MODIS Science Team Meeting Minutes

May 14 - 16, 1997

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MODIS SCIENCE INTEREST GROUP
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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
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
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
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
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/199705/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 Project Science Office Update	Michael King
3. Overview of EOS AM Project Activities	Yoram Kaufman
4. PM-1 Platform Status Report	Claire Parkinson
5. EOSDIS Status Report	Rick Obenschain
6. NPOESS Presentation to the MODIS Science Team	Stan Schneider
7. Validation of the MODIS L1B Product	Bob Murphy
8. Version 2 Delivery Schedule	Ed Masuoka
9. EOS AM-1 Direct Access System	Bob Murphy
10. Geolocation Workshop Report	Alan Strahler
11. Data Assimilation Office Status Report	Yong Li
12. OCTS Project Status Update	Hajime Fukushima
13. The MODIS Fire Algorithm	Yoram Kaufman
14. MODIS Cloud Mask Progress and Current Status	Steve Ackerman
15. MODIS Instrument Status Report	Tom Pagano
16. Summary from Algorithm Developers Forum	Joe Glassy
17. Ocean Group Splinter Summary	Wayne Esaias
18. Atmosphere Group Splinter Summary	Michael King
19. Land Group Splinter Summary	Chris Justice
20. Status of Version 2 Software	Bob Evans
21. Evaluation of Chl a Algorithms for SeaWiFS	Stephane Maritorena
22. Remote Sensing Reflectances	Dennis Clark
23. AOL Flight Scenarios for Validation Campaigns	Frank Hoge
24. Atmosphere Group Splinter Agenda	Michael King
25. EOS Validation Planning Schedule	Michael King
26. Quality Assurance Report	Allen Chu
27. Level 3 Design and Development Plans	Xu Liang
28. File Specs, QA Plan, Level-2 and -3 Software Development	Rich Hucek

29.	Ancillary Data Issues	Kathy Strabala
30.	Ancillary Data: Data Assimilation, Surface Temperature, etc.	Ran Song
31.	DAO File Specs	Ran Song
32.	Data Storage Volume Requirements	Rich Hucek

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1.0 Plenary Session

1.1 Introduction

Vince Salomonson, MODIS Team Leader, convened the MODIS Science Team (MST) meeting and welcomed participants. Salomonson stated that the instrument is currently undergoing consent-to-ship review at SBRS. Thermal vacuum testing was completed successfully, and polarization issues have been resolved. The instrument will soon be shipped to Valley Forge, and it is expected to launch in 13 months. Tom Pagano from Santa Barbara Remote Sensing (SBRS) will deliver a detailed instrument status report later in the meeting. Salomonson noted that the agenda (Attachment 1) also calls for Rick Obenschain to present an EOSDIS status report.

1.2 EOS Project/Program Science Report

Michael King, EOS Senior Project Scientist presented the EOS Project Science Office Update (Attachment 2). He reported that the biennial review process has been instituted to look at things like how MTPE programs are addressing science themes, processes for incorporating new technologies, partnerships with commercial and international entities, etc. EOS is implementing an interagency validation strategy, incorporating satellites, surface networks and field campaigns. King presented a timeline showing Earth system model development; the goal here is to have fully coupled earth system models by the year 2010.

King presented a table comparing the numbers of EOS data products in May 1993 to the numbers in April 1997. The total number has increased from 239 in 1993 to 282 in 1997; this jump is attributable to certain algorithms, most notably data assimilation, that were not taken into consideration in 1993. King dispelled the perception that there is an astronomical overload of data products; many of these products can be accounted for as front-end calibration. Turning to ATBD development, King reported that 12 of 20 instrument teams have completed the ATBD process, and most ATBDs are now available via the Web.

King stated that with the last few charts in his presentation he hoped to expose participants to issues with which he could use assistance. He announced that the Standard Data Products Resources Board, chaired by Skip Reber, has been established to assess and manage changes to the EOS data products list. As such this Board will, among other things, add and delete data products and ensure that resource allocations are consistent with science priorities. Chris Justice asked how those kinds of decisions are made--on the basis of science requirements, perceptions of usefulness of products, or identification of "tall poles?" King explained by way of background that at first Board membership focused on DAAC resources and allocation. Yoram Kaufman and Bruce Barkstrom were then added to represent instruments. King replied that Justice's

question leads to the Board's main dilemma, namely the accuracy of the data products database. Hughes ECS is building its database to the February 1996 baseline, although the 1997 Data Products Handbook differs substantially. Discrepancies have emerged as some interim products have drifted to standard. King expressed concern that a mechanism be put into place to provide a reality check between actual MODIS sizing requirements and what Hughes understands the requirements to be.

King announced that 340 letters have been received in response to the NRA for the correlative measurement program for EOS-wide validation. Turning to the Science Plan, he reported that 6 of the 10 chapters have been received. Salomonson suggested that the more interesting scientific questions contained in the Science Plan will push instrument development and, ultimately, shape the evolution of EOS.

1.3 AM-1 Project Science Status and Early Science

Yoram Kaufman, EOS AM Project Scientist, presented an overview of EOS AM Project activities (refer to Attachment 3). He reported that David Herring, recently hired as Outreach Coordinator, has created an EOS AM Bulletin Board System (BBS) and will be creating an EOS AM Web site as well. Kaufman encouraged use of the BBS to discuss issues like the calibration maneuver and early science. Kaufman indicated that the EOS Project Office is assessing how best to perform the calibration maneuver, or deep space look, for MODIS and CERES. He announced that AM-1 plans to publish two informational brochures; the first will be completed early this summer, and will be oriented toward the technical community. The second brochure, scheduled for publication in January 1998, will be written at the lay reader level.

Kaufman stated that he is actively seeking to hire an outreach scientist to coordinate MTPE PAO outreach efforts like brochures, museum exhibits, articles and press releases. He proposed that a special issue of the Journal of Geophysical Research (JGR) be published at the launch of AM-1, and presented a schedule for papers. Salomonson suggested that the special issue should not be published until 9 months after launch, when there might be some early images from the instrument available. Kaufman has asked Herring to assist in promoting a contest to name the AM-1 platform.

1.4 PM-1 Status

Claire Parkinson, PM Project Scientist, presented the PM-1 platform status report (refer to Attachment 4). She reported that the PM-1 Independent Annual Review (IAR) began yesterday (May 14) and runs through today. The spacecraft is now in month 13 of its 54-month development period. The work by TRW, the spacecraft contractor, was delayed by 6 months (September 1995 - April 1996) because of a protest to the Common Spacecraft contract, but launch is still scheduled for December 2000, and overall progress has been rapid since TRW came onboard.

