MODIS Science Team Meeting Minutes

June 24-26, 1998

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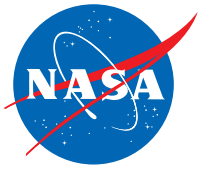

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GLOSSARY OF ACRONYMS

ACE	Arctic Cloud Experiment
ADEOS	Advanced Earth Observing Satellite
AFGL	Air Force Geophysics Lab
AGI	Advanced Global Imager
AGU	American Geophysical Union
AHWGP	*Ad Hoc* Working Group on Production
AIRS	Atmospheric Infrared Sounder
AMOC	AM-1 Mission Operations Center
AMPR	Advanced Microwave Precipitation Radiometer
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
CCA	Circuit Card Assembly
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
CSTOL	Colorado Spacecraft and Telemetry Operations Language
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
ECL	EOS Command Language
Ecom	EOS Communications
ECS	EOS Core System (part of EOSDIS)
ECSO	Executive Committee for Science Outreach
EDC	EROS Data Center
EDOS	EOS Data and Operations System
EDR	Environmental Data Record
EFS	Electronic Filing System
EGS	EOS Ground 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
FAM	Forward Analog Module
FIFE	First ISLSCP Field Experiment
FM	Flight Model
FOS	Flight Operations Segment
FOV	Field of View
FPA	Focal Plane Assembly
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
MEM	Main Electronics Module
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
MOCE	Marine Optical Characterization Experiment
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
NEΔL	Noise Equivalent Radiance Difference
NEΔT	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
NRA	NASA Research Announcement
NRC	National Research Council
NSF	National Science Foundation
NSIDC	National Snow and Ice Data Center
OBC	On-Board Calibrator
OBC-B	On-Board Calibrator Blackbody
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
PDPS	Production Data Processing System
PDQ	Panel on Data Quality
PDR	Preliminary Design Review
PFM	Protoflight Model
PGE	Product Generation Executive
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
RSMAS	Rosenstiel School of Marine and Atmospheric Science
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.
SSI&T	Science Software Integration and Test
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
TGARS	Transactions on Geoscience and Remote Sensing
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
VBNS	Very High Performance Backbone Network Service
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 or you can access this list via the WWW at
http://modarch.gsfc.nasa.gov/MODIS/SCITEAM/199806/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. EOS AM-1 Status	Kevin Grady
3. Flight Operations Segment	Rick Obenschain
4. ECS Science System Status from a MODIS Perspective	Mike Moore
5. Briefing on PFM and FM1 MODIS Sensors	Bruce Guenther
6. MODIS Emergency Backup System	Ed Masuoka
7. Goddard DAAC Status	Stephen Wharton
8. NSIDC DAAC Issues	Greg Scharfen
9. SeaWiFS Initialization Cruise Results	Howard Gordon
10. MODIS Airborne Simulator (MAS) Results	Steve Ackerman
11. EOS AM-1 Outreach	David Herring
12. Image Formats: Vector and Raster	Rob Simmon
13. MODIS Early Images / Web Products Summary	Bob Kannenberg
14. Aerosol Radiative Forcing of Climate	Yoram Kaufman
15. EOS PM Project Status	George Morrow
16. Status of MODIS LAI / FPAR Algorithm	Ranga Myneni
17. MODIS Atmosphere Group Summary	Michael King
18. Land Discipline Report	Chris Justice
19. MODIS Early Images / Web Products Meeting Agenda	Bob Kannenberg
20. EOS AM-1 Outreach and Early Images / Web Products	David Herring
21. Early Images from MODIS	Liam Gumley
22. GDAAC Early Image Plans	George Serafino
23. Introduction to MEBS and Prototyping Milestones	Bill Engelmeyer
24. MODIS Atmosphere Group Meeting Agenda	Michael King
25. Atmosphere Software Delivery Status	Rich Hucek
26. MODIS Adaptive Processing Summary	Liam Gumley
27. The NPOESS Preparatory Project: A Transitional Mission from EOS to NPOESS	Bob Murphy
28. Skin vs. Bulk SST	Ian Barton
29. Objectives of the ADEOS 2 / GLI Mission	Motokai Kishino
30. ASTER Specifications and SST	Motokai Kishino

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1.0 Plenary Meeting
June 24 - 26

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

1.1 Introduction

Vince Salomonson convened the Moderate Resolution Imaging Spectroradiometer (MODIS) Science Team meeting. He stated that originally we thought we would be near launch at this time, but launch has been delayed and there are still some challenges to be met. These challenges include fixing the Flight Operations Segment (FOS) software, resolving the MODIS instrument's electronic crosstalk issue, and formulating a PI-led adaptive processing plan for MODIS AM-1 data. (Refer to Attachment 1 for the meeting agenda.)

1.2 AM-1 Status

Salomonson introduced Kevin Grady, who replaced Chris Scolese as the EOS AM-1 Project Manager. (Scolese is now the Associate Director of EOS at GSFC in the Flight Projects Directorate.) Grady announced that the AM-1 spacecraft will not launch for at least another 6 months, and more specific information will not be available until July (Attachment 2). At present all of the instruments, equipment modules and major assemblies have been successfully tested, delivered and integrated onto the spacecraft. Grady noted that modifications are being made to the flight software in order to perform the calibration maneuver, which is critical for MODIS. Launch site facilities have been prepared and checked out, and transportation equipment is completed and ready for use with AM-1. Grady reviewed a "top ten" list of concerns, and number one on that list is the FOS software which, at present, does not support a flight-ready configuration. Rick Obenschain and his team are in the process of cleaning up this software, as well as developing an alternative system, the AM Mission Operations Center (AMOC) which, so far, looks promising. Salomonson commended the entire AM-1 Project on a job well-done.

1.3 Earth Science Data and Information System (ESDIS) Status

1.3.1 FOS Status

Obenschain provided an overview of the FOS situation (Attachment 3). In March it became apparent that the FOS software had significant stability problems that would preclude a launch in the September timeframe. At present there remain 47 outstanding Severity 1 discrepancy reports (DR) ("Severity 1" indicates an impact to operations, with no workaround). To resolve these DRs the EOS Core System (ECS) developer (Raytheon) has, among other things, brought in additional staff and expanded the software testing program

so as to uncover problems as soon as possible. The developer is working to an internal schedule reflecting a launch date of January 30, 1999.

1.3.2 AMOC Status

As Grady mentioned earlier, the AMOC is being developed as an alternative to the FOS. The FOS was intended to control all of the EOS spacecraft, whereas the AMOC would be used exclusively to control the AM-1 spacecraft. A prototype AMOC is now operating in Goddard Space Flight Center (GSFC) Building 32, and Obenschain anticipates that the finished product will be available sometime during the second quarter of 1999. So far thermal vacuum spacecraft data has been flowed successfully from the EOS Data and Operations System (EDOS) to the AMOC.

