MODIS Science Team Meeting Minutes

October 22-24, 1997

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MODIS SCIENCE INTEREST GROUP
October 22 - 24, 1997

GLOSSARY OF ACRONYMS

ADEOS	Advanced Earth Observing Satellite
AFGL	Air Force Geophysics Lab
AGU	American Geophysical Union
AHWGP	*Ad Hoc* Working Group on Production
AIRS	Atmospheric Infrared Sounder
AO	Announcement of Opportunity
APAR	Absorbed Photosynthetically Active Radiation
API	Application Programmable Interface
ARVI	Atmospherically Resistant Vegetation Index
ASAS	Advanced Solid State Array Spectrometer
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
ATBD	Algorithm Theoretical Basis Document
ATMOS	Atmospheric Trace Molecule Spectrometer
ATSR	Along Track Scanning Radiometer
AVHRR	Advanced Very High Resolution Radiometer
AVIRIS	Advanced Visible and Infrared Imaging Spectrometer
BAT	Bench Acceptance Test
BATS	Basic Atlantic Time Series
BCS	Blackbody Calibration Source
BOREAS	Boreal Ecosystem Atmospheric Study
BRDF	Bidirectional Reflection Distribution Function
CAR	Cloud Absorption Radiometer
cc	cubic convolution
CCB	Configuration Control Board
CCN	Cloud Condensation Nuclei
CCRS	Canada Centre for Remote Sensing
CDHF	Central Data Handling Facility
CDR	Critical Design Review
CEES	Committee on Earth and Environmental Sciences
CEOS	Committee on Earth Observation Satellites
CERES	Clouds and the Earth's Radiant Energy System
CIESIN	Consortium for International Earth Science Information Network
CNES	Centre National d'Etudes Spatiales (French Space Agency)
COTS	Computer Off-The-Shelf
CPU	Central Processing Unit
CZCS	Coastal Zone Color Scanner
DAAC	Distributed Active Archive Center
DADS	Data Access and Distribution System
DCW	Digital Chart of the World
DEM	Digital Elevation Model
DIS	Data and Information System
DMA	Defense Mapping Agency
DMCF	Dedicated MODIS Calibration Facility
DoD	Department of Defense
DOE	Department of Energy
DPFT	Data Processing Focus Team
DPWG	Data Processing Working Group

DSWG	Data System Working Group
DTED	Digital Terrain and Elevation Data
ΔPDR	Delta Preliminary Design Review
ECS	EOS Core System (part of EOSDIS)
Ecom	EOS Communications
EDC	EROS Data Center
EDOS	EOS Data and Operations System
EDR	Environmental Data Record
EFS	Electronic Filing System
EM	Engineering Model
EOS	Earth Observing System
EOSDIS	EOS Data and Information System
EPA	Environmental Protection Agency
ER-2	Earth Resources-2 (Aircraft)
ERS	ESA Remote Sensing Satellite
ESA	European Space Agency
ESDIS	Earth Science Data and Information System
ESIP	Earth Science Information Partners
ESTAR	Electronically Steered Thinned Array Radiometer
FIFE	First ISLSCP Field Experiment
FM	Flight Model
FOV	Field of View
FPAR	Fraction of Photosynthetically Active Radiation
FTP	File Transfer Protocol
FY	Fiscal Year
GAC	Global Area Coverage
GCM	General Circulation Model
GCOS	Global Change Observing System
GE	General Electric
GIFOV	Ground Instantaneous Field-Of-View
GLAS	Geoscience Laser Altimeter System
GLI	Global Imager
GLRS	Geoscience Laser Ranging System (now GLAS)
GOES	Geostationary Operational Environmental Satellite
GOOS	Global Ocean Observing System
GSC	General Sciences Corporation
GSFC	(NASA) Goddard Space Flight Center
GSOP	Ground System Operations
GTOS	Global Terrestrial Observing System
HAPEX	Hydrological-Atmospheric Pilot Experiment
HDF	Hierarchical Data Format
HIRS	High Resolution Infrared Radiation Sounder
HOTS	Hawaii Ocean Time Series
HQ	Headquarters
HRIR	High Resolution Imaging Radiometer
HRPT	High Resolution Picture Transmission
HRV	High Resolution Visible
HTML	Hypertext Markup Language
I & T	Integration and Test
ICD	Interface Control Document
IDS	Interdisciplinary Science
IFOV	Instantaneous Field-Of-View
IGBP	International Geosphere-Biosphere Program
IMS	Information Management System

IORD	Integrated Operational Requirements Document
IPAR	Incident Photosynthetically Active Radiation
IPO	Integrated Program Office
ISCCP	International Satellite Cloud Climatology Project
ISDN	Integrated Services Digital Network
ISLSCP	International Satellite Land Surface Climatology Project
IV&V	Independent Validation and Verification
IWG	Investigators Working Group
JERS	Japanese Earth Resources Satellite
JGR	Journal of Geophysical Research
JPL	Jet Propulsion Laboratory
JRC	Joint Research Center
JUWOC	Japan-U.S. Working Group on Ocean Color
K	Kelvin (a unit of temperature measurement)
LAC	Local Area Coverage
LAI	Leaf Area Index
LaRC	NASA Langley Research Center
LARS	Laboratory for Applications of Remote Sensing
LBA	Large-scale Biosphere-Atmosphere experiment in Amazonia
LCD	Liquid Crystal Display
LDOPE	Land Data Operational Product Evaluation Facility
LTER	Long-Term Ecological Research
LUT	Look-Up Table
MAB	Man and Biosphere
MAS	MODIS Airborne Simulator
MAT	MODIS Algorithm Team
McIDAS	Man-computer Interactive Data Access System
MCST	MODIS Characterization Support Team
MERIS	Medium Resolution Imaging Spectrometer
MFLOP	Mega FLOP, or a million floating point operations per second
MGBC	MODIS Ground Based Calibrator
MISR	Multiangle Imaging Spectro-Radiometer
MOBY	Marine Optical Buoy
MODARCH	MODIS Document Archive
MODIS	Moderate-Resolution Imaging Spectroradiometer
MODLAND	MODIS Land Discipline Group
MOPITT	Measurements of Pollution in the Troposphere
MOU	Memorandum of Understanding
MPCA	MODIS Polarization Compensation Assembly
MSS	Multispectral Scanner (Landsat)
MST	MODIS Science Team
MTF	Modulation Transfer Function
MTPE	Mission to Planet Earth
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan`
NASIC	NASA Aircraft Satellite Instrument Calibration
NDVI	Normalized Difference Vegetative Index
NCEP	National Center for Environmental Prediction
NE∆L	Noise Equivalent Radiance Difference
NE∆T	Noise Equivalent Temperature Difference
NESDIS	National Environmental Satellite Data and Information Service
NIR	near-infrared
NIST	National Institute of Standards and Technology
nn	nearest neighbor

NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	Net Primary Productivity
NPS	National Park Service
NRC	National Research Council
NSF	National Science Foundation
NSIDC	National Snow and Ice Data Center
OBC	On-Board Calibrator
OCR	Optical Character Recognition
OCTS	Ocean Color and Temperature Scanner
ONR	Office of Naval Research
OSC	Orbital Sciences Corporation
OSTP	Office of Science and Technology Policy
PAR	Photosynthetically Active Radiation
PDQ	Panel on Data Quality
PDR	Preliminary Design Review
PFM	Protoflight Model
PGE	Product Generation Executable
PGS	Product Generation System
PI	Principal Investigator
POLDER	Polarization and Directionality of Reflectances
QA	quality assurance
QC	quality control
QCAL	calibrated and quantized scaled radiance
RAI	Ressler Associates, Inc.
RAID	Redundant Array of Inexpensive Disks
RDC	Research and Data Systems Corporation
RFP	Request for Proposals
RMS	Room Mean Squared
RSS	Root Sum Squared
SAR	Synthetic Aperture Radar
SBRC	Santa Barbara Research Center (changed to SBRS)
SBRS	Santa Barbara Remote Sensing
SCAR	Smoke, Clouds, and Radiation Experiment
SCF	Science Computing Facility
SDP	Science Data Processing
SDSM	Solar Diffuser Stability Monitor
SDST	Science Data Support Team
SeaWiFS	Sea-viewing Wide Field of View Sensor
SIS	Spherical Integrating Source
SNR	Signal-to-Noise Ratio
SOW	Statement of Work
SPDB	Science Processing Database
SPSO	Science Processing Support Office
SRC	Systems and Research Center
SRCA	Spectroradiometric Calibration Assembly
SSAI	Science Systems and Applications, Inc.
SSMA	Spectral/Scatter Measurement Assembly
SST	Sea Surface Temperature
STIKSCAT	Stick Scatterometer
SWAMP	Science Working Group for the AM Platform
SWIR	Shortwave Infrared
SIMBIOS	Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies

