on the calibration data flow as outlined during the MMS SWT and FIELDS meetings.
 |
|  |  |  |  |
|  |  | EDI |
|  |  |  | Ship Set 4 - GDU SN9R* GDU assembly, bench test, baseline FFT in vacuum
* PER
* Vibration

GDE - UNH efforts* Replace of optocoupler in GDE SN9
* Perform TVAC cycle after replacement

Flight Software* Start implementation of Gun HV ramping
 |
|  |  |  |  |

|  |  |  |
| --- | --- | --- |
|  |  | SDP (UNH, KTH/IRFU) |
|  |  |  | * Support commissioning planning activities
 |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  | ADP/SDP/DSP (LASP) |
|  |  |  | ADP* Obs 3&4 ADP RE cover removal & Inspection.

Systems and Program Management* Support project as needed.
 |
|  |  | Commissioning and Mission Operations (Needell) |
|  |  |  | * Continued support for Commissioning planning
* Attend FORR
* Release Final version of FIELDS CDPU Users Manual
 |
|  |  |  |

This document contains technical data that is controlled by the International Traffic in Arms Regulations (22 CFR 120-130) and is being transferred by authority granted under TA 1741-05 and TA 3514-09. This information may not be transferred to any other foreign person or entity without prior approval of the US State Department.

\*\*\* end \*\*\*