1.3.3 ECS Status

Obenschain asked Mike Moore to discuss ECS status from a MODIS perspective (Attachment 4). Moore reported that delayed production rules will in turn delay Science Software Integration and Test (SSI&T) activities needed to resolve integration issues; delay end-to-end testing across Distributed Active Archive Centers (DAAC); and potentially increase the Operations load due to workarounds. ECS will attempt to mitigate these situations in several ways. Ongoing SSI&T will be performed in the mini-DAAC. The Ocean Data Day rule will be accelerated to the L7/NCR Patch. An October 1998 patch is planned to provide basic Land Tiling, and a January 1999 patch is planned to provide remaining production rules.

Moore pointed out that the Version 0 interface does not support Quality Assurance (QA) very well. The selection of products for science QA is difficult, and additional DAAC operations support is required. In the near-term, ECS is initiating an effort to enhance the Version 0 Client; for the long-term, ECS is studying the feasibility of independent Client and Data Management elements.

Moore was asked about the status of certification testing, and replied that certification testing is being treated as a set of end-to-end system tests. ECS is building up to a data day test with whatever data is available at that time. After that the DAACs will perform additional operational readiness testing, and ramp up to performing a 3-day test. Moore asserted that there is no intention on the part of ESDIS to set a hard deadline to say that if something is not ready for certification testing, then it cannot go to launch.

1.4 MODIS Instrument Status

1.4.1 Protoflight Model (PFM) Instrument

Bruce Guenther reported that the Protoflight Model (PFM) instrument has completed all of its spacecraft thermal vacuum testing and is integrated aboard the AM-1 platform now at Valley Forge (Attachment 5). Remaining PFM sensor concerns are as follows: electronic crosstalk (formerly known as the Shortwave Infrared [SWIR] second sub-frame problem); Thermal Model and operating temperature; and EEPROMS. The MODIS Characterization Support Team (MCST) and Santa Barbara Remote Sensing (SBRS) continue to work these

issues. (Guenther presented a detailed presentation on electronic crosstalk later during the Closed Door portion of the meeting.) Regarding operating temperature, Guenther indicated that the instrument is likely to be running roughly 10 degrees colder than originally anticipated. Modeling indicates that blanketing the main electronics module (MEM) should allow us to raise the temperature of the electronics without significantly raising the temperature of the optics (it is important that the blackbody not get too cold, or the thermistors can saturate.) Finally Guenther stated that fixes have been implemented to eliminate the potential for blown fuses due to phantom commands. The fixes include a software change and rewiring of two circuit card assemblies (CCA) in the forward analog module (FAM).

1.4.2 Flight Model 1 (FM1) Instrument

Guenther reviewed fixes made to the FM1 instrument. The fix to eliminate phantom commands was somewhat more substantial on the FM1 instrument; in addition to rewiring the FAM, the CCAs in the main electronics module (MEM) were re-worked. The SWMIR out-of-band light leak in the 5.3 µm region has been eliminated by adding a blocking filter coating to the cold window above the SWMIR focal plane assembly (FPA). SWMIR light leaks affecting Bands 24, 25 and 26, and potentially Band 5 have been incorporated; four stripes were painted on the FPA mask and one stripe was painted on the IFA mask near Band 6. A reduced-scatter scan mirror has been integrated on FM1, and this mirror should result in improved sea surface temperature (SST) data for the MODIS Ocean (MOCEAN) Group. Guenther indicated that he will discuss the FM1 test program offline with Otis Brown.

1.5 MODIS Emergency Backup System (MEBS)

Masuoka provided an overview of MEBS capabilities (Attachment 6). He noted that MEBS will soon be folded into the Team Leader Computing Facility (TLCF). MEBS will be able to generate all at-launch products in sufficient quantities to enable the Science Team to test, debug and validate its algorithms. (Coverage goal is 100% of Level 1 and 25% of Level 2 products and above.) Masuoka announced that MEBS intends to conduct a "week-in-the-life" test with PGEs from all 3 disciplines producing both Level 2 and Level 3 products in the August or September time frame. He reviewed processing hardware now on the floor. MODLAND QA requires additional storage space, and the additional tape library is in the SDST budget for FY99. Science products can be ordered through the MEBS Web site located at: http://modisdm.nascom.nasa.gov. Salomonson indicated that at launch we should definitely have Level 1 products, and enough processing capability to make higher-order products for validation but, as far as serving the community and interfacing with ECS, we are not there yet.

1.6 GSFC DAAC (GDAAC) Status

Wharton reported that PGEs 01, 02 and 03 have been fully integrated and tested, and a chain test of these three PGEs has been completed (Attachment 7). The GDAAC is looking at how to run production processing so as to maximize the system capability and minimize run times. PGEs 04, 07, 08, and 11 have been integrated and successfully run in the ECS

Production Data Processing System (PDPS). Wharton stressed that the GDAAC needs test data to benchmark Level 1 and Level 2 processing (at a minimum 6 hours of data is necessary, although optimally the GDAAC would like to have 24 hours of data). The last page of Wharton's presentation contains a table summarizing PGE status at the GDAAC.

1.7 National Snow and Ice Data Center (NSIDC) DAAC Status

Greg Scharfen reported that ECS Version 2 Drop 4.05 was installed at NSIDC in April; Drop 4p is expected to be installed in August (Attachment 8). Staffing, training and SSI&T at NSIDC are on schedule. A MODIS-NSIDC Technical Interchange Meeting (TIM) was held in Boulder in May. Issues discussed included network capacity and production planning. Scharfen noted that EBNet will be used for DAAC-to-DAAC data transfer.

1.8 MOCE/SeaWiFS Initialization Results

Howard Gordon presented results of the Marine Optical Characterization (MOCE)/Sea-viewing Wide Field-of-view Sensor (SeaWiFS) initialization cruise, led by Dennis Clark (Attachment 9). Gordon stated that on-orbit adjustment of the sensor calibration is based on a comprehensive suite of surface measurements (vicarious calibration). Calibration will be maintained thereafter by less intensive means, including the solar diffuser, lunar views and the Marine Optical Buoy (MOBY). The SeaWiFS initialization cruise served as a "dry run" for MODIS. Gordon presented various plots depicting data gathered during the cruise, and noted that there is still a great deal of data to be analyzed. He concluded that overall the initialization exercise was a success. Preliminary calibration of all SeaWiFS bands relative to 865 nm was completed.

