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MODIS-N CALIBRATION HANDBOOK

prepared and edited by
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MODIS Characterization Support Team (MCST)

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MODIS-N CALIBRATION HANDBOOK

1. Introduction

1.1 Overview

This document is intended as an introduction to the results of the radiometric, geometric, and spectral calibration/characterization of the MODIS-N instrument scheduled for launch on the EOS-A platform in 1998. Readers of the document are expected to be those in the EOS program who are concerned with calibration, but not concerned primarily with the MODIS-N calibration efforts. This document provides these readers with sufficient information so they will have a clear picture of MODIS-N calibration/characterization plans. Every attempt will be made to make this handbook succinct yet complete. It is the intent to maintain and up-date this document as part of the information mode available to both EOS and non-EOS scientists through the EOSDIS's (EOS Data and Information Systems) DADS (Data Analysis and Distribution System).

MODIS-N is an imaging scanning spectro-radiometer. It views the Earth from an orbit of 705 km. and continually scans through the nadir to $\pm 55^{o}$. The instrument measures the at-satellite radiance in 36 bands from 0.408 mm to 14.385 mm. The footprint of the detectors varies from 0.25 km. (2 bands) to 0.5 km. (5 bands) to 1 km. (29 bands). Some properties of the bands are summarized in Section 7.5.

The spectro-radiometer itself is a 2-mirror off-axis Gregorian design. Radiation from the Earth passes through a dichroic beamsplitter which separates the light into four major bands. Discrete interference filters provide the higher spectral resolution.

Calibration sources include views of the Sun through a diffusing plate, the moon, deep space, a blackbody, and a spectro-radiometric calibration assembly which provides a measure of the wavelength stability of the instrument.

1.2 Science Calibration/Characterization Objectives

The MODIS-N specifications call for a radiometric calibration accurate to 5% below 3 mm and 1% above 3 mm. Stray light must be less than 1% and co-registration of different detector elements must be to within 0.1 pixel. Polarization sensitivity must be less than 2% at all wavelengths from 0.43 to 2.2 mm.

1.3 Organizations and Responsibilities

The MODIS Characterization Support Team (MCST) provides the overall planning and coordination of the MODIS-N calibration efforts under the direction of the MODIS Science Team. Hughes/SBRC, the instrument contractor, does the ground calibration and characterization and demonstrates that the specifications are met.

2. Pre-Launch Calibration/Characterization

2.1 Objectives/Rationale

Before launch, tests will be conducted to characterize the properties of MODIS-N. These plans call for the testing of the following radiometric properties: Gain, offset, signal versus radiance, linearity, signal-to-noise ratio, on-board calibrator performance, spectral matching, coherent noise, scan modulation, and band-to-band stability. The Modulation Transfer Function (MTF) will be measured along-track and across-track. Spectral band shapes and out-of-band radiation levels will be measured. The transient response including rise time and overshoot or undershoot will be tested. Polarization sensitivity will be measured. The spectral band registration along-track and crosstrack will be measured. Most of these tests will be made under ambient conditions and under vacuum conditions. A total of 29 different types of characterization tests are planned.

As part of EOS calibration planning, MODIS-N and all EOS-A platform instruments will be cross-calibrated using a common known source and/or using a traveling standard radiometer. These activities are in early planning stages and will be summarized when they become public.

The results summarized in this section come from two sources. The primary input comes from the MODIS-N contractor, Santa Barbara Research Center (SBRC), in Santa Barbara, CA. A parallel calibration and characterization effort has been provided by the MODIS Characterization Support Team (MCST) at NASA's Goddard Space Flight Center in Greenbelt, MD. Initial drafts of this document carry requirements prior to the availability of results.

2.2 Radiometric Calibration

Before launch the MODIS-N Calibrator will be used to provide a series of checks on the instrument. These checks include a radiometric sensitivity check and measurements of band-to-band registration, coherent noise, MTF, IFOV, transient response, optical alignment, scene simulation, and coherent noise.

2.2.1 Absolute Calibration

A minimum absolute radiometric calibration accuracy of ± 5% is required in the visible and near-infrared and ± 1% in the thermal infrared is required.

