MODIS Team Meeting Minutes

Minutes of the MODIS Team Meeting held on Tuesday, December 5, 1995.

Action Items:

113. Determine the best method to display a fixed pattern noise (herringbone, Spec 3.4.5.3.3). Assigned to Knight 8/15/95. Due 10/15/95.

115. Locate a Heliostat drive for the Solar Diffuser Test. Assigned to Barnes 11/07/95. Due 12/22/95.

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
		Helen Phillips

The following items were distributed:

1) Weekly Status Report #218
2) SBRC Memos submission from week #210
3) Minutes of the previous team meeting

MODIS Technical Weekly December 8, 1995

sent to MODIS.Review

1.0 Introduction

Jose Florez documents the investigation into the failure of the 128 and 184-pin MALCO/Microdot connectors installed in the PFM MODIS MEM and AEM CCA's.
He also includes proposed corrective actions.

Tom Pagano responds to Ed Knight's reasons for having the Bench Test Cooler (BTC) at Valley Forge. Tom is flexible in terms of use of the BTC, but he does not believe it is needed for what is planned; and use of the BTC does involve some risk to flight hardware.

Dick Weber has expressed the agreement with Ed's comments on the need for the BTC and has provided the following comments. The chief I&T activity on the spacecraft is compatibility testing. We need to know whether the cooled bands are disturbed by activity elsewhere on the spacecraft before we go to thermal vacuum testing. How will we know whether the cooled MODIS bands are susceptible to interference by other S/C systems prior to thermal vacuum testing at LMAS without using a BTC? Dick's comments were provided in email messages on November 29 and December 4.

Bob Martineau presents focal plane status for flight models.

Yoram Kaufman has analyzed the transmission data for the band 26 filters for flight model 1, flight model 2, and the spare. This data was provided by Tom Pagano via email on December 4. Yoram checked the filter responses at the 80%, 50%, and 5% levels for each of the three filters and found them are acceptable. The filter responses are in the range of very low water vapor transmission and can do the job for which they were designed. With concurrence from Bill Barnes, I informed Tom Pagano on December 6 that the filter transmissions were okay.

On December 5, Bob Kiwak arranged for Dick Weber, Ken Anderson, and Mike Roberto to visit the lab in building 30 where the life tests will be performed on ten halogen and ten vacuum bulbs of the types to be used in the SRCA. Details of the test philosophy and setup were provided by Henning Leidecker and Chuck Powers. Bulbs were selected based on a consistent number of turns and filament shape. These tests will be performed under ambient conditions but at temperatures which duplicate thermal vacuum conditions.

2.0 Jose Florez (MALCO/Microdot connector failures and proposed corrective actions)

from Jose Florez 12/6/95 6:28 pm
Subject: Investigation of the MALCO/Microdot Connector Failures

This report documents the investigation into the failure and proposed corrective actions of the 128 and 184-pin MALCO/Microdot connectors installed in the PFM MODIS MEM and AEM CCA's. The report is based on information obtained during telecons with SBRC personnel, as well as a trip to SBRC (Santa Barbara), and MALCO/Microdot (Pasadena).

Background

During testing of the first PFM FIFO board back in October, an open contact was detected in the CCA's 184 pin MALCO/Microdot female connector. The open was found after the board had been subjected to 12 unpowered thermal cycles from -30 oC to +75 oC, but before power was applied to the board. The connector was removed from the board and subjected to Failure Analysis, which uncovered the reason for the failure to be undercrimping of the solid wire to the barrel. The condition was aggravated by backfill of epoxy into the barrel.

There are 24 184-pin connectors in the MEM, one per CCA. The 24 184-pin connectors mounted on PFM boards were tested for continuity. 12 of the 24 connectors exhibited bad contacts ranging in numbers from 1 to 17 per connector.

Four additional 184-pin connectors were pulled from stock and subjected to similar processing as the ones mounted on the PFM CCA's. Then 20 temperature cycles from -55oC to +125oC were performed. All the connectors exhibited from 9 to 17 bad contacts.