1.9 Atmosphere Products Results Obtained Using MAS Data

Steve Ackerman indicated that the MODIS Airborne Simulator (MAS) has flown often on the ER-2 aircraft, most recently this past May and June as part of the Fire Arctic Cloud Experiment (ACE) conducted in Alaska (Attachment 10). Ackerman showed the instrument configuration flown aboard the ER-2 during ACE, and pointed out that it was very similar to the configuration slated to fly aboard the AM-1 and PM-1 platforms. He presented a number of images from the ACE experiment, including strata-type clouds over open water. Michael King added that the MODIS cloud particle retrieval algorithm was run with MAS data during ACE. Ackerman presented MAS data from the WINDS experiment which suggests that the MODIS Cloud Mask is working well. The Cloud Mask also compares well with Lidar data. Ackerman reported that MAS images from SUCCESS indicate that CO_2 slicing is working well.

1.10 EOS AM-1 Earth Observatory Web Space/Public Relations

1.10.1 Outreach Team and ECSO Concept

Herring announced that he has formed the EOS AM-1 Outreach Team, which is based at GSFC and comprised of visualizers and science writers who will contribute to the EOS AM-1 Earth Observatory Web Space and "tell the stories" suggested by data from the instruments aboard the AM-1 platform (Attachment 11). Ultimately, Herring intends to extend the AM-1 Outreach team to include visualizers, writers and other potential contributors at other NASA centers, universities, the DAACs, etc. Right now he is trying to establish a closer working relationship between the Outreach Team and the MODIS science community; in the long term, he hopes that the Outreach Team will be able to effectively "showcase" AM-1 scientists' work in the public media, as well as render data products easily accessible and understandable to public "translators" (like educators, media writers and environmental awareness groups). Herring reviewed the Executive Committee for Science Outreach (ECSO) concept. Comprised of senior and prominent EOS scientists, the ECSO was formed to harvest new science results and amplify media play, as well as to provide peer review while helping to formulate and temper the messages conveyed by the results. While the ECSO will meet regularly to discuss new results and stories for publication, it will also have to react as necessary to political decisions (e.g., the Kyoto agreement) and natural disasters (e.g., volcanoes, wildfires, etc.). Herring encouraged Science Team members to contact ECSO members or himself if they feel they have a story to tell. The ECSO can then link principal investigators (PI) with AM-1 writers and visualizers in order to produce press releases and publish the story in the Earth Observatory Web space.

1.10.2 Visualizations

Herring introduced AM-1 Outreach Team members Mark Sutton and Rob Simmon, who will be producing visualizations of AM-1 data for the Earth Observatory. They demonstrated several animations similar to those that they envision producing with MODIS and other AM-1 instrument data. Sutton noted that he is particularly interested in creating data fusion animations, overlaying data from two different instruments. To demonstrate this point he presented an animation depicting the correlation between Normalized Difference Vegetative Index (NDVI, or "greening") and SST. Simmon distributed a handout outlining preferred image formats (Attachment 12).

1.10.3 Earth Observatory Web Space

Sutton presented a tour of the prototype Earth Observatory Web space, still very much a work in progress, which is designed according to a "room" concept. Rooms that the user can enter include a site overview, study, tour, indices, site map, library, laboratory and related links. The target date for establishing a working prototype online is September 1. Sutton asked Science Team members to think about what they might contribute to the Earth Observatory and contact him at: sutton@agnes.gsfc.nasa.gov. Herring reviewed some candidate AM-1 global data sets (global biosphere [MODIS], fires and fire susceptibility, etc.). He stated that he would like feedback from Science Team members as to what products will be ready in the first 60 days after launch, and respective priorities for publicizing these products. He added that at present there are many different NASA offices, as well as universities, involved in Earth science outreach and this can be confusing. He hopes that the Earth Observatory will alleviate some of this confusion by serving a

"one-stop shopping" function; if possible, it might include data from the Tropical Rainforest Measuring Mission (TRMM), SeaWiFS, and other missions.

1.10.4 Global Fire Monitoring Web Site

Herring encouraged Science Team members to visit the Global Fire Monitoring site located at: http://modarch.gsfc.nasa.gov/fire_atlas. In late May the White House Office of Science and Technology Policy (OSTP) requested a rapid response report on the Mexican fires, so in approximately three days (and a couple of nights) the Outreach Team constructed the Global Fire Monitoring site, which includes numerous and creative visualizations of satellite fire data, accompanying explanatory text and links to related sites. Ultimately, the information contained within this site will comprise a case study within the larger Earth Observatory Web space. The Fire Monitoring site received approximately 75,000 hits in in its first 2 weeks after going online, and has already garnered complimentary mentions in several publications.

1.11 Results of MODIS Early Images/Web Products Meeting

Kannenberg reported that a MODIS Early Images/Web Products Meeting was held June 23 to bring together the outreach and visualization specialists with representatives from the discipline groups, MEBS and the GDAAC to discuss early production plans (i.e., roughly the first six months after launch) (Attachment 13). Herring discussed the Earth Observatory, the ECSO concept, and the Global Fire Monitoring site. Simmon and Sutton presented some of the visualizations that they have created. These visualizations typically require the use of several different software packages. As the Earth Observatory matures, Sutton would like to bring in a programmer to automate the visualization process as much as possible. George Serafino addressed that point by asserting that the GDAAC recognizes the need to subscribe to a full or channel-subsetted MODIS granule. Early image/Web product points of contact were designated for each of the discipline groups, MEBS, GDAAC and the Earth Observatory. (For complete minutes of this meeting, refer to Section 2.0.)

1.12 Product Accuracy Summaries

Kaufman presented an example of a product accuracy summary, and proposed that MODIS PIs should draft summaries for their respective data products. Categories of information contained in the summary include optimal and non-optimal conditions for derivation from the EOS data, caveats, theoretical accuracy, pre-launch verification, post-launch verification and references.

1.13 Remote Sensing of Smoke and Aerosol Forcing of Climate

Kaufman stated that radiative forcing of climate represents a major uncertainty over the last 160 years of climate change research (Attachment 14). MODIS and other satellite data, used in conjunction with ground data and modeling, will enhance our understanding of both direct and indirect radiative forcing. Kaufman discussed indirect radiative forcing and presented plots depicting the effects of smoke particles on clouds. He suggested that

there may be a relationship between how white a cloud appears and the amount of particulates it contains (i.e., polluted clouds with larger amounts of particulates will appear to be whiter). Kaufman explained that it is easier to understand the effects of direct, rather than indirect, radiative forcing. Above 1 micron, the effect of radiation on smoke is more pronounced. MODIS will allow us to resolve spectrally the surface and aerosol radiative forcing.

1.14 EOS PM-1 Status

George Morrow announced that he took over as PM Project Manager after Marty Donohoe retired last December. Morrow reviewed the PM organization chart, noting that Pete Pecori is now the Deputy Project Manager and Ken Anderson is the Instrument Systems Manager. Morrow reported that a Critical Design Review (CDR) of the spacecraft was just successfully completed (Attachment 15). Integration and Test (I&T) is scheduled to start in June 1999. However, the PM Project is assessing the impact of the FOS delay on spacecraft I&T and developing a risk mitigation approach. Morrow indicated that the FOS problem will probably not affect the PM schedule, but it may affect the cost. PM-1 is still working toward a December 2000 launch date.