2.2.2 Relative Calibration

A ± 2% accuracy relative to the Sun is required. Over two weeks, a ± 0.5% stability is required. Section 3 is devoted to in-orbit calibrations.

2.3 Geometric Calibration

The pointing accuracy of MODIS-N will be sufficient to locate any pixel on the Earth's surface to with ± 0.5 times the length or width of the pixel. Registration of pixels to 0.1 pixel or better will be made, but a pointing knowledge of 30 arc seconds and alignment changes of 60 arc seconds will reduce the overall pointing knowledge to 0.5 pixels. Section 4 is devoted to in-orbit geometric calibrations.

2.4 Spectral Calibration

The spectral response of MODIS-N as a function of time must either be stable or measured with sufficient accuracy so that the overall radiometric calibration goals are reached. MODIS-N has a Spectro-radiometric Calibration Assembly (SRCA) which allows the spectral response of the scanning radiometer to monitored over time. Section 5 is devoted to in-orbit spectral calibrations.

3. In-Orbit Radiometric Calibration/Characterization

3.1 Objectives/Rationale

The characterization efforts before launch and the use of known radiation sources in orbit will allow the initial in-orbit calibration to be measured and maintained within specifications during the mission life. Multiple calibration techniques and sources will be used to obtain the necessary calibration accuracy. Sections 3.2 through 3.5 describe different calibration techniques. The approach to synthesizing the multiple approaches into a single official calibration algorithmis discussed in Section 6.

3.2 Instrument-Based Calibration Methods

Radiometric calibration of MODIS-N will be made through the use of known sources to establish the instrument's response. These known sources include the Sun, the [illegible] cold or dark space, a blackbody, and an incandescent source. [illegible]

3.2.1 Spectro-Radiometric Calibration Assembly (SRCA)

A single blackbody operating at the ambient temperature will be used to calibrate the MODIS-N thermal channels. The blackbody will be viewed once per scan and calibrate channels 20 through 36. The blackbody itself is aluminum with v-groove cuts of 25°. Its effective emissivity is 0.992 or greater.

The Spectro-Radiometric Calibration Assembly (SRCA) can be used for radiometric checks in the visible and near infrared since it has an incandescent source. It can be used at any time during the orbit. The SRCA is also used in spectral calibration and spatial registration studies.

3.2.2 Solar Diffuser Stability Monitor (SDSM)

A solar diffuser plate is part of the MODIS-N design. It can be used to calibrate channels 1 to 7 and 17 to 19 once each orbit. The properties of the diffuser plate are monitored, in turn, by the Solar Diffuser Stability Monitor (SDSM) which alternately views the sun and the diffuser.

This method of calibration is a primary method of calibration since the entire optical path of the instrument is monitored.

3.2.3 External Lunar

MODIS-N can view the moon, once per month in the spring and autumn, when deep space is viewed. For 4 to 6 times per year, for periods lasting about one day, the moon is visible in the deep space scans. The moon is an extremely stable radiation source, which potentially allows it to be used for calibration. The intensity of the lunar disk will vary during the year as the Earth-Sun distance changes and will also vary with the lunar libration angle and phase angle. The MODIS-N design only allows the moon to be observed when it is in a gibbous phase about 22.5° beyond the half-moon phase. Given the precise illumination and observation geometry, a high spatial resolution model of the spectral radiance from the moon will be calculated. This radiometric image will then be transforms to match the resolution and orientation of MODIS-N. Periodically then, MODIS-N will be exposed to a stable radiometric source, allowing the long-term stability of the instrument to be monitored. Hugh Kieffer of the USGS-Flagstaff is the principal investigator for lunar calibration; Dr. Kieffer is a Team Member of both the ASTER and HIRIS Facility Teams.

This method of calibration is a primary method of calibration since the entire optical path of the instrument is monitored.

3.3 Instrument Cross-Comparison Methods

3.3.1 Cross-Sensor/Within Platform

Several passive remote sensors using visible radiation are planned for the EOS-A platform. Each instrument will be independently calibrated. After corrections for differences in footprint size, spectral resolution, and pointspread functions are made, the radiances measured by the separate should agree to within their stated accuracies. If they do agree, it tells us that any biases, whether the bias is zero or not, are the same. The more instruments that agree, the more confidence we can have that correct measurements are being made. Potential comparison instrument include MODIS-N (am) to MODIS-N (pm), MODIS-T, AIRS, ASTER, EOSP, and MISR. Several of these potential configurations are discussed below.