Parkinson reviewed the list of instruments, including MODIS, that are now planned for the PM-1 mission. She presented an illustration comparing the stowed and deployed

dimensions of the spacecraft. When stowed, an AMSR reflector is in the way of MODIS, so it is important that this reflector moves out of the way during deployment. Parkinson announced that TRW has signed off on interface control documents (ICD) for all but one (Humidity Sounder for Brazil [HSB]) of the instruments planned for PM-1. Development of this instrument and of the AMSR are behind schedule because the earlier intended instruments (a Microwave Humidity Sounder [MHS] and a Multifrequency Imaging Microwave Radiometer [MIMR]) were being developed by the Europeans, who pulled out of both projects. Brazil has agreed to support HSB, and Japan has agreed to support AMSR. (Specifications and additional details on all PM-1 instruments can be found in Attachment 4.)

Parkinson indicated that on May 6 a meeting was held to discuss the desirability of conducting a PM-1 calibration maneuver. The MODIS and CERES teams are in favor of the maneuver, while the AMSR and AIRS teams are opposed. TRW will examine the feasibility and potential impacts associated with performing the maneuver one time on day 45 of the mission, with MODIS and CERES powered on, and AMSR and AIRS powered off. From what Parkinson has heard so far, this compromise appears to be reasonable.

1.5 EOSDIS Status Report

Rick Obenschain, EOSDIS Project Manager, presented the EOSDIS Status Report (refer to Attachment 5). Obenschain stated that his presentation would focus on science data processing, as that is of primary interest to MODIS Science Team members, but first he presented some system-wide overview material. He reviewed the status of EOSDIS Mission Systems, including the Flight Operations Segment (FOS), EDOS, ground stations and networks. He pointed out that ISTs have been installed at MODIS, CERES and MISR sites, and that Release A IST usability testing with the MODIS Instrument Operations Team is complete. The biggest near-term challenge for mission systems will be finding adequate time with AM-1 spacecraft and instruments to thoroughly test operational interfaces.

Obenschain indicated that the EOSDIS Core System (ECS) represents a real challenge. The original contract called for delivery in the October / November 96 timeframe. When it was evident that this schedule would not be met, EOSDIS reprioritized activities, and broke Release B into two pieces, B.0 and B.1. Release B.0, due May 15, 1998, will have limited product generation capability but will allow MODIS all the capabilities necessary to support early mission calibration and algorithm testing and refinement. Release B.0', an early incremental build, will be demonstrated in August; it will provide the capabilities necessary for critical functions. If B.0 is delayed and not delivered as scheduled, then B.0' can at least provide the capabilities critical for launch. Release B.1 is scheduled for delivery January 15, 1999. The Pre-Release B Testbed will be installed and checked out this week at the EDC DAAC, and the GSFC DAAC SSI&T team is conducting additional testing. Obenschain expressed his concern that the August demo of B.0', initially intended as an internal demo, has evolved into a "go / no-go" decision point. As such, the scope of the demo has been expanded to the point where

preparation is impacting development of B.0. This impact, estimated to be about 4 to 6 weeks, will be taken into consideration by Sara Graves' review committee.

Obenschain noted that EOSDIS has been criticized for losing sight of the fact that it is a support entity, which must respond to the needs of instrument teams and scientists. He reported that funds have been allocated and held to support SM-1, Landsat-7 and SAGE III emergency backup plans. MODIS is currently revising its backup plan proposal.

Obenschain indicated that the ESSAAC Committee and GSFC have asked EOSDIS to look at where it should go in the future. Five alternatives were identified, ranging from continuing with the baseline architecture to implementing a total PI-mode architecture, and AM-1 instrument teams were polled to determine their preferences. Obenschain stated that if it makes sense for a team to use a system outside of EOSDIS, and it does not cost the program money, then use of the outside system will be given consideration.

Obenschain opened the floor for questions, and Mark Abbott asked who will be establishing the August demo criteria to gauge how meaningful B.0' prime is? Obenschain responded that he has asked Hughes to stretch as much as possible when exercising capabilities; however, he reiterated that he is leery of "raising the bar too high," as that may cause a significant schedule impact.

Chris Justice voiced his concern that ESDIS is considering the reduction of instrument interdependencies and, from the Land point of view, these interdependencies are critical. Obenschain replied that ESDIS had been asked to look at ways to cut costs in the out years. We are evaluating the savings associated with data volume reductions of 25 % and 50 %. The likely scenario is that the number of Level 2, 3 and 4 products will be reduced, at least for the initial phases of each flight mission, and 100 % of the Level 1 products will be produced.

Wayne Esaias asked when the decision would be made to turn on the emergency backup plan? Obenschain answered that on or about September 1, 1997, it should be clear as to whether Release B.0' contains the necessary functionality. If it does not, then the emergency backup plan will be fully energized.

1.6 Coordination with Integrated Program Office (IPO)/National Polar-orbiting Operation Environmental Satellite System (NPOESS)

Stan Schneider reported that NPOESS intends to fly in three orbits: 0530 sun-synchronous, 1330 and EUM (between 930 and 1030). Of most interest to MODIS is the Visible and Infrared Imaging Radiometer Suite (VIIRS), which will be a single sensor or suite of sensors that address visible IR imagery and radiometric measurements. VIIRS meets critical NPOESS requirements for imagery, sea surface temperature (SST) and soil moisture. Delivery of the first flight unit is slated for January 2004. Schneider presented a list of products that VIIRS will provide, and noted that ocean color is a new capability for the operational community. (Refer to Attachment 6.)

The RFP for VIIRS differs from the typical NASA RFP in that the vendors were asked to deliver the algorithms as well as the product However, most of the expertise in algorithm development resides in universities and the government, so Operational Algorithm Teams (OAT), consisting of DoD, NOAA and NASA representatives, have been formed to oversee the algorithm development process.

Schneider stated that according to the NPOESS MOA, "if the decision is made to fly a NASA instrument on the NPOESS platform instead of continuing to fly it on a NASA research spacecraft, because the research instrument will meet the convergence operational requirements in a cost-effective manner and continues to provide data so as to fulfill primary NASA research mission requirements, NASA will provide additional copy(s) of the instrument for flight on the NPOESS platform at no unit cost to the NPOESS program." As a result of this requirement, studies of selected NPOESS/MTPE instruments and algorithms, including a comparison of MODIS and VIIRS, are being conducted. From the NASA side, both Bob Murphy and Ken Anderson are involved in this effort. Initial findings indicate that MODIS and the proposed VIIRS differ significantly as currently planned. A higher spectral resolution is required by MTPE, while a higher spatial resolution is required by NPOESS, and calibration approaches are different. There may be a possibility for cooperation at the modular level (i.e., ocean color). Schneider announced that the NPOESS Web site is located at: http://www.laafb.af.mil/SMC/PK/NPOESS/rfp.htm