TAC	Test and Analysis Computer
TBD	To Be Determined
TDI	Time Delay and Integration
TDRSS	Tracking and Data Relay Satellite System
TIMS	Thermal Imaging Spectrometer
TIR	Thermal Infrared
TLCF	Team Leader Computing Facility
TM	Thematic Mapper (Landsat)
TOA	Top Of the Atmosphere
TOMS	Total Ozone Mapping Spectrometer
TONS	TDRSS On-board Navigation System
TRMM	Tropical Rainfall Measuring Mission
UARS	Upper Atmosphere Research Satellite
UPN	Unique Project Number
URL	Uniform Resource Locator
USGS	United States Geological Survey
UT	Universal Time
VAS	VISSR Atmospheric Sounder
VC	Vicarious Calibration
VISSR	Visible/Infrared Spin Scan Radiometer
VIS	Visible
WAIS	Wide-Area Information Servers
WVS	World Vector Shoreline
WWW	World Wide Web

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ATTACHMENTS

Note: Below is the list of handouts and viewgraphs that were presented at the meeting. Each attachment can be accessed by clicking on the title (if you are using Adobe Acrobat [PDF]) or you can access this list via the World Wide Web (WWW) at `http://modarch.gsfc.nasa.gov/MODIS/SCITEAM/199710/attachments.html`

If you are unable to access any of the attachments or have questions, contact Bob Kannenberg at Code 922, NASA / GSFC, Greenbelt, MD 20771; call (301) 286-4625; or e-mail rkannenb@ pop900.gsfc.nasa.gov.

Title	**Author**
1. Science Team Meeting Agenda	Bob Kannenberg
2. MODIS Reflective Band Characterization	Bruce Guenther
3. Data Production and Readiness Plans Agenda	Ed Masuoka
4. Version 1 SSI&T Status and Lessons	Ed Masuoka
5. GSFC DAAC MODIS Version 2 SSI&T Overview	Steve Wharton
6. V1 and V2 SSI&T at EDC	Jeff Eidenshink
7. NSIDC V1 SSI&T Status	Spencer Shiotani
8. Version 2 SSI&T	Ed Masuoka
9. Version 2 Schedule	Ed Masuoka
10. MODIS Network Status	Sol Broder
11. MODIS Emergency Backup System Progress Update	Bill Engelmeyer
12. Fitting within 25, 50, 75, 100	Ed Masuoka
13. SDST Questionnaire	Al Fleig
14. Cloud Mask Validation	Steve Ackerman
15. ESDIS Status	John Dalton
16. MCST Thermal Emissive Bands Calibration Report	Bruce Guenther
17. MODIS PC Band Crosstalk	Chris Moeller
18. Current Status of GLI Science Mission	Hiroshi Murakami
19. PM-1 Project Description and Status	Marty Donohoe
20. AMSR and AIRS ATBD Algorithms	Claire Parkinson
21. MCST Summary Report	Bruce Guenther
22. MOCEAN Summary	Wayne Esaias
23. MODIS Atmosphere Group Summary	Michael King
24. MODLAND Summary	Chris Justice
25. SDST Summary Report	Ed Masuoka
26. Atmosphere Product SWIR Dependencies	Steve Platnick
27. Radiation and Aerosol Measurements near Hawaii	J. Porter
28. Optical and Ancillary Measurements at High Latitudes	Dariusz Stramski
29. MOBY Update	Dennis Clark

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1.0 Introduction

Vince Salomonson, MODIS Team Leader, convened the MODIS Science Team (MST) meeting and welcomed participants. He expressed concern that MODIS is a bit behind the other teams whose instruments will fly on the AM-1 platform with regard to algorithm preparation, etc., and added that at this meeting he hopes that SDST will clarify exactly what deliveries it needs, and when. Turning to the PFM instrument, Salomonson reported that it is on the spacecraft and is scheduled to enter thermal vacuum testing on November 13. Finally, he announced that some of the newly-selected validation scientists are in attendance today, and welcomed them to the meeting. (Refer to Attachment 1 for the MST agenda. Note that the sub-topics presented by MCST and SDST differ somewhat from those listed on the agenda.)

2.0 Characterization of MODIS in the VIS/NIR and SWIR

2.1 Overview

Bruce Guenther outlined MCST's two primary objectives for its MST meeting presentations: first, to provide MST members all they need to know to understand the instrument and accomplish their goals for Level 2 products and above; and second, to acquire feedback from MST members on issues such as the handling of SWIR features in algorithms, as well as what approach to take with the linear or nonlinear algorithm decision. (For the entire MCST "MODIS Reflective Band Characterization" presentation, refer to Attachment 2. Guenther's introductory material is contained in Section 1 of this attachment.) Guenther cited several caveats that apply to the MCST presentation. Wherever possible MCST results have been checked for consistency with SBRS results; discrepancies will be noted. Most analysis so far has been on the Primary electronics, with which the instrument will go into orbit. Despite the volume of data, there are areas where measurements were unsuccessful or inadequate; MCST will interpolate, extrapolate and use models where necessary, and these instances will be flagged.

2.2 Reminders, Concerns and Alerts

Among the concerns, Guenther indicated that MCST has not yet done system-level calibration of the solar diffuser (SD) with a calibration source (sunlight or otherwise), and the SD / solar diffuser stability monitor (SDSM) has never been tested on the ground as a system. MCST will learn to do the calibration on-orbit. MCST is still trying to understand the out-of-band spectral light leaks affecting Bands 5, 6, 7 and 26 (i.e., the SWIR bands have a sensitivity to thermal radiation at 5.3¨µ). Salomonson asked Guenther if he views any of these concerns as show-stoppers, and Guenther replied that he does not. Those concerns that he has cited are things that MST members should be cognizant of when developing their algorithms. Guenther stated that his biggest concern is the subframe (or “second sample”) problem for the SWIR bands (5, 6 and 7). When MCST looks at the data set for Bands 5 and 7, different values are produced the second time the detectors are read out, as compared to the first time the detectors are read out. With Band 6, the first sample is actually problematic; the bottom line is that for all three of these bands, samples 1 and 2 are not as well-behaved as they should be when compared to one another. Guenther reported that some crosstalk remains in the SWIR bands. He requested that MST members who want to work below 0.3Ltypical should speak to MCST about their needs, and discuss whether a linear or nonlinear algorithm should be utilized. Finally, Guenther announced that parameters for calibration equations and instrument characterization will be published on the MCST home page.

2.3 Test and Data Overview

Ed Knight noted that there are a series of charts near the back of Attachment 2 that he is not going to brief, including the “Murphy charts” for reflectance bands, with the spec values that we are interested in and equivalences in reflectances. He reported that Gerry Godden, in conjunction with University of Wisconsin (UW) personnel, has devised a correction for the “smile effect” in the spectral responses that led to artificial channel-to-channel variations. The in-band spectral responses are now final. Knight reviewed the PFM thermal vacuum timeline, as well as MCST calibration methodology. He noted that the PFM instrument was subjected to both hot and cold temperatures more extreme than those anticipated on-orbit. With regard to spectral tests, he indicated that the out-of-band data set still needs to be merged with the in-band data set. With regard to the response vs. scan angle data, MCST may revise the curve fit.

Knight alerted MST members that the SBRS Detector numbering convention (employed in this presentation) is the reverse of the Level 1B numbering convention (refer to Attachment 2, page 2-7). MODLAND members have pointed out that the SBRS convention is inconsistent with commercial off-the-shelf (COTS) mapping software; Guenther will address this in his presentation on October 24. Knight clarified nomenclature as follows: “DN” is the raw digital number output by MODIS (0 to 4095); “dn” is the signal digital number (scene minus space view); and “DN*” is the corrected scene digital number (i.e., corrected for response vs. scan angle, temperature, and has the space view subtracted off).