AIRS (Atmospheric Infrared Sounder) has a 13.5 km. nadir footprint with five channels in the visible region from 0.4 to 1.1 microns. Inter-comparison to MODIS-N will consist of combining many MODIS pixels, weighted by the AIRS pointspread function to form an image like a single AIRS pixel. Because MODIS-N also appears to have better spectral resolution in the visible, several appropriately weighted MODIS-N bands will be required to match the AIRS resolution. Repeated comparisons of AIRS pixels with MODIS-N simulated AIRS pixels should give a reasonable indication of the amount of agreement.

Both AIRS and MODIS-N also make thermal infrared measurements which allow comparisons to be made. At each thermal wavelength, contributions are coming from all layers of the atmosphere and the surface usually expressed through atmospheric weighting functions. If the two instruments do not have similar bandpasses, the comparison is made difficult since the same layers of the atmosphere are not sampled equally. It is likely that radiances in the thermal bands for these two instruments will not be compared directly, but a derived geophysical parameter such as sea surface temperature will be used for the inter-comparison. The thermal cross-calibration technique for this pair of instruments and for other pairs of instruments is a topic requiring further study.

ASTER (Advanced Spaceborne Thermal Emission and Reflection) has a 30 meter nadir footprint and one near infrared band from 850 to 920 nm. Since MODIS-N has bands centered at 865 and 905 nm an inter-comparison is possible using appropriate weights or filter factors for the two instruments. Spatially the MODIS-N pixel can be simulated by summing up the ASTER pixels using the MODIS-N pointspread function as the weighting function. Inter-comparisons in the thermal infrared are also possible for these two instruments.

EOSP (Earth Observing Scanning Polarimeter) has a 10 km. nadir footprint and several spectral bands in the visible region. MODIS-N radiances can be spatially re-mapped, using the EOSP pointspread function, and spectrally re-mapped, using the EOSP filter transmission functions, to match the EOSP radiance observations.

MISR (Multi-angle Imaging Spectro-radiometer) has four viewing angles which can be duplicated by MODIS-N. Four other MISR viewing angles cannot be matched by MODIS-N. MISR has spectral bands centered at 440 and 860 nm which are closely matched by MODIS-N bands at 443 and 865 nm. The wavelength resolution for MISR is not available, but probably is less than MODIS-N. By spectrally re-mapping MODIS-N and spatially re-mapping MISR, a matching image for the two instruments appears possible which will allow them to be inter-compared.

The University of Arizona, under the direction of Dr. Philip Slater, plans to perform cross-calibration comparisons of the type described in this section. They have extensive experience with AVHRR-SPOT comparisons and NOAA-9, NOAA-10, and Landsat TM comparisons.

3.3.2 Cross-Platform In-Orbit

Using sensors on other satellites for inter-comparison proceeds much like the inter-comparisons described above. The major difficulty and drawback in comparisons between two satellites is that seldom are both satellites over the same region at the same time so matching satellite and solar geometries can be obtained. Without the geometry and temporal match, the inter-comparison become considerably more involved. Some potential comparison instruments are AVHRR, SPOT, and Landsat as discussed below. Other potential comparisons with MERIS, SeaWiFs, GOES, and other satellites are also possible.

AVHRR (Advanced Very High Resolution Radiometer) has a 1.1 km. nadir footprint, which is close to the 1 km. nadir footprint for some MODIS-N channels. AVHRR has a lower spectral resolution than MODIS-N. AVHRR's channel 1 measures in the range of about 560 to 700 nm and channel 2 covers about 720 to 970 nm. Weighting the MODIS-N bands centered at 531, 565, 653, 681, 750, 865, 905, 936, and 940 nm by the filter transmission of the AVHRR interference filters should allow an AVHRR type scene to be constructed from the MODIS-N observations. The initial pre-flight filter transmissions for AVHRR are known, but because filters of this type change their properties in flight, it is not clear that using the pre-flight transmission functions will give correct results. Another drawback with the AVHRR/MODIS-N inter-comparison is that the AVHRR sensors are not well calibrated. It is also not clear if the present AVHRR design will be flying in the MODIS-N era. Finally comparison between the two sensors will be limited to those times when both are crossing the same scene within as yet to be defined window of time.

