

MODIS Team Meeting Minutes

Minutes of the MODIS Team Meeting held on Tuesday April 5, 1994.

Action Items:

73. Complete the MODIS brochure and released for printing. Assigned to Bauernschub 10/18/93. Due 11/15/93.
75. Determine if the four electronic module boxes can be individually thermal tested in air, or must the thermal testing be done in a vacuum. Assigned to Silva 10/26/93. Due 11/ 9/93
86. Complete CDR Action Items. Assigned to ALL 3/15/94. Due 4/ 7/94

The following items were distributed:

- 1) Weekly Status Report #132
- 2) SBRC Memos submission from week #124
- 3) Minutes of the previous team meeting

Attendees:

Dick Weber	Bruce Guenther	✓ Larissa Graziani
✓ John Bauernschub	✓ George Daelemans	✓ Bob Martineau
Rosemary Vail	John Barker	✓ Bob Silva
Lisa Shears	Patricia Weir	Ken Brown
✓ Mike Roberto	✓ Mitch Davis	✓ Robert Kiwak
✓ Nelson Ferragut	Jack Ellis	✓ Harvey Safren
✓ Gene Waluschka	✓ Ken Anderson	✓ Ed Knight
Kate Forrest	✓ Rick Sabatino	✓ Harry Montgomery
✓ Bill Barnes	✓ Cherie Congedo	Marvin Maxwell
Les Thompson		✓ Bill Mocarsky/ Rick Mills

MODIS Technical Weekly April 8, 1994

SUMMARY

The availability of acceptable kinematic mounts for vibration testing in Florida in June remain a real concern at this time. Jim Mayor's (Swales) analysis in a memo dated April 5, 1994 concludes based on the analyses described in the memo that it can NOT be concluded that the kinematic mounts, as designed, could sustain the likely MODIS test environment without failure. Jim recommends that a material with better fracture properties, e.g. A-286 steel be used for the fittings for test purposes. He strongly recommends several design modifications for future applications.

The Quarterly Management Review (QMR) replan session was held at Santa Barbara Research Center (SBRC) on March 29 th via a video conference with the majority of the GSFC MODIS personnel at GSFC. In the replan portion of the QMR, SBRC made several suggestions in identifying/eliminating

non-value added efforts as well as other changes to enlist GSFC's help, reduce paper work, and free up more time for the SBRC team to devote to building and testing the instrument.

A splinter session on detector hybrid reliability was held on March 30th. Bob Martineau recommends that the detector division try a mock-up for temperature cycling that has a flight configuration (proper size of readout portion of hybrid and the sapphire motherboard mounted to beryllium), since the hybrids with their indium bonds would be very difficult to analyze.

The splinter session on stray light was held during the afternoon of March 30 th. Stray light has the potential of being substantially larger than detector crosstalk or ghosting, now that ghosting fixes are being implemented. At this time, we need to validate the predictions of the effects of stray light from the scan mirror, fold flat, and telescope optics. In conjunction with validating the predictions, we need to determine if the mirrors are state of the art in terms of surface roughness micro structures and surface figures.

There were also walk throughs to observe the hardware. Some of the items observed included one of the Ground Support Equipment (GSE) black bodies, electronics boards, the radiant cooler, the assembly area for the objective assemblies, the frame for long wave infrared (LWIR) objective assembly, and the scan mirror. From a hall window, at a distance we saw the aft optics platform (AOP) in the high bay area with dichroic, visible (VIS), and near infrared (NIR) assemblies mated to the AOP. The AOP was supported by the AOP test fixture assembly. The integration and alignment collimator (IAC) was partially set up in the highbay.

SBRC did its usual professional top level technical presentation of the status of MODIS at the QMR on March 31 st. Comments on the review from the MODIS technical team are being compiled.

Comments on the QMR are requested by Mike Roberto via telemail by next week, by April 12 th if possible. MODIS team members are asked to comment if you have suggestions/concerns about any of the replan proposals.

The calibration peer review is scheduled for April 13th and 14th. The review will be held at GSFC in building 21, room 183, starting at 9 am on April 13 th. On April 14, the current location is building 22, room 365.

Kate Forrest has decided to devote more time to her family and has resigned from GSFC. We wish her the best.