2.4 SWIR Issues

2.4.1 General

Guenther stated that there are currently three SWIR problems that MCST is working to resolve: the out-of-band spectral leak at 5.3μ, subframe variations in Bands 5, 6 and 7, and crosstalk. MCST has devoted the better part of the last 6 weeks to trying to understand and correct these problems and, as a result, SWIR band calibration has not been completed.

2.4.2 5.3µ Light Leak

Guenther reviewed a series of graphs depicting the out-of-band response for the SWIR bands (refer to Attachment 2, Section 3). He stated that Steve Platnick is assessing the science impacts of the 5.3µ light leak. As regards MODIS Atmosphere products, Platnick has summarized his findings in a table entitled "Atmosphere Product SWIR Dependencies" (refer to Attachment 26). It appears that MOD04 (Aerosols) and MOD06 (Cloud Retrieval) will be affected the most. The 5.3µ leak in SWIR will be worst for "dry" atmosphere conditions (i.e., warm surface and low sun). Guenther reported that there is another light leak at 2.7µ, although Moeller has indicated that this leak is not likely to have any impact on science.

2.4.3 Subframe Variations in Bands 5, 6 and 7

Guenther indicated that subframe variations appear in all of the SWIR bands (i.e., 1 through 7). Bands 1 through 4 show a difference of only a few DNs, which has been attributed to small differences in integration times. This variation can be removed in calibration by applying individual coefficients to the subframes. Bands 5 through 7, however, show differences of 10's to 100's of DNs, and the mechanism for this has yet to be established. The "subframe that is clocked first" is subframe 1 for Bands 5 and 7, and subframe 2 for Band 6. Jim Young explained that subframes 1 and 2 should be affected by the optical leak. Subframe 2 is affected by crosstalk. Young and MCST hope to look at these two things together and make some sense of this situation. Guenther indicated that MCST now has many clues to solving the subframe problem. He concluded that MCST believes that the first subframe will be good and useable; the second subframe remains questionable, and MCST will have to find some way to flag this in the data set.

2.4.4 Crosstalk

Knight reported that Band 5 is receiving a crosstalk signal from Band 7, a smaller one from Band 6 and a very small one from Band 26. The first SBRS analysis of crosstalk data showed some crosstalk of less than 1 percent, and that changing the detector bias (Vdet) lowers the crosstalk from SWIR into the MWIR. Kaufman asked if there is a downside to changing the detector bias, and Knight replied that this would change gains too, and then the MWIR would be affected. Guenther added that so far MCST analysis has not indicated sufficient benefit vs. cost to pursue this.

MCST's first analysis of crosstalk data was inconclusive. Spectral out-of-band signal and subframe variations can be identified in the data, thus complicating estimates of how much crosstalk is actually occurring. Young indicated that the way SBRS normalized the data in crosstalk initially will be redone and normalized in another way. The SBRS numbers should be considered very preliminary at this stage.

2.4.5 Linearity/Nonlinearity

Knight reported that several bands are showing nonlinear response at low radiances, and there is presently no clearly identified mechanism for this. At the August Calibration Workshop at GSFC, MCST was requested to re-examine the linearity of the SIS(100) calibration. SBRS, however, stands behind the linearity of SIS(100) output and calibration. Landsat data may indicate a small nonlinearity in calibration. Landsat did use a transfer radiometer, and it is unclear whether this translates to MODIS. Knight indicated that MCST is fitting over a range 0.3Ltyp to 0.9Lmax, and it may wish to switch to 0 to 0.9 Lmax. MST feedback on this issue would be appreciated.

MCST has begun looking at residuals, and early results indicate that there may be some improvement by going to nonlinear algorithms in some bands. Knight acknowledged that converting from DNs to percent uncertainties and radiances for the linear and nonlinear algorithms might be helpful to some MST members, and he can provide converted data to anyone interested. Guenther stated that using a quadratic equation for fitting below 0.3 Ltyp will make a significant difference. Mueller added that it will be easier for him to make a decision once he sees numbers in terms of radiances and reflectances, instead of DNs.

2.4.6 Uncertainties

Knight stated that the uncertainty model has been revised so as to focus on “tall poles.” Uncertainty numbers remain very preliminary. Knight reviewed the radiance, DN*, DN* uncertainty and reflectance equations used by MCST (refer to Attachment 2, Section 3.3). He called attention to the “Estimated Radiometric Calibration Uncertainties (Total) for VIS / NIR / SWIR Regions” table on page 3.3-15, and noted that values come in at or below spec in most cases, with the exception of those values boxed with bold lines.

2.5 Other PFM Instrument Characteristics

2.5.1 Spectral Performance

Knight reported that the “smile effect” has been removed. He summarized VIS, NIR and SWIR Relative Spectral Responses (RSR) (refer to Attachment 2, page 4-3; data also available online via anonymous ftp at: ringmaster.gsfc.nasa.gov). A slight air-to-vacuum wavelength shift has been detected for all bands (<0.89 nm for all VIS / NIR bands), and MST members should let MCST know if this is significant for their products. MCST has some normalization problems to resolve before it can get an end-to-end spectral response.

2.5.2 Spatial Performance

Knight announced that MCST expects to have spatial performance characterization completed shortly. Track instantaneous fields of view (IFOV) were compiled from optical bench assembly data; where possible, aft optics assembly (AOA) data were used. Scan IFOVs were compiled from PC02 data (system level) where possible; otherwise, AOA data were used (scaled to PC02). Knight presented a series of charts depicting IFOVs and their uncertainties. Esaias asked about the larger uncertainties in Bands 8 and 9. Knight replied that these might be the result of a weak signal, and MCST will take another look at them.

2.5.3 Polarization

Knight reported that SBRS made additional polarization measurements in April 1997, and this data is presented in Attachment 2. The following key issues remain: no valid data for Band 5, and Band 6 is marginal; Band 2 data is only valid at 0° scan angle; and it is not yet established how to fill in data for end channels.

3.0 Data Production and Readiness Plans

Note
(This discussion is identified in the meeting agenda as "ESDIS, DAAC and TLCF Readiness.")

3.1 Overview

Ed Masuoka reviewed the agenda for the SDST-led "Data Production and Readiness Plans" portion of the MST meeting. Refer to Attachment 3.

3.2 Version 1 Algorithm SSI&T Plans

Masuoka reviewed the Version 1 Product Generation Executables (PGE) that have been integrated at the GSFC DAAC (GDAAC), EROS Data Center (EDC) and National Snow and Ice Data Center (NSIDC) (refer to Attachment 4). PGE 16 will not be integrated at the GDAAC because Version 2 is more complex that Version 1, and is in-house now. Chain testing is now being performed at the GDAAC on the PGEs that have completed integration. PGEs 17 through 20 (MOCEAN Level 3) are currently being tested at SDST, but may not be through testing in time to be officially transferred to the GDAAC because efforts are being redirected to Version 2. Likewise, redirection of effort to Version 2 may prevent PGE 47 (Sea Ice 10-day) from being officially transferred to the NSIDC DAAC. Masuoka discussed the lessons learned during Version 1, including resolution of environmental issues (i.e., compatibility of things like compilers, toolkits, and standards checkers between the TLCF and the DAAC).

3.3 DAAC Readiness and Plans

3.3.1 GDAAC

Steve Wharton presented an overview of the GDAAC Version 2 SSI&T schedule (refer to Attachment 5). He reported that Version 1 SSI&T will run through mid-November, after which Version 2 SSI&T will formally begin. Phase 1 of Version 2 includes Drop 1 of the "rump" version of ECS on October 30. Phase 2 will include the complete I&T of algorithms to maximize the number of PGEs for certification testing. March 2 will be the official deadline for GDAAC to submit PGEs for ECS qualification testing. Phase 3 begins on April 15, which is the last day for the GDAAC to receive new PGEs from SDST in time to complete SSI&T by launch. Between April 16 and June 1, certification testing will be conducted, and there may be limits to GDAAC SSI&T capability. Wharton indicated that workarounds are being explored so that more PGEs can be ready in time for launch. He added that the Version 2 SSI&T schedule is much more aggressive than the Version 1 schedule; lessons learned in Version 1, improved coordination between SDST and GDAAC, and the availability of necessary hardware should expedite the Version 2 SSI&T process. Wharton indicated that the GDAAC hopes to have 16 PGEs ready for certification testing by April 15, and another 11 PGEs are expected to be ready at launch. Murphy added that timely code delivery is essential to the GDAAC maintaining its schedule. Refer to Attachment 5 for more details as to prerequisites, approaches and risks associated with Version 2 SSI&T.