SPOT has a 10 meter nadir footprint and several visible bands which offer opportunities for inter-comparison with MODIS-N. SPOT images can be spatially re-mapped and MODIS-N images can be spectrally re-mapped to achieve synthetic images which can be inter-compared.

Landsat has a 30 meter nadir footprint and visible bands covering 450-520, 520-600, 630-690, and 760-900 nm which offer opportunities for inter-comparison with MODIS-N. Landsat images can be spatially re-mapped and MODIS-N images can be spectrally re-mapped to achieve synthetic images which can be inter-compared.

The University of Arizona plans to perform cross-calibration comparisons of the type described in this section. They have extensive experience with AVHRR-SPOT comparisons.

3.3.3 Target Related/Aircraft

MODIS-N radiances will be compared to the radiances measured from high flying aircraft such as NASA's ER-2 aircraft using an Optronic model 740A spectroradiometer. Except for small corrections of the order of less than 5% for the path radiance caused by atmospheric scattering above the aircraft, co-located radiances from these two sensors should be nearly the same. The technique assumes the spectral response of the satellite radiometers remains unchanged over time and measured changes in response are gain changes only. Co-location of the aircraft and satellite observations can be done by fine-tuning the navigation of the satellite such that the maximum correlation between the two sets of measurements is achieved. Since the aircraft radiometer can be re-calibrated in the laboratory with traceability to NIST standards, the technique allows the MODIS-N observations to be maintained to within several percent over the entire 15 years of the EOS experiment. The technique is slightly more complicated to use when significant stratospheric aerosols are present such as those from El Chicon or Mt. Pinatubo.

3.4 Target-Based Calibration Methods

3.4.1 Target Related/Ground Reflectance

In-situ observations of radiance from the ground or from aircraft can be compared to satellite radiance observations by using radiative transfer models. These in-situ radiance measurements, in effect, become known sources suitable for calibration. The following sub-sections describe these techniques. Buoy observations of pigment concentration can also be compared to MODIS-N derived values for the same pigment concentration. A difference in the two determinations can indicate a calibration problem exists, which can be corrected by altering the calibration until the two pigment concentrations exists. This technique may not calibrate the spectrometer so much as tune the spectrometer-radiative transfer-pigment concentration algorithm combination.

MODIS-N radiances can also compared to ground observations provided a good radiative transfer model is available and the composition and vertical structure of the atmosphere are well measured. Co-located ground and satellite measurements then allow the calibration of the satellite sensor to be checked much as is done using high flying aircraft.

Characterizing atmospheric composition requires measurements of total precipitable water, total ozone amount, and aerosol optical depth as a function of wavelength. Atmospheric water vapor can be measured using radiosondes, or total precipitable water vapor meters using either solar or microwave radiation. Dobson spectrometers can provide total ozone amounts. Aerosol properties can be measured using lidar, sunphotometers, aureole meters, combined pyranometers and pyrheliometers giving the diffuse-direct ratio, or pyrheliometers equipped with Schott glass filters. The combination and choice of instruments has not yet been made.

3.4.2 Bio-Optical Oceans

Water leaving radiances over the many ocean locations at wavelengths greater than about 700 nm are thought to be close to zero. An accurate radiative transfer model allows the path radiance to the satellite radiance to be determined. This path radiance therefore provides a known source which allows MODIS-N to be calibrated. This technique makes the instrument calibration and the radiative transfer model self-consistent.

Buoy measurements of pigment concentration can be compared with MODIS-N determined pigment concentrations. A discrepancy between the two may be solved by altering the calibration of the satellite. This technique is called bio-geochemical normalization.

3.5 Image Related

3.5.1 External Image Related Radiometric Rectification

Certain regions on Earth contain areas which are radiometrically stable. For example, exposures of bedrock may have a relative stable reflectance over long periods of time. These radiometrically stable areas within images can be used to correct other portions of an image so that they are internally self-consistent with the stable portions of the image. The technique is referred to as "within image radiometric rectification" and is generally applied to high resolution images such as those produced by Landsat or SPOT. The applicability of the technique to MODIS-N images will be researched and applied.

