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| Investigation: FIELDS |
| Progress accomplished this period: | May 2014 Reporting Period |
| 1. | Project Management and Product Assurance |
|  | a. | Project Management* Provided additional information requested to support review at SwRi of the July 2013 FIELDS cost change proposal.
* Supported the following PERs and associated TRRs
	+ EDI GDU SN9
* Supported the following FRBs
	+ FM7 SDP (boom wire retraction stop)
	+ FM9 EDI GDU (insufficient beam at 500 eV)
* Supported the following Acceptance Reviews or PSRs
	+ None
* Received delivery of the following flight hardware items at UNH
	+ SDP FMs 7 & 8 for retest (from GSFC)
* Delivery of the following flight hardware items from UNH to FIELDS partners
	+ FM8 EDI Gun and GDE for rework and recalibration (to IWF)
* Prioritized and coordinated the efforts of the UNH team, subcontractors, foreign partners, outside vendors and in-house workshops to optimize schedule performance.
* Supported processing of NCRs
 |
|  | b. | Product Assurance |
|  |  | Turco / Salwen* GDU FM9 anomaly investigation support
* Spare EDI Gun Beam board kitting and assembly support
* Spare EDI GUN EEE parts procurement
* EIDP uploading
* EDI Gun HVOC life testing support
* SDP 7 and 8 FFT support
 |
| 2. | Systems Engineering and FIELDS I&T |
|  |  | Rau, Dors, Needell* Supported SDP SN07/08 FFT
* Conducted EMI/EMC testing on SDP SN02 (flight spare)
* Released GDU SN06 EMI Test report
* Updated the CDPU Software requirements Specification and generated ECR
* Supported CDPU FSW change review and Acceptance Test
* Continued supporting commissioning planning discussions with SOC including WIKI procedure reviews for CEB LV on, ADP RE deploy, SDP deploy, ADP boom deploy, and EDI LV on
* Continued I&T planning for FIELDS at the OBS level
* Supported GDU problem investigations and risk analysis (FM9 FRB)
* Supported GDU SN09 PER
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| 3. | Post-Delivery Support (UNH) |
|  |  | IS and Observatory Support (FIELDS)* Supported post stack vibe VIF tests
* Supported OBS-1, 2 and 4 Functional Tests with SDP Motor/HOP tests
* Supported removal of SDP SN07/08 from OBS-2
* Performed inspections on SDP SN07/08 and GDU SN02
* Transported SDP SN07/08 to UNH for FFT
* Performed partial GDU SN02 Acceptance Test at GSFC
* Began development of SDP door deployment procedure
* Received training on manual SDP door opening and closure using SN02
* Updated ADP RE Deployment Test procedure
* Supported and reviewed OBS WOA and procedure development and closeout
* Reviewing all test data from previous OBS tests
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| 4. | Science and Science Data Processing  |
|  |  | SWT and SWG * Participation in all science planning discussions.
* Continued preparation of the FIELDS instrumentation paper

Science data processing activities (Compiled by Chutter)* ALL
	+ Continued working through coordinate system requirements
	+ Continued working on software to run at SDC
	+ Continued working on revising MMS CDF Guide and providing input to SDC Developers Guide
	+ Continued populating FIELDS Processing documents
* UNH
	+ Improved products to be used for mag spin axis offset determination
	+ Have initial release of “real time” plotting to be used during commissioning
	+ Started work on EDI E Field interfaces
	+ Continued review of science and engineering telemetry from observatory level testing
* LPP
	+ Errors and warning management in progress: the software has been modified to return a warning/error value. Several values have been defined. Need to complete the list of return values.
	+ Ephemeris inputs required for coordinate transformation have been reviewed.
* UCLA
	+ Work continues on magnetic field data processing
	+ Developing inflight calibration procedures
	+ Work continues on inflight calibration and procedures
* GSFC
	+ Successfully tested hermite interpolation algorithm recommended by Michael Henderson for interpolating spacecraft position and velocity
	+ Worked on metadata and versioning for L1B and QL
* IRFU
	+ Continued implementation of functional version of DCV and DCE processes
	+ Clarified implementation of functional version of DCV and DCE processes
	+ Discussed interaction between SDP and ADP processing
* LASP
	+ Discussed interaction between ADP and SDP processing
	+ Working on ADP software
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| 5. | Magnetometers |
|  | a. | DFG  |  |
|  |  |  | * Evaluation of observatory test data
* Continued activities in the frame of EDI/MAG data processing and in-flight calibration
 |
|  | b. | AFG |  |
|  |  |  | Science* Magnetometer paper submitted, reviews received, under revision.