1.15 LAI-FPAR Algorithm

Ranga Myneni indicated that in January 1997 a decision was made to revise the Leaf Area Index (LAI)/Fraction of Photosynthetically Active Radiation (FPAR) algorithm. Myneni thanked Joe Glassy and University of Montana personnel for delivering the code for the new algorithm. Myneni summarized the development and status of the MODIS LAI/FPAR algorithm (Attachment 16), which is based on a three-dimensional formulation of the radiative transfer process in vegetation canopies. It allows the use of information provided by the MODIS (single-angle and up to seven shortwave spectral bands) and Multiangle Imaging Spectroradiometer (MISR) (nine angles and four shortwave spectral bands) instruments within one algorithm. The LAI/FPAR algorithm should allow us to more accurately evaluate the exchange of carbon between the atmosphere and terrestrial vegetation.

1.16 Atmosphere Group Summary

King reported that all Atmosphere PGEs are presently at SDST or the GDAAC (Attachment 17). The Atmosphere group may take advantage of the additional launch delay time to add an aerosol correction in the September/October time frame. Atmosphere storage volume is currently 37.3 GB/day for Version 2. (The Version 1 delivery in May 1997 was 19.2 GB/day, and the ECS baseline of February 1996 was 31.8 GB/day.) Atmosphere processing requirements are 1634 MFLOPS/day. (The Version 1 delivery was 1836 MFLOPS, which includes the factor of 1.6, and the ECS baseline was 654 MFLOPS/day.) King reported that some issues and questions arose from the Atmosphere group's discussion of the AM-1 adaptive processing proposal. Atmosphere is concerned that if MEBS is performing regular processing, then where does the backup capability reside? The group also raised the issue of

software version control, especially as it pertains to Cloud Mask; it appears that the Cloud Mask will be run at multiple locations (including the ECS mini-DAAC, the GDAAC, Miami, MEBS and NOAA), so it will be necessary to ensure that software changes flow down to all of these locations. Turning to validation activities, King indicated that the Atmosphere group recently participated in the Fire ACE experiment, and analysis of that data is ongoing. Finally the Atmosphere Validation Plan will be revised to reflect the AM-1 launch delay; NASA Research Announcement (NRA) validation scientists' activities; EOS PM-1 needs; and rapid response to aerosol events (e.g., Mexican wildfires).

1.17 MODIS Land (MODLAND) Group Summary

Chris Justice indicated that instrument performance continues to be a MODLAND concern, although this should be addressed by continuing MCST analysis (Attachment 18). The Geolocation schedule appears to be on track; right now we are waiting for ground control point data from EDC. Justice stated that MODLAND would like a schedule for MEBS Land product testing and Land production testing at the DAACs. Turning to the AM-1 adaptive processing proposal, he indicated that MODLAND endorses PI processing, assuming it is funded at a level to do the job properly. MODLAND will continue to work closely with SDST on a reorganization and staffing plan. He noted that if the proposal is approved, there remain MODIS/MISR processing issues to be addressed. John Townsend cautioned that without ESDIS to impose standards, the discipline groups will have to assume this responsibility in order to ensure compatibility. Justice indicated MODLAND would like to see an aggressive pre-launch test (using simulated MODIS data) of Land product archive and distribution capabilities at the participating DAACs. Justice stated that the delayed launch raises contractual issues, and narrows the window to do science. With regard to the budget, he commented that last-minute cuts can be extremely difficult to accommodate, and MODLAND will need additional validation resources for the second half of 1999.

1.18 MOCEAN Group Summary

Esaias indicated that MOCEAN's primary concern is the electronic crosstalk problem. If this problem can be fixed on the FM1 instrument (scheduled to fly aboard the PM-1 platform), MOCEAN is in favor of placing it aboard the AM-1 platform in place of the PFM instrument. (Other fixes made to the FM1 instrument, including a new scan mirror, would benefit the Ocean community.) Esaias reported that he was pleased with the results from the SeaWiFS initialization cruise; these results have increased confidence that MODIS has been properly scoped. Turning to the adaptive processing proposal, Esaias indicated that MOCEAN also approves and looks forward to PI-led processing. He addressed the comment that Townsend made about standards and compatibility by acknowledging that a certain amount of standardization is necessary but, in the immediate future, we need to deliver data products, and too many standards and protocols may impede rapid delivery. Esaias announced that MOCEAN intends to use a good deal of SeaWiFS data to test its

processing system. (Necessary translators have been developed at Miami.) MOCEAN plans to update its validation plan in light of the launch delay and other factors. Esaias commended Herring and the AM-1 Outreach Team on their efforts so far, and added that MOCEAN has targeted fluorescence and SST as early images.

1.19 MCST Summary

Guenther reviewed action items currently being worked by MCST. He noted that processing speed at the GDAAC should not be an issue for the Version 2.1 Level 1B software. There has been some discussion about the best method to compute brightness temperatures, and Bob Murphy will attempt to get consensus on this issue. Guenther plans to discuss possible changes to the Level 1B code with the discipline group leaders. When making these changes, we would have to be careful not to impact Level 2 code. Guenther concluded that we need to do a better job on the planned verification of computed Level 1B products; some verification has been done, but more is needed.

1.20 Conclusion

Salomonson thanked Science Team members for their cooperation with the latest round of budget cuts. He stated that over the next few weeks the electronic crosstalk problem will be further analyzed. More definitive information should be available by August, and Team members will be notified about the status of this issue. The AM-1 adaptive processing proposal is another issue in progress, and the Team will be kept apprised of its status. The next Science Team meeting will likely be held in November 1998.

2.0. MODIS Early Images/Web Products Meeting
June 23, 1998

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

The meeting was chaired by Bob Kannenberg and David Herring. Present were Mark Sutton, Rob Simmon, Rob Sohlberg, George Riggs, Bryan Baum, George Serafino, Bill Engelmeyer, Liam Gumley, Jay Johnson, David Shirey, Jan-Peter Muller, Eric Vermote and Mike Comberiate.

2.1 Introduction

Bob Kannenberg reported that he, David Herring and Kevin Ward met with MODLAND Group Leader Chris Justice in January to begin discussing MODIS early images and web products. At that time Justice requested that the MODIS Administrative Support Team (MAST) organize a meeting to bring together the outreach and visualization specialists with representatives from the Discipline Groups, the MODIS Emergency Backup System (MEBS) and the Goddard Distributed Active Archive Center (GDAAC) to discuss early production plans (i.e., roughly the first six months after launch). Kannenberg distributed and reviewed the meeting agenda (Attachment 19).

