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Inside

EDITOR'S CORNER

"RED" AND "BLUE" TEAMS REVIEW EOS

As part of an internal examination of all major NASA programs, Daniel Goldin, NASA Administrator, has established "red" and "blue" teams to review content, schedule, and cost of numerous NASA programs, including EOS. The blue team consists of NASA employees (Headquarters and Goddard) who "own" the program and budget resources; the red team consists of NASA employees with project management experience outside EOS. The blue team is chaired by Chris Scolese of NASA Goddard, the red team by John Casani of JPL.

The red team is meant to challenge the current approach and suggest innovations to help NASA do programs "cheaper, faster, and quicker, without compromising safety." The challenge of the red and blue teams together is to try to find more-efficient and innovative ways to implement EOS. NASA will use the results from the examination of EOS and other NASA programs to decide what NASA should and should not do in a constrained budget environment, and to set priorities consistent with proposed budgets and national interests.

The review is focused on the NASA budget for later years, not the 1993 request, which has already been pared back, consistent with congressional directives, to the current level of spending plus inflation. The overall guideline for the review process is a constant 1993 budget in the coming years, meaning that NASA would operate in the near term with as close-to-an-inflation adjustment as possible, a substantial downsizing from currently projected long-term budgets.

Goldin has set a 30 percent reduction in budget as a target—meant to make the red and blue teams stretch, explore every option, assess innovative techniques and approaches, and reassess EOS content and configurations. He has stressed that NASA does not plan to cut each and every program by 30 percent.

This review is projected to take at least six months.

—Jeff Dozier
EOS Project Scientist

NEWS FLASH!

President Bush has approved a National Space Policy Directive establishing a focused national effort to improve the world's ability to detect and document changes in the Earth, especially the global climate.

The new directive is in the form of a press release from the Office of the White House Press Secretary, dated June 5, 1992. The release says that the President's action was taken the previous week.

The new policy directive was developed by the National Space Council and calls into being a "Space-based Global Change Observation System (S-GCOS), to be led by NASA with participation from other government agencies. "S-GCOS is a comprehensive, multi-agency effort to collect, analyze, and archive space-based observations on global change." The other implementing agencies cited in the directive are the Departments of Energy, Commerce (NOAA), Interior, and Defense. In addition, the directive "encourages international cooperation in global change observation from space and directs the Department of State to provide support to the implementing agencies." The directive recognizes the recommendations of the Earth Observing System Engineering Review Panel.

NASA is directed to lead the preparation of "a coordinated and integrated interagency S-GCOS Program Plan that is to be forwarded to the National Space Council, the National Security Council, and the Office of Management and Budget not later than July 1, 1992." Annual Progress Reports on the program are to be forwarded to the same organizations in March of each year.

Of direct relevance to our EOS readers are the statements that NASA is to continue with Mission to Planet Earth and, therefore, with EOS and EOSDIS, now in support of S- GCOS. EOSDIS is referred to as the NASA part of the Global Change Data and Information System (GCDIS) for S-GCDOS. The directive also states that EOS should have intermediate- and small-sized satellites as recommended by the EOS Engineering Review Panel.

The Department of Energy is directed to "participate with NASA and the other appropriate S-GCOS agencies in developing satellite systems to maintain data continuity for the understanding of the Earth's radiation budget, starting in 1995, consistent with the S-GCOS Program plan."

The Department of Defense is "to seek to make appropriate technology and data from [its programs] available to [S-GCOS]."

In addition to providing general support of S-GCOS, the directive states that the Department of Commerce (NOAA) "shall work with other appropriate agencies to transition, as appropriate, systems, technology, and/or sensors developed for use in the S-GCOS to operational use."

The Department of Interior's role as the managing agency for land-oriented science data is affirmed.

—Renny Greenstone
EOS Project Science Support Office,
Hughes STX Corp.

Two EOS Investigators and Two Former Investigators Elected Fellows of the American Geophysical Union.

—Jeff Dozier
EOS Project Scientist

Among the 28 distinguished scientists elected as 1992 Fellows of the American Geophysical Union (AGU) are two EOS investigators and two co-investigators on one of the instruments that was deselected as part of the recent restructuring, as announced in the May 12, 1992 issue of *Eos, Transactions of the American Geophysical Union*. Election to Fellowship in AGU is based on the individual attaining acknowledged eminence in a branch of geophysics. The number of Fellows elected annually is limited to no more than 0.1% of the AGU membership. The two new Fellows who are EOS investigators are:

William R. Holland, NCAR. "For major contributions to the development of eddy-resolving numerical ocean models and their use in understanding the general circulation of the ocean." Dr. Holland is a co-investigator on Timothy Liu's interdisciplinary investigation.

V. Ramanathan, University of California, San Diego. "For contributions to the atmospheric sciences, particularly in the areas of the greenhouse effect of trace gases, the Earth's radiation budget, general circulation of the atmosphere, and climate change." Dr. Ramanathan is a co-investigator on the CERES instrument and on Bruce Wielicki's interdisciplinary investigation.

In addition, two members of the GOS (Geomagnetic Observing System) instrument team were selected. GOS was recently de-selected from EOS as part of the restructuring required by the reduction in budget from $17 billion to $11 billion:

Edward Benton, University of California, San Diego. "For his work on magneto-hydrodynamics of the core, and his novel use of MAGSAT and other data to extract information about the magnetic fields and fluid flow near the top of the core."

Edward J. Smith, JPL. "For outstanding contributions to instrument development and data interpretation in the exploration of planetary and cometary magnetospheres and the heliosphere, and for service given over more than 30 years."

This brings the number of EOS investigators, panel members, or staff who are AGU Fellows to 42. ❑

News from ARM

The March 1992 issue of the ARM Monthly Bulletin describes two newly proposed Department of Energy Atmospheric Radiation Measurement Programs:

"The first, called Atmospheric Radiation Measurement-Unmanned Aerospace Vehicles (ARM-UAV), would develop and operate unmanned aerospace vehicle (UAVs) for sustained airborne measurements over Cloud and Radiation Testbed (CART) sites, including top-of-the-troposphere fluxes, flux divergences, remote sensing and *in situ* measurements. The need to fly above the tropopause (e.g., 18 km for the tropical Pacific) for multiple diurnal cycles, and at sufficiently low cost to permit sustained coverage, argues for a new generation of UAVs specifically designed for climate studies.