1.7 Short Reports

1.7.1 Level 1B Validation Plans

On behalf of Bruce Guenther, Bob Murphy discussed Level 1B validation plans (refer to Attachment 7). Murphy reported that the Level 1B plan is not as well-developed as we would like it to be. The validation approach will incorporate aircraft, ground-based, ship-based and mooring platform sensors. MODIS derived TOA spectral radiances will be validated in the 16 VIS/NIR and 4 SWIR bands using high radiance sites (i.e., White Sands) and low radiance sites (i.e., Tahoe). TIR bands 31 and 32 will be validated directly; other TIR bands will be validated by referring to 31 and 32 via the onboard blackbody. Long-term stability will be monitored by lunar looks through the space view port 3 to 7 times per year. Radiometric calibration change over days to weeks will be checked with solar diffuser measurements. Murphy noted that in the Level 1B draft algorithm, no follower algorithm is incorporated. Until MST allows a follower algorithm, the solar diffuser will not be integrated. The University of Arizona will conduct vicarious calibration campaigns for ASTER and MODIS. Vicarious calibration of thermal bands will be used to change temperature offsets of the average blackbody and cavity temperatures. Murphy indicated that there is a great deal of work to be done early on in the Level 1B validation process. He anticipates that the Level 1B Validation Plan will be revised and available for review sometime in early 1998.

1.7.2 Version 2 Delivery Schedule

Ed Masuoka, SDST Leader, reported that software will be received from April through October, and that science software need dates are driven by synthetic data, product dependencies, time to test at TL-SCF, and time to integrate and test at the DAACs (refer to Attachment 8). Version 2 software requirements are completed. SDST is finishing up metadata work with ECS, and Masuoka stated that he would like to put a freeze on metadata this month (May), and the earlier the better. Some metadata work must be redone according to the Software Delivery Guide, which arrived later than expected. Masuoka presented the Version 2 schedule, and noted that the schedules for "testing at the DAACs (February)" and "launch software freeze (April)" are being reworked by ESDIS/ECS.

1.7.3 Phase-in Plan for Data Products

Masuoka indicated that the phase-in plans for data products are being worked by the discipline groups. He cited the dependencies between Land and Atmosphere as a key issue that needs to be worked. Masuoka intends to send an e-mail message about phase-in to Skip Reber.

1.7.4 Direct Broadcast/Reception

Murphy reported that the Project has a Level 1 requirement to provide direct broadcast of data, but there is no requirement for reception of same. EOS AM-1 Direct Access System (DAS) capabilities include real-time direct broadcast (DB) of MODIS data and ancillary data, as well as real-time direct downlink (DDL) of ASTER (Vis-NIR-Thermal High Resolution) data (refer to Attachment 9). The DAS broadcast frequency is 8.2125 GHz. The I and Q channels will carry identical data in the DB mode; in the DDL mode, MODIS will be on I and ASTER on Q. Murphy stated that direct broadcast would promote the use of MODIS data by our international colleagues, and enable their participation in our validation programs. NASA HQ is interested in direct broadcast, and a joint EOS-HQ effort may produce a cost-effective way to receive, process and distribute data. The University of Wisconsin (UW) is willing to scope out a proposal for a prototype receiving station. In response to a question from Alan Strahler, Murphy clarified that direct broadcast is available to any group capable of receiving it, whereas direct downlink is available (on command) only to a NASA or a specified Japanese station. DB is available continuously. DDL requires S/C opertations. Wayne Esaias asked whether a station can receive MODIS and Landsat direct broadcast data simultaneously, and Murphy replied that the station can only receive data from one at a time.

1.7.5 Geolocation Validation

Strahler reported that the Geolocation Validation meeting held May 13 was very successful (refer to Attachment 10). Participants reviewed Version 3.0 of the Geolocation ATBD. Strahler stated that the geolocation process can be divided into two

parts. The first part is production, including attachment of latitude and longitude to each pixel. The second part is bias and trend analysis. Overall, good progress has been made in geolocation validation; there are no "showstoppers," although the schedule is tight.

Strahler anticipates that Version 2 production code should be delivered as scheduled on June 9, 1997. The Version 2 base algorithm should be delivered between June and September 1997. Strahler reviewed the ground control points, both island and land, being used for bias and trend analysis. He noted that the Land GCP database acquisition needs to move forward quickly. The geolocation group needs to plan post-launch activities and experiments. Strahler indicated that at the May 13 meeting some inter-instrument issues emerged, and these will be taken up by the SWAMP. The Geolocation Group will take the action to work the issue of band-to-band registration in the event of SRCA failure.

1.7.6 Data Assimilation Office (DAO) Status Report

Yong Li presented the Data Assimilation Office (DAO) status report (refer to Attachment 11). He reviewed the methodology behind GEOS-3 Gridded Data Products. The GEOS-3 system is expected to be operational in June 1998. He encouraged Science Team members to contact him for copies of the file specification. Anyone in need of DAO data should complete the data survey form (available at the registration desk or from Li); the DAO will then respond as to whether their data is suitable for the user's purposes described in the survey. Justice questioned the need for the survey, saying that by this time the DAO should be addressing the requirements that it has already been given. Li encouraged more direct communication between the MODIS Discipline Groups and himself. Salomonson suggested that Land and DAO work together to clarify DAO data requirements. Li was asked if DAO had backed away from the ozone product, and he replied that it will be available at launch**.** Li also presented a sample test data set that DAO had already created, which covers the period July 31 through September 1,1996. This data set was created for MODIS software testing and based on the requirements received in that time frame. The test data set is available now in HDF-EOS format. ECS is currently working on the metadata for this data set.

1.8 Early Results from the Ocean Color and Temperature Scanner (OCTS)

Hajime Fukushima, Leader of the OCTS Sensor Team, reported that OCTS is collecting global VIS and IR data with a 700m resolution (refer to Attachment 12). Overall instrument performance has been satisfactory, although he noted a couple of problems. The tilt mechanism could not be set to its full range (±20 degrees), so it is now set at ±19 degrees. Also, sensor degradation in the IR bands requires periodical baking. (Instrument operation will be suspended June 21 - 29 for baking.) Fukushima stated that calibration numbers for the visible bands will soon be updated using AVIRIS data from observations made in April and May. He noted that on April 10 the calibration system was changed to allow for the vicarious calibration factor and, so far, the vicarious calibration results appear to be good. Salomonson stated that it is very

encouraging to see the OCTS data appear, and expand upon the Coastal Zone Color Scanner data.