Pre-launch Preparations* Work continues and code is being developed and documentation written for magnetic field data processing.
* Hannes Leinweber developing inflight calibration procedures, and generating code.
* Louise Lee converting analysis software to Python.
* Support SODAWG – emphasis on data products and associated coordinate systems.

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

Engineering: Post-delivery Activity* Watching over activities in assessing LM6142.
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|  | c. | SCM | * SCM FMS => SENSOR S/N FM4 + PREAMP S/N FM3
	+ - SCM FMS (sensor, preamp) fully packed and ready for delivery if needed.
		- ADP complete.
* Final review of the FMS ADP in progress.
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| 6. | EDI |
|  |  | Ship Set 1 - SN9* FRB
* Replaced Beam Generation System (new BGS: SN 13)
* Reran FFT in vacuum
* PER

Gun - IWF efforts* Ship Set 2 - SN 4
	+ Discovered offset (140 volts) on Upper Injector (OPT\_DEFL board) during integrated board stack testing; disassembly; problem is gone in board level test;

Optics* Modeling of impact of 140 volt offset in Upper Injector Amplifier.

Flight Software* Continued implementation and testing of electric field mode

HV amplifier trend root cause investigations (UNH)* Investigations of root cause for LED current drift observed in Guns continue at UNH with separate tests of the two DEFL boards removed from the FM4 Gun. The team met again to review results, define the next test steps and begin preparations for a briefing to the project.
* A GSFC LED test indicated a downward trend of the radiant flux of one of the two LEDs removed from an HVOC that was installed in EDI Gun FM4 and had exhibited a trend during Gun calibration. The significance of the measurement was confirmed and the test was repeated with a similar, albeit lower rate, trend

HVOCs* CTR measurements of the 12 UNH HVOCs in the life testing sequence indicate stable behavior after 2000 hours dynamic cycling. This testing will continue with the next CTR measurement planned after 2500 hours.
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| 7. | SDP/BEB/LVPS  |

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|  | a. | SDP/BEB/LVPS (KTH/IRFU/Oulu)* All hardware efforts are complete.
 |
|  | b. | SDP (UNH)Flight Spare SDP (SN2):* Conducted full EMI testing of SDP FM02, the flight spare. Emissions were in-family. Susceptibility tests did not reproduce the "TV anomaly.”

SDP FMs 7&8* Conducted successful FFTs, including full deployment, of both units upon return to UNH following the Obs environmental testing.
	+ A boom wire retraction stoppage was encountered during the re-stow operation (SN7). See problems.
 |
|  | c.  | SDP (LASP)* No LASP activities. SDP work at LASP is complete.
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| 8. | ADP |
|  | a. | LASP ADP Post-Delivery Support Activities * Obs #1 – No LASP activity
* Obs #2 – No LASP activity
* Obs #3 – No LASP activity
* Obs #4 – No LASP activity
* ADP WOA closure review
* Supported MMS IS I&T planning teleconferences
* Revised the ADP observatory deployment procedure

Axial Electronics Box (AEB)* No activity
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| 9. | DSP, Thermal, Systems Engineering, Product Assurance and Management (LASP) |
|  |  | DSP - No activities this month. Thermal - No activities this monthSystems Engineering and Program Management* Provided requested updates to ADP EIDP
* Provided requested backup information to support LASP’s July, 2013 cost to complete proposal.