3.3.2 EDC

Jeff Eidenshink discussed the EDC Version 1 and 2 SSI&T schedule (refer to Attachment 6). He reported that a total of 6 Version 1 PGEs have been delivered so far, and the average infusion time per PGE is 3 weeks. He anticipates that 9 of 31 Version 2 PGEs (all MODIS) should be delivered pre-launch. Esaias asked why the ECS drop dates differ for EDC and GDAAC, and Eidenshink replied that the EDC dates represent just delivery, whereas the GDAAC dates indicate when the drops become operational.

3.3.3 NSIDC

Spencer Shiotani reported that NSIDC has completed SSI&T for PGEs 43 (Daily Snow Cover) and 45 (8-day Gridded Snow Cover). Both PGEs have metadata problems that will be deferred to Version 2. Infusion testing is underway for PGE 44 (Daily Sea Ice). PGE 47 (8-day Gridded Sea Ice) has not yet been received. Shiotani also reviewed the NSIDC data flow. Refer to Attachment 7.

3.4 Version 2 SSI&T

Masuoka reviewed the MODIS SSI&T timeline, and pointed out that the launch-critical release must be at the DAAC by January 15 (refer to Attachment 8). The at-launch system must be certified by May 30. Certification testing will encompass 3 days of continuous processing and, among other things, focus on time transitions, terminator crossing, crossing the poles and handling errors. Masuoka indicated that code delivery to SDST is not done until the file spec is baselined. Murphy asked who does the baselining, and Masuoka replied that SDST and the individual developer work together on it. Masuoka pointed out that changing a file spec can throw off other developers in the chain. Refer to Attachment 8 for more detailed information on the code acceptance process.

Turning to the Version 2 Schedule (as of October 16) (refer to Attachment 9), Masuoka reported that many developers have not delivered their code when promised. Late code deliveries ripple through the whole system, and can jeopardize other products in a chain. Masuoka asked that the discipline group leaders inform him as to when their respective groups plan to deliver those items that are now past due. SDST may need to prioritize deliveries in order to deal with this situation. Masuoka encouraged MST members to contact him by phone to talk about any potential show-stoppers. Murphy reiterated that it is critical that we firm up and adhere to code delivery dates. He asserted that SDST really has its hands full right now, and any developer requiring a significant amount of assistance from SDST should outline his or her expectations in an e-mail message to Murphy.

3.5 Network Status

Masuoka summarized network status for Sol Broder (refer to Attachment 10). Masuoka announced that the ESDIS network budget will be scrubbed to save money. Broder asks that MST members consider how the downsizing of product volumes will impact the size of Q/A volumes requested. Attachment 10 contains a series of summary charts with current network capacities and estimated future product volumes. Broder asks that MST members check these numbers and send any comments to him via e-mail.

3.6 MODIS Emergency Backup System (MEBS) Status

Bill Engelmeyer reported that MEBS has either completed, or is on target to complete, all of its prototyping milestones (refer to Attachment 11). MEBS is intended to be ready at launch for some limited processing. A "day in the life" test, looking at 16 products, will be conducted in November. An "hour in the life" test has already been successfully conducted. MEBS has a Web site from which science products can be ordered (http://ltpwww.gsfc.nasa.gov/MODIS/SDST/mebs).

3.7 At-launch Volumes and Loads

Masuoka reviewed the 25, 50, 75, 100% processing ramp-up recommended by the EOS Review Group (ERG) to reduce costs without serious impact to EOS science (refer to Attachment 12). He noted that there are more resources at the DAACs than are necessary to satisfy the phased processing requirement at launch. Masuoka called attention to the proposed allocation of resources at the GDAAC (page 3 of Attachment 12). Of the 3,120 total MFLOPS available, 1,507 are available for higher-level products (i.e., higher than Level 1). Based on the June 1997 baseline, higher-level processing at the GDAAC could possibly be divided as follows: MODLAND, 609 MFLOPS; MOCEAN, 701 MFLOPS; and Atmosphere (without Cloud Mask), 197 MFLOPS. Masuoka asked that each of the discipline groups consider whether this strawman allocation of resources at the GDAAC will work and, if not, how should resources be allocated? (Fleig visited each of the discipline group breakout sessions the day before, and distributed an SDST Questionnaire [refer to Attachment 13] with more specific questions for discipline group consideration.) Fleig asked that the discipline groups also consider how they will assist SDST in debugging immediately after launch, as well as how best to make and distribute early images (i.e., “first light products”). Once all of the groups have answered these questions, it will be necessary to ensure that their respective plans mesh so that MODIS presents a unified position to EOS.

3.8 Results of Breakout Sessions

3.8.1 MODLAND

a. At-launch Resource Allocation: Justice indicated that MODLAND would like to test algorithms with a global month of Level 1B data; once the algorithms are tested and verified, then MODLAND would like to make products on a regional basis in order to satisfy the 25% constraint. MODLAND would like to run all of its products operationally at full resolution at a Year+1 and have sufficient resources to support reprocessing of these data.

b. At-launch Code Problem Resolution Approach: Justice suggested that MODLAND needs to work more as a team with SDST and the GDAAC. Overall, there needs to be a more hands-on approach where the discipline group members can assist in implementing adjustments to code.

c. Early Products: MODLAND proposes to use the MEBS strings being developed and, through the Land Data Operational Product Evaluation (LDOPE) Facility, run the early products there. Justice proposed that MODIS package up data sets for the community at large, and EDC could distribute these packages via CD or WWW.

3.8.2 MOCEAN

a. At-launch Resource Allocation: Esaias reported that MOCEAN plans to make all of its Level 2 products at 1-km resolution, based on hardware available at the GDAAC and MODIS processor allocations; if necessary to meet a 25% constraint, only every other pixel will be used. As more processing comes online, MOCEAN would like to go back and start reprocessing one year after launch. Esaias added that a T-1 link exists between Miami and GSFC, although it will have to be utilized to full capacity. The T-3 link planned in the ESDIS baseline must be installed if the Miami MOCEAN SCF is to play an active role in the Q/A of ocean data and refining MOCEAN algorithms post-launch.

b. At-launch Code Problem Resolution Approach: MOCEAN will perform debugging remotely from Miami.

c. Early Products: MOCEAN believes that it can make products in a matter of days, provided that good L1B data is available. Esaias indicated that having Cloud Mask would be helpful, but it is not absolutely necessary. Fluorescence, chlorophyll and productivity for the visible bands are all important products to disseminate quickly.

3.8.3 Atmosphere

a. At-launch Resource Allocation: Gumley reported that Atmosphere would meet the 25% constraint by processing data from roughly 8 days a month. UW is concerned that the T-1 line currently in place may not be adequate to get all the necessary Level 1B data, but if UW becomes part of VBNS, then the requisite bandwidth will be available. Fleig asked if MOCEAN had any problems with the 8-day Atmosphere plan, and Esaias said that it did not. (Cloud Mask will be produced everywhere all the time anyway.)

b. At-launch Code Problem Resolution Approach: Atmosphere already has a good working relationship with Rich Hucek and SDST, and there is no need for major changes between now and launch. Much of the Atmosphere group is already on-site at GSFC, and debugging can be done remotely from UW as well.

c. Early Products: Atmosphere would prefer to produce “first light” images independently.

4.0 Plenary Session, October 23

4.1 MODIS Visualization Tool

Dave Santek demonstrated the MODIS Visualization Internet Environment - Wisconsin (MODVIEW) tool. MODVIEW will be Web-based, and enable the user to browse large databases, display MODIS data, and overlay maps, latitude/longitude lines and ancillary data. More information is available via the Web at: www.ssec.wisc.edu.