The second new program, Atmospheric Radiation Measurement small climate satellite (ARMsat), seeks to improve the understanding of regional-to-global-scale atmospheric processes through the implementation of an ARMsat observational system. This observational system will involve the integrated use of the ARM-CART ground systems, UAVs, and existing polar-orbiting and geostationary operational satellites, designed and deployed in direct support of this program. These small satellites are designed to bridge key gaps in observational needs, with the proposed ARMsat-1 focusing on radiation-cloud interactions and ARMsat-2 on water-vapor-cloud interactions.

Together ARM-CART, ARM-UAV, and ARMsat will form an impressive set of nested measurement systems for understanding atmospheric radiation processes over the wide variety of spatial and temporal scales needed to develop improved climate models." We note that Tom Ackerman, an EOS Co-I, is ARMsat Science Team Leader.

NASA Awards Graduate Student Fellowships in Global Change Research

—Janine Harrison
Presidential Management Intern, NASA Headquarters, Code SE

From a pool of 367 applicants, 63 PhD candidates were selected to receive 1992-93 Graduate Student Fellowships in Global Change Research. The 63 fellowship recipients will each receive $20,000 per year towards their PhD-level work at accredited U.S. universities or other institutions of higher education. An additional $2,000 is also available to the student's faculty adviser to help provide support for the student's research. After the initial award, the fellowship is renewable for an additional two years, pending satisfactory progress, based on academic performance and faculty advisor evaluations. With the third year of the Global Change Fellowship Program now underway, the program is nearing its goal of funding 150 fellowships per year.

The research proposals fell into seven basic global change categories, and the distribution of 1992 fellowships among these categories is as follows: Biogeochemical Dynamics (13), Climate and Hydrologic Systems (26), Data and Information Systems (5), Ecological Systems and Dynamics (11), Human Interactions (2), Solar Influences (2), and Solid Earth Processes (4). Four of the fellowships within the Climate and Hydrologic Systems category are for research specifically related to the Tropical Rainfall Measuring Mission (TRMM) and will be funded by TRMM. Additionally, the NASA Headquarters Climate and Hydrologic Systems Branch will provide funds for two fellowships within this category, and the Ecosystem Dynamics and Biogeochemical Cycles Branch will provide funds for two fellowships within the Ecological Systems and Dynamics category.

The adjacent table of 1992 Global Change Fellowship recipients presents additional information about each of the 63 students and lists their abbreviated proposal titles. The 1992 Fellowship recipients have diverse backgrounds. They are enrolled in 35 different universities from 24 different U.S. states; 24 recipients are women researchers; and foreign recipients include 3 from Canada, 2 from India, 2 from China, 1 from Argentina, and 1 from Israel.

Selecting this year's 63 recipients from a field of 367 was no easy task. The large number of high quality research proposals made the review process difficult. The three-step selection process involved scientists familiar with the proposed research area submitting reviews by mail. A panel of scientists from NASA Centers, the Office of Human Resources and Education, and Earth Science and Applications Divisions of NASA Headquarters, along with members of professional scientific societies and academic institutions then convened to make the final recommendations. NASA Headquarters made the final selection based on these recommendations. Both the mail-in evaluations and the panel review considered the following criteria: the student's academic record, the quality of the research proposal, and the relevance of the proposed research to EOS and NASA's Mission to Planet Earth.

Now in its third year, the Global Change Fellowship Program continues to provide financial support to graduate students pursuing PhDs in Earth systems sciences. The program's ultimate goal is to increase the number of well-trained Earth scientists in the EOS era; hence, the program is designed to grow as the launch of EOS satellites approaches. The program is attracting outstanding scientists, both in the role of graduate fellows and as faculty advisors.

An announcement for the 1993 Global Change Fellowships will be released in December of 1992, both as an information packet and as an article in *The Earth Observer*. Interested graduate students who would like additional information about the program should contact the Earth Science Support Office at (202) 479-0360 for a copy of the EOS Reference Handbook. Specific questions about the fellowship program should be directed to Dr. Ghassem Asrar, Global Change Fellowship Program, NASA Headquarters, Code SE, Washington, DC 20546. ❑

