

MODIS Team Meeting Minutes

Minutes of the MODIS Team Meeting held on Tuesday July 25, 1995.

Action Items:

94. Provide a detailed (high fidelity) analysis of scatter in the scan cavity. The results would determine the need for PF near field scatter measurements vs scan angle. Assigned to Guenther 8/23/94 Preliminary results due 10/15/94. Final due 2/28/95. New due date 4/28/95

112. Analyze the ScMA optical design. Assigned to Waluschka 1/31/95. Due 2/ 7/95

Distribution:

✓ Richard Weber	✓ Bruce Guenther	Larissa Graziani
✓ John Bauernschub	George Daelemans	Bob Martineau
✓ Rosemary Vail	✓ Mitch Davis	Bob Silva
Lisa Shears	✓ Ken Anderson	Robert Kiwak
✓ Mike Roberto	Rick Sabatino	Harvey Safren
✓ Gene Waluschka	Cherie Congedo	✓ Ed Knight
✓ Bill Barnes	Jose Florez	Harry Montgomery
✓ Les Thompson	✓ Gerry Godden	Marvin Maxwell
✓ John Bolton	✓ Sal Cicchelli	✓ Bill Mocarsky
Pat Delosa		

The following items were distributed:

- 1) Weekly Status Report #199
- 2) SBRC Memos submission from week #191
- 3) Minutes of the previous team meeting

MODIS Technical Weekly July 28, 1995

sent to MODIS.Review 7/28/95 at about 1:10 PM

1.0 Summary

A flight software test readiness review, software configuration management review, and software assurance review will be held August 1 at SBRC. Attendees from GSFC will include Ken Anderson, Rick Sabatino, Bob Silva, Marghi Hopkins, and Jeff Bowser. There will be round table discussions on the GSE software.

The Test Analysis Computer (TAC) software source code was received by MCST personnel on July 26. Recommendations by Tom Pagano on use of this code are provided.

Mitch Davis reported testing was completed on the SAM flight layout PC cards and the new design does not show any missing codes!! The redundant card test was completed for the SAM and MEM. A problem was discovered in this interface which was traced to a design error in the Formatter Actel. A fix has been identified which will involve reprogramming the Actel and adding several jumpers.

Backplane wiring is progressing with about 600 of 1200 point-to-point wirewrap wires having been installed.

David Jones reported on inspections being performed on PFM S/MWIR FPA filter bonds to determine if additional adhesive is needed. These filters were attached using the same process that was used for the LWIR FPA.

Ed Knight expresses a concern about testing which may affect SBRC's Performance Verification Plan. Ed mentions that for the calibration transfer to orbit to succeed using the SRCA and OBC, it is necessary to check these calibrators against the external calibrators at more than the nominal operating temperature. Limited checks with the OBCs are needed at each of the three instrument temperatures at which we perform instrument calibration.

Gerry Godden mentions the June 30, 1995 BRO report should be considered preliminary for limited distribution. A section of the report is being redone to meet the Statement of Work specified approach for seven cloud sizes. Several specified appendices are still in process.

Gerry also suggests five priority improvement items for MODIS optical/calibration performance:

- 1) Eliminate/reduce LWIR crosstalk and/or ghosting related to gap between bands 27 and 33 and the space between bands 31 and 36.
- 2) Eliminate/reduce the optical crosstalk features associated with SWIR Bands 5,6,7 and the MWIR Bands 21,22.
- 3) Eliminate/reduce the optical crosstalk features associated with the NIR 250 m resolution Bands 1 and 2.
- 4) Reduce near-field scattered light for VIS and NIR.
- 5) Demonstrate that the planned scan angle response measurement procedure changes will achieve the required accuracy for all bands. As a backup to this for the thermal bands, evaluate and implement the scan cavity corner secondary blackbody option.

Bruce Guenther has prepared an MCST suggested purpose for the calibration peer review. Bruce's suggestions are enclosed.

2.0 Tom Pagano (TAC Software Source Code Away!)

email from Tom Pagano July 20, 1995 15:36 PDT
Team,

I've just instructed Eric Augustine to send NASA all our TAC source code in electronic form.

It should be understood that this is pre-released software and is subject to change and revision. We have not released the Version Description Document, so this source code cannot be traced at this time. It is only meant to give the NASA TAC team an idea of how the routines work.