1.9 Early Results from Polarization and Directionality of Reflectances (POLDER)

Didier Tanre reported that like OCTS, POLDER resides on the ADEOS platform. The POLDER instrument utilizes a camera composed of a two-dimensional CCD detector array, wide FOV telecentric optics and a rotating wheel carrying spectral and polarized filters. Tanre reviewed instrument specifications and planned products, to include ocean color and marine aerosols, land surfaces and aerosols over land, and radiation budget, water vapor content and clouds. Tanre indicated that POLDER has no onboard calibration device, and it is difficult to work on bulk calibration. Calibration is being done with radiometric methods, such as absolute calibration using Rayleigh scattering, polarization calibration over sunglint and clouds, inter-band calibration over sunglint and clouds, multitemporal calibration over desert sites, OCTS/POLDER intercalibration and statistical relative calibration over clouds. Salomonson inquired about the accuracy that POLDER aims to achieve, and Tanre responded that an accuracy of ±2-3 % is anticipated. The spec for polarization is better than ±1 %. Tanre stated that POLDER is looking at the cloud mask by using the reflectance threshold in IR and NIR data, polarization and the oxygen-A absorption band. He demonstrated how POLDER data is used to determine the phase of clouds, from which we can better derive optical thickness for liquid water clouds. POLDER aerosol optical thickness images are being compared to sun photometer data measured from the ground. King suggested that POLDER data be compared with data from the German MOS instrument. Data will be available late 1997 (point of contact: Anne.Lifermann@cst.cnes.fr).

1.10 MODIS-like 1-km BRDF and Albedo Retrievals over New England

Strahler presented the work of Robert d'Entremont at BU, whose objective is to prototype the MODIS/MISR BRDF/albedo algorithm using satellite observations, as well as to demonstrate the retrieval of BRDF and spectral albedo at a 1-km spatial resolution. Strahler explained that the research plan is to obtain AVHRR data and make comparisons. The algorithm is a kernel-driven semi-empirical BRDF model based on view and illumination angles. Reflectance is based on 3 terms: a constant for isotropic scattering; a weight applied to a BRDF shape for volume scattering; and a weight applied to a BRDF shape for surface (geometric-optical) scattering. Strahler presented twoexamples of kernel shapes, the Ross (thick) kernel and the Li (sparse) kernel. (The first is for volume scattering, and the second for surface scattering.) The data set comes from AVHRR and GOES visible band data. Strahler showed a number of images taken over New England, and demonstrated how the Ross kernels have BRDF with a moderate-to-strong bowl shape, and no hotspots. These are associated with forests and dense crops. The Li kernels are more dome-shaped, with hotspot peaks. These are associated with urban and suburban regions. Strahler concluded that this work is moving beyond the theoretical stage, and he is looking forward to using the algorithms on real MODIS and MISR data.

1.11 Evaluation of MODIS Fire Algorithm Using SCAR-B Results

Yoram Kaufman explained the methodology that he and Chris Justice used to construct the MODIS fire algorithm (refer to Attachment 13). MAS data gathered over fires in Brazil indicate that MODIS fire detection capability will be much better than that of AVHRR. For example, MODIS channels will not saturate in the tropics. Kaufman indicated that MODIS data will be used to generate a fire energy product, that will distinguish the order of magnitude of fires. He will also attempt to determine how much of a fire is flaming, and how much is smoldering, and what the temperatures are in different parts of a fire. Kaufman presented a table summarizing the fire information from four regions of Brazil, based on the 40-m resolution MAS observations and on the reduced resolution simulated 1 km MODIS data. Salomonson asked when we might have early MODIS fire results, and Kaufman replied that we should have results very soon after launch. He added, however, that the combination of both AM- and PM-data will be essential to doing real science related to fires.

1.12 MODIS Cloud Mask Progress and Current Status

Steve Ackerman announced that there has been little change in this area since he last presented this overview one year ago. He noted that there have, however, been two significant changes since the ATBD review. The first change involves replacing the wetland bit with a desert scene bit in the land water flag. That change will be contained in Release 2. The second change will not show up in the 48-bit cloud mask file spec. This change involves putting a cloud adjacency effect into bit field 12. This change will not show up until after launch. Refer to Attachment 14.

Ackerman indicated that he had received complaints that, for certain processing paths, it was unclear as to which tests were being run. To address this situation the new ATBD will contain a table to show the processing path, and check marks will indicate which tests are being run. Ackerman reported that he has been working with various field experiments and getting feedback on where cloud mask works and where it does not. He encouraged MST members to obtain the available code to read MAS HDF files, run the cloud mask on a MAS scene, and let him know the results.

1.13 MODIS Instrument Status

1.13.1 Introduction

Before introducing Tom Pagano from SBRS, Bill Barnes announced that the instrument had passed its final consent-to-ship review and is on its way to Lockheed Martin in Valley Forge. Barnes stated that sometime in the next 3 to 6 months MCST intends to hold a workshop to present an in-depth analysis of instrument test data. Overall, though, we believe we have a good data set, and that we can get all of the characterization that we need. Barnes concluded by saying that Dick Weber has retired and will be replaced by Ken Anderson as MODIS Instrument Manager. Barnes stated

that Weber is directly responsible for many of the successes that the MODIS team has had, and thanked him for all of his efforts.

1.13.2 Testing

Tom Pagano stated that comprehensive environmental tests have validated the instrument's principal design features and demonstrated that MODIS is an excellent spectroradiometer. (Refer to Attachment 15.) Pagano reviewed the ambient and thermal vacuum tests that had been performed. He noted that all tests were performed at hot, cold and nominal temperatures, ten degrees beyond what we expect to see in the space environment. Problems encountered during thermal vacuum testing (leaks, space background simulator, etc.) were solved without having to break vacuum. Pagano showed a video entitled "MODIS Calibration and Environmental Testing," and stated that he would make copies available if requested.

1.13.3 Compliance

Pagano reported that most major performance areas have some non-compliances but, in most cases, the instrument complies with specifications. (A sensor is labeled non-compliant in an area when as few as one of the 470 channels does not meet specification.) Waivers are out for non-compliant areas. Refer to Attachment 15 for the Compliance Matrix, Parts 1 - 4, as well as details on each of the non-compliant areas.

1.13.4 Summary and Concerns

Pagano reiterated that overall instrument performance is excellent, and he expects improvements in many noncompliant areas with further data analysis". Concerns include crosstalk, which is higher than expected. It may be possible to improve this by a factor of 4. Another concern is the Near Field Response, which is mostly noncompliant. Finally the dynamic range is noncompliant on several bands, although Band 21 represents the biggest concern.

1.14 Algorithm Developers and Discipline Group Meeting Reports

1.14.1 Algorithm Developers Meeting

Joe Glassy reported that overall the Algorithm Developers feel they have made progress working as a team amongst themselves and with their SDST contacts. Programmers are encouraged to see a reduction in SDST staff turnover, as this aids "institutional memory." Some long-standing issues persist, however, such as frequent specification changes within a given development cycle. Glassy suggested that better communication between algorithm developers and SDST personnel would be mutually beneficial, and encouraged use of Mike Heney's Programmer BBS where appropriate. Glassy summarized the action items that emerged from the meeting. Refer to Attachment 16.