1992 Global Change Fellowship Recipients

GCC	Fellow	Country	Institution	Abbreviated Proposal Title
Biogeochemical Dynamics	James Robert Christian	Canada	University of Hawaii	The Role of Bacterial Exoenzymes and Exopolysaccharides in Biogeochemical Cycling in the Upper Ocean
	Montgomery Ford Cochran	U.S.	Yale University	Weathering, Plants, and the Geochemical Carbon Cycle
	Rachel Freifelder	U.S.	Stanford University	Biogeochemical and Ecosystem Effects of Grass Invasion and Fire in Hawaiian Seasonally Dry Forest
	Sara Ann Garver	U.S.	University of California, Santa Barbara	SeaWiFS Ocean Color Inversion Method for the Study of Upper Ocean Ecosystem Dynamics
	Raphael M. Kudela	U.S.	University of Southern California	Estimation of New Production For a Coastal Upwelling Region Using Remotely Sensed Sea Surface Temperature and Pigment Concentrations
	Kristen J. Leckrone	U.S.	Indiana University	Development of a Technique for the Rapid Determination of Stable Carbon Isotopic Composition of Dissolved Organic Carbon Seawater
	Natalie Marie Mahowald	U.S.	Massachusetts Institute of Technology	A 3-D Model of Trace Gas Transport and Chemistry Based on Observed Winds: Determination of Regional Sources of Nitrous Oxide, Methane and CFCs
	Carolyn M. Malmstrom	U.S.	Stanford University	Long Term Patterns of Regional Carbon Dioxide, Nitrous Oxide, and Methane Flux in Hawiian Ecosystems
	James Howard Mather	U.S.	University of Pennsylvania	Measurement of Tropospheric OH Using a Laser-Induced Fluorescence Technique
	Ann M. Middlebrook	U.S.	University of Colorado	Heterogeneous Chemistry of Model Stratospheric Aerosol Films
	Michael James Mills	U.S.	University of Colorado	Mid-Latitude Ozone Chemistry: Observations and Predictions of OC10
	Ajit Subramaniam	India	State University of New York	Role of Trichodesmium Blooms in Enhancing Primary Production in the Northwestern Indian Ocean: Use of Satellite Images
	Shari Ann Yvon	U.S.	University of Miami	The Cycling of S02 in the Marine Atmosphere
Climate & Hydrologic Systems	Sybil Michelle Anderson	U.S.	University of California, Los Angeles	Modeling and Analysis of Marine Sulfur Chemistry/Climate Feedback Mechanism
	Sundar Anand Christopher	India	South Dakota School of Mines & Tech.	Cloud Radiative Forcing in the Tropics: The Effects of Optical Property Retrievals and Scene Identification
	Charlotte A. DeMott	U.S.	Colorado State University	A Radar and Modeling Study of Oceanic and Continental Mesoscale Convective Systems (TRMM)
	A. Scott Denning	U.S.	Colorado State University	Investigation of Atmosphere-Biosphere Interactions Using a General Circulation Model with Land Surface Properties Specified from NOAA AVHRR Data
	Alexander Gershunov	U.S.	University of California, Santa Barbara	Water Vapor Within and Beyond the Greenhouse
	Richard J. Gosnell	U.S.	University of Colorado	Sensitivity of Tropical Oceans to Fresh Water Flux and the Use of TRMM Data in Ocean Modeling
	John Scott Green	U.S.	University of Delaware	An Improved Climatology of Oceanic Precipitation (TRMM)
	Darren Jeffrey Hakeman	U.S.	Stanford University	Improvement of Global Rainfall Sampling Through Long Range Detection of Lightning Series (TRMM)
	Jeffrey A. Hicke	U.S.	University of California, Santa Barbara	A Study of Surface Cloud Forcing
	Paul Raymond Houser	U.S.	University of Arizona	Soil Moisture Investigations
	John David Isham	U.S.	University of Massachusetts	An Electronically Steered Thinned Array Radiometer for Global Change Research
	Tara L. Jensen	U.S.	Colorado State University	Studies of the Relationship Between Marine Aerosols and Cloud Properties
	John A. Knaff	U.S.	Colorado State University	Study of the Apparent Fundamental Relationship Between the Stratospheric QBO and Tropical Convection
	Alison M. MacDonald	U.S.	Massachusetts Institute of Technology	A Global Inverse Solution to the Heat and Freshwater Fluxes of the World Ocean
	Thomas L. Mote	U.S.	University of Nebraska	Spatial and Temporal Variations of Passive Microwave-Derived Surface Melt on the Greenland Ice Sheet
	Karen L. O'Brien	U.S.	Pennsylvania State University	The Impacts of Deforestation on the Climate of Chiapas, Mexico
	Andrew W. Paylor	U.S.	University of Massachusetts	Effects of Low Wind Speed and Rain Upon Radar Backscatter from the Ocean Surface
	Andrew Ness Pilant	U.S.	Michigan Technological University	Observation of the Effects of Snow Microstructure, Dielectric Properties and Substrate Conditions on Snow Microwave Emission
	Jie Song	China	University of Delaware	Influence of Heterogeneous Land Surface on the Surface Energy Budget at GCM Scales
	Richard G. Wagner	U.S.	University of Wisconsin	Atmosphere-Ocean Dynamics and Mechanisms of Climate Change in the Tropical Atlantic Sector
	John Wallace Weatherly	U.S.	University of Illinois	Study of Sea Ice and Salinity Anomalies in the Arctic Ocean Using a Coupled Ice-Ocean Model
	Rodney James Weber	Canada	University of Minnesota	New Particle Formation in the Marine Troposphere by Homogeneous Nucleation
	Wendall T. Welch	U.S.	University of Washington	Baroclinic Instability in Global Heat Transport
	Charles Eric Williford	U.S.	Florida State University	Analysis of Microwave Data-Based Algorithms for Improving Global Model Initialization and Prediction
	Denise L. Worthen	U.S.	University of Washington	A Modeling Study of the Hydrology of the Arctic Ocean
	Sandra E. Yuter	U.S.	University of Washington	Evolution of Vertical Structure of Tropical Precipitation (TRMM)

KEY GCC = Global Change Category D&IS = Data & Information Systems HI = Human Interactions SI = Solar Influences

1992 Global Change Fellowship Recipients

GCC	Fellow	Country	Institution	Abbreviated Proposal Title
D&IS	Yongmao Chen	China	University of California, Santa Barbara	A Spatio-Temporal Data Model and High-Level Language
	Ari Juels	U.S.	University of California, Berkeley	An Algorithmic Model for Massively Parallel Computers, With Sequoia 2000 as a Testbed
	Daniel J. Kraiman	U.S.	University of California, San Diego	I/O Performance of Scientific Applications on Supercomputers
	Aya C. Soffer	Israel	University of Maryland	An Integrated Heterogeneous Multimedia Image Database
	Gerard K.C. Yeh	U.S.	Stanford University	A Low Power Pipeline Interleaved Image Signal Processor for Remote Sensing
Eco-system Dynamics	Virginia Bryan Brown	U.S.	Colorado State University	Testing Models of Plant Canopy Structure and Gas Exchange
	Lisa J. Carlson	U.S.	Oregon State University	Modeling Forest Response to Climate Change: Lessons from the Past
	Sarah Elizabeth Hobbie	U.S.	University of California, Berkeley	Effects of Increased Temperature on Tundra Plant Community Composition and the Consequences for Ecosystem Processes
	Michael A. Lefsky	U.S.	University of Virginia	Interfacing Remotely Sensed Data with Physiologically Based Vegetation Models
	Manuel Lerdau	U.S.	Stanford University	Plant Function and Monoterpene Emission
	Camille Parmesan	U.S.	University of Texas	Use of a Butterfly Species as a Bio-Indicator of Climate Change: A Time-Series Analysis of Population Extinction Rate
	Christopher C. Spaur	U.S.	North Carolina State University	Late Holocene Coastal Wetlands Evolution at Jerret Bay, North Carolina
	Ricardo Villalba	Argentina	University of Colorado	Long-Term Forest Dynamics in Patagonia
	Alison M. Wallace	U.S.	State University of New York	The Effects of Genetic and Environmental Variation in Response to Increased CO2 on the Competitive Ability of Lupinus
	Brian J. Wilsey	U.S.	Syracuse University	Plant Responses to Simulated Grazing and Elevated Atmospheric CO2: A Comparative Ecosystem Approach
	Charles G. Wray	U.S.	Yale University	A Phylogenetic and Paleodimatic Analysis of Foraminiferal Evolution
HI	Lisa Lynn Gezon	U.S.	University of Michigan	Conservation in Madagascar: Using Satellite Images to Understand the Human Dimensions of Forest Degradation
	Andrew Sluyter	Canada	University of Texas, Austin	Holocene Environmental Change of the Southern Gulf of Mexico Tropical Lowland
SI	Eugene C. Cordero	U.S.	University of California, Davis	Solar Influences on the Dynamics of the Equatorial Middle Atmosphere
	Theresa Peggy Hartsell	U.S.	University of Colorado	Multi-Spectral Modeling of Observed Solar Time Series
Solid Earth Processes	Alan Ford Arbogast	U.S.	University of Kansas	Paleoenvironments and Desertification of a Large Sand Sheet in the Central Great Plains
	Darryl E. Granger	U.S.	University of California, Berkeley	Measurement of Physical and Chemical Weathering Associated with Mountain Ranges: Implications for Long-Term Global Climate Change
	Rick Edward Holasek	U.S.	University of Hawaii	Remote Sensing Analysis of Co-Ignimbrite Eruption Plumes Detected by Weather Satellites
	Gregory Ernest Tucker	U.S.	Pennsylvania State University	Modeling the Interaction of Climate, Tectonics and Topography on a Regional Scale