4.2 MODIS Cloud Mask Status

Steve Ackerman stated that he intends to address Cloud Mask validation, and focus on visualization of results, “ground truth” (Lidar [CLS] and weather observations), users, and intercomparisons with other instruments (refer to Attachment 14). Gumley demonstrated the prototype visualization tool, called Sharp, developed at UW using MAS data. The software is very user-friendly, and runs on any platform that runs IDL. Among other things, the tool allows the user to add the cloud mask overlay, do some simple band math, and create GIF files on screen. The software is available on the Web at: http://cimss.ssec.wisc.edu/~gumley/sharp/sharp.html. Ackerman presented a series of graphs showing that MAS Cloud Mask results agree with Lidar data. MAS Cloud Mask also compares favorably with AVHRR data. Ackerman reported that MODIS and MISR personnel are now investigating how best to compare data at launch.

4.3 ESDIS Status

John Dalton summarized ESDIS Status and discussed the August ECS demo as it pertains to MODIS (refer to Attachment 15). He reported that ESDIS is planning for an incremental approach to ECS releases, in order to provide earlier access to high-priority functions and better serve evolving community needs. Dalton noted that the Release B.0', B.0, B.1 series of releases has been replaced by Version 2.0, 2.1, etc.; he reviewed the timeline showing when ESDIS expects to have each Version ready. (Version 2.0 is due in June 1998, and Version 2.1 is due in November 1998). Turning to the August demo, Dalton indicated that, overall, it was a success. The original criteria consisted of 46 functions; of these, 3 involved production rules that were not exercised by the available PGEs. MODIS PGEs 1, 2 and 8 were used to demonstrate chaining. Dalton acknowledged that there is much work to be done to tune the ECS system to meet at-launch performance requirements. Performance bottlenecks and tuning steps have been identified, and a plan is in place to support the AM-1 and Landsat-7 data flows. In reviewing the phased development of ECS capabilities to meet at-launch needs, Dalton reported that some automated operations such as system fail-over may be introduced after launch and, therefore, increase the need for manual operations procedures early in the mission. Asked to define certification, Dalton responded that certification means that the DAACs have the operating elements of the system, as well as some PGEs they can use to test and verify that the system does what it is supposed to do. Certification does not mean that all of the at-launch science software is in the system and is fully tested; rather, it is a pre-launch demonstration that the DAAC operators and science software developers can use the system to perform essential functions. Dalton addressed the land tiling issue, stating that the basic capability to gather granules within a tile will be in pre-launch, operationally-tested Drop 3. However, the capability to cluster tiles to make best use of resources will not be integrated until near launch, in Drop 4.

5.0 Characterization of MODIS in the MWIR and LWIR

5.1 Overview

Guenther outlined the topics to be covered in this section (refer to Attachment 16). He reported that, overall, MCST feels good about progress made with the DN vs. Radiance algorithm. However, MCST has encountered some difficulty fitting radiance over the full range which the MST has requested. MCST has almost completed work on RSRs; Band 29 was problematic, but Guenther indicated that MCST believes they now understand it. He listed unresolved issues as follows: spatial/spectral crosstalk in PC bands, electronic effects of roughly 1/2 to 1%, and Band 21 calibration. In spite of its relatively high uncertainty, Band 21 likely will provide adequate data to meet science needs for the PFM mission because this is a first measurement of this fire band. Consequently, MCST will remove Band 21 from its list of PFM concerns, but certainly attempt to do better with the FM-1 instrument. Guenther concluded that, overall, the PFM emissive IR calibration situation is encouraging. Masuoka asked Guenther when he expects to have a new Level 1B algorithm, and Guenther estimated that it should be available in roughly 4 weeks. Guenther added that this algorithm will improve technical performance, but will not change interfaces, file formats or toolkits calls.

5.2 Objectives

Guenther listed four objectives that MCST hopes to accomplish with this presentation:

a. Provide the MST with an overview of thermal emissive band calibration methodology.

b. Address key issues identified at the September 11 and 12 workshop in Madison (refer to Attachment 16, pages 1-6 and 1-7).

c. Identify key issues for continued investigation and development.

d. Acquire consent to build Level 1B at-launch code.

5.3 Summary of Test Data Sets

Gerry Godden expressed his intent to focus on 5 of the 16 bands in which the MST has shown particular interest. The 4 data sets to be discussed are as follows: radiometric calibration (RC02), response to On-board Calibrator (OBC) blackbody warm-up / cool-down cycles (MF109), RSRs, and PC bands crosstalk evaluation. Godden announced that Special Test Requests (STR) will be conducted in 2 months at Valley Forge in order to fill gaps in Blackbody Calibration Source (BCS) testing. Godden reviewed the temperature plateaus at which OBC data were taken, and commented that MCST hopes to obtain more data at the nominal plateau with the OBC. (Refer to Attachment 16, Section 2 for details.)

5.4 Instrument Key Features, Requirements and Performance Summaries

Godden reviewed the material contained in Section 3 of Attachment 16, as follows:

a. Reference configuration charts.

b. Requirements and performance summary charts.

c. Calibration temperature ranges.

d. Scan mirror reflectivity vs. angle of incidence (AOI).

e. OBC performance.

f. Predicted Lsat's and Tsat's.

g. ADC non-linearity test results.

h. ECAL test results.

Godden noted that Section 3 contains the Performance Summary Charts (or "Murphy Charts") for the thermal emissive bands. With regard to scan mirror reflectivity vs. AOI, Godden presented charts created with data from Lincoln Laboratory. He indicated that these measurements have been performed twice, by different Lincoln personnel, and the numbers seem to match (with an error bar of roughly 1%). MCST has found that a Lorentz function works better for fitting here than does a quadratic function.

5.5 RSR Summary

Godden reported that RSRs were reviewed intensely at the Madison workshop, so in the MST forum he will present only the key issues (refer to Attachment 16, Section 4 for details). He emphasized that the discussion would focus exclusively on in-band, not broad-band, RSRs. MCST has corrected measured RSRs for non-orbit transmission effects. Following the "smile" correction procedure, no wavelength scale adjustment is required for the CO_2 13.8µ absorption feature alignment. Godden discussed SpMA out-of-plane aberrations (i.e., light is "red-shifted" towards the end channels). (Refer to Attachment 16, Section 4 for details.)

5.6 L vs. DN Calibration Algorithm Summary

Jack Xiong reviewed the material contained in Section 5 of Attachment 16, as follows:

a. Overview of equations, fitting ranges and estimated BCS uncertainties.

b. L vs. DN charts (at 4 instrument temperature plateaus).

c. Band-by-band calibration fitting summaries.

d. Level 1B algorithm demonstration.

e. Short-term (4-day) repeatability assessment.

f. Calibration coefficient temperature dependencies.

g. Comparisons of BCS and OBC blackbody calibration coefficients.

h. Comparability assessments (primary vs. secondary electronics, and mirror side A vs. mirror side B).

As regards L vs. DN calibration, MCST has made the following conclusions:

a. A quadratic algorithm achieves reasonable fitting errors for most bands.

b. A cubic algorithm is recommended for Bands 20, 22 and 23.

c. BCS to OBC blackbody calibration transfer requires consideration of variable scan mirror reflectances.

d. Short-term stability is less than 0.5% for all bands (except Band 21).

e. The Level 1B algorithm must account for a temperature dependence of calibration coefficients.

f. Operating CFPAs at NLT (control heater off) changes the gain of the PV bands by about 5%, and the PC bands by about 50 - 60%.

g. Changing electronics from Primary to Redundant will cause a small offset change, perhaps requiring separate calibration coefficients.

h. There is a detectable difference between mirror sides for all bands. This must be accounted for in the Level 1B algorithm coefficient set.

5.7 BCS to OBC Calibration Transfer Method

Godden explained the BCS to OBC calibration transfer method. Refer to Attachment 16, Section 6.

5.8 PC Bands Crosstalk

Chris Moeller discussed a possible correction algorithm for PC bands crosstalk (refer to Attachment 17). A linear correction algorithm is desirable; based on testing of RC-02 data sets, this approach appears feasible. The goal is to characterize crosstalk to within 1%. Moeller noted that, because of spatial dependencies of crosstalk, it may be advantageous to use NxN pixel correction instead of single pixel correction; he acknowledged that most MST members (and potential non-MST users in the community) would probably prefer full-resolution corrected data (i.e., single pixel correction), but that NxN correction would suffice for MODIS cloud products from PC bands.