3.5.2 Class-specific Scene Equalization

A generalization of the within image radiometric rectification technique in which multiple scenes are used will also be employed for monitoring the MODIS-N stability.

4. In-Orbit Geometric Calibration

The SRCA will provide in-orbit spatial registration measurements. The assembly consists of an incandescent lamp source which illuminates a double pass grating spectrometer that provides a light source of known wavelength to the scanning spectro-radiometer. When a recticle pattern is deployed in front of the SRCA exit slit, the alignment of spectro-radiometer can be measured and compared to previous measurements.

5. In-Orbit Spectral Calibration

The SRCA will provide in-orbit spectral calibration. The assembly consists of an incandescent lamp source which illuminates a double pass grating spectrometer that provides a light source of known wavelength to the scanning spectro-radiometer.

6 Official MODIS-N/MCST Calibration Algorithms/Models

6.1 Objectives/Rationale

During routine processing, one calibration algorithm will be used to determined the Level-1B radiances. This official algorithm may be one technique, but it is more likely to be a combination of methods. MCST has the responsibility of supplying this algorithm to convert the raw Level-1A quantized value to Level-1B radiances.

6.2 Algorithm Sensitivity/Simulation Studies

7. Definitions, References, and Tables

7.1 Table of Personnel to Contact for More Information

TOPIC	CONTACT PERSON(S)	TELEPHONE
General	John Barker Phil Slater	301-286-9498 602-621-4242
Ground Calibration of MODIS-N alone	Jim Young	
Cross-calibration prior to flight	Bruce Guenther Phil Slater	301-286-5205 602-621-4242
In-flight Calibration	John Barker	301-286-9498
Cross-calibration in orbit	Phil Slater S. F. Biggar	602-621-4242
Calibration using Ground-Truth Measurements	Phil Slater S. F. Biggar	602-621-4242
Calibration using Aircraft Underflights	Peter Abel Mike King	301-286-6829 301-286-5909
End-of-Flight Tests	John Barker	301-286-9498
Thermal Calibration	Peter Abel	301-286-6829
Visible Calibration	John Barker	301-286-9498
Lunar Calibration	Hugh Kieffer	602-556-7015
EOS Calibration Plans	Bruce Guenther	301-286-5205

7.2 Data Dictionary/Glossary

7.3 Acronyms

A

AIRS — Atmospheric Infrared Sounder
ASTER — Advanced Spaceborne Thermal Emission and Reflection
AVHRR — Advanced Very High Resolution Radiometer

E

EOS — Earth Observing System
EOSP — Earth Observing Scanning Polarimeter

G

GOES — Geostationary Operational Environmental Satellite

I

IFOV — Instrument field of view

M

MCST	MODIS Characterization Support Team
MERIS	Medium Resolution Imaging Spectrometer
MISR	Multi-angle Imaging Spectro-radiometer
MODIS-N	Moderate Resolution Imaging Spectrometer - Nadir
MODIS-T	Moderate Resolution Imaging Spectrometer - Tilt
MTF	Modulation transfer function
N	
NASA	National Aeronautics and Space Administration
S	
SeaWiFs	Sea Viewing, Wide-Field-of-View Sensor
SBRC	Santa Barbara Research Center
SDSM	Solar Diffuser Stability Monitor
SRCA	Spectro-radiometric Calibration Assembly
T	
TM	Thematic Mapper

7.4 References

Hughes, Santa Barbara Research Center, 1991. Instrument Design Summary (MODIS-N).

Hughes, Santa Barbara Research Center, 1991. Moderate Resolution Imaging Spectrometer - Nadir (MODIS-N). Phase C/D Proposal. Technical Design Summary.

1990 Reference Handbook. EOS, Earth Observing System.

MCST Presentation at the MST Meeting (9/24/90).