KEY GCC = Global Change Category D&IS = Data & Information Systems HI = Human Interactions SI = Solar Influences

EOS PROJECT ORGANIZATIONAL CHANGE

—Dick Austin
Deputy Associate Director for EOS / Resources

The Goddard Center Director approved an EOS Project organizational change effective May 31, 1992. The new organization establishes five separate Division-level projects within the Office of the Associate Director of Flight Projects for EOS, as shown in the accompanying chart. This reorganization is a consequence of the EOS program restructuring conducted by NASA in response to Congressional direction last year.

Key assignments effective with this reorganization include:

- EOS AM Project (Code 421)

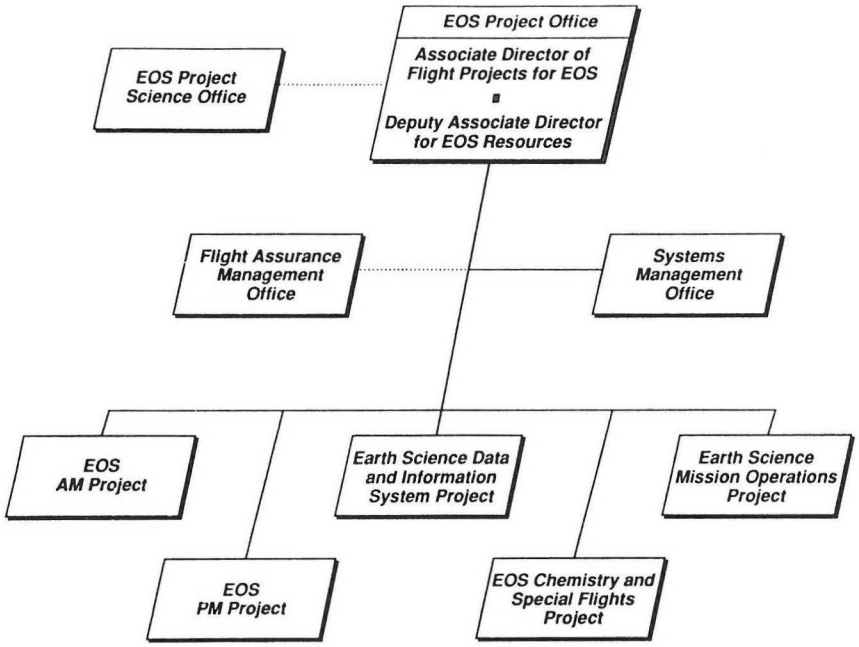
  Project Manager — Christopher Scolese
  Deputy Project Manager— Kevin Grady

- EOS PM Project (Code 422)

  Project Manager— Marty Donohoe
  Deputy Project Manager— John Pandelides

- Earth Science Data and Information System (Code 423)

  Project Manager — John Dalton
  Deputy Project Manager — H. K. Ramapriyan



- Chemistry and Special Flights Project (Code 424)

  Project Manager — Arlene Peterson
  Deputy Project Manager— Nick Chrissotimos

- Earth Science Mission Operations Project (Code 425)

  Project Manager — Chuck Trevathan
  Deputy Project Manager— John Donley

The Earth Science Mission Operations Project has operations responsibility for Earth science missions such as UARS, as well as responsibility for implementation of the ground segment for Landsat-7. The Project Science Office, Systems Management Office, and Flight Assurance Management Office provide the necessary science and technical integration across the individual EOS projects. ❑

PANEL REPORT

CALIBRATION/VALIDATION PANEL HOLDS FIFTH MEETING

—Mitchell K. Hobish Research and Data Systems Corporation
(with assistance from Peter Abel, Jim Butler, Bruce Guenther, and Bob Haskins)

The EOS Calibration / Validation (Cal / Val) Panel met in Boulder, CO from April 7 through April 9, 1992. The meeting was attended by approximately 60 representatives of the EOS community and associated organizations.

Day 1

The first day was devoted to meetings of the Reflected Solar Working Group (WGA), chaired by Bruce Barkstrom, Langley Research Center, and the Thermal Infrared (TIR) Working Group (WGB), chaired by John Gille, NCAR. The main item on both groups' agendas was discussion of calibration reviews at PDR. Both groups suggested that review panels include members of the calibration community as well as representatives from the science community and from the EOS Project itself. Both groups addressed the desirability of allowing these panel members to submit action items during the review, and that such action items should be cleared before the end of the review. WGB felt that a stated charter should be provided, and that the contents of any presentations to a review panel should be consistent with mandated calibration plans as described in the 1988 Announcement of Opportunity. It was also generally concluded that calibration reviews as part of the PDR process would make calibration more visible to the EOS Project, which in itself was deemed necessary and desirable.

Both groups also addressed calibration activity requirements, although the specific items were different. WGA discussed the philosophy of calibration; calibration equipment list; calibration geometry, including the instrument itself, chambers, and sources; error requirements and error budgets; and calibration traceability diagrams. Also discussed were equations, including instrument data reduction, calibration data reduction, and procedure outlines. The attendees had also generated a list of items to be depended on, which included: preflight and in-flight (cross-calibration) modeling/measurements, coefficient traceability, flight qualification of component characteristics, and mathematical models.

Reflected Solar Working Group (WGA)

WGA heard a presentation by Bruce Barkstrom on CERES. He stated that the calibration chamber for the instrument has been modified, since CERES must be calibrated completely in vacuum. The integrating sphere for CERES calibration will be modified to isolate it thermally from the instrument, thereby reducing interference from long wave IR radiating from the sphere. The accuracy goals for the chamber are 1% in the visible, and 0.3% in the long wave IR. Bruce discussed the lessons learned from ERBE and their applicability to CERES. He also mentioned that CERES is working toward providing electronic access for its documentation.