1.14.2 Ocean Group Splinter Summary

Wayne Esaias, Ocean Group Leader, enthused that MODIS looks great, and added that we probably know more about MODIS than we even thought to ask about previous sensors. Ocean algorithms and software are on schedule. Esaias stressed that emergency backup planning (and testing) is essential. The Ocean Group would like to see a full end-to-end data flow demonstration included in the August ECS demo. Murphy added that, within MODIS, we need to define our own success criteria--independent of the criteria defined by the Graves committee--for the August demo.

Esaias expressed his concern over the potential burden that direct broadcast would place on science software and code developers if they become the interface to the world for science software support. He feels that ESDIS, or some entity other than the Science Team, should be responsible. Refer to Attachment 17 for the Ocean Group summary presentation. For complete minutes of the Ocean Group splinter, refer to Section 2 of these minutes.

1.14.3 Atmosphere Group Splinter Summary

Michael King, Atmosphere Group Leader, announced that the Atmosphere QA Plan was submitted to the ESDIS Project Office in March 1997; the next iteration, to include Level 3 QA, is expected in July 1997. King reviewed figures showing the data volume increases due to QA; cloud mask accounts for the most significant increase. Level 3 development is on schedule, and code should be delivered in July 1997. Liam Gumley at UW demonstrated a prototype of a MAS online visualization tool, which will be very useful for cloud mask development. King reported that since the ECS February 1996 baseline, Atmosphere storage volume requirements have grown by roughly 30 %, and this increase has been driven by cloud mask and QA. Atmosphere data still represents a relatively small fraction of overall MODIS data volume. Refer to Attachment 18 for the Atmosphere summary presentation. For complete minutes of the Atmosphere Group splinter, refer to Section 3 of these minutes.

1.14.4 Land Group Splinter Summary

Chris Justice, Land Group Leader, cited the need for a MODIS instrument "performance/operation" log to establish a link to QA. Land has asked MCST to look at this. Land has suggested that SDST assess establishing a similar platform-wide performance log. Justice reported that the Land Version 2 code delivery schedule currently meets SDST needs. Land needs simulation and DAO test data sets for Version 2. Justice indicated that the Land Group is aware that it is the "tall pole" when it comes to volumes and loads, and the Group is currently looking at how to refine these areas. Justice discussed Land validation activities, including the upcoming Grassland PROVE field campaign a the Jornada Experimental Range in New Mexico. Refer to Attachment 19 for the Land summary presentation. For complete minutes of the Land Group splinter, refer to Section 4 of these minutes.

1.15 Summary

Salomonson stated that in his mind the intensity of the MODIS effort has now shifted from the instrument itself to the software, and it will stay that way until launch. The issues surrounding software and validation require attention from us all. If not now, but soon, flexibility with requirements will be clamped, and we will have to become more creative. We have an exercise to look at validation and products, and we need to establish these numbers. We must provide specifics to EOSDIS in order to justify and obtain what we need. The next MST meeting will be held in the GSFC area in October 1997.

2.0 Ocean Group Splinter Minutes
May 14 - 15, 1997

Minutes taken by Mike Heney
(mheney@pop900.gsfc.nasa.gov)

Wayne Esaias opened the May 14 session with an overview of the morning's meeting of the Science Team members. Besides budget issues, topics discussed included EOSDIS review panels, the data system emergency backup plan, and new Ocean Color sensors.

Esaias noted that he believes that the Ocean team's responsibility will probably end with EOS-PM1, and that instruments and teams will be recompeted for EOS-AM2 and beyond. Current team contracts expire in 2000.

Otis Brown provided a status report from the EOS-PM1 platform meeting held earlier at GSFC. Spacecraft maneuvers was a primary topic of discussion. MODIS Oceans would like some on-orbit maneuvering to do a lunar look in order to better characterize the scan mirror. A similar maneuver, which will benefit MODIS, ASTER, and MISR, is planned for the EOS-AM1 mission. On the EOS-PM1 platform, however, AIRS and the other instrument teams object to these maneuvers. In particular, the AIRS instrument would need to be spun down before the maneuver and spun back up afterwards, each of which would require about a week. Brown presented the pro-maneuver position, making reference to GOES-8 characterization, and noted that the error on MODIS would be greater because of the larger scan angle. In addition, pre-launch characterization of the mirror reveals uncertainties that are of the same order of magnitude as the accuracy required by the science, which indicates a need to do a characterization of the mirror on-orbit. Given that the idea is to make the best possible data set for 20 years down the line, early on-orbit characterization is desirable. One possible solution would be to do any on-orbit maneuvering for MODIS characterization early in the mission while the other instruments are still locked down, with later lunar looks coming when the geometry happens to be right rather than maneuvering to get a lunar look. Claire Parkinson has asked that the engineers look at possible scenarios for on-orbit maneuvers from an operational viewpoint, to be followed by further discussions of the science requirements for maneuvers.

The discussion moved on to the EOSDIS review, and to the suggestion that Oceans degrade their data products, reducing the data volume to 10% or less of the currently baselined data volume by going to 5-km resolution data sets. There was a discussion of data volumes in the 250-meter bands, differences between Land, Atmospheres, and Oceans requirements, and temporal granularity. Evans noted that the full DAAC capabilities would not be available until 12 to 18 months post launch, and that the at-launch system would be somewhere between B.0 and B.0', with B1 being the full-capability system. It was generally agreed that reductions in data products for Oceans was not a reasonable request, especially in light of the plans for subsetting to 5 km, data processing facilities in Miami, and the schedule for bringing B1 on-line.

Esaias invited members of the oceans groups to give brief presentations on "Hot Science Results." These included:

- Mark Abbott discussing results from the recent Southern Oceans /JGOFS (Joint Global Ocean Flux Survey) campaign in the Antarctic.
- Kendall Carder discussing work in modeling chlorophyll levels, using data from the CZCS along with direct observation. He suggests that using 490 nm rather than 412 nm in the models may eliminate the need to separate Case 1 and Case 2 waters in the models.
- Frank Hoge discussed phytoplankton concentrations and the use of a 3x3 inversion model rather than a 5x5 model.
- Wayne Esaias discussed the classification of the oceans into high-variance vs. low-variance regions, comparing CZCS data classes to McGowan's faunal data from the 1960s. He noted a good correlation mapping BATS/HOTS zones to faunal abundance maps.

Bob Evans discussed the status of the Version 2 software, reviewing the data flow, QA flags, and metadata definitions. (Refer to Attachment 20). He noted that the final version of the Version 2 code is due to Ed Masuoka by the end of June. There was a discussion of the synthetic data set provided by SDST; there seems to be an issue with the resulting radiances coming out a factor of 3 too large; this will be investigated. It was again noted that the proposed cut-back on Oceans products makes little sense given the processing capacities of the DAAC and the Oceans TLCF/SCFs. It was suggested that it might be useful to make the ancillary data processed from NMC into HDF format available to the community as a whole, rather than just the Oceans group.