2.2 EOS AM-1 Outreach Effort

Herring indicated that he has formed the EOS AM-1 Outreach Team, which is based at GSFC and comprised of visualizers and science writers who will contribute to the EOS AM-1 Earth Observatory Web Space and "tell the stories" suggested by data from the instruments aboard the AM-1 platform (Attachment 20). Ultimately, Herring intends to extend the AM-1 Outreach team to include visualizers, writers and other potential contributors at other NASA centers, universites, the DAACs, etc. Right now he is trying to establish a closer working relationship between the Outreach Team and the MODIS science community; in the long term, he hopes that the Outreach Team will be able to effectively "showcase" AM-1 scientists' work in the public media, as well as render data products easily accessible and understandable to public "translators" (like educators, media writers and environmental awareness groups). Herring briefly discussed the Executive Committee for Science Outreach (ECSO) concept. Comprised of senior and prominent EOS scientists, the ECSO was formed to harvest new science results and amplify media play, as well as to provide peer review while helping to formulate and temper the messages conveyed by the results. While the ECSO will meet regularly to discuss new results and stories for publication, it will also have to react as necessary to political decisions (e.g., the Kyoto agreement) and natural disasters (e.g., volcanoes, wildfires, etc.).

2.3 Global Fire Monitoring Web Site

Herring encouraged attendees to visit the Global Fire Monitoring site located at: http://modarch.gsfc.nasa.gov/fire_atlas. Over the past couple of months he has worked with Chris Justice and Yoram Kaufman to produce a press release on MODIS' new fire

monitoring capability. In late May, the White House Office of Science and Technology Policy (OSTP) requested a rapid response report on the Mexican fires, so in approximately three days (and a couple of nights) the Outreach Team constructed the Global Fire Montoring site, which includes numerous and creative visualizations of satellite fire data, accompanying explanatory text and links to related sites. Ultimately, the information contained within this site will comprise a case study within the larger Earth Observatory Web space. The Fire Monitoring site received approximately 75,000 hits in its first 2 weeks, and has already garnered complimentary mentions in several publications. Bryan Baum asked if the hits to the page were being broken down and tracked, so that we know what exactly the public is most interested in seeing (e.g., text, tables, animations, etc.). Herring replied that at present this kind of break-down is not being done, and added that this is an issue that he has been thinking about and would like to explore further.

2.4 Techniques for Producing Visualizations

Before demonstrating some of the visualizations that reside on the Fire Monitoring site, Mark Sutton explained that because of the severe time constraint under which this site was constructed, he did not worry about accommodating potential users who may not have the Internet connection or computing power to quickly download and view the relatively large files required by many of the visualizations. This issue will be looked at more closely when the Earth Observatory site is constructed. Sutton presented posters showing the location of fires burning in Florida and Mexico. These posters, also created after a request from the White House, were made with Geostationary Operational Environmental Satellite (GOES) data.

Sutton and Rob Simmon presented several of the visualizations that currently reside on the Fire Monitoring site. Liam Gumley enthused that these are truly some fabulous images, but noted that one of the problems he has run into at the University of Wisconsin (UW) is the tension between scientists, interested strictly in data products, and public relations specialists, interested in presenting an appealing image with perhaps less strict scientific value. Herring acknowledged this concern, and stated that he hopes to present AM-1 data to the public in a digestible form while working closely with the scientific community. NASA is tasked with sharing its data with the general public, and at a level that the general public can understand. Sutton asked that scientists keep in mind what the Outreach Team can do for them in terms of amplifying their findings, especially when those findings have topical relevance. Baum asked what software packages are necessary to create the kinds of visualizations demonstrated by Sutton and Simmon, and Simmon replied that, depending on the type of visualization, he will often use at least three or four different packages. Sutton explained that he and Simmon have developed many of these multiple-package techniques themselves, and that as the Earth Observatory matures he would like to bring in a programmer to automate the visualization process as much as possible. Simmon distributed a hand-out containing preferred image formats (Attachment 12).

2.5 Interactive Earth Observatory Web Space

Herring indicated that at present there are many different NASA offices, as well as universities, involved in Earth science outreach. This can be confusing for people at NASA, let alone the general public, when trying to obtain information. He hopes that the Earth Observatory Web space will alleviate some of this confusion by serving a "one-stop shopping" function; if possible, it might include data from the Tropical Rainforest Measuring Mission (TRMM), the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), and other future missions. The public is probably less concerned with which instrument produces the information and images published in the Earth Observatory than with the information itself.

Sutton presented a tour of the prototype Earth Observatory Web space, still very much a work in progress, which is designed according to a "room" concept. Rooms that the user can enter include a site overview, study, tour, indices, site map, library, laboratory and related links. The target date for establishing a working prototype online is September 1.

Herring requested guidance from the GDAAC, MEBS and the discipline groups as to what MODIS data sets will be ready when (i.e., Launch plus 30 days, Launch plus 60 days, etc.) We need to establish interfaces to ensure that the right outreach people are talking to the right science people. Herring noted that eventually the Outreach Team will likely develop a template for data submission to ensure a consistent look and feel.

2.6 Atmosphere Group Early Image and Web Product Plans

Gumley stated that the Atmosphere Group aims to provide real-time global and regional images (updated daily) for inclusion in the MODIS web using Level 1B data only (Attachment 21). He added that right now he is only talking about Level 1B, the calibrated, geolocated radiances, and not cloud mask, cloud height, etc. Until we understand the Level 1B data, we cannot move on to Level 2. Kannenberg asked who will maintain the "MODIS web," and Gumley replied that the Atmosphere Group intends to maintain its own site for early images, but will gladly feed images to a centralized MODIS site if one exists. Kannenberg replied that a centralized early image gallery is something that MAST may want to create and add to the existing MODIS Home Page.

Gumley indicated that Atmosphere will require a rolling, automated 24-hour archive of MODIS 1-km Level 1B and Geolocation data. This archive will reside in the TLCF and, as new data comes in, it will overwrite data from the previous 24-hour period. Atmosphere will establish preset global and regional images that will be made on a regular basis, but it will also have to respond to unusual events like hurricanes or wildfires, and these images will be generated manually. Gumley presented some example images from the MODIS Airborne Simulator (MAS), TRMM, SeaWiFS and the Advanced Very High Resolution Radiometer (AVHRR).

He stressed that simplicity and as much automation as possible will be the keys to success for generating useful images in the first 6 months after launch.

2.7 MODLAND Early Image and Web Product Plans

Vermote stated that he is looking forward to working with the Outreach Team to make some real "value added" visualizations. He has access to data sets from AVHRR and SeaWiFS, and the vusualizers may want to start working with these prior to launch. Vermote will supply SeaWiFS aerosol data sets to Sutton and Simmon. MODLAND will discuss early images in detail at its Science Team meeting breakout session.