5.9 Conclusions

Guenther concluded that MCST is getting close to achieving 1% radiometric accuracy, and this is pretty remarkable given the difficulties experienced with the PFM instrument. While PFM is perhaps not the exact instrument that we wanted, it is a well-characterized instrument that we can use. Overall the instrument should be able to support all the science the MST has signed up to, as well as some science that the MST hopes to do. Guenther, Godden and Xiong will be happy to receive any additional questions or comments via e-mail.

6.0 Plenary Session, October 24

6.1 Global Imager (GLI) Status

Hiroshi Murakami presented a status report on NASDA's GLI Science Mission. He explained that GLI is a general purpose, medium spatial resolution visible-infrared imager that will make atmosphere, land and ocean color observations. GLI is scheduled to launch in 1999. (Refer to Attachment 18 for more details.)

6.2 AM-1 Status

Ken Anderson reported that the PFM instrument will go into thermal vacuum testing in early- to mid-December, and it will remain there approximately five weeks. Following thermal vacuum testing, the instrument will be shipped to the West coast in plenty of time for launch. Anderson announced that there are presently no major concerns that would prevent launch as scheduled in June 1998. He confirmed that the solar array is no longer an issue. Jan-Peter Muller asked if there is any possibility of launching earlier than June, and Anderson replied that there is not.

6.3 PM-1 Status

Marty Donohoe presented an overview of PM-1 status (refer to Attachment 19). Overall the project is in good shape as regards technical and schedule issues, although cost reserves have been reduced. The PM-1 Project will be discussing I&T and flight operations with TRW in November. Donohoe indicated that MODIS FM-1 instrument issues now being addressed include the SWIR light leak, test flow modifications and scan mirror replacement. He thanked Anderson for ensuring that MODIS instrument issues are addressed quickly by SBRS. Donohoe noted that MODLAND had been concerned about FM-1 stability and pointing; he believes that this issue has been resolved and summarized in a memo, but he will double-check this.

Claire Parkinson presented an update on the algorithms for the two instruments (AMSR and AIRS) aboard PM-1, but not AM-1. Refer to Attachment 20. MST members may want to think in terms of collaborative efforts with these two instrument teams.

6.4 MCST Summary

Before summarizing the MCST presentations Guenther announced that, during the first instrument comprehensive performance test, telemetry has flowed successfully from Valley Forge to the MCST computer facility at GSFC (refer to Attachment 21). He reminded MST members that the MCST look-up tables (LUT) use the SBRS detector-numbering convention, which is inverted from the pixel convention used in the MODIS Level 1 products. Guenther reviewed Level 1B file format changes, noting that at this meeting he had hoped to get an MST recommendation as to how to handle the SWIR 500-meter bands "second sample" problem.

Guenther reviewed the major PFM issues still to be resolved. The stray light issue (OBC-B, for high scan angles, +50 degrees and higher) will be investigated further pending results from an improved FM-1 test. With regard to SWIR radiometric behavior, Guenther cited two issues: the spectral leak, which is now being studied, and the second sample problem, which might possibly be solved with an algorithm fix on-orbit. MCST is still waiting for access to the Spherical Integrator Source (SIS), so as to make round-robin measurements; this must be done before March 1998. Salomonson concluded that overall we have a robust instrument; we know what it can and cannot do, and we should expect good results.

6.5 MOCEAN Summary

Esaias reported that the new validation affiliates are meshing nicely, and he anticipates that they will make major contributions. MOBY is deployed and operational, and being used to good effect for SeaWiFS. A SeaWiFS initialization cruise is scheduled for January 10 through February 8. Funds for the MODIS initialization cruise must be obligated within months in order to assure ship availability. Information on MOBY/MOCE activities and data is available online at:

http://moby.mlml.calstate.edu

With regard to the instrument, Esaias indicated that he is investigating the potential benefits of replacing the scan mirror; so far it appears that replacement will provide substantially more useful data near clouds. MOCEAN was pleased to learn that the deep space maneuver has been baselined. With regard to products, Esaias reported that Version 2.0 code will be delivered on schedule; he anticipates that delivery of Version 2.1 code will be on schedule as well, although this schedule remains TBD. Turning to resource allocation, he reiterated that MOCEAN plans to make all of its Level 2 products at 1-km resolution, based on hardware available at the GDAAC and MODIS processor allocations; if necessary to meet a 25% constraint, only every other pixel will be used. As more processing comes online, MOCEAN would like to go back and start reprocessing one year after launch. Refer to Attachment 22.

6.6 Atmosphere Summary

King voiced Atmosphere’s concern that crosstalk between SWIR bands needs to be better characterized. Guenther has agreed to provide additional analysis, and Atmosphere algorithm developers will assess impacts. Also, the crosstalk in Bands 33 - 36, discussed earlier by Moeller (refer to paragraph 5.8), will have a significant impact on Atmosphere algorithms. King indicated that Atmosphere is very concerned about the subsampling problem, whereby Bands 5 and 7 are well characterized for different pixels than Band 6.

King reviewed the dates when Atmosphere code is expected to be delivered to SDST (refer to Attachment 23). He noted that execution of Level 3 code requires Version 7.2 of the Fortran compiler, which the GDAAC does not now support. Masuoka has been apprised of this issue, and it is being worked. Finally King reported that a Kalahari desert validation campaign is planned for August/September 1999. This will be a collaborative effort with MODLAND and others.

6.7 MODLAND Summary

Alan Strahler reported that MODLAND is concerned about the light leaks affecting Bands 6 and 7, but there are no show-stoppers as regards the instrument. MODLAND would like to see faster SDST turnaround on code adjustments; after delivery to SDST, MODLAND developers will chaperone their products through the system. With regard to production reduction, Strahler expressed concern that EOS science is in jeopardy if peer-reviewed products are cut. MODLAND feels that the proposed ramp-up of EOSDIS capacity is too slow. There is the need for full operational capacity to generate the suite of MODLAND global products in near real-time at Launch+1 year, and to start reprocessing those products which have undergone significant refinement completing the reprocessing by Launch+2 years. Strahler reviewed MODLAND's strategy to meet the proposed ramp-up (refer to Attachment 24). As regards early MODIS products, MODLAND recommends land data packages, which would be multi-instrument packages designed to meet general user needs in the first 9 months. (These packages would be coordinated through the SWAMP.) Strahler indicated that MODLAND is concerned about network capacity, and would like reassurance that plans will be implemented and DAAC-SCF links will be tested prior to Launch (6 months lead time). Finally, Strahler reported that MODLAND feels more confident as regards geolocation. However, MODLAND would like to see a plan for post-launch implementation and a schedule for prototyping/testing the land control point algorithm, which has slipped from earlier expectations.

6.8 SDST Summary

Masuoka reviewed the status of the 10 Version 2 PGE's that have been received by SDST, and then listed 5 Version 2 PGEs that are late (refer to Attachment 25). He outlined MODIS PGE delivery priorities, explaining that Priority 1 PGEs include Level 1 products (3), PGEs for EGS certification (15), and at-launch PGEs (19). Priority 2 PGEs are post-launch PGEs, of which there are 27. More PGEs may be added to the post-launch list, depending on deliveries from the MST, the speed with which the SDST and DAAC personnel can get PGEs integrated and tested at the DAACs, and the impact of external requirements changes on our software delivery. Masuoka stressed that, for at-launch PGEs, the software must meet standards and be robust. The schedule for integration is tight, and few Version 2.1 PGEs can be accepted without dropping at-launch PGEs. PGEs that are delivered late may end up post-launch, or cause other PGEs to be moved to post-launch. Masuoka requested that the discipline groups assist SDST as much as possible with the SSI&T process after delivery, whether this means having somebody on-site or on-call to help fix identified problems. In order to better monitor PGE status, King requested that Masuoka make his PGE tracking spreadsheets available via the Web, and Masuoka agreed to do this.