Carole Bruegge (JPL) discussed the MISR instrument and noted that MISR will be the driver on the size of the GE-provided integrating sphere. She also discussed the use of fidelity intervals as a tool to determine the uncertainty of the MISR radiances and as a tool to calculate MISR signal-to-noise ratios. Carole also presented information on the photodiode calibration facility at JPL and discussed the properties of diffuser materials. She noted that the proposed baseline diffuser design

for MISR (spectralon-coated indium-tin oxide) must be characterized for space flight. She showed data describing a specular peak in the BRDF for this material that was more pronounced at longer wavelengths.

Catherine Gautier (UCSB) spoke on AIRS, and stated that she hopes to apply much of the work from MODIS to her own calibrations. She is currently performing a cross-calibration study using data from AVHRR channel 1 and the single visible HIRS channel. The AIRS project is also examining the problem of polarization in the short wave channels. They are also looking for areas of homogeneity on the Earth's surface for vicarious calibration of the instrument.

Round-robin comparison transfer standards were discussed by Chris Cromer (NIST), who indicated that the weak link in these standards is their interference filters. He stated that NIST was not prepared to build these instruments under "low-bid" conditions, but that NIST would be willing to calibrate the transfer standards.

Denny Ometz (Westinghouse) addressed TRMM and the new AVHRR. AVHRR will carry inflight calibration devices, including a diffuser that measures solar flux as the instrument passes over the poles. They are aiming for 5% absolute accuracy and 2% stability during flight.

Stuart Biggers (University of Arizona) described radiometers that will be used in EOS cross-calibrations. The silicon-QED-based instrument under construction is designed for operation at ambient temperature and pressure. Still to be determined is if the radiometer must operate in a vacuum. Other requirements must be addressed as well.

Thermal Infrared Working Group (WGB)

WGB was treated to a presentation by Chris Palmer (Oxford University) on limits to in-orbit radiometric calibration accuracy, with illustrative examples based on ISAMS data. The conclusion was that stray light effects can amount to several tenths of a percent even when careful attention has been paid to their exclusion and characterization, and that such effects may be considerably more important in the error budget than more traditional culprits, such as thermometry uncertainties.

H. Omai (Fujitsu, Ltd.) discussed ASTER TIR subsystem calibration. Carol Johnson (NIST) reviewed probable roles of NIST in the EOS program, and stated that NIST, because it is not a regulatory agency, is uncomfortable with the notion that calibration accuracy is "traceable" to NIST standards. Round-robin calibration requirements were discussed in light of this statement, although no conclusions were reached. Larry Jacobson (Utah State University) discussed their TIR calibration experience and described three multifunction calibration vacuum chambers they have available. Controlled parameters include source radiance, illuminated area, illuminated solid angle, and variable background radiance.

Nick Koepp-Baker (GE) described how instrument calibration will be verified on arrival at GE. After platform integration, calibration will be available in a thermal vacuum chamber with a calibration target that may be supplied by the instrument team, and probably would be the one used for earlier calibration activities at the manufacturer's facility.

Y. Yamaguchi (Geological Survey of Japan) addressed inflight cross-calibration of ASTER/TIR and MODIS, which has the potential of improving ASTER calibration at low radiances since ASTER cannot view space as a calibration target. He suggested that suitable transfer targets could be snow/ice fields in Greenland and Antarctica, or cloud tops, with spectral band models used to correct for differences in atmospheric transmittance.

AM Observatory Splinter Working Group

During an evening session of this first day's activities, an AM Observatory Splinter Working Group met, with representatives of the five AM Observatory instrument teams among the 26 people in attendance.

The first presentation was by Nick Koepp-Baker (GE), during which he described the current (tentative) instrument accommodation at GE for the AM satellite. These designs are based on the constraints imposed by the three-foot extended fairing of the Atlas IIAS-class launch vehicle. Acoustic shock testing requirements have been established for the instruments; these requirements must be met before delivery to GE for integration. The splinter WG recommended that a complete review and re-evaluation of the rationale for calibration and testing schedules be accomplished during the Platform and Observatory Preliminary Design Reviews.

Nick described two candidate cross-calibration chambers at GE. The

larger, a 24-foot chamber, is cryo-pumped and clean for these tests. The second, an 8-foot chamber, is an oil-pumped chamber. There will be contention for access to the larger chamber. The smaller chamber would require some reworking to be suitable for Cal/Val purposes. Funding for such improvements may be difficult to obtain. Of some surprise to the splinter WG were the data presented by Carl Maag (SAIC) on the current status of contamination of spacecraft and instruments while they are in the shuttle or in low earth orbit. There is often modest degradation of the instruments due to contamination in orbit; this degradation is significant in comparison to the long-term stability requirements of the EOS mission. The AM Observatory does not yet have any contamination diagnostic equipment contained in its baseline design; the WG expressed strong support to seek a change in this situation.

Day 2

The second day of the meeting started with a plenary session. Bruce Guenther introduced Mitch Hobish, of Research and Data Systems Corporation (RDC) as the Cal/Val Panel's Executive Secretary, and distributed minutes from the fourth Cal/Val Panel Meeting, a draft of a Cross-calibration Plan, and a draft Data Product Validation Policy. He discussed the need for development of data product validation policy over the next 1-2 months. Next, Bruce Barkstrom and John Gille each presented the results of their respective Working Group meetings of the previous day (see summaries, above).

Dr. Akira Ono (MITI/NRLM) then presented his response to an action item from the previous Panel meeting, addressing the VIS/NIR and SWIR transfer radiometers developed at NRLM for pre- and in-flight calibration. He described two levels of comparison—at the instrument manufacturer's and at the platform integrator's site—and discussed round-robin measurement procedures. Dr. Ono then presented a characterization of VIS/NIR and SWIR transfer radiometers constructed for ASTER comparisons, and showed data on long-term stability of these radiometers over a 1.5 year span. There was some variation, but typically it was within 1% over 1.5 years. One radiometer was examined over 6 years: it, too, was typically within 1% spectral radiance. Spectral characteristics appear stable over a 6-year period on a log scale, but on a linear scale there is some shift, which translates to 0.3-0.4 nm. Industrial radiometers show larger size-of-source effects. He then showed recent data on round-robin comparisons over 7 sites, compared with a national lab and his lab. There were small deviations, but well within "allowance level," i.e., <1% of radiance scale. The conclusion from this exercise was that round-robin measurements can demonstrate procedural errors and indicate ways to improve. He concluded that round-robin measurements must be done more than once, as the first is basically a try-out; the second is required for good data. Discussion on the points he raised generated a consensus that 1% should be a common goal for all instruments.