2.8 GDAAC Early Image and Web Product Plans

George Serafino presented the GDAAC's preliminary plans for early images and web products (Attachment 22). He noted that Herring and Gumley have already made many of the points contained in his presentation. With regard to responding to special events, he cautioned that the system will require a shake-out period and that we should be careful about "saturating" the system with too many requests. The GDAAC may provide an interim "browse" product in order to familiarize potential customers with MODIS products. In response to the point that Sutton made earlier about automating the visualization process, Serafino asserted that the GDAAC recognizes the need to subscribe to a full or channel-subsetted MODIS granule. Turning to image generation and viewing specifics, Serafino noted that the GDAAC anticipates writing its own software in C, rather than using commercial off-the-shelf (COTS) software.

2.9 MEBS Early Image and Web Product Plans

Bill Engelmeyer reported that MEBS did not slow its schedule because of the AM-1 launch delay. As originally planned, MEBS is on target to be ready for operations in December 1998. Engelmeyer assured Outreach Team members that MEBS personnel are very eager to assist with creating visualizations, and he encouraged anybody interested to tour his facility and see the system in action. He also suggested that attendees visit the MEBS Web site, from which they can order data. With the new AM-1 adaptive processing proposal, to be discussed in more depth at the Science Team meeting, MEBS will assume many regular processing responsibilities that formerly belonged to ECS. Refer to Attachment 23.

2.10 GOES Visualization Tool

Mike Comberiate gave a presentation on a GOES Visualization Tool for use by students in the classroom. The tool allows the students to take GOES data and create their own images with it.

3.0. Atmosphere Group Splinter Minutes
June 25, 1998

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

3.1 Introduction

Michael King convened the MODIS Atmosphere Group meeting and reviewed the agenda (Attachment 24). Agenda topics included Software Development and Testing (Rich Hucek); Adaptive Processing and Post-launch Evaluation (Liam Gumley); Validation Plans (King); Advanced Global Imager (AGI) (Bob Murphy); and results from the recent Fire Arctic Cloud Experiment (ACE) (Steve Ackerman, Steve Platnick and King).

3.2 Software Development and Testing

3.2.1 Delivery Status

Hucek reviewed the delivery status of Atmosphere code (Attachment 25). Presently Aerosol/Water Vapor, Atmospheric Profiles and Cloud Mask are at the Goddard Distributed Active Archive Center (GDAAC). Cloud Top Properties, Cloud Optical Depth, Cirrus Detection, Level 3 Tiling, Level 3 Daily and Level 3 Monthly are being either tested or integrated by the Science Data Support Team (SDST). Hucek indicated that the SDST Test Group will not release Cloud Top Properties until all of MOD06 is received (Cloud Optical Depth has not yet gone into testing). Originally an aerosol correction was to be incorporated but, because of schedule pressures, it was dropped. Hucek stated that Atmosphere might take advantage of the extra time afforded by the launch delay to add the aerosol correction back sometime in the September/October time frame. The University of Wisconsin (UW) intends to implement the Clear Sky Radiances code. King asked if there are any major problems with Atmosphere code, and Hucek replied that there are not. We do not have large test data sets but, so far, the algorithms that have reached the GDAAC seem to be running without incident. Hucek added that he has successfully conducted tests (albeit somewhat limited) on those algorithms that have not yet reached the GDAAC, and they also appear to be functioning well.

3.2.2 Storage Volume Requirement

Hucek reported that the total Atmosphere Version 2 storage volume requirement is now 37.3 GB/day. By comparison the Version 1 (May 1997) delivery was 19.2 GB/day, and the ECS Baseline of February 1996 was 31.8 GB/day. (The increase in volume since Version 1 is due primarily to QA.) The Atmosphere storage volume represents a very small fraction of the total MODIS requirement.

3.2.3 Processing Requirements

Hucek reported that the total Atmosphere processing requirement is now estimated at 1634 MFLOPS/day. The Version 1 (May 1997) delivery was estimated at 1836 MFLOPS/day, and the ECS Baseline of February 1996 was 654 MFLOPS/day. Hucek pointed out that the Version 2 estimate does not include the factor of 1.6 that had been added to the Version 1 estimate in order to account for additional coding.

3.2.4 Production Rules for the Cloud Product (PGE06)

Hucek indicated that at present the components of the Cloud Product (Cloud Top Properties, Optical Depth and Cirrus Detection) are linked in such a way that if the Cloud Top Properties process fails, the remaining two processes will not run. Given the extra time before launch, Hucek would like to restructure PGE06 so that any of the three processes will execute irrespective of the success of the other two processes.

3.2.5 DAAC Hand-off/Code Updates

Hucek reported that the GDAAC would process Level 1 data and PGE03. SDST will act as the Science Computing Facility (SCF) code delivery interface. Hucek expressed concern that currently the procedure for integrating code updates post-launch has not been completely defined. Bryan Baum pointed out that in the first 6 months or so after launch we will definitely want a quick-turnaround process to shake out code. Bill Engelmeyer replied that SDST recognizes this need, and he plans to have an SDST Integration and Test person assigned specifically to work with Hucek and the rest of the Atmosphere Group in order to quickly make necessary updates. Gumley stated that the code update procedure should spell out explicitly how often code will be updated (i.e., do we insert small changes into the production stream as received, or do we collect the changes to all the algorithms and then update them at one time, perhaps once a week?). Gumley announced that in July UW plans to conduct its first complete internal review of the Cloud Mask code.

3.3 Adaptive Processing

3.3.1 Post-launch Visualization Tools

King indicated that Gumley and others at UW have been working on a plan to make visualization tools and design specifications available via the Web. King asked that Group members provide Gumley with input as this process develops.

3.3.2 MODIS Adaptive Processing Summary

Gumley reported that the MODIS Science Team was recently asked to submit a proposal outlining how it would perform its own PI-led adaptive processing of AM-1 MODIS data. (The Team has already begun planning a PI-led processing effort for the PM-1 era.) Ed Masuoka presented an adaptive processing proposal during the closed door portion of the Science Team meeting, and Gumley summarized the main points (Attachment 26). This proposal will be ready for Science Team review by July 24. Essentially the GDAAC would be responsible for processing all MODIS data to Level 1B. The GDAAC will also handle archive and distribution. SDST's MODIS Emergency Backup System (MEBS) will be responsible for processing all

Level 2 and 3 products. Masuoka's proposal calls for processing all products at 100%, as opposed to the 25-50-75-100% ramp-up that ESDIS had outlined.