I strongly recommend that NASA personnel NOT CHANGE THIS SOURCE CODE to meet their needs. You will lose all your changes when we send you an update. Let SBRC make the changes for you so that it gets incorporated into the official controlled versions.

The official release of the source code will take place in October (the last thing we do before we have the delta SWTRR)

Thank You

T. Pagano

3.0 Mitch Davis and Jose Florez

email from Mitch Davis 7/24/95 2:35 PM
Elect. 7/24/95 telecon

This weeks telecon with SBRC included Jose Florez, Mitch Davis and Ed Clement. The status is as follows:

- The testing was completed on the SAM flight layout PC cards, [the test included the SAM, MEM and simulated inputs at the focal plane interface.] The new design does not show any missing codes!!
- The redundant card test was completed with the SAM and MEM. A problem was discovered in this interface. The MEM Formatter card would only read from the Primary SAM cards, if the Primary SAM Clock/Bias card was active. [Similarly, the MEM Formatter card would only read from the Secondary SAM cards, if the Secondary SAM Clock/Bias card was active.] This was traced back to a design error in the Formatter Actel. A fix has been identified which includes reprogramming the Actel and adding 12 jumpers.
- Testing is continuing on the FIFO Swap problem. As of Friday, SBRC could not cause the problem to occur in the MEM. However, as Ed pointed out, it usually occurred in the afternoon.
- The backplane wiring is progressing, about 600 of 1200 point-to-point wirewrap wires have been installed. The connectors requiring splicing will be installed next.
- The motherboard "fit check" did not occur because the MEM housing has not been delivered to SBRC from the vendor.
- Progress is slow on filling the parts storages. The Format Generator and FDDI should be complete in 3 weeks, the FIFO in two weeks and the Single Board Computer in one week.

From this time on, the weekly call will be initiated by GSFC instead of SBRC.

4.0 David Jones (PFM SW/MWIR FPA)

email from David Jones 7/28/95 12:06 AM

The filters on this assembly are attached with the same process as the LWIR. The problem with the loose filter on the EM LWIR, produced concern at SBRC re the PFM SW/MWIR FPA. On Monday it was decided to return the PFM SW/MWIR FPA to the Detector Division for additional inspection and (if necessary) some additional adhesive (Dow Corning Silicone 93-500) Receiving-Inspection at the Det Div., identified some other problems (these are discussed in Peter Jemerson's report for this week).

An Eng. Order (EO) has been generated to provide explicit instructions for applying adhesive, and the inspection criteria for acceptance. It is my understanding that the adhesive/bonding and inspection has not yet been completed.

5.0 Ed Knight (Need to calibrate SRCA and OBC at each of the three instrument temperatures at which calibration is performed)

email from Ed Knight 7/24/95 11:22 AM

A concern about testing arose that may affect SBRC's Performance Verification Plan.

Specifically, for the calibration transfer to orbit to succeed using the SRCA and OBC blackbody, it is necessary to check these against the external calibrators at more than the nominal operating temperature. We perform the calibration at three instrument temperatures and need to do limited checks with the OBCs at these same instrument temperatures.

The current performance verification plan does not include any limited checks of in-flight calibration requirements as part of CPT-2, which is the test set conducted at all instrument temperatures. (Table 11-2 of the Performance Verification Plan). Since a limited test will take little time, and can in fact be conducted concurrently with a limited calibration or spatial test, the impact of this revision to the test plan should be minor at this point. The test required would be more than the functional tests (MFI-09 and MFI-15) but less than the full calibration test (PC17).

If you have any questions, we can discuss this further.

Ed Knight

6.0 Gerry Godden (BRO Draft Final Report Status; Five Improvement Issues for MODIS Optical/Calibration Performance)

excerpts from email from Gerry Godden 7/21/95 3:21 PM

Status of this Preliminary Report: The Breault Research Organization (BRO) Final Report dated June 30, 1995 should be regarded as preliminary for limited distribution. This report in its current version contains a description of the model, input parameters, summaries of measured BSDF data, samples of tabular data and preliminary conclusions. Complete tables of data covering a wide range for several important parameters will be available on magnetic disk. Much of the tabular data presented here are based on the APART model calculation of the point source Normalized Detector Irradiance (NDI). This report presents integrated Earth irradiance results for two albedo levels for annular ring geometry. Since this integration form does not meet the Statement of Work (SOW) specified approach for seven cloud sizes, this section is being redone and will be available in a subsequent release of their final report. Several specified appendices are still in process.

email from Gerry Godden 7/21/95 5:33 PM

Priority Improvement Items for MODIS Optical/Calibration Performance

- 1) Eliminate/reduce both major LWIR optical crosstalk, and/or ghosting features.