Chuck McClain provided a status update on SeaWiFS, now scheduled for launch July 9, 1997. Concerns include the power budget and the availability of ship time for a characterization cruise. He noted that lunar views for characterization were partially contingent on the power budget.

Jim Mueller provided a SIMBIOS status update. He noted that the project was looking to add investigators to do atmospheric correction validation. He discussed the need for contingency arrangements for data should there be a launch failure or other problem with SeaWiFS. He talked about the upcoming SIMBIOS science team meeting in late summer 1997, which would include discussions of radiometer calibration and NIST participation and availability and use of Alaskan data and OCST level 3 data. It was suggested that the SIMBIOS project talk to the JGOFS team when developing their implementation plan.

Chuck McClain discussed the SeaWiFS Bio-optical Algorithm Mini-workshop (SeaBAM). The workshop's website can be found at http://seabass.gsfc.nasa.gov/~seabam/bioopt_workshop/bioopt_workshop.html

Stephane Maritorena reported on results from a statistical and graphical analysis of various ocean chlorophyll algorithms. From this, he has derived a new algorithm, "Ocean Chlorophyll 2", for use on global data sets. This is an empirical, two band (490/555) with a third order polynomial and an additional coefficient. There followed a discussion of the advantages and disadvantages of global rather than regional pigment algorithms. The MODIS empirical algorithm can easily be configured to conform with OC-2. Refer to Attachment 21.

The session was adjourned until tomorrow.

Dennis Clark opened the May 15 session with a report on comparative measurements he and Carder performed in January 1997. They derived remote sensing reflectances using a plaque and with incident spectral irradiance, and eventually will compare above-water and below-water measurements. His presentation is included as Attachment 22. The analysis was done in response to a concern from the ATBD review that Clark's and Carder's measurements have different observational underpinnings. Clark's presentation reviewed deficiencies in the SeaWiFS protocol for measurements, and noted that because of diffuse light, sun glint, and other water surface effects, the measurements turn out to be very noisy. The result of his analysis is that while the absolute measurements at various wavelengths do differ between the in-water and remote-sensing techniques, the ratios between bands correspond well, and it is the ratios, rather than the absolute measurements, that are used in the in-water bio-optical algorithms. Clark feels that the SeaWiFS protocol for making above surface water-leaving radiance is infeasible and needs revision, as it depends on measuring a single wavelength, while the derivation of band ratios do correspond well and give usable values. Clark and Carder fully agree that the above water approach is not yet suitable for vicarious calibration or direct validation of water-leaving spectral radiance.

Clark then proceeded to give a MOBY/MOCE status update. MOBY will be deployed July 21-22 to begin operational data collection as part of a validation cruise. The ship is otherwise scheduled between the end of July and late November. He is hoping to schedule an initialization cruise for SeaWiFS either in September/October 1997 if a slot frees up, otherwise it will be in January 1998. He discussed processing concerns with shipboard-collected data, while noting that they can keep up with day-to-day processing of buoy data. There was some discussion on scheduling and funding a MODIS initialization cruise of about 20 days in late 1998.

Frank Hoge lead a discussion of AOL flight scenarios for Validation campaigns (refer to Attachment 23). Possible track-lines for flying over Hawaii and coordinating with SeaWiFS and MODIS initialization cruises were discussed. There was some discussion of determining if it would be possible to specify a relationship between MODIS and SeaWiFS ground tracks, and what that relationship should be if it is possible. Hoge asked the team to consider whether it was more valuable to take the aircraft out to Hawaii to support validation cruises or, instead, to work over Carder's cruises in the Gulf of Mexico and other campaigns in the Atlantic. There is a cost involved with

getting the C-130 out West, and this needs to be weighed against the value of the validation data collected.

There was a discussion about getting OCTS data to correspond with Clark's Hawaii cruises for data validation. Specific data needs for the team were reviewed.

Barry Herchenroder briefly discussed the need for ancillary data set. In particular, he noted the need for a total integrated daily PAR data set.

MODIS participation on the Japanese GLI instrument was discussed. Mark Abbott is the lead PI (on behalf of MOCEAN) on the GLI team; Janet Campbell will be representing MODIS at the next GLI science team meeting. The use of MODIS ocean color data in GLI algorithms was discussed.

Future ocean color sensors were discussed. Esaias discussed the need for the ocean color community to look beyond PM. He noted there would likely be no MODIS on the EOS-AM-2 platform, despite the fact that FM-2 might be the most cost-effective instrument. There is a growing view that "MODIS-Next" should be broken into perhaps 3 instruments. The Science Team originally had a responsibility to guide Mission To Planet Earth (MTPE) through 15 years of data collection. This was initially thought to be covered with 6 MODIS instruments on 3 AM and 3 PM platforms; this will not happen. The team needs to consider ADEOS-II, GLI, "cheapsats", and other data collection possibilities. There needs to be a discussion and consensus among U.S. investigators about future capabilities and needs, and the key science questions that need answering; from that, a strategy for building the necessary data sets can be devised. Such a discussion will be held near the time of the SIMBIOS meeting.

Campbell noted that she has a paper on why simultaneous measurements at high spatial resolution are necessary. Gordon mentioned that high spatial resolution is needed for the coastal zone. Esaias noted that there is also a need for high temporal resolution (down to sub-tidal periods). Two possible strategies for this include platforms chasing each other in orbit (formation flying), or using a geosynchronous platform. These requirements, as well as others, need to be taken into consideration when planning future ocean color sensors.

The session was adjourned.

3.0 Atmosphere Group Splinter Minutes
May 14 - 15, 1997

Minutes taken by Bob Kannenberg
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3.1 Validation Plans and ATBD Revisions

3.1.1 Introduction

Michael King convened the MODIS Atmosphere Group Splinter and reviewed the agenda (refer to Attachment 24), which appears somewhat ambitious as it reflects the fact that the Group has made significant progress in many areas since the last Science Team meeting. He reviewed the EOS Validation Planning Schedule now posted on the Web for the AM-1 and PM-1 time frames (refer to Attachment 25).

3.1.2 AM-1

King announced that David Starr has requested revised validation summary charts by July 11, 1997. He noted that the Atmosphere Group had made a conscious decision to reduce original post-launch validation plans. However, a couple of items may be added back in: CERES has spoken to Steve Platnick about Atmosphere Group participation in a mission over the north slope of Alaska, and the Land Group would like to coordinate a joint experiment related to biomass burning over the Kalahari desert. Platnick indicated that there are some slots in the Spring and Fall of 1999 where the Alaska mission might be inserted into the schedule. King reported that the recent NASA Research Announcement (NRA), now on the street, has generated significant interest; selection of investigators should be complete by August 1997.

3.1.3 PM-1

King briefly reviewed the PM-1 validation planning schedule. He stated that some instruments are just now beginning to think about PM-1 validation.