There are 20 128-pin connectors in the AEM CCA's. These connectors were also built by MALCO/Microdot using the same process they use for the 184-pin devices. To date no failures have been observed in the 128-pin

parts. 22 of these devices were pulled from stock for testing. They have been subjected to 20 temperature cycles like the 184-pin connectors. No bad contacts have been detected in the connectors checked to date. The equipment used by SBRC to measure resistance had a resolution of .1W.

Based on the above information SBRC decided to replace all the 184-pin connectors in the MEM, and complete on going testing on the AEM 128-pin connectors before making a final decision on their disposition.

A factor compounding the replacement of the 184-pin parts in the MEM CCA's is that 6 of the 12 CCA designs (plus their redundant counterparts) have a T-bar structure to provide a path for thermal dissipation, and to support the connectors during insertion into the backplane. This bar reaches over the 90o bend of the connector wires to provide support to the connector body. The result is a condition where a new connector can not be placed in its proper position for installation in the board without first cutting a section of the T-bar. Since the T-bar is glued to the board, removal by chemical means is a process that requires 12 hours of exposure to acetone. This is not considered an acceptable option.

Meeting at MALCO/Microdot

A visit to the manufacturer of the connectors, MALCO/Microdot in Pasadena, California, took place on November 29, 1995. In attendance were Bob Cummings, Bob Silva, Pete Jemerson, and Jose Florez representing GSFC; Ed Schultz of SBRC; and Carl King (QA Manager), Tom Lincoln (Director of New Product Development), and Ms. Maye Despard (Customer Relations) representing MALCO/Microdot.

There was agreement between all the parties that the cause of the problem was insufficient pressure on the wire caused by undercrimping, and aggravated by the epoxy backfill. MALCO indicated that, although infrequently, this problem has occurred before. Microdot performed cross-section analysis of failed pins from the 184-pin connectors which provided confirmation. For their analysis they use a technique of measuring two parameters in the cross-section of a crimp, known as the "A" and "B" dimensions, to determine the quality of the crimp.

The 128-pin connectors have not been focused on at all by MALCO. In addition, they indicated that the problem has never been observed in the male connectors, used in the MODIS backplanes, and there is no reason to suspect their quality at this time.

During the discussion it was pointed out by MALCO that these parts were produced to an SBRC specification which differs from the QPL part, that has been qualified for flight, in the wire gauge (25 instead of 24) in addition to the 90o bend of the connector wires. For that reason these parts should have been subjected to qualification testing. GSFC must determine if a resubmission of the NSPAR is in order. Ed Schultz indicated that

24-gauge wire can not be used because the flight boards were laid-out and built with holes which are too small.

It was learned that the machine used for crimping had been out of service for several months prior to re-activation to make the MODIS connectors. During a tour of the facility it was noticed that there are no written procedures nor documentation for the setup and calibration of the machine. They have a guru that knows how the machine works and does the adjustments.

In trying to identify differences between the 128 and 184-pin connectors that could justify not replacing the first, it was proposed that it was possible the machine was originally setup for 24 gauge wire and 25 gauge wire was crimped until the condition was detected after a run for the 184-pin connectors. After adjustments were made another run was produced which was used for the 128-pin connectors. That could explain the undercrimping in the failed parts. We suggested a test to reproduce those conditions, but MALCO stated that the machine has been refurbished since then and it would not be possible to duplicate the conditions at the time of manufacture of our connectors.

The discussion then centered about suggestions for corrective action. A caucus of the GSFC representatives was conducted and the following consensus obtained:

184-pin Connectors

We concur with Microdot's five corrective actions for each lot manufactured (for our replacement connectors):
1. Perform pull test of 5 (randomly selected) out of every 50 crimps produced. (4 fast, 1 slow).
2. Tightened the tolerance on the "A" dimension.
3. Check the "A" and "B" dimensions.
4. Allow the epoxy to cure at room temperature before curing in the oven.
5. Measure contact resistance of all pins in one connector at room temperature and +125oC.