DISCUSSION

Management

John Bauernschub gave a presentation on the Preliminary Design Review (PDR) for the MODIS Science Data Support Team (MSDST) data processing algorithms, which was held at GSFC in the building 8 auditorium on March 31 st. About 80 people in attendance at the MSDST PDR, including potential contractors. The MODIS ground processing software will consist of three builds. The first build (beta) is due one year after the date of contract and includes the first look at the code. Version 1 corrects the beta version. Version 2 is the version evaluated for launch readiness.

The replan proposal by SBRC includes several suggestions which trade a reduction in the efficacy of the GSFC oversight with the freeing up of more time for SBRC to build and test the instrument. Examples include:

- 1) Reduce the regularly scheduled weekly teleconferences to bi-weekly.
- 2) Change weekly memo and status packages to bi-weekly.

- 3) Change monthly reports to bi-monthly.
- 4) Elimination/simplification of future CDRL requirements.
- 5) All requests for data/analysis from GSFC will be funneled through the GSFC Program Office to the SBRC Program Office. The replan has a total of twenty suggestions.

System Engineering and Calibration

The regular weekly telecon was held on Monday, April 4 th. Attendees at SBRC included Tom Pagano, Neil Therrien, Jim Young, and Dzung Phan. At GSFC, attendees were Bill Barnes, Ed Knight, Harry Montgomery, and Mike Roberto.

Systems engineering and calibration has changed to the bi-weekly format for telecons.

Tom Pagano expresses an interest in reviewing recommendations concerning PC detector calibration from Larry Goldberg. Harry Montgomery faxed this information to Tom. Larry would account for the irradiance at the focal plane from each optical element as a function of its temperature.

The MSAP Params file and other data was provided to Ken Anderson for Ed Knight

Ed Knight had the following comments and questions related to data processing and to the QMR. SBRC responses are included where available:

- 1) How often are the MODIS and spacecraft times synchronized and what is the maximum difference in these times?

Reference: General Instrument Interface Specification, Rev A, July 8, 1993; paragraphs 5.4.3.2, 5.4.3.4, and figure 6-4. From these, synchronization is every 1.024 seconds, and the difference between the two times needs to take into account the accuracy of the reference frequency and the time mark accuracy. This would be about 1 msec at the beginning of the mission and will degrade during the mission (possibly to about 10 msec).

- 2) Will we get a copy of the inflight calibration tests?

Response: The final version of CDRL 404 will slip.

- 3) We will probably get limited linearity measurements on the Engineering Model (EM).

Response: In thermal/vacuum (T/V), the IR bands will be emphasized. Spot checks will be made for the VIS and NIR. Full up testing of the VIS/NIR in T/V will be at the protoflight (PF) level.

- 4) There are only two weeks in T/V for the EM. Sources will include the Blackbody Calibration Source (BCS) and the Space View Source (SVS). This limits the scope of the IR calibration for the EM.

- 5) We may be able to get fixed pattern noise analysis out of test data from other tests.

6) There is a concern that the on-board calibrators (with the exception of the blackbody) will not be part of the EM. Mockups from the full scale model will be integrated with the EM. However, we need to be sure these mockups will be representative of the actual hardware in terms of their impact on stray light. The SRCA mirror could be a problem.

Response: Jim Young does not believe that far field scattering will be a factor in the EM test. SBRC will check for scatter off representative surfaces for on-board calibrators.

- 7) Page 44. Is there a memo on measuring ghosting? Response: N03710.

8) We may be in trouble in discriminating between MODIS and the Integration and Alignment Collimator (IAC) in terms of measuring stray light.

Response: We need to characterize the IAC very well. SBRC is now thinking of other approaches.

9) Page 46. Describe updated measurements.

Response: A two times improvement is expected in scatter. Detector crosstalk measurements are being made now.

10) Page 48. Data reduction software will be developed by systems engineering for the EM. It will be implemented on Sun Workstations in Fortran. This software could go to the Test Analysis Controller (TAC) for use with the protoflight. Could this software be provided to GSFC?

Response: yes, informally without a CDRL.

11) Does the simulator include electronics calibration?

Response: Not yet, but it will later. The gains and offsets are in the model now.