We know that there is a crash effort under way to paint a thin strip between Bands 27 and 33 (Feature #1; associated with the PC-PC substrate gap). There has been no discussion, nor discernible activity to repair the significant ghosting/crosstalk feature exhibited between, and on both sides of Bands 31 and 36 (Feature #2). GSFC's Dr. Qiu and Gene Waluschka ghosting model indicates that this feature may be primarily the result of ghosting (between the top surface of the filter and some of the LWIR channel aft-optics). If this is the case then more is needed than painting a second stripe on the FPA between Bands 31 and 36. It may well be that both ghosting (topside of the filter) and optical crosstalk (bottomside of the filter) effects are taking place, and that two separate classes of fixes are needed to reduce this problem.

The first attempt to eliminate/reduce the PV-PC gap crosstalk feature was unsuccessful. It is entirely likely, that additional attempts will be required to close in on solutions for both problems (Feature #1 and

Feature #2). It is important that program plans be modified to provide time for iterative/convergent solutions to fix this problem, and satisfactory performance be demonstrated at the lowest practical assembly level prior to integration into the PFM.

2) Eliminate/reduce the optical crosstalk features associated with the SWIR Bands 5,6,7 (500 m resolution bands) and the MWIR Bands 21,22.

This problem was listed as a bulleted item in their EM Test Data Review package. Very little has been reported on this. The only glimpse we have about the magnitude of the effect was given in Jim Young's IM (PL3095-N04674) which displays significant satellite responses for Bands 5 (~30%), Band 6 (~20%), and Band 7 (small/but detectable). There has been no discussion regarding possible mechanisms, nor specific plans to evaluate and fix these substantial effects.

Again, it is important that program plans be modified to provide time for iterative/convergent solutions to fix this problem, and satisfactory performance be demonstrated at the lowest practical assembly level prior to integration into the PFM.

3) Eliminate/reduce the optical crosstalk features associated with the NIR 250 m resolution Bands 1 and 2.

We know that SBRC intends to address this problem by inverting the NIR filter to take advantage of the slightly smaller bottom side mask size, and thereby eliminate a ~1 to 2% leak possibly due to a slight angular misalignment between the top side and bottom side masks. This will present a significantly changed and unknown situation regarding ghosting. Unless SBRC has independently verified that this fix works and does not have associated penalties, it is quite risky to just turn this filter over and fly it.

Program plans should be modified to provide time for iterative/convergent solutions to fix this problem. Optical reflection details of the underside of the NIR filter should be provided to GSFC/Dr. Qiu to incorporate into his ghosting model to provide an early indication that the proposed approach will not significantly increase ghosting.

4) Further reduction of VIS and NIR near-field scattered light.

At or below specification transient response performance is essential for the VIS/NIR ocean bands, 8-16. Due to the expected large cloud top radiances, which result in heavy saturation for each of these bands, after-the-fact image processing restoration will be difficult, if not impossible, due to the lack of knowledge of the brightness of the cloud tops. Due to the higher cloud top radiances (above the saturation levels) for the NIR Bands 13-16, the problem is more severe than for the VIS channels 8-12.

Replacement of the OCLI Dichroic #1 with the OFC Dichroic #1 is planned and is estimated to reduce the scatter contamination about a factor of 5-8. It is unlikely that this will be sufficient to bring the NIR ocean bands 13-16 into specified performance. At a minimum, replacement of element E2 in the NIR objective assembly should be planned for possible retrofit on PFM, and be the baseline design for F1 and F2. Replacement of the PFM E2 with a more carefully manufactured and coated E2 would enable further reduction in scatter levels by ~40% to 70% for the near-field region. This is a large gain for critical ocean band products.

Replacement of the tall-pole scatter contributors (percent scatter contribution by element) for the VIS channel would most likely involve replacement of more than one element. Scatter can be reduced probably

20% to 50% by replacing the top contributors (E1 and E3) (this requires more analysis of the Breault model results). At a minimum, replacement of these elements should be planned for possible retrofit on the PFM, and be the baseline design for F1 and F2.