6.9 Conclusion

Salomonson thanked the newly-designated validation scientists for attending the meeting. He also thanked Barbara Conboy and MAST for coordinating the logistics. Salomonson stated that the instrument appears to be in good shape; it is not perfect, but we are aware of the few flaws and are dealing with them accordingly. The next step for the MST is data products, and much remains to be done in this area. Salomonson emphasized that MST members must deliver code to SDST when promised; delivery slips ripple through the system, and ultimately jeopardize science after launch. Once code is delivered and PGEs are integrated, the Team will turn its attention to validation and science.

6.10 Next MST Meeting

The next meeting is tentatively scheduled for May 1998 in the GSFC area.

7.0 Atmosphere Splinter Minutes
October 22 , 1997

Minutes taken by Bob Kannenberg
(rkannenb@pop900.gsfc.nasa.gov)

7.1 Introduction

Michael King convened the MODIS Atmosphere Group and reviewed the list of subjects that he planned to discuss, as follows:

a. Shortwave and longwave calibration results as they are likely to affect atmosphere algorithms (i.e., problems with Bands 5, 6 and 7, issues and concerns as related to PFM and FM-1, etc.).

b. Data product status update (in preparation for defense of MODIS Atmosphere's early data processing scenario at EOS review of AM-1 products, anticipated for late November).

c. Validation updates (including Kalahari Desert plans and desires), and input from Pincus and Kaufman on the recent WAVES workshop.

d. Schedule and plans for a 2-day Atmosphere Group meeting, and a target of test cases for Atmosphere members to run algorithms on in advance and then compare preliminary results.

e. NPOESS imager, the likely follow-on to MODIS for the AM-2 era. Collect input for charts that contain Atmosphere algorithm channel requirements. Make suggestions for a future imager.

f. Update on Global Imager (GLI).

g. Visualization tool demonstration.

7.2 Calibration Results

Steve Platnick has been investigating the effects of the Band 5, 6, 7 and 26 out-of-band response problems on atmosphere products, and he summarized his findings in a table entitled “Atmosphere Product SWIR Dependencies” (refer to Attachment 26), which he will distribute to the group. It appears that MOD04 (Aerosol Product) and MOD06 (Cloud Product) will be affected the most. Platnick indicated that the 5.4 µm leak in SWIR will be worst for “dry” atmosphere conditions (i.e., warm surface and low sun). Kaufman reported that while at the WAVES workshop he heard that NOAA has a corrections procedure for a leak at 5 µm into 1.6 µm, and he added that MCST might look into this. King requested that Atmosphere members assess the potential impacts of the 5.4 µm leak on their own algorithms.

Kaufman suggested that crosstalk between the SWIR bands may be an even bigger problem for Atmosphere than the light leak. Platnick indicated that further MCST analysis is needed in this area. Guenther acknowledged that normalization of crosstalk data is very difficult, and that MCST still has a great deal of work to do here. Guenther will provide the results of further crosstalk analysis to the Atmosphere group, so that group members can assess impacts.

Guenther revisited the subsampling problem discussed earlier (refer to paragraph 2.2), and stated that he is upbeat about solving this problem on Bands 5 and 6. He suggested that the Band 7 subsampling problem will be much more difficult to solve, as he suspects it may be traced to the focal plane. Subsampling whereby bands 5 and 7 are well-characterized for different pixels than Band 6 is a major concern for the Atmosphere group.

The group discussed characterization for the SWIR bands at 0 - $0.3L_{\text{typical}}$, and decided that characterization in this range is required. Use of a non-linear algorithm here could potentially be beneficial for Bands 5 and 6 when used for low signal (aerosol) applications.

7.3 Data Product Status Update

7.3.1 Delivery Dates

King reported that there has been continuing discussion at NASA of cutting the percentage of AM-1 production capacity. He anticipates that he will have to defend Atmosphere products before an EOS Review Board in late November. He asked Group members to tell him what we can realistically expect to deliver at launch, and stressed that we must make the dates we establish for code delivery to SDST.

Status of Atmosphere deliverables is as follows:

a. Cloud Optical Thickness and Effective Radius was delivered on September 1.

b. Aerosol Product and Water Vapor delivery to SDST by November 1.

c. Cloud Mask delivery to SDST by November 15.

d. Cloud Contrast Detection to SDST by November 15.

e. Atmospheric Profiles by December 1.

f. Cloud Top and IR Phase delivery to SDST by December 15.

g. Level 3 Code delivery: Daily by November 15, and Monthly by December 15. (Execution of Level 3 code requires the Version 7.2 Fortran compiler, and Masuoka has been made aware of this. Zonal tiling is not expected to be a problem.)

7.3.2 Issues

With regard to Contrail/Cirrus detection, Gao reported that he is waiting for a Level 1B reader to be developed. Hucek explained that there are limited resources available for this kind of work and, so far, nobody has been able to sign up to it. It may be necessary to insert a place-holder for this product at launch.

With regard to Level 3 code, King stated that it will not run without all of the Level 2 pieces. Level 3 code is a far better-designed, much more professional code than most, if not all, Level 2 codes, and we will use it to find bugs and errors in Level 2.

King stated that after delivery of Atmosphere code, there must be rapid turnaround and feedback from SDST. Fleig expressed concern that, as compared to Ocean and Land code, Atmosphere code requires more integration work by SDST after delivery. Hucek urged group members to run the Forcheck tool on their code prior to delivery, to ensure compliance with ESDIS standards. He realizes that it will pick up all kinds of trivial items (e.g., tabs), and that it can be somewhat cumbersome overall. He invited group members to telephone him when they run Forcheck, and he can assist in expediting the process.

7.4 SDST Questionnaire

Fleig distributed copies of the SDST questionnaire (refer to Attachment 13) for discussion at the short discipline breakout sessions scheduled for the following day (October 23). The basic question asked is, “What do you expect from SDST, particularly after launch?” (For all of the discipline group responses to the questionnaire, refer to paragraph 3.8 in the “ESDIS, DAAC and TLCF Readiness” portion of the MODIS Science Team [MST] minutes.)

7.5 Validation Updates

7.5.1 WAVES Workshop

Kaufman reported that he and Pincus attended the WAVES Workshop held the previous 2 days at Hampton University, where discussion focused on atmosphere-specific validation activities in the AM-1 and SAGE-III eras. Kaufman stated that roughly 10 percent of the newly-selected validation investigations are applicable to MODIS Atmosphere. He encouraged close interaction between MODIS Atmosphere and these investigators, and added that he would like to see these people invited to future Atmosphere group and MST meetings. He introduced Andy Heymsfield, one of the new investigators, who presented a brief summary of cloud experiments at NCAR.

7.5.2 Kalahari Desert Campaign

Kaufman and King discussed the Kalahari campaign with Chris Justice, Tim Suttles, Bob Murphy, and David Starr, and it looks like it will be a coordinated effort with MODLAND in the August/September 1999 time frame (i.e., the biomass burning season). First priority is use of the University of Washington CV-580 aircraft, which would carry cloud imagers, flux radiometers, and lidar, as well as instruments to measure aerosol and cloud microphysics and atmospheric chemistry. Second priority is the use of the NASA ER-2, which would allow transit opportunities over Saharan dust and Namibian stratus. There is an established European (especially German) Earth science presence in the Kalahari, and some cooperative efforts between MODIS and the Europeans are likely.

7.5.3 Posters for the EOS Validation Meeting

King announced that each of the MODIS discipline groups is expected to submit a poster for the upcoming EOS Validation Meeting in Atlanta. Group members should forward input to King.

7.5.4 ATBD Review

King reminded group members that it has been one year since the Atmosphere ATBD Review, and asked that revised ATBDs be submitted in the near future (they are all past due).

7.6 Plan for 2-day Atmosphere Group Meeting

Gumley suggested to King that the Atmosphere group run test cases with existing MAS data sets and MODIS algorithms, and then discuss results at a meeting to be held after delivery of at-launch code, but before launch. After some discussion it appears that this meeting will occur in early February, and the specific location remains TBD. King will begin to coordinate logistics and circulate a strawman agenda via e-mail.

7.7 NPOESS Imager/Future MODIS

King reported that the NPOESS imager is the likely follow-on to MODIS in the AM-2 era. He has a matrix linking products to bands, and he will verify these links with group members individually, as well as discuss Atmosphere's "wish list" as regards a reduced future sensor.