After an action item review, Bruce Guenther led a discussion of the relationship between EOS and the CEOS Working Group on Calibration and Validation. NASA will provide terms of reference for passive microwave. So far there has been little success in generating a critical mass of interest in this topic, although CEOS is interested. The solution is to have suitable representatives across the EOS program involved in this process. The chair of that activity may be a US individual, as NASA has the responsibility to make microwave activities happen.

Next to be discussed were cross-comparison issues, such as sources and radiometers. Guenther stated that there was no need to discuss this in depth, as it had already been discussed during this meeting. However, it has not yet been discussed (publicly) how it will be done, what is the cost, etc. Bruce asked for input from each team describing the nature of planned activities, hardware to be built, proposed schedule, and an estimate of how much it will cost.

Data Product Validation Policy Development

A draft of a policy statement was provided, primarily to highlight paradoxes existing in the program. As it stands, the draft policy is inadequate but it is seen as a place to start. Guenther stated that details would be presented later during this meeting, with the hope that the group would look at all provided material and begin formulating ideas on what data product validation should be. The goal of this activity is to provide to the SEC or IWG a recommended data product validation policy for EOS. It may not be this panel's final charge to do this, but we have responsibility to open up issues, and to lay the groundwork. The group is to provide written comments to Bruce Guenther and Mous Chahine as part of a consensus process. It was requested that the members be realistic (financially) based on limited funds,

especially with respect to AO statements. It was also requested that members be realistic about the impact/implication of having their (or some other scientist's) name on a data product having gone through quality control for the first 6 months, but with no funds available past that. Inputs over the course of the next month will go to the EOS Project Science Office (PSO), for Guenther and Hobish to submit to Chahine, Gille, Barkstrom, and the Program Office at HQ for comments. After one more revision it should be a relatively mature statement for review by Panel members. If consensus is then reached, it will be taken to the IWG and Program Office for submission as validation policy. Of particular importance is a statement about the right role for the Calibration/Validation Panel and the PSO for determination of how data product validation activities will develop.

Data Product Validation Concept

This session was chaired by Mous Chahine (JPL), who opened the discussion by proposing that Data Product Validation (DPV) may be viewed as an error bar with reference to a surface standard. For example, one could compare remote sensing data with *in situ* data using, e.g., radiosonde, or rawinsonde-derived data. He stated forcefully that we must be careful about what we assume is truth. The operational question, then, is how best to define DPV? Bob Haskins (JPL) suggested that validation must take into account long-term and day-by-day measurements, including process studies. This was followed by a discussion of error bar problems. The consensus was that relative statistics along with absolute must be provided. If accuracy can't be met, then an unchanging metric (even with a built-in bias) may be useful anyway.

This raised the question, do all instruments have their own standards, or can we agree on standards? It was concluded that data placed in EOSDIS as a standard set must have associated error bars. Indeed, we really need two error bars: accuracy, precision. This is likely unnecessary for each measurement, since trends are important here, but the concept must be addressed. In order to address these issues, Chahine proposed the following subcommittees:

- *In situ* Data Group: to deal with standard "yardstick" determination (zero-order validation);
- Satellite Data Group;
- Model Data Group: to deal with level II validation/models, 3-6 h forecasts, etc.; and
- Validation Techniques and Analysis Tools Group: to deal with software to allow you to understand how accurate *in situ* data are, look at trends, etc.

Next on the agenda was a presentation by Ralph Kahn on "Validation Issues and Techniques," based on the experience of the JPL Exploratory Data Analysis Team at validating HIRS2/MSU cloud parameters. Their work was well-received by the Panel, and may provide an excellent paradigm by which the rest of the EOS activities may operate. The main thrust of their approach was to start by establishing program flow control to provide a framework to place assumptions (IF statements). While they started with existing code, Kahn stated that they could do the same kind of analysis based on first principles.

The day ended with a presentation by Paul Bailey on validation lessons learned from UARS. Bailey's presentation emphasized the need to get IDS investigators involved early and often, despite their own antipathy and apathy with respect to validation plans. He was most emphatic about the need to learn from the mistakes of others, and that EOS (or any other program) would be remiss if they did not take advantage of the "corporate memory" available from experience with missions such as UARS.

Day 3

Mous Chahine opened the day's activities with a presentation on GEWEX (The Global Energy and Water Cycle Experiment), during which he described the programmatic basis for GEWEX, and indicated that elements of the experiment might serve as a model for EOS-in-miniature. Of particular interest was the way responsibilities for aspects of the experiment had been arranged so as to cut across international organizational boundaries as well as scientific disciplines.

J. Bates presented information on NOAA Pathfinder data sets and distributed a section of the "Final Report of the TOVS Pathfinder Scientific Working Group," which dealt with TOVS Pathfinder validation and intercomparison. This report raised points that are germane to discussions of EOS data product validation, and reaffirmed Paul Bailey's contention that EOS would be well-advised to heed the lessons learned by other programs. The rest of the day was devoted to further developing concepts and approaches for DPV, and resulted in a draft template for the construction of an EOS Data Validation Plan template.

Conclusion

The consensus was that the fifth meeting of the EOS Calibration/Validation Panel was productive, and particularly so in terms of developing our concepts for data product validation. We can look forward to significant progress in this area as we continue to work and refine the issues raised in Boulder.

The next meeting of the Cal/Val Panel will be the week of September 14 in Logan, UT in conjunction with the Third Annual Utah State University/Space Development Laboratory IR Radiometric Sensor Calibration Symposium. ❑

The Earth Observer

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SEC MEETING IN CHICAGO
MAY 15, 1992

The Science Executive Committee of the EOS Investigators Working Group met in Chicago on May 15. As highlighted in the new EOS electronic bulletin board, "EOS.NEWS," there were two key results of the meeting:

1. The two EOS instrument panels have now been merged into one, so that the former Facility Instruments Panel and the former PI Instrument Panel are now the EOS Instruments Panel. Members of the new panel are the Team Leaders and PIs of all selected EOS instruments. Bruce Barkstrom, of NASA Langley Research Center and CERES instrument PI, was appointed chair of the new panel.

2. The agenda for the next IWG meeting, July 20-22, in Keystone Colorado, will have a strong science focus, deemphasizing programmatic topics. Eight plenary lecturers will survey various components of the Earth system and review measurements and science expectations from EOS.