7.5 Tables

MODIS VISIBLE FOCAL PLANE CHANNELS			
Channel Number	Central Wavelength (um)	Bandwidths (microns)	Signal to Noise Ratio
3	0.470	0.020	438
4	0.555	0.020	428
8	0.415	0.015	1284
9	0.443	0.010	1241
10	0.490	0.010	1456
11	0.531	0.010	1452
12	0.565	0.010	1281

MODIS NEAR INFRARED FOCAL PLANE CHANNELS			
Channel Number	Central Wavelength (um)	Bandwidths (microns)	Signal to Noise Ratio
1	0.659	0.050	241
2	0.865	0.040	438
13	0.653	0.015	1630
14	0.681	0.010	1238
15	0.750	0.010	1061
16	0.865	0.015	1053
17	0.905	0.030	463
18	0.936	0.010	119
19	0.940	0.050	643

MODIS SHORT AMD MID-RANGE INFRARED FOCAL PLANE CHANNELS			
Channel Number	Central Wavelength (um)	Bandwidths (microns)	Signal to Noise Ratio
5	1.240	0.020	274
6	1.640	0.020	433
7	2.130	0.050	225
20	3.750	0.180	1098
21	3.750	0.050	12
22	3.959	0.050	649
23	4.050	0.050	746
24	4.465	0.050	161
25	4.515	0.050	510
26	4.565	0.050	499

MODIS THERMAL OR LONG-WAVE INFRARED FOCAL PLANE CHANNELS			
Channel Number	Central Wavelength (um)	Bandwidths (microns)	Signal to Noise Ratio
27	6.715	0.360	272
28	7.325	0.300	498
29	8.550	0.300	1425
30	9.730	0.300	803
31	11.030	0.500	2572
32	12.020	0.500	2085
33	13.335	0.300	431
34	13.635	0.300	340
35	13.935	0.300	295
36	14.235	0.300	201

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MODIS-N CALIBRATION PLAN

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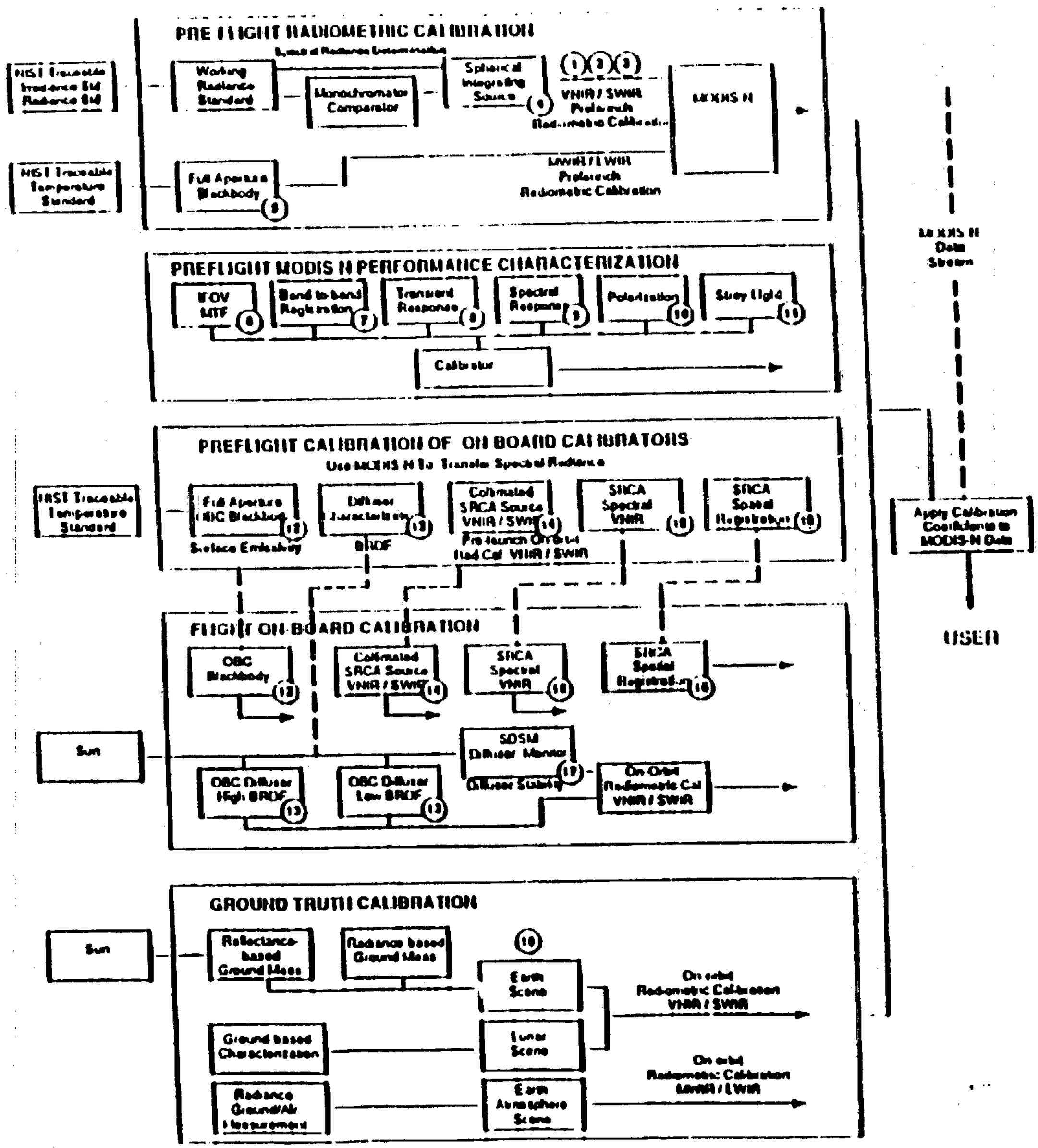