Tom Pagano mentioned the VIS and NIR are on the optical bench now. The other focal planes are lagging. The IAC is nearly ready now and SBRC may start with the VIS.

Neil mentioned the brassboard electronics has been partially integrated with the focal planes and works in the static mode.

Neil mentioned the simulator is complete thru the first stage. It is written in MAC Fortran. Some of the final stages of the simulator may be delayed.

Jim Young continues to investigate scan mirror near field scatter. He is looking at electronic bi-directional reflectance distribution function (BRDF) data from Speedring (TMA Technologies in Bozeman, Montana made the measurements). With the EM GSE testing, SBRC will be looking for stray light. Jim Young will attend the calibration peer review.

There is a question of how close to a cloud we can operate based on the size of the cloud. SBRC's analysis indicates we can operate within 2 km of clouds up to a certain size. As the clouds get larger, we have to get further away. This has been analytically quantified by SBRC. If for the various seasons, GSFC could provide SBRC with information on the distribution of clouds of various sizes, it would be possible to provide a better estimate of the number of days needed to provide MODIS coverage of the Earth.

Ed Knight is going to look around at shareware to see if he can find a better editor for SBRC for the Sun Workstation.

Structural Analysis

Cherie Congedo mentioned concern about the structural analysis of the Main Electronics Module (MEM) being stopped before completion. The MEM is part of the load bearing structure.

The thermal vacuum testing of the radiant cooler in May will include detectors. The test may then provide information on the PC detector cracking problem.

Electronics

There is a question about the fall back position if the Plessey 31750A microprocessor chip is not available for MODIS. Mitch Davis will discuss this with SBRC. SBRC indicated at the QMR that replacement of the Plessey chip would be VERY undesirable (costly and slow).

Mechanics

Nelson Ferragut participated in review sessions on mechanisms with Gene Gochar and SBRC personnel at SBRC during the week of the QMR. Additional information was provided to Gene at that time. Follow up is needed with Gene to determine if he has all the information he needs.

Radiation Testing of Filters

There was a conversation with Russ Clement of NRaD on April 7 th.. The first three filter samples were received by NRaD in the March/ April time frame last year. The fourth sample was received after the start of the new fiscal year.

For the testing, cobalt 60 gamma ray sources owed by NRaD are used. NRaD does not have any proton exposure capability. However, in the past, they have been able to relate the use of the gamma ray source with some equivalent proton dose. The radiation mostly causes an ionization of the filter, whether from protons or from electrons generated by Compton scattering. Longer wave samples tend to be more susceptible to radiation, particularly samples containing ZnS.

The last filter to be tested may be the most susceptible to radiation.

NRaD uses S Cubed in San Diego to run the radiation tests. S Cubed is in the process of relocating and building a new facility which should be ready in July. Russ hopes the last sample can be tested in July or August. After testing the last sample, Russ will prepare a final report on all the testing. No funds are needed to complete this work. The contract number is S82078E. Russ is at (619) 553-5433.

In a conversation with Kate Forrest, the contracts person at Wallops for the filter tests was identified as Dolly Harrison at 71068.

Kinematic Mounts

A conversation with Jim Mayor was held on April 6 th. Jim has prepared an analysis of the kinematic mounts in a memo released on April 5 th. Non of the mounts are good without non destructive evaluation (NDE). The conclusion is that KM#2 has to be changed for the MODIS test program. Depending on the size of flaw that Brad Parker can detect, KM#1 and KM#3 may have to be changed. Changing all mounts to A-286 stainless would help.

Titanium flaws propagate fast. KM#2 at the shoulder region is marginal; however, the lug area can NOT be shown to have a safe-life with any reasonably detectable initial flaw (0.030 inches). This is not detectable by Brad with eddy current measurements.

KM#1 and KM#3 need to be inspected to determine if they are okay. However, there is a real question about whether Brad Parker can detect with eddy current measurements the required flaw size. The required flaw size is 0.1 inch at the shoulder and 0.2 inches elsewhere for the 1 and 3 axis mounts. The eddy current measurements might be good only for the shoulder area.

Thermal

George Daelemans suggested that bi-monthly submittals of the weekly reports will result in GSFC getting further behind in reviewing the work being performed by SBRC.