3.3.3 Possible Adaptive Processing Issues and Concerns

Gumley stated that MEBS has always promised the Atmosphere Group a revolving 24-hour archive of Level 1B data, and that does not appear to have changed under the new plan. Kaufman expressed concern that if MEBS is responsible for routine, daily processing, then where will the independent backup processing capability reside? He stated further that for an emergency plan to have real value, it needs to be completely independent, and it is currently unclear how this will happen within the adaptive processing proposal. Gumley cited software version control, especially with regard to the Cloud Mask software, as another issue that requires further clarification. It appears that the Cloud Mask will be run at several places—including the GDAAC, ESDIS Mini-DAAC, RSMAS, MEBS and NOAA—and we need to ensure that any software changes flow down to all of these entities. King noted that Cloud Mask is also likely to be very popular with the direct broadcast stations. Gumley replied that that raises another issue, namely should Atmosphere structure its code so that it can run outside of the PGS toolkit? Gumley stated that under the new plan Atmosphere expects there to be a Team Leader Computing Facility (TLCF) test environment, outside of the production environment. Finally, he indicated that no matter how the adaptive processing plan is ultimately implemented, he expects that Hucek will continue to play a major role in the successful creation of Atmosphere data products.

3.4 Advanced Global Imager (AGI)

Murphy reported that efforts are underway to determine the logical continuation of MODIS measurements into (and beyond) the AM-2 and PM-1 eras. He and other Science Team members have been working with the Integrated Program Office (IPO) to implement MODIS-like requirements within the National Polar-orbiting Operational Environmental Satellite System's (NPOESS) Visible Infrared Imaging Radiometer Suite (VIIRS), anticipated for launch in 2009. In order to continue many of the MODIS measurements after the launch of PM-1 but before the launch of VIIRS, the Advanced Global Imager (AGI) will be launched in 2004. The AGI is a "reduced MODIS" sensor, likely containing 20 bands, and two different contractors have been given money to design such an instrument. Murphy distributed a paper to the Science Team entitled "The NPOESS Preparatory Project (NPP): A Transitional Mission from EOS to NPOESS," (Attachment 27) which outlines plans for future sensors in more detail. In this paper he proposes that the platform that would contain the AGI would also include a Clouds and the Earth's Radiant Energy System-II (CERES-II) instrument, as well as a third as-yet undetermined sensor that would complement the AGI and CERES-II sensors.

3.5 Fire Arctic Cloud Experiment (ACE)

King stated that Ackerman had already presented some of the Fire ACE images earlier at the plenary session. Suzie Young and Tami Beitzel have assembled a book that summarizes the experiment, and the book is available to Group members. King presented images from a couple of interesting cases. The first involved a "black hole" that appeared in multi-layer clouds directly over the SHEBA ship. He suggested that this was the result of a wake or hole behind the NCAR C-130Q research aircraft as ice crystals were produced by the aircraft propeller vortices and then fell out of the clouds. The second case that King presented involved data gathered using a unique flight pattern designed by Steve Platnick in which the ER-2 flew four flight legs, each displaced 45° from each other, in order to gather multiple passes and a complete bidirectional reflectance pattern of clouds over the SHEBA ship. AirMISR was turned on every time the plane flew over the ship. Data from this flight pattern were used to create images of altocumulus opacus clouds and their boundary structures.

Platnick presented images merging MODIS Airborne Simulator (MAS) data with Advanced Microwave Precipitation Radiometer (AMPR) data. Paul Hubanks made this type of MAS data available on the Web during the experiment. Platnick noted that the instrument configuration aboard the ER-2 was very similar to the configuration slated to fly aboard the AM-1 and PM-1 platforms.

3.6 Validation

3.6.1 Validation Plan Update

King reported that the Atmosphere Group last updated its Validation Plan in June 1997. Since then nothing has fundamentally changed in terms of philosophy and approach. However, the launch slip of almost one year means that dates for validation activities will have to be pushed out accordingly. Additionally, the timeline needs to be extended past the year 2000 to incorporate EOS PM-1 validation needs. King indicated that he would like to see the Validation Plan incorporate the activities of the NASA Research Announcement (NRA) validation scientists. Also, the Group may want to include in the Plan an additional strategy for rapid response to aerosol events (e.g., Lorraine Remer's recent trip to Mexico to make measurements during wildfires). King stressed that Atmosphere Group members review the current plan (available on the Web) and submit suggested revisions to him as soon as possible.

3.6.2 ER-2 Flights

Requests for ER-2 flights are due tomorrow (June 26), and King has submitted one flight request for SAFARI 2000 in southern Africa in August 1999. One of the ER-2 planes will be out of commission for 4 months beginning in November 1998. In addition, there is now an agreement in place with the University of Washington and DoE that will allow us to submit requests for use of these aircraft facilities for EOS investigations.

4.0. MODIS Ocean (MOCEAN) Group Splinter Minutes
June 25, 1998

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

4.1 MODIS Instrument Issues

MODIS Ocean (MOCEAN) group leader Wayne Esaias chaired the meeting. A discussion of MODIS instrument issues was first on the agenda. Possible fixes to the electronics reset problem were discussed, including the possibility of modifying the system timing. One possible effect of this would be to increase the 1 km nominal pixel size to 1.05 km, which appears acceptable. Since the ocean visible/near infrared bands are not affected by this problem, MOCEAN does not have strong concerns about this issue.

The MODIS instrument on the AM-1 platform is the "proto-flight model" (PFM), which is the first copy of the instrument. The second copy of MODIS, "Flight Model 1" (FM1) has a number of fixes made to problems that were identified after the PFM delivery to Valley Forge for integration onto the AM-1 platform. FM-1 is scheduled to go into thermal vacuum testing in early July; some additional tests beyond those currently planned for thermal vac will be needed to fully understand the instrument's performance to see if a software fix for the reset problem is possible. A hardware fix for this problem may or may not be possible. In addition, it is important to assure that time delay and integration (TDI) on Bands 13 and 14 is working, which again requires thermal vac testing.

There is a consensus within the Oceans group that, given the likelihood of a launch delay to mid-1999, it would be preferable to fully characterize and fix the FM1 instrument and fly it on the AM platform, with the PFM instrument then fixed and flown on the PM platform. This would be subject to budget and launch schedule constraints, but seems to be the preferred option. A decision on this should be made on or about August 1, 1998.

4.2 SeaWiFS Calibration/Validation

Chuck McClain next gave an update on the SeaWiFS calibration/validation program's progress. He reported that the AMT-6 validation cruise from Cape Town, South Africa to the UK was a success with all instruments working well, and he anticipates a good data set from that cruise.

He noted that solar and lunar looks are being used to calibrate Bands 7 and 8, while MOBY data is being used for Bands 1 through 6. In solar calibration, it looks like the response degradation is flattening out. The color of the cover (which has not yet been opened) is changing over time, which was expected.