3.1.4 ATBD Revision Schedule

King indicated that so far he has not received a single revised ATBD (due June 1, 1997).

3.2 Quality Assurance

Allen Chu announced that Version 1.0 of the Atmosphere QA plan was submitted to the ESDIS Project Office in March 1997 (refer to Attachment 26). King stated that he has reviewed this document and asked other Group members to do so as soon as possible. Delivery of the next iteration, which will include Level 3 QA, is anticipated in July 1997. QA flags have increased data volumes of Atmosphere products as follows:

MOD04	Aerosol Product	+2%
MOD05	Water Vapor	+41%

MOD06	Cloud Product	+36%
MOD07	Atmospheric Profiles	+5%
MOD35	Cloud Mask	+265%

Chu indicated that the complexity of the Cloud Mask product accounts for its exceptionally large increase in data volume. Chu reviewed MODIS Atmosphere Inventory Metadata (refer to Attachment 26); he noted that inventory metadata is searchable, while archive metadata is not. He updated the Group on the ECS data model functionality (subscription, data search / order and metadata). Release B.0 is anticipated 6 to 9 months prior to the AM-1 launch; Release B.1 is anticipated 9 months after the AM-1 launch. Chu reported that he plans to attend the EOS QA Working Group meeting to be held in June or July 1997. Topics to be discussed include operational B.0 and B.1 QA planning, and ensuring that each instrument team will be able to perform QA shortly after launch. King commented that at the last Science Team meeting the Atmosphere Group had not even thought about QA, so the QA plan represents real progress in this area. King thanked Chu for his efforts.

3.3 Software Development and Testing

3.3.1 Level 3 Design and Development

Xu Liang reviewed Level 3 design and development plans (refer to Attachment 27). The design is based on a "tile" approach, where each tile is a 5° ¥ 360°. The resolution is 1° ¥ 1°. Liang presented a table containing the MODIS Level 3 daily and monthly parameters and associated information for 1° ¥ 1° grid cells at launch. She then explained the calculations and methodology behind the Atmosphere daily products, including mean, standard deviation, histograms, joint PDF and regressions. Level 3 outputs consist of 21 attributes; there are between 500 and 900 HDF fields. Liang demonstrated how the daily products are used to calculate the monthly products. Liang reviewed the Level 3 Development and Delivery Schedule published by Rich Hucek in March 1997. It now appears that Level 3 development is on schedule, and that monthly aggregate code should be delivered by the end of July 1997 as anticipated. Liang asked that Atmosphere Group members to submit any suggestions or requests regarding what they would like to see in the monthly Level 3 product.

3.3.2 Discussion

Bryan Baum inquired as to whether the Atmosphere Group had established a minimum data requirement for daily and monthly products, in the event that data arrive incomplete or non-sequentially. Hucek replied that the Group has yet to establish a production rule to address that situation. Liang stated that the daily and monthly file sizes are now roughly 1 gigabyte, which is a concern. It may be necessary to break up the files to diminish size (i.e., possibly have one file for aerosol, one for cloud, etc.). Baum suggested reducing the number of histograms, but Robert Pincus noted that removing histograms still does not reduce the amount of parameters, which is really the

problem. King asked if the Ocean and Land Groups had encountered similar problems and, if so, how did they respond? Hucek replied that the Ocean Group is using separate files according to parameters.

3.4 Near Term Work Plan

3.4.1. File Specs and QA Plan

Hucek presented a table containing the ECS Inventory Metadata (including attribute name and source of value) that he is proposing for Version 2 (refer to Attachment 28). He indicated that there is some controversy regarding measured parameters, which are science parameters (i.e., an SDS array) produced by your code for which individual QA flags and statistics are reported. Hucek stated that his colleague Fred Patt believes the Atmosphere Group should incorporate at least one measured parameter. Hucek listed the parameters that he believes should be included in Version 2. (These parameters are denoted by an asterisk in Attachment 28.)

3.4.2 Level-2 Software Development

Hucek reviewed the Level 2 software development schedule. It is imperative to get file specs frozen, (especially cloud mask) by May 20. Hucek reported that he is now developing a cloud mask reader for Version 2. He expressed concern that the ancillary data reader may not be distributed by May 23 as anticipated, and wondered if GSFC might obtain a reader from the University of Wisconsin. This reader would also be used for DAO data. Hucek noted that the schedule calls for implementation of clear sky radiance files by May 30, but added that we may not have the right design there. Kathy Strabala stated that it is unreasonable to expect that MOD04, MOD05 and MOD07 will be delivered by June 2 as scheduled. Liam Gumley indicated that MOD06-CT should be attributed to Fry, and not himself.

Hucek reported that the Atmosphere Group has asked SDST for a generic routine to read data. Steve Platnick explained that he and other Group members spoke with Ed Masuoka and requested assistance in meeting Version 2 deliveries, as well as development of software routines to facilitate long-term maintenance of the code. The routines should be readable and relatively immune to I/O file spec changes; also, the code should not be "frozen" when a programmer leaves. Platnick stated that in his opinion, prior to Version 2 delivery, the Atmosphere Group needs subroutines to read Level 2 products, as well as subroutines to read cloud mask, Level 1B and geolocation files. After Version 2 delivery (or post-launch), the Atmosphere Group needs generic file open/close modules, "creating" and "writing" modules for HDF output files, and subroutines to handle ECS inventory and archive metadata.

3.4.3 Level 3 Software Development

Hucek reviewed the Level 3 daily product software development schedule. He pointed out that the daily file spec is huge, but Paul Hubanks has a good handle on it. Hucek expects that Level 3 code will be delivered by the end of July 1997.

3.4.4 Ancillary Data: Data Assimilation, Surface Temperature, etc.

Strabala summarized Atmosphere Group ancillary data issues (refer to Attachment 29). She asked whether we had identified all of the data sets that we need for Version 2. Baum agreed to provide a surface emissivity map. Barry Herchenroder announced that he has made a preliminary attempt to prioritize the data products that the Atmosphere Group needs. He will provide a copy of this to Ran Song. Strabala noted that reading DAO data has been problematic, as the data format changes without warning, and the UW GRIB reader can no longer recognize the format. Herchenroder responded that Cobalt conversion software exists to alleviate this problem, and he can supply more specific information on how to obtain it. The Atmosphere Group will take the action to both get consistency of and prioritization of ancillary data sources. Strabala stated that, so far, DAO data have emerged as the biggest question mark (i.e., do we feel confident in the scientific quality of the data set?).

3.4.5 Goddard EOS Data Assimilation System (GEOS DAS)

Ran Song announced that the GEOS-3 DAS will be operational in June 1998 for AM-1. She reviewed the assimilation configurations, product types, product file collections and data file (refer to Attachment 30). (Refer to Attachment 31 for additional file specs.) Song asked Yong Li when the DAO will make a sample data set available. Li replied that the sample data set is available in HDF format, and he can provide both the data and assistance in reading it. King stated that this data is necessary for algorithm purposes.