Other significant outcomes of the meeting were these: Jeff Dozier will mail copies of the EOS strategy document that he is preparing to SEC members; Senator Gore and staffers will be invited to participate in the next IWG meeting; potential topical science workshops were discussed and the SEC felt that Bruce Barkstrom should go ahead with a workshop on clouds, radiation, and climate.

Ghassem Asrar, EOS Program Scientist, presented his thinking on management of EOS science. He wants to assure coordination of the "science" activities of both the interdisciplinary investigators and the instrument scientists. He is working with the Project Office at Goddard to review the science components of the instrument activities.

Asrar also reported on the Pathfinder data sets. Pathfinder is a joint NASA/NOAA effort to incorporate Earth science data from several sources in an active archive. A benchmark period for the data, April 87 to November 88, has been selected. Data are to be made available for AVHRR, TOVS, GOES, SSM/I, and Landsat land cover data. The AVHRR effort is furthest along, and the SSM/I effort is furthest behind.

The first AVHRR products are to be available in early 1993. A new calibration and new atmospheric corrections are to be added. Land products are due in January; ocean products are due in March; and atmospheric products are to be available in June 93. The data will be available from at least one DAAC, and browse products plus the software needed to access them will be provided.

—Renny Greenstone
EOS Project Science Support, Hughes STX

SCIENCE TEAM MEETINGS

AIRS Science Team Meeting

Hartmut H. Aumann, AIRS Science Team Member, JPL

The AIRS Science Team held a meeting on April 29, 30, May 1, 1992 at the World Weather Building, 5200 Auth Road, Camp Springs, MD. The purpose of the meeting was to give the team an update on programmatic issues and to review the hardware, algorithm development and data system status.

Mous Chahine, AIRS team leader, briefed the team on the significant events:

(a) The restructuring of the EOS platform into the AM, PM, and Chemistry missions has impacted AIRS: The AIRS/AMSU/MHS instruments are on the PM platform, scheduled for launch in 2001. The funding build-up anticipated for FY 92 will now occur in FY 94. Science product development at a "level of effort" consistent with the funding will require prioritizing of products and lead to fewer products at launch than proposed.

(b) NOAA is very close to making a formal commitment to putting AIRS, together with AMSU-A and MHS, on the NOAA P/Q platforms.

Fred O'Callaghan, AIRS Project Manager, supported by Chris Miller and Marion Reine from LORAL, discussed the status of the AIRS hardware. Major progress has been made in the cooler, the HgCdTe detectors and the multiplexers. BAe and LMSC/Lucas have demonstrated cooling capacity (1.5-2.3 watt at 55 K) and vibration control consistent with the AIRS requirements. Coolers of the same design used in ATSR and ISAMS continue to work flawlessly in space. The first arrays of HgCdTe detectors fabricated to AIRS specifications have now been tested. The PV arrays meet the AIRS requirements short of 13.4 micron. HgCdTe PC arrays meet the AIRS requirements in the 13.4 to 15.4 micron region.

Mark Domen (GSFC) presented details of tests performed on the engineering model of AMSU-A at Aerojet. All channels meet the NEDT requirement except channel 9, which is 10% high. Linearity and calibration accuracy are much better than required. AMSU-A has a 3.33 degree step size, while the AIRS and MHS designs assumed an AMSU-A design with a 3.30 degree step size. Consequences of this are being evaluated.

Graeme Mason (EUMETSAT) provided MHS status material. Selection of a design by British Aerospace (BAe) or Matra Marconi Space (MMS) is expected later this year. The polarization of the surface-sensitive channels of MHS and AMSU-A is the same (vertical at nadir). Synchronization with AMSU-A and AIRS is achieved via an 8-second marker in the clock signal provided by the spacecraft. The desired spatial co-registration pattern with AIRS, AMSU-A and MHS at nadir requires that all three instruments scan perpendicular to the ground track (i.e. zero helix angle). In order to facilitate the combination of AIRS and MODIS data, the synchronization and helix angle alignment of MODIS are under evaluation.

The high point of the meeting was the discussion of retrieval algorithm capability using the first AIRS data simulation under clear/night conditions using the predicted AIRS/AMSU-A/MHS instrument performance. The radiances for the test were calculated for 200 profiles from the mid-latitude winter ocean set of radiosondes provided by Norm Phillips. The prototype algorithm of the team headed by Joel Susskind (GSFC) was able to present retrieval results: The rms retrieval error was 1.3 K (goal is 1 K globally), using 257 channels (93 ground surface temperature and emissivity, 61 temperature sounding, 8 AMSU-A, 70 moisture, 18 ozone, 17 cloud clearing). A climatology first guess was used. Given the difficult set of profiles used in this test, this performance of the prototype algorithm was considered very respectable.

Teams headed by Henry Fleming (NOAA/NESDIS) and Bill Smith (University of Wisconsin) were able to verify the simulation data, but were not able to complete the retrievals in time for this team meeting. Phil Rosenkranz (MIT) reported on retrievals using microwave data only. The retrieval, which may replace climatology as the first guess, produced good results.

The next AIRS data simulation will include 300 profiles for day and night under clear conditions with more realistic surface emissivities. The data set will be distributed in June 92, with results to be reviewed at the next team meeting.

Half a day of the meeting was dedicated to the first informal review of the AIRS data system functional requirements. Issues related to data structuring, resource allocation between temperature/moisture retrieval and research product generation, algorithm upgrade and validation policies, and data generation time lines were discussed.

The next team meeting will be on September 9, 10, 11, 1992 at UCSB in Santa Barbara, CA. ❑

5TH TES SCIENCE TEAM MEETING

Reinhard Beer, Principal Investigator, JPL

The fifth meeting of the TES investigator team convened at JPL on the 5th, 6th, and 7th of May 1992. Representatives of all subgroups were present with the exception of Oxford University who were involved in a UARS review that week. In addition, the meeting was attended by representatives from NASA HQ, the Goddard EOS Project Office, NOAA, and the EPA.

Data Analysis Working Group

As has become our standard practice, the first day was given over to the Data Analysis Working Group, chaired by Curt Rinsland (LaRC).

Tony Clough (AER Inc.) presented his most recent work on the trial retrieval of tropospheric ozone, the highest priority species for TES. His results are very encouraging provided that we do not attempt to "over-resolve" the height variation (i.e. retrieve at markedly sub-scale-height intervals). His work does, however, demonstrate the importance of having an accurate atmospheric temperature and humidity profile and a stratospheric column density for O_3. Fortunately, all this information can be extracted from TES data.