Quality Assurance, Parts, and Materials Engineering – No LASP activities |
| 10. | CEB  |
|  | a. | Hardware |
|  |  |  | * No activity. CEB hardware activities are complete.
 |
|  | b. | CDPU Software  |
|  |  |  | * Implemented changes to CDPU FSW for final pre- launch release.
* Conducted SwAT on FSW
* Prepared tested and delivered Upload scripts to IS I&T for uploading FSW to the Observatories starting early in June.
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| 11. | Commissioning and Mission Operations (Needell) |
|  |  | * Supported Post Vibrations Observatory Functional Tests.
* Delivered updated Command/Telemetry Database spreadsheets to support new FSW and OBS3 TVac.
* Continued working with SOC to plan FIELDS Commissioning Activities.
* Participated in bi-weeky Commissioning telecons.
* Conducted week FIELDS Commissioning Planning meetings.
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| 12. Problems encountered and updates this period |

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|  |  | SDP* [NEW] Boom wire retraction stopped during stowing process (SDP FM7) (PFR-10160.53-138-OP)
	+ The SDP SN7 boom wire retraction stopped during re-stow following successful FFT. The remainder of the stowing operation completed normally.
	+ Symptoms are similar to deployment stoppages observed in TV but included a slight rise in motor current. This feature is under investigation.
	+ FRB (6 June 2014) recommended disconnection of the pinion gear and assessment of motor sound in three deployer orientations. That testing is underway.

 EDI* [UPDATE] 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.
	+ UPDATE
		- 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 retest of the removed BGS. NCR to remain open pending this investigation
* [NEW] Beam pointing deviation relative to the Gun/GDE calibration (GDU FM9) (PFR-10160.53-139-OP)
	+ The FM9 Gun Calibration at IWF is not 100% valid after the exchange of the beam generation system. See PFR-10160.53-136. A pointing deviation of about 2 degrees between the calibration and the actual pointing with the new BGS has been determined in testing at UNH.
	+ Action (UNH): prepare the inflight calibration plan for presentation at PSR.
* [NEW] 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. IWF is reassembling the stack of the first three boards and will investigate the anomaly in that configuration.
* [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
	+ UPDATE: 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.
* [UPDATE] EDI GDU FM6 Red limit violation of Gun Anode HV amplifier LED current (PFR-10160.53-128-IP)
	+ When switching the gun energy from 250 eV to 500eV during the first (baseline) full functional test in vacuum, the GDU primary current increased to 156 mA which is out of family compared to other GDUs (expected current in that instrument state: ~121 mA). The next analog HK sample showed a red limit violation on the Gun Anode HV amplifier LED current (39mA). The red limit violation was not a transitional effect but stayed, as did the non-nominal primary current.
	+ Subsequent investigation and FRB discussion indicate that the problem is most likely related to the HVOC in the negative side of the anode amplifier. Analysis showed that the circuit would perform within requirements with this device disconnected. The recommended modification to the beam board was made. Subsequent tests in vacuum of the Gun were successful. The GDU6 was reintegrated and the FFT in air was successful.
	+ UPDATE: GDU6 has successfully completed environmental testing. Performance of the anode HV amplifier is as expected. Closure awaits Acceptance Review approval.
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| 14. Issues and concerns |
|  |  | From FIELDS PM* The EDI Gun continues to be the critical path for GDU and FIELDS. Commitments of the IWF team to the Solar Orbiter project as well as continued technical problems have made the schedule issue more acute. UNH continues to offer support to IWF in efforts to help resolve technical issues and minimize schedule impacts.
* The risk record regarding GDU performance and schedule (PIMS ID 176, MMS Project) is being used as a tool to help coordinate mitigation efforts.
	+ The FM2 EDI GDU has been returned to UNH from GSFC for additional testing and characterization. This is a risk mitigation effort to prepare this unit for flight should that be necessary.