5) Demonstrate that the planned scan angle response measurement procedure changes will achieve the required accuracy for all bands (based on an appropriate allocation of the total specified accuracy for each band). As a backup to this for the thermal bands, evaluate and implement the scan cavity corner secondary blackbody option.

This would provide a continuously available measure of the scan mirror induced scan angle response between the OBC blackbody (AOI 26=B0) and the scan cavity corner position at 65=B0 AOI. Conceptually, the implementation of this feature would involve proper location of the scan cavity roof temperature sensor (there already is one close by) and revising flight software to enable the required scan sector change.

7.0 Bruce Guenther (MCST suggested purpose for calibration peer review)

email from Bruce July 25, 1995 2:19 PM

Purpose/Content of Calibration Peer Review

Establish how SBRC will determine the performance of the PFM including the testing and data analysis approaches to verify the sensor has met specification. To the extent that PFM testing and analysis builds on the EM testing then EM results are applicable to this Review. Error or uncertainty estimates are essential components of the analysis that demonstrates performance verification. The approach for traceability of scales in the laboratory as well as on-orbit are needed. The areas of radiometry, spectral and spatial characterization are required. A verification matrix approach identifying which are the data sets needed for accomplishing the calibration approaches, and the strategy for obtaining each required data set is required. In cases where data compliance is demonstrated through a curve-fit routine, that routine must contain as an additional output product the measurement residuals from the curve fit.

Documentation which establishes the calibration of the GSE must be provided, and an uncertainty estimate of performance of this equipment must be available to support the MODIS system level calibration or characterization error budgets.

In IR calibrations, the Goddard MODIS Characterization Support Team (MCST) has been identified as late and currently weak in development of our calibration approaches for this area. We must establish the most likely strategy for success and develop that strategy. SBRC has advocated using a "Universal Curve" approach. MCST cannot accept that approach over traditional approaches which have been successful for decades without a clear demonstration that the approach is sufficiently accurate and that adequate test data will be obtained to sustain this approach.

The "Universal Curve" approach must be proven to the Review Panel no later than at this meeting. If the Peer Panel is not persuaded that the "Universal Curve" has been demonstrated, we then will need to review the IR calibration strategy in the context of a conventional calibration approach.

Describe how software for flight operations will be reviewed, tested and validated.

In most instances MCST must verify SBRC results through TAC analysis and other means. The information provided in this Review must be documented keeping in mind the verification requirement.

Specific questions of interest to us are:

Present any further work quantifying the effects of charge subtraction done since the EM Test Data Review. What is the effect on linearity? What is the effect on system noise levels? (Note that we have seen some of this data, but it's a matter of quantitative answers so we can assess the feasibility of using c-sub on-orbit).

Describe the relationship of Document 151868, Requirements for Software for Data Analysis, to the PFM testing, and identify how discrepancies will be rationalized, as necessary. Provide documentation which establishes the flight system by component serial number.

We are keenly interested in data on stray light, near field response (along track as well as scan), complete spectral out-of-band measurements, and stray light characteristics. Describe how the IR scan angle sensitivity of the mirror is being quantified and tested. If you are unable to perform this testing with the required uncertainty, provide your strategy that you recommend to MCST so the Level 1B product can meet required uncertainty levels.

Define the acceptance criteria, or the consent to deconfigure from any test setup.

Point spread functions had been rejected early in the test design because it was thought that the GSE could not be designed with adequate light levels. The EM test data seems to indicate this estimate was erroneous. Provide a description of how PSFs could be obtained.

Provide in a single place a list of EM testing STRs and a brief description of the purpose of each. Identify which are anticipated to be used (or modified) for the PFM test program.

Describe and review key subassembly level testing for the PFM. Describe the approach for establishing MODIS stability over time and temperature during SBRC testing, and during spacecraft integration testing at Valley Forge.

Provide your strategy for trend data analysis.

In the case of the SDSM and SRCA, there were no EM versions of these subsystems. Describe your verification procedures for these systems. How are these procedures different from what you would do if there had been a system of this design built before? Describe the calibration of each OBC.

**The Review will be Chaired by B. Guenther, MCST Head.
End of Bruce's Report**

**Mike Roberto
July 28, 1995**