Larry Sparks and Jim McComb (JPL) described progress on the parallelizable retrieval algorithm SEASCRAPE (Sequential Evaluation Algorithm for Simultaneous and Concurrent Retrieval of Atmospheric Parameter Estimates). The first tests of this approach are imminent, using existing ATMOS solar occultation data. The incorporation of surface effects for TES is in progress, beginning with the accumulation of a database of infrared emittances and reflectances for a large variety of natural and artificial surfaces. Later, the same group, together with Graham Bothwell (JPL), presented a "road map" of the approach to TES levels 1a, 1b, and 2 processing.

Reinhard Beer (JPL), Curt Rinsland and Aaron Goldman (U. Denver) discussed various aspects of the Mt. Pinatubo aerosol that is strongly evident in the recent ATMOS data, both as a general opacity source and also as a strong sulphuric acid feature centered at about 1180 cm^{-1}. The importance to TES is that the aerosol falls within the TES limb-sounding altitude range and is very widespread (ATMOS detected it over its entire latitude range from 60° S to 30° N). Although (presumably) the Pinatubo aerosol itself will have dissipated by the time TES flies, similar events are likely to occur during the TES mission, and we need to understand how to measure and correct for its effects.

Aaron Goldman and Curt Rinsland discussed their recent measurements of tropospheric gases (Goldman in the laboratory, Rinsland over long air paths from Kitt Peak), and Linda Brown (JPL) described the latest (1992) version of the HITRAN spectral line database and the areas which still need improvement.

Plenary Sessions

Following welcoming remarks from Reinhard Beer, Joe McNeal (NASA

HQ) outlined the restructured EOS program, which currently has TES flying on the CHEM payload in 2002. The team was warned that more restructuring is likely, and that any cost over-runs on the "AM" and "PM" payloads could jeopardize later instruments such as TES.

Frank Wright (JPL) gave an overview of the plans and schedules for TES over the next year. The major hurdles are an engineering review later this year and a cost review in the spring of 1993. Frank then gave an introduction to a new program called the Airborne Emission Spectrometer (AES). AES is intended both as an engineering test-bed precursor to TES and as a scientific investigation in its own right.

AES is being developed under the congressionally-mandated "dual-use technologies" program, wherein the intelligence community has transferred funds into the civilian sector to encourage developments such as AES. Our partners in the utilization of AES are the NOAA Wave Propagation Laboratory and the EPA Las Vegas Office. NOAA wishes to use AES from the ground in an up-looking mode to study cloud emissivities (in conjunction with on-going DIAL LIDAR studies). EPA is interested in exploring airborne passive remote sensing of atmospheric pollution and in studying gaseous emissions from Superfund sites (many of which have unknown contents).

AES is being developed at JPL and is strongly based on the Mk.IV solar occultation FTS that has been used in every polar stratospheric ozone campaign on the NASA DC8 aircraft and has also made several successful balloon flights. Consequently, AES will be an ambient temperature instrument and will, therefore, not be able to operate as a limb-sounder; it will be strictly a downlooking sensor. In most other respects, it closely resembles TES, having the same spectral coverage and resolution. However, in order to save money, AES will use 1x4 detector arrays instead of the 1x32 arrays planned for TES.

AES is scheduled to begin test flights in the Spring of 1994.

Mike Gunson (JPL) provided an overview of the recent ATMOS/ATLAS1 flight that successfully recorded more than 90 solar occultation events during the course of the 9-day mission. Each "event" comprises approximately 100 spectra covering the altitude range 0-250 km. The relevance to TES and AES is that a) the teams have several members in common, and b) the SEASCRAPE algorithm will have its first tests on ATMOS data, so the team is keenly interested in its performance.

Jennifer Logan (Harvard) showed the results of her modelling of tropospheric CO under conditions similar to those at the time of the MAPS shuttle mission. The correspondence is excellent except for the high CO measured over northern Russia and Siberia, for which no adequate explanation has yet been advanced.

The remainder of the meeting was devoted to AES. Reinhard Beer began by describing the science requirements for AES. While similar to those for TES, the emphasis will be, of course, on the tropospheric mixing layer and on local and regional processes rather than the global view offered by TES. AES is being proposed as an element of the DC8-based Global Tropospheric Experiment (GTE), an on-going program of *in situ* and remote sensing of the lower atmosphere. AES has also been proposed for the Boreal Ecosystem-Atmosphere Study (BOREAS).

Members of the engineering team (led by Tom Glavich of JPL) then described the various sub-systems and elements of AES. Because AES is aircraft-based, the autonomous pointing and tracking system of TES will be replaced by an interactive video tracker so that the on-board operator can select the target areas to be investigated. While the detectors and signal chain are direct TES heritage, the data will be recorded on board rather than telemetered. In addition, AES uses conventional pumped (solid) N_2 cooling rather than Sterling-cycle coolers. Again, this is a matter of resources. AES is a cost-capped program: all monies available are already in-house.

The team expressed great satisfaction at the advent of AES and felt that it will provide both important tropospheric science and help to strengthen the case for TES in the crucial time-frame of the next few years.

The team also agreed that the next science team meeting should be held in Cambridge, MA at AER Inc., October 13-15, 1992. ❑

GLRS/GLAS TEAM MEETING

Bob Schutz, GLAS Team Leader, University of Texas

The GLAS Team met at Goddard on February 24-25, 1992.

The discussion focused on the restructuring of EOS, the impact of descoping GLRS, and updates on activities and plans. As a result of the descoping process, the GLRS Team supported a proposed change in instrument name to Geoscience Laser Altimeter System (GLAS). The team recommendation for a name change was forwarded to NASA Headquarters, and concurrence for the change was subsequently received.

Since Dr. Miriam Baltuck was on NASA travel, Dr. Joe Engeln summarized the steps leading to GLRS descoping. The descoped GLRS retains the altimeter component, but the ranging component has been deselected. Dr. Engeln noted the possibilities for collaboration with other agencies and international partners on the ranging aspects.

The selected altimeter component has been tentatively assigned to the altimeter series of EOS, with the first flight planned for 2002. Each team member was informed of the selection/deselection in a letter from Dr. L. Fisk.

Les Thompson, representing the EOS Project Office at Goddard, summarized the project status and a recent project reorganization. Bob Schutz (U. Texas), GLAS Team Leader, reviewed the ad hoc Team Meeting held in September at Annapolis for the purpose of updating the team on the IWG meeting and other meetings.

Stimulating discussions on the expected contributions of laser altimetry to the EOS Climate Change objectives as well as the prospects for recovery of the ranging component under other programs took place after the project summaries. While the meeting agenda focused on laser altimeter aspects of GLAS, some ranging-related