George has requested the Spectroradiometric Calibration Assembly (SRCA) drawing tree from Paul Bortfeldt. Eric Johnson will be sending the drawing tree to GSFC.

For the May radiative cooler test, a cooler test plan is needed. This should be reviewed by GSFC prior to the test.

Samples of the cooler bands have been received by GSFC for conductance measurements. Paint samples and the painted honeycomb samples are still needed.

Since the testing of the electronics boxes in thermal vacuum prior to integration with the EM is lost based on the replan, George is recommending testing of each type of electronics board in a bell jar. Paul will negotiate for this test. SBRC has an infrared camera which could be used for this test. SBRC would need a quartz or germanium window about 4 inches in diameter (something that would transmit 10 microns). Some kind of rotary table would be needed and vacuum compatible cabling. There should also be two shrouds which could be heated to simulate the electronic board's thermal interactions with other boards in an electronics box. George and I saw two bell jars in the basement of the detector building which held the video conference. These were glass bell jars, but some parts could possibly be used for a MODIS electronics board test. SBRC also has other bell jars.

At the QMR, Dick Julian mentioned that critical subassemblies will receive inexpensive card level vacuum tests in a bell jar. In questionable cases, additional bell jar tests will verify temperatures.

Focal Planes

Based on discussions during the March 30 th meeting on indium bump bonding separations, three of four S/MWIR fanout detector assembly mockups failed during temperature cycling. At least two opened up after 100 cycles. The bumps opened at the four corners and spread inward. Bob Martineau believes this seems like a coefficient of thermal expansion (CTE) mismatch. Joe Banuck believes the problem could be due to one of the following:

1) The chip was not put down in a representative fashion. The vacuum chuck was on top of the hybridized detector, holding the detector in place. As the epoxy between the sapphire motherboard and the readout portion of the fanout detector assembly hybrid cured, the hybrid pieces (held together by indium bonds) may have been pulled apart. Bob believes that the more likely thing is that the vacuum chuck would have failed before the indium bonds.

2) The problem may have resulted from not using the invar base. The hybrid was just bonded to sapphire. This may be a CTE problem. Bob thinks this is plausible.

Bob has recommended to Joe Banuck that the temperature cycle testing be done in a flight configuration with the sapphire mounted to beryllium and with fanout detector assemblies of the same size as flight detector assemblies. This would be very useful since a structural analysis of the setup with the indium bonds would be very difficult. Joe plans to look into getting beryllium and will look into a larger fanout size.

SBRC has six W1 detector cables (for PV detectors), some with discrepancies. Three cables were contaminated and SBRC is seeing if this lean can be removed. For each MODIS model, a total of four W1 cables are needed, one for each of the four focal planes.

For the S/MWIR Protoflight Model (PFM) subarrays, there are five possible sets of subarrays. One set is needed for the PFM. However, Bob believes there should also be backup sets.

Optics

There may be a group at Oak Ridge which does work with regard to surface roughness. Gene Waluschka will give Oak Ridge a call.

The stray light includes near field and far field. The near field involves light from within the field of view which scatters in a cone about the main specular reflected beam for each location on the mirror. This could be determined as a function of angular deviation from the specular reflection. The far field involves rays

which are outside the field of view of MODIS but which are brought into the field of view by scatter off the optical surface. Jim Young and Gene believe the near field scatter is of the most concern.

As Gene Waluschka pointed out, the BRDF data at TMA was taken at 6348 angstroms. Results were then extrapolated by Jim Young to other wavelengths using an algorithm. Jim and Gene share questions about the angle of incidence and wavelength dependence of the stray light. More test data may be needed.

Replan Impact on Specifications

On April 7th, Bill Barnes, Ed Knight, and Mike Roberto reviewed the MODIS specification and the Calibration Management Plan for changes required to implement the replan proposed by SBRC. The only MODIS spec change is to delete the last sentence of section 3.1.4.5. Ed has documented other proposed changes to the MODIS spec in a mail message dated April 7th entitled "Other Spec Changes".

For the Calibration Management Plan, on page 4-1, Ed identified the need to indicate the El Segundo facilities would be used for the flight models.

Mike Roberto April 8, 1994