There is a bit of an anomaly in the degradation rate in Bands 7 and 8. Bands 1 through 6 show less degradation with increasing band number; bands 7 and 8 do not mach this behavior. Bands 1 through 6 are holding fairly steady in lunar calibration,

while Bands 7 and 8 showing change. The project is considering applying a correction to Band 7 based on the lunar data, then building a correction for Band 8 from this to preserve the Band 7/Band 8 ratios.

McClain reviewed the calibration of SeaWiFS to MOBY data, discussing the effects of scatter, optical thickness and aerosol, and "cloud glint" on calibration. He noted difficulties in obtaining good chlorophyll-A values, especially near coastal zones. Using Bands 6 and 8 rather than 7 and 8 for producing a chlorophyll-a product is an option The 6-8 algorithm has advantages in coastal zones and high-turbidity regions, and can use SeaDAS to generate coastal products.

There was a brief discussion of differences in results depending on atmospheric models used; specifically, the HITRAN 82 model produces different results than the HITRAN 94 and HITRAN 96 models.

4.3 MODIS Adaptive Processing and QA Plans

Esaias reported that the Adaptive Processing proposal has been distributed, and that it looks like it is a move in the right direction. The plan would develop a system that gives the MODIS Team more control over processing and product generation issues, and would allow the Team to decide how the trade-offs between processing and capacity should be made.

A primary issue with the system is network bandwidth, especially for doing QA. The network capability currently does not exist for the data volumes required, and may not be forthcoming. One possible option would be to have QA done at the GDAAC, doing something similar to what MODLAND is doing with their Land Data Operational Product Evaluation (LDOPE) strategy. The Miami facility is also capable of doing significant amounts of processing for MODIS, and has had access to the National Science Foundation (NSF) network. It is important that each team member determine which bands and which data products they will need to perform QA on their products in order to help size network, storage, and processing requirements under the adaptive processing scenario.

Availability of data sets for testing was discussed. Miami is able to provide climatology data and SeaWiFS data for testing; since SeaWiFS data is reality-based, it can be used to help do QA and calibration of early MODIS data. SDST is planning on making test data sets available at the GDAAC, with no current plans to obtain SeaWiFS data for system testing.

4.4 "Hot Science" Reports from Team Members

A series of short presentations on "hot science" results were given. Kendall Carder discussed chlorophyll-a measurements in the open ocean off the Florida coast from SeaWiFS and a recent cruise. John Porter reported on aircraft campaigns over Hawaii to measure aerosol optical depth. These flights overflew Dennis Clark's SeaWiFS initialization cruise. Mark Abbot reviewed the results from the southern ocean polar campaign, where 11 of 12 buoys were recovered (one was lost due to collision with an iceberg), and good data was retrieved from 9 of the radiometers on those buoys. Ian Barton reported on work with sea surface temperatures (SST) and

the differences between skin temperature and bulk temperature (Attachment 28). Models using AVHRR data currently produce skin temperatures about 0.5 K warmer than the in-situ measured bulk temperatures; the expected values should be 0.2 to 0.3 K cooler. Barton also reported on the Miami IR workshop, where a radiometer round-robin was held; an absolute accuracy of better than 0.1K was achieved. A report on the workshop is available on the web at: http://www.rsmas.miami.edu/ir.

4.5 GLI status

Motokai Kishino of NASDA briefed the team on the status of the GLI instrument, to be flown on the ADEOS 2 platform (Attachment 29). He discussed cross-calibration of MODIS with GLI and validating GLI products with MODIS products. He also talked about ASTER specifications as applied to SST (Attachment 30), and discussed doing MODIS/ASTER joint observations for collecting SST data. He proposed a test site near Japan where a warm current runs next to cold water, providing a high dynamic range for data values.

The GLI home page is at http://www.eorc.nasda.go.jp/ADEOS-II/GLI/adeos2.html.

4.6 Budget Issues

Budget projections for processing through Launch+4 years (2003) were discussed. The primary focus was on the processing system, and ensuring that the budget covered additional costs at Goddard and Miami for the additional costs that will be incurred as a result of the increased data processing responsibilities.

4.7 MOCEAN Early Products

MOCEAN early products were discussed briefly. It was agreed that calibration will be critical, as the team wants to avoid putting out fatally flawed early products. For early products, the team will concentrate on products like fluorescence that are new and different than what has been done before.

4.8 EOS-PM and Beyond

Murphy discussed the 20 band AGI (reduced MODIS) study. He noted that there will be a combined land/ocean band. Oceans can work on either side of 620 - 670 nm water vapor band. Bo-Cai Gao would prefer a narrow band around 610 for sediments and suspended bathymetry. The trade-offs between MODLAND's 250 meter requirement and MOCEAN's narrow band needs were discussed. One of the drivers behind MOCEAN's needs is the desire to develop a baseline to establish a heritage that is better than AVHRR for oceans.

4.9 MODIS Validation Planning

The MOCEAN group discussed the effects of the launch delay on validation planning. The group reworked the validation schedule timeline chart, which is one year old. Some validation activities are complete: MOBY is now operational, and several AMT cruises and the Gulf of Maine cruise have been completed. The team has met almost all of its validation goals to date. A number of planned activities,

such as initialization cruises, need to be post-launch, and will need to be scheduled when the launch date is more definite and imminent.

Recent and upcoming cruises were discussed, including those listed on the SIMBIOS web page, a series of Japanese recent and planned cruises, daily measurements taken from instruments on board ferries in Australia, and a number of Gulf of Mexico cruises.

A number of factors affect MODIS initialization cruise scheduling. These include the instrument turn-on date, ship availability, calibration orbits where no ground data is taken, glint considerations at the Hawaii site, the narrowness of the swath, which precludes any chance for 2 passes in a day, and availability of aircraft and instruments for overflight validation.

It was agreed that there is a need to protect the Hawaii MOCE cruise for MODIS initialization by ensuring that there are no competing cruises or campaigns that place conflicting demands on PI time. Given that scheduling cannot be done until a firm launch date is set, this may present some difficulties.

Robert Frouin summarized efforts to plan an international cruise for cal/val in 2000 on board a Russian ship. The cruise would last about 6 months and consist of 6 legs of 3 weeks at sea followed by one week in port. MODIS would be interested in a segment off northwest Africa to look at Saharan dust, provided the time of year was appropriate for those measurements. Logistics concerns were brought up both in terms of suitability of the ship for the instruments to be used as well as financial considerations.

Algorithm evolution and recompetition

Esaias noted that the MOCEAN group has a responsibility to produce data products until launch + 4 years, which currently would be 2003. The contracts for the PIs run through 2001. Esaias hopes to see the current contracts extended or renegotiated so that the PIs can fulfill their responsibilities through launch + 4 years, and would welcome the chance to add more scientists to the project if possible.