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)* ALL
	+ Confusion about use of LANL attitude/ephemeris files and/or software at the SDC, reviewing needs to help SODAWG write statement of work for LANL
* LPP
	+ [in progress] Conversion of TT2000 (64 bits long integers) to double precision floating point numbers introduces errors (tents of nanoseconds). This conversion is needed to correct for leap seconds and also for tplot variable timing => need to keep LONG64 all along the process => calibration software has to be modified.
* GSFC
	+ Awaiting sensor orientation information of AFG and DFG
	+ Coordinate transformation software may need to be more portable to run at more than just SDC
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NCR Summary: Provided separately (Excel file)

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| Activities planned for next reporting period |
|  |  | Management |
|  |  |  | * Prepare contract modifications for U of Iowa, UCLA and LASP based on modification expected from SwRI for FIELDS July 2013 proposal.
* Update the Gun and GDE schedule.
* Continue to review and update the EDI GDU delivery and risk mitigation.
* Continue to push open NCRs to closure. Support FRBs as needed.
* Continue to prioritize and coordinate the work of the UNH team and its FIELDS partners.
* Support/staff T/V testing as needed
* Receive delivery of the following items at UNH
	+ EDI SN4 Gun and GDE (from IWF)
	+ SDP FMs 3, 4 and 12 for rework and testing (from GSFC)
	+ FM2 EDI GDU for additional functional testing and characterization (from GSFC)
* Delivery of the following flight hardware items from UNH to FIELDS partners
	+ None
* Prepare and conduct the following PERs and associated TRRs
	+ TRRs: EDI GDU SN9 Vibration and TV testing
* Prepare and conduct the following PSRs or Acceptance Reviews.
	+ None planned for June.
* Make or coordinate delivery of the following to GSFC IS or S/C teams
	+ SDP FMs 7&8
* CDRL and contract deliverable submissions:
	+ None planned
 |
|  |  | Product Assurance, Configuration Management, Parts, Materials, Facilities |
|  |  |  | Turco/Salwen* EDI GDU FM9 TV test support
* Continued EDI Gun HVOC life test support
* NASA workmanship standard certifications
* SDP refurbishment support
 |
|  |  | Systems Engineering & FIELDS I&T |
|  |  |  | Rau, Dors, Needell* Support SDP SN07 anomaly investigation
* Release new version of CDPU SRS
* Finish the GDU SN02 Acceptance Test
* Perform GDU SN06 Acceptance Test
* Perform GDU SN09 EMI, Magnetics, FIT and Acceptance Test
* Continue submitting FIELDS verification material for closure
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|  |  | Post-Delivery Support (UNH) |
|  |  |  | IS and Observatory Support (FIELDS)* Finish development of SDP door deployment procedure for OBS level
* Support SDP SN03/04/12 removal, inspection and transport to UNH
* Transport GDU SN02 to UNH for testing as future flight unit
* Submit ADP RE Deployment WOA
* Support OBS-3 ADP canister thermistor anomaly investigation
* Prepare for OBS-3 TV testing and personnel scheduling
* Support the OBS-3 pre-TV Functional tests including SDP Motor/HOP test
* Support OBS-3 TV
* Perform magnetometer boom inspections as available
* Support OBS-4 ADP RE deployments
* Support OBS-4 AFG/DFG boom deployments and magnetometer functional
* Support OBS-2 operating hours testing
* Continue I&T planning for FIELDS at the OBS level
 |
|  |  | Science |
|  |  |  | SWT and SWG* Support science telecons as needed
* Continue preparation FIELDS Instrumentation papers