MODIS-N CALIBRATION MANAGEMENT PLAN BLOCK DIAGRAM COVERING PREFLIGHT AND ON-ORBIT ACTIVITIES INCLUDING MATH MODEL INDEX

Type of Calibration	Source	Mechanism	Aperture	Spectral Bands	Usage Frequency (Max)	Other Comments
Zero Radiance	Space		Full	All	Once per scan line	
Radiometric	Sun	Solar illuminated diffuser	Full	VIS/NIR/SWIR less 8 through 16	Once per orbit	BRDF = 0.18 sr^{-1}
Radiometric	Sun	Solar illuminated diffuser	Full	VIS/NIR/SWIR	Once per orbit	BRDF = 0.018 sr^{-1}
Radiometric & DC Restore	Blackbody	Blackbody	Full	MWIR/LWIR Restore (All)	Once per scan line	
Radiometric	Incandescent source	SRCA spectrally shaped collimator	Partial	VIS/NIR/SWIR	Available any time during orbit	
Spatial Registration	Incandescent source and IR source	SRCA	Partial	VIS/NIR/SWIR MWIR/LWIR	Available any time during orbit	
Spectral (MODIS N)	Incandescent source	SRCA grating monochromator	Partial	VIS/NIR/SWIR	Available any time during orbit	Grating is rotated to produce λ scan
Spectral (monochromator)	Incandescent source	SRCA grating monochromator and filter	Full	0.40 μm ≤ λ ≤ 1.00 μm	Available any time during orbit	Grating is rotated to produce λ scan
Diffuser stability monitor	Sun	SDSM grating spectrograph and fold mirror	Full	0.40 μm ≤ λ ≤ 2.20 μm	Available once per orbit	High BRDF diffuser
Diffuser stability monitor	Sun	SDSM grating spectrograph and fold mirror	Full	0.40 μm ≤ λ ≤ 2.20 μm	Available once per orbit	Low BRDF diffuser

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MODIS-N IN-FLIGHT CALIBRATION CAPABILITY

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Appendix

for

MODIS Calibration Status Report

to

Reflected Solar Working Group A

at the

5th Meeting

of the

EOS Calibration and Data Product Validation Panel

of the

EOS Investigator Working Group (IWG)

from

MCST (MODIS Characterization Support Team)

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Tuesday, 7 April 1992
The Broker Inn, Boulder, CO

Outline for
MODIS Calibration/ Characterization Plan

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Calibration Working Group
MODIS Science Team Meeting
13-16 April 1992