The following is SBRC's proposed incoming inspection (all connectors):
1. Visual inspection.
2. Tinning of connector wires.
3. Baseline measurement of contact resistance at ambient and +125oC.
4. 30 temperature cycles from -55oC to +125oC @ 15 oC/min, 10 min dwell.
5. Repeat contact resistance measurements at ambient and +125oC.

The GSFC team proposes the following modifications to SBRC's plan:
1. Resistance measurements to be performed at 1milliW accuracy.
2. Use the relative DmilliW between all the pins in a connector as the pass/fail criteria as Microdot does.
3. Perform resistance measurement at cold, in addition to ambient and high temperatures.
4. Lower upper temperature cycle limit to +100oC.

5. Consider reducing the number of temperature cycles from the current 30 to minimize stress to the parts.

124-pin Connectors

The GSFC team provides the following recommendations concerning the 124-pin connectors:
1. Don't do anything with the connectors mounted on the PFM boards until more information is known.
2. The SBRC testing performed to date does not provide accurate information about the quality of the connectors. Modify testing of all the residual connectors to:
a) Consider sending to Microdot for testing.
b) Resistance measurements to be performed at 1milliW accuracy.
c) Use the relative DmilliW between all the pins in a connector as the pass/fail criteria as Microdot does.
d) Perform additional microsections, including the longitudinal dimension, to look for epoxy backfill. If epoxy is detected the lot must be discarded.

Microdot will search through their documentation for lot traceability, process control, sequence of processing, etc. The goal is to identify differences in material or processing that can set the 128 and 184-pin connectors apart.

Additional issues

In addition to the issue of the connectors themselves there are other factors to be considered:

1. SBRC is working on a plan to cut the T-bars on the MEM boards. The plan must be reviewed by our QA. There is concern with the potential for ESD, vibration, and debris that will be generated by the process.
2. The number of heat cycles a solder pad can undergo before degradation of the pad to trace interface is noticeable has been established at 5 through studies conducted by GSFC reliability personnel. In all likelihood that figure will be exceeded with the rework necessary for connector replacement. The resulting reliability after the rework must be assessed.
3. Procurement of connectors for future builds. Resubmission of NSPAR and connector qualification must be addressed.

Jose

3.0 Tom Pagano (Comments on Ed Knight's reasons for having the BTC at Valley Forge for testing at the spacecraft level)

Author: "Pagano, Thomas S" <tpagano@msmail3.hac.com> at Internet
Date: 11/29/95 2:44 PM
---------- Message Contents

Ed,

One of the problems with E-mail is that dialog is not possible. It probably would have saved us both some time to just talk. I don't mind if you call me any time.

Zerothly, I'm not hard pressed to not use the BTC. I'm just saying it is not a requirement by SBRC systems engineering.

Firstly, I know the PC and PV are different, I was implying the PV boards. My apologies for the omission I wasn't trying to present "not true" information. Electronic calibration is discussed in the memo as applied to the PC bands (see more below).

Second. Responsivity variation is only an issue in the VIS/NIR bands. The IR bands have the on-board blackbody for radiometric correction. We expect them
to change, that's why we have a blackbody.

Thirdly, the predominant differences in the gains between the bands occurs in the readout, not the analog electronics. This makes most of the analog electronics more uniform.

Fourthly, the lowest noise levels are in the VIS/NIR (generally less than 1 count, IR generally 1 to 2 counts ref PL3095-N05274 and N05274. This is where we have the greatest sensitivity.

Fifthly, the BTC introduces spatial shifts of significant magnitude and therefore we cannot check the alignment stability with the BTC. This must be done in T/V. Also spatial shifts after acoustics is extremely unlikely since we will have demonstrated alignment stability after acceptance and qual level vibrations at that point.

Sixth, although we haven't demonstrated ecal stability, we have demonstrated csub stability. The best IR thermal vacuum data was taken with csub on. Since both use the same circuit, I expect the stability to be quite good.