3.4.6 Prototype MAS On-line Visualization Tool

Gumley demonstrated a prototype of the MAS on-line visualization tool developed at UW by himself and a colleague. Among other things, the tool provides user-friendly "quick-look" and printing capabilities, and is very useful for cloud mask development. Histograms and scatter plots are also built in. Gumley plans to make the tool available on the Web for MODIS use. Visualization of MODIS data, including the bowtie effect, has also been developed by Gumley.

3.4.7 Data Storage Volume Requirements

Hucek presented a table showing data storage volume requirements for Atmosphere products (refer to Attachment 32). Since the ECS February 96 baseline, Atmosphere storage volume requirements have grown by roughly 30 % (31.8 to 41.5 gigabytes). This increase has been driven by QA and cloud mask. Hucek pointed out that, overall, Atmosphere data still represents a relatively small fraction of MODIS data. Compared to the Land and Ocean Groups, Atmosphere has relatively few products. King stated that the increase in Atmosphere data volume is actually much less than he had anticipated.

3.5 Data Processing Scenarios: Post-launch and Beyond

Gumley focused on four post-launch data processing scenarios, as follows:

a. A 24-hour rolling backup of MODIS Level 1B data on TLCF. Gumley noted that this scenario requires the user to write an automated script to pull the data while they are available. After 24 hours, the data would be archived and more difficult to access.

b. Maintain simple, stable file storage and management to enable automatic FTP scripts.

c. Ensure that Level 1B capabilities are completely in place before phasing in Level 2.

d. Maintain a stable TLCF environment, with a parallel test environment to assess software and operating system upgrades. (This is driven by experience with NCEP data.)

3.6 NASDA GLI Project

Takashi Nakajima reviewed the status of the NASDA GLI Project. The MODIS Atmosphere Group is assisting GLI with data flow and algorithm expertise. Steve Ackerman will attend the next GLI meeting, and he plans to hire somebody to convert MODIS codes to GLI. King noted that GLI is very similar to MODIS, although GLI is bigger than MODIS (5 focal planes instead of 4). He added that he is very impressed by the progress made by GLI, as it took MODIS much longer to reach the same point.

4.0 Land Group Splinter Minutes
May 14 - 15, 1997

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

4.1 Introduction

The MODLAND Discipline Group discussed primarily MODIS validation, instrument (and SWAMP), and data system issues.

4.2 Validation

MODLAND is currently refining their validation plan. MODLAND will help coordinate a land instrument validation meeting this September / October 1997 to coincide with after PI selections from the NASA Validation AO. The meeting will be used to coordinate land instrument validation activities; define EOS land test sites; discuss satellite acquisition activities for MODIS, MISR, Landsat and ASTER; coordinate campaign scheduling; study data team management and interfaces; and evaluate instrument calibration issues. MODLAND will submit a no-cost proposal to LBA for testing and validation of MODLAND products. MODLAND is currently working on the Jornada, Arizona validation site with Grassland PROVE this May and the Walker Branch validation campaign PROVE in August. MODLAND heard a presentation about the "MODLERS" activities, useful in particular to MODLAND validation activities. MODLAND will participate with MODLERS on a special journal.

4.3 Instrumentation

MODLAND outlined some specific instrument and SWAMP issues: 1) need a MODIS instrument "performance and operation" log to establish a QA link; 2) need a history data file / log of the platform wide performance to be accessed for product QA; 3) need to speed up ground control point database development to be ready for launch; and 4) requests MCST to provide a "current status" of WWW base of summary data of the specifications versus the performance for not only the MODIS science team but also the user community.

4.4 Data Systems

Last, MODLAND is increasing their data system work. The land Version 2 code delivery meets SDST needs. MODLAND needs simulation and DAO test data sets for Version 2 delivery. MODLAND needs a firm commitment from DAO for at-launch products as part of the Land processing chain (e.g., precipitation and ozone). Currently MODLAND is refining their product volumes and loads with emphasis on L2 / 2g archiving. The University of Maryland land cover change product needs to have an assigned allocation. MODLAND is considering having simplified versions of products for at-launch processing. There is a concern about the capability of ECS to provide adequate product archiving and DAAC on demand processing. There is an active

MODLAND EDC DAAC activity to develop an operational production prototype of land cover.

The ECS networks for land Science Computer Facility QA needs updating and reevaluation. MODLAND recommends MCST to pursue having a data file log on instrument and platform performance for QA. The land QA plan is currently under development.

4.5 MODLAND Action Items

1. *Running*: Maintain link as coordinator with MODLERS.

2. *Huete, Strahler and Running*: Contribute to MODLERS special journal issue.

3. *Running*: Assign a guest editor from MODLAND for MODLERS special journal.

4. *Strahler, Myneni and Justice*: Examine using MODLERS to address landcover-related validation issues.

5. *Wolfe*: Determine what Atmosphere products should be reprioritized in reference to MODLAND products requirements.

6. *Justice*: Coordinate a validation forum meetings this early Fall, after the AO selections.

7. *Vermote and Wolfe*: Pursue evaluation of missing atmospheric information for Level 1B data.

8. *Fleig*: Sort out metadata and software issues related to preparation of MODLAND synthetic data sets.

9. *Wan (IR) and Vermote (optical):* Interact with MCST about the the MODIS Calibration ATBD.

10. *Wolfe*: Determine what atmospheric products are needed for MODLAND products for possible increased priority status.

11. *Wolfe*: Examine and help quantify data volume and load numbers for the MODLAND products.

12. *MODLAND Group*: Give to Masuoka (SDST) network input requirements by the Fall of 1997.

13. *Huete*: Prepare a short (~2 pages) proposal from MODLAND to be involved at no-cost with LBA.

14. *Privette*: Obtain a couple of more GPS units for Jornada.

15. *Justice*: Prepare an agenda for validation meeting to determine validation activities (i.e., what, where and who).

16. *Wolfe*: Set up MODIS geolocation sites with reference to validation sites.

17. *MODLAND Group*: Provide 1-2 pages of text by product to Dave (?) for QA and other requirements.

18. *MODLAND Group*: Send QA networking requirements to Masuoka.

19. *Wolfe and Dave (?)*: Provide a QA log on scheduling.

20. *Masuoka*: Determine if network support for Muller can be under MODIS and not MISR.

21. *Justice*: Coordinate SDST and MODLAND meeting at GSFC or Sioux Falls.

22. *Wolfgang*: Work on Level 3 data in relation to volume and loads.

23. *MCST Group*: Derive a MODIS instrument "performance/operation" log, linked to QA.

24. *Fleig*: Ensure that land-sea mask will be part of 2.1 for subsequent use in synthetic data sets.