7.8 GLI Update

Ackerman reported that he attended the last GLI meeting, where he learned that the data flow diagram presented at the last MST meeting has been revised, as suggested by MODIS. GLI will use a 16-bit Cloud Mask. The next GLI meeting will likely by held in June 1998. (Hiroshi Murakami of NASDA presented a detailed GLI status report as part of the MST plenary session; refer to Attachment 18 for more information.)

7.9 MODIS Visualization Tool

Liam Gumley demonstrated a prototype visualization tool developed at UW using MAS data (called Sharp). The software is very user-friendly, and runs on any platform that runs IDL. Among other things, the tool allows the user to add the cloud mask overlay, do some simple band math, and create GIF files on screen. In the future, Gumley hopes to add a simple import and export feature. The software is currently available on the Web at:

http://cimss.ssec.wisc.edu/~gumley/sharp/sharp.html

8.0 MOCEAN Splinter Minutes

October 22 , 1997

Minutes taken by Dave Toll
(toll@toll.gsfc.nasa.gov)

8.1 Introduction

The MODIS Ocean (MOCEAN) Discipline Group discussed primarily instrument characterization, data product and processing issues, and validation.

8.2 Instrumentation

Guenther reported on the problems associated with the MODIS SWIR bands. The problem is likely with the instrument electronics and is significantly affecting one-half of the SWIR data. Guenther is asking for MOCEAN feedback on how to best correct the SWIR data when converted to Level 1B data. He also requested inputs on MOCEAN plans, if any, to use the Band 6 (1628-1652 nm) data.

Guenther reported that Gordon and MCST are investigating polarization effects on Band 8. Guenther thinks the variation in the detectors should be correctable using a parabola. Guenther will take an action item to revisit this problem.

Barnes reported that the FM-1 scan mirror has 25% more near field scattering than the recently delivered FM-2 mirror. Barnes said that overall the FM-1 mirror is worse than the protoflight mirror. Barnes said that to replace the FM-1 mirror will be very expensive and MOCEAN should assist in preparing a cost-benefit analysis to determine if the work is justified. Currently, Godden is investigating how close we can work to clouds and the "far field effects." This is an urgent issue that must be resolved soon. Esaias said MOCEAN will review the FM-1 testing plans. Last, Esaias also said having only three temperature testing procedures may be insufficient to characterize FM-1. Guenther said that the testing will be more complete, however, for FM-1 in comparison to PFM. (Refer to plenary minutes for a more detailed discussion of FM-1 testing issues.)

8.3 SDST Issues

Fleig reported there are three primary SDST issues:

a. Fleig said SDST needs to know how much MOCEAN data processing and storage is required for each product, especially after launch when there will be more limited resources. In addition, identification of cross-discipline products is needed for coordination of resources. Esaias said that he and Bob Evans believe that the currently available hardware will support full production of MOCEAN products if used efficiently, based on timing runs at Miami using similar hardware and V-2 code. Limitations on processing alternate algorithms at the DAAC as part of the validation and T&E phase can be overcome by providing a full set of L1 data to the MOCEAN SCF at RSMAS. If necessary, MOCEAN will emphasize use of a scheme such as processing of every other pixel to reduce the volume and load for the first year of processing. (Coastal data may need to be sampled more extensively.) Esaias said that other software code restrictions to get to the 25% reduction mandate would be very difficult for MOCEAN to implement, since many products are derived in the same modules. Esaias reported that the ramp-up time after the first year of data processing should be increased by 2 to 4 times than the current projected amount by ESDIS in order to allow for incorporation of improvements and research products. In addition, Esaias noted product dependencies (cloud masking, water vapor, cloud products) that were removed for the processing during the first year must be reconsidered for data processing efforts in the second year and beyond. In addition, Esaias said reprocessing of early, full MODIS data should now be planned and scoped by SDST and ESDIS.

Evans said MOCEAN needs to know when they will have access to global L1B data at 1 km. In addition, Evans noted any changes to the formatting of the MOCEAN data by the DAAC will have significant impact on Miami's software. Evans said further planning should be developed in case there are problems at the DAAC. Evans is concerned that there are insufficient tracking procedures to diagnose potential DAAC errors, especially in the batch-oriented structure of data processing by the GDAAC.

b. Fleig said that MOCEAN needs to determine their logistical interactions with the DAAC once data processing starts. Esaias and Evans indicated that MOCEAN will not have a permanent person at the DAAC, but would need access in the event of any significant problem. Evans noted that science-related issues are best completed at the University of Miami. However, he noted that the GDAAC and not the University of Miami is (and should be) the gateway for worldwide access to MOCEAN products. Hence, a very close working relationship should be established. Evans requested that overall the GDAAC should focus on the Level 1 products, and distribution of data, as their highest priority. Fleig noted that the Level 1A file quality should be fine. The Level 1B should require more attention.

c. Fleig reported MOCEAN should identify any products or images that need to be produced immediately after launch. Esaias said that MOCEAN has a very good heritage from practice associated with the SST Pathfinder and SeaWiFS. Overall, there should be several MODIS global products that will make an immediate, positive impact. Esaias said the MOCEAN fluorescence products will make a new and special science contribution. Results from Letallier and Abbot demonstrate that the chlorophyll fluorescence can be related to physiology and growth state of phytoplankton biomass (chlorophyll) brought about through nutrient additions by ocean mixing upwelling dynamics.

8.4 Other Data Issues

Esaias said that the Level 2.0 Product Code was delivered to ESDIS on schedule. He also said that MOCEAN should make sure that the Level 2.1 Product Code is delivered on schedule. He said MOCEAN would like a 2.1 delivery schedule from SDST. Esaias said any inputs from SDST should be given back to MOCEAN as soon as possible. Carder wanted to know when MOCEAN will receive Level 2 simulated data for testing. Reed (GSC for ECS) said that there have been some personnel changes, slowing the development of the MODIS simulated data set, especially for aerosol effects. Esaias said that Miami and SDST should work with ECS to derive a synthetic data set.

8.5 Validation

8.5.1 Validation Associates

The IR Validation Associates were attending a sea surface temperature conference and did not attend the MOCEAN session.

a. C. McClain reported on the twice-yearly oceanic cruise activities associated with Hooker (PI), Maritorena and himself.

b. J. Porter discussed radiation and aerosol measurements near Hawaii. Work will support ocean color and MODIS radiance products (refer to Attachment 27).

c. D. Stramski reported on in-situ measurements in the Greenland and Norwegian seas (refer to Attachment 28).

d. C. McClain reported on latest developments from SeaWiFS.

e. Clark provided an update on MOBY activities (refer to Attachment 29). Clark reported that MOBY was deployed and is operational. Esaias said the data and analyses are very important and are providing excellent results. MOBY activities can be followed on the web at: http://moby.mlml.calstate.edu.

8.5.2 Winter Cruise Period

The ocean group discussed activities associated with the Winter Cruise Period. Esaias reported that there are problems with the sun photometer network that have to be evaluated. McClain said he will look into the CIMEL radiometers and pulse radar system and report back. McClain said the critical work is associated with verifying the atmospheric correction. Esaias reported that MOCEAN will interact with Porter to coordinate validation activities between 10 January and 8 February on an 18-day SeaWiFS Initialization Cruise. Esaias said we need to obligate funds for the MODIS Initialization Cruise within months in order to maintain priority on ship schedule.

8.6 Action Items

1. Esaias will set-up meeting schedules for MOCEAN prior to Launch and associated with the Winter Cruise.

2. Guenther will revisit the detector level Band 8 polarization problem with possible corrections.

3. Masuoka to estimate when MOCEAN will have access to global L1b data at 1 km.

4. Evans, Gordon and Masuoka to assist Reed and ECS to derive a MODIS synthetic data set for MOCEAN processing.

5. Masuoka and MODIS (Evans) to work with DAAC to define a Delivery 2.1 schedule, if needed.

6. McClain to look into problems associated with the CIMEL radiometers and pulse radar system.

7. Conboy and Esaias to obligate funds for the MODIS Initialization Cruise within months.

8. Masuoka and ECS should plan a schedule for reprocessing efforts of early, full MODIS data.