Science data processing plans* ALL
	+ Work on INITIAL versions of software by end of November
	+ Continue populating FIELDS Processing document
	+ Use SPDF tools to verify CDF and skeleton files follow MMS CDF Guide
	+ Finalize errors and warning management
	+ Support SODAWG
* UNH
	+ Work on real time data display
	+ Continue work on scripting to control processing
	+ Continue L0 to L1 software updates as necessary – many new features added at Iowa meeting
	+ Work on error and warning management at SDC
* LPP
	+ Test further the SCM calibration software with the new SCM L1A CDF files provided by M. Chutter in Mag123 system.
	+ Digital filter response will be tested in the calibration software (may be postponed to later in 2014 depending on work load)
	+ [in progress] Convert time processing from double precision floating points (Epoch16) to long64 (TT2000)
	+ Include coordinate transformation from mechanical frame OMB to GSE in L1BtoL2 : interface with K. Bromund’s software as decided on the data processing group meeting, Iowa, March 2014
	+ Include CDF version number computation (vX.Y.Z)
* UCLA
	+ Continue developing in-flight calibration procedures
	+ Continue converting analysis software to python
	+ Generate test files using Cluster data
* GSFC
	+ Work on coordinate transformation software.
	+ Implement fully functional QL and L2pre software.
	+ Continue work with LANL and DSWG to define requirements for attitude/ephemeris data product and transformation software
	+ Implement metadata and proper versioning scheme in L1B, QL, and L2pre data product.
* IRFU
	+ Generate test files using Cluster data
* LASP
	+ Continue improving DCE software
 |
|  |  | AFG |
|  |  |  | * Continue work on data products guide.
* Continue developing inflight calibration procedures.
* Continue software analysis activities.
* Continue to support SODAWG.
* Generate magnetometer data test files using Cluster data.
* Develop milestones for prelaunch preparations. Milestones based on activities conducted in association with Mission Readiness Tests.
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|  |  | DFG |
|  |  |  | * Continue support of observatory testing.
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|  |  | SCM |
|  |  |  | * FMS ADP: final review to be completed.
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|  |  | EDI |
|  |  |  | Ship Set 1 - SN9* Vibration, TVAC, Detector Characterization

Gun - IWF efforts* Ship Set 2 - SN 4
	+ Reassemble Board stack; test; start calibration
* Ship Set 4 - SN 8
	+ Diagnose problem with anomalously low resistance found during Safe-to-Mate at UNH

Flight Software* Continue implementation and testing of electric field mode

Investigation of HV amplifier trends* Continue board level testing at UNH.
* Report findings to Project

HVOCs (UNH)* Continue the HVOC life testing (12 devices). The 3000 hour program should finish in July.
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|  |  | SDP/LVPS/BEBs/Preamp/Probe (KTH/ Oulu/IRFU) |
|  |  |  | * Hardware work is complete. No hardware activity planned.
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|  |  | SDP/LVPS/BEBs/Preamp/Probe (UNH) |
|  |  |  | UNH SDP:* Continue investigation of the boom wire retraction stop for FM7. Rework if necessary as determined by FRB.
* Return FM7 and FM8 SDPs to GSFC
* Rework the FM3 and FM4 fine wire crimps.
* Perform FFT, including full deployment, on FMs 3, 4 and 12.
* Return FMs 3, 4 and 12 to GSFC (July)
* Prepare and distribute the report of the EMI/EMC testing of the FM2 at Retlif Laboaratories.
* FFT of FM2, the flight spare, will be conducted now that EMI testing at Retlif is complete. This activity is part of the investigation of deployment stoppage anomalies in TV (additional EMI/EMC testing)
* Continue investigation of SDP boom wire deployment stoppages in effort to understand root cause.

LVPS* No activity planned
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|  |  | ADP/SDP/DSP (LASP) |
|  |  |  | QA/Parts/Materials – No activities plannedDSP – No activity plannedADP* Travel to GSFC with ADP PI, Bob Ergun, for final ADP functional and deployment testing on Obs #4.

AEB – No activity plannedSDP* Provide inputs regarding SDP sphere marking and cleaning.

Thermal* Perform thermal analysis of ADP preamp in deep eclipse

Systems and Program Management* Support project as needed.
 |
|  |  | CEB Hardware and Software |
|  |  |  | * Upload FSW to OBS3 and hopefully a few more. (OBS 3 upload completed on 6/2/2014)
* Support "operating hours" run time on OBS 2 as requested.
* Prepare for and support OBS3 TVac.
* Prepared for and support several I&T tests (ADP RE deployments, Mag Boom Deployments)
* Support SDP and EDI Integrations as needed.
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|  |  | Commissioning and Mission Operations (Needell) |
|  |  |  | * Continue updating activity plans with SOC
* Conduct Weekly FIELDS Commissioning planning meetings
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