Seventh, the whole point of using the ecal is to measure electrical response variation, not "instrument" or optical variations. Do you expect the optics to change during ambient "compatibility" testing? Is some instrument going to outgas or somehow affect our instrument throughput?

Eight, you're correct in that the PC electronic calibration will be ambiguous. In fact we may not even get all bands, depending on the offsets the detectors have when warm. Remember, however, that even using the BTC that radiometry in the IR bands is highly subject to background drifts and temperature drifts of the outer cooler stages and not accurate anyhow. On EM, we had problems even getting some of the PC bands in ambient due to the large offsets and high backgrounds.

Ninth, Ecal is coarse, however the noise riding on any one level can be measured. Are you trying to get linearity using ecal, I'd suggest you don't.

Tenth, No. Ecal is not for absolute measurements. SBRC never said we will measure "absolute stability" of the electronics using ecal. A linearity "check" is possible. You do not want to make any absolute measurements in ambient with or without the BTC. As you'll note we deleted all radiometric tests in ambient for PFM testing.

Eleventh, historical precedence does indicate that the noise levels are stable. You keep bringing up instrument stability. I propose that ambient tests is not the place to measure responsivity stability, only noise stability. Remember, we are looking for transient signals during ambient spacecraft tests. Responsivity will be drifting around due to thermal effects, guaranteed.

Twelfth, correct, acoustics and shock are schedule after T/V leaving no check of instrument IR response after these events. I don't like this either and would recommend to LMAS that they put acoustics and shock before T/V testing. Again, this is late in the program, MODIS spatial stability will have checked out with qual vibe levels (see fifthly).

Thirteenth, BAT test is not for verifying that the instrument survived the trip, it is to provide a baseline set of performance tests, and prepare us for integration into the spacecraft. This baseline will be compared with ambient and thermal vacuum data acquired while integrated to the spacecraft.

Fourteenth, correct, we haven't determined what trending is useful. I can say however, that the only clean environment to perform trending of noise and responsivity is in thermal vacuum. It is where the conditions are similar. Again the ambient environment with the BTC is not the place to measure instrument response stability.

You did not address the logistical issues:

1) Special fixturing will be required to hold the cryostat, BTC and nitrogen bottles will need to be supplied every 24 hours. These are high pressure (6000 psi) tanks that are very heavy and dangerous around the flight hardware.

2) There is real risk of damage to the radiative cooler and dewar stem while using the BTC. In addition, qualified personnel are required around the clock to support the test.

I appreciate your concerns and your 14 reasons why we need the BTC. I hope I've mitigated all of them, but would be happy if I only mitigated some of them. We cannot expect to do responsivity stability while using the BTC. We should be able to measure instrument transient behavior due to

incompatibilities and noise stability for most bands without it.

Tom P.

4.0 Bob Martineau (flight model detector status)

December 6, 1995
SUBJECT: Weekly Input for 12/5/95

1) Flight Model SCAs:

- Two of four SMWIR SCAs are being mounted and wire bonded to test carriers for testing. The other two will be mounted and wire bonded following completion of paperwork.

2) Flight Model 1 Detective Assemblies and FPAs:

- The F1 VIS and NIR FPAs have been delivered.

- F1 LWIR testing is complete. The original F1 LWIR filter/bezel filters have been removed and are being inspected prior to use. The mask is completed, and delivery of the FPA to the systems division is expected this week.

- The F1 SMWIR DA (S/N 11) completed radiometric test. The B26 replacement filter was not installed as reported last week. It has a spectral non-conformance and is awaiting Goddard approval of a waiver before being mounted (editor's note: see introduction for approval information)

3) Flight Model 2 Detective Assemblies:

- The F2 VIS and NIR FPAs have been delivered.

- The F2 LWIR DA has been wire bonded and will begin radiometric test this week. The filter/bezel for this unit will be built after rework of the F1 filter/bezel is complete. Receipt of the filter/bezel and delivery of the FPA are expected in January.

- The F2 SMWIR DA (S/N 12) completed radiometric tests. Building of the filter/bezel will begin upon receipt of the bezel from Speedring.

MR
12/8/95