AGENDA

Goddard Space Flight Center
Building 22, Room 365
Monday, April 13, 1992

0830	Phil Slater	Introductions and Introductory Remarks
0845	John Barker	MODIS Characterization Support Team (MCST) Report
0930	Bruce Guenther	MODIS-Related EOS Cal/Val Panel Issues
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1000	Jim Young	MODIS-N Instrument Cal/Val Plans Status
1100	John Barker	MODIS Science Calibration Plans
1115	Stuart Biggar	Cross-Calibration Progress, Plans and Concerns
1125	Brian Markham	Simulated MODIS Imagery from TM
1135	Jan-Peter Muller	Modeling of MODIS Sensors
1145	Ken Brown	MODIS Aircraft Simulator (MAS)
1155	Peter Abel	NASA Aircraft-Satellite Instrument Calibration
1205	Bill Barnes	SeaWiFS Instrument Calibration
1215	Phil Slater	Identify Calibration-Related Issues/Action Items
1300	ADJOURN	

AGENDA

MODIS Science Team **Calibration Working Group**
Goddard Space Flight Center
Building 8, Auditorium
Tuesday, April 14, 1992

1515	Phil Slater	Review Agenda for Meeting
1530	Jim Young	SBRC Proposed Cross-Track Calibrator
1615	Peter Abel	Aircraft/Satellite Cross-Track Calibration
1630	Joann Harnden	Alternatives for Cross-Track Calibration Multi-Year Scene Statistics 90-Degree Observatory Rotation ("MISR" mode)
1645	Phil Slater	Recommendation on Cross-Track Calibration for MODIS Science Team
1715	ADJOURN	

AGENDA

MODIS Science Team **Calibration Working Group**
Goddard Space Flight Center
Building 8, Auditorium
Wednesday, April 15, 1992

0800	Phil Slater	Review Agenda for Meeting Prioritize Calibration Issues
0815	Jim Young	Discussion of Instrument-Related Calib. Issues - Thermal Bands Calibration Accuracy - Lunar Calibration Options - Solar Panel/Door Modification - SRCA Changes and Options - Imbedded Detector Data in Housekeeping Telemetry - Radiometric Math Model - Band-Pass Options
0945	Phil Slater	Identify any Proposed Changes in Requirements
1000	BREAK	
1015	John Barker	Proposed Schedule of Reviews Plans, Instruments, and Calib. Algorithms
1030	Phil Slater	Develop Recomendations for Science Team Proposed MODIS Calibration Peer Review Panel Develop Action Items for MCST, Working Group, etc.
1200	ADJOURN	

AGENDA

MODIS Science Team **Calibration Working Group**
Goddard Space Flight Center
Building 8, Auditorium
Thursday, April 16, 1992

0800	Phil Slater	Review Agenda for Meeting
0810	John Barker	Plans and Options for Cross-Calibration
0820	Stuart Biggar	Pre-Launch Cross-Calibration Options
		In-Orbit Ground Validation Experiments
0825	Peter Abel	NASA Aircraft-Satellite Instrument Calibration
0830	Phil Slater	Prioritize Cross-Calibration Issues

0845 Panel Discussion on Cross-Calibration of MODIS with other Sensors

EOSPM/AIRS	Larry Strow	UMBC
EOSAM/ASTER	Hugh Keiffer	USGS
	Akira Ono	JPL
	Phil Slater	U. AZ
NOAA/AVHRR	Phil Slater	U. AZ
SPOT	Phil Slater	U. AZ
CERES	Mike King	GSFC/913
	Bruce Wylicki	LaRC
Landsat TM	Les Thompson	GSFC/925
EOSAM/MISR	Carol Bruegge	JPL

1000 BREAK

1015 Phil Slater
Review Calibration-Related Issues/Action Items
Action Items for MCST and Individuals
Recommendations to MODIS Science Team (MST)
Agenda for Fall Cal Discipline WG Meeting
Input to EOS Cal Meeting October 1992

1130 ADJOURN

MODIS/MCST Feedback Sheet

on MODIS Calibration Handbook and MODIS Characterization/Calibration Plan

Questions ? **Concerns ?**

Suggestions ? **Actions for Next Meeting?**

Name: **Date:**

For E-mail correspondence address GSFCmail:JBarker or BGrant.
For updates on the latest events and available documents, CHECK MCST.BB bulletin board on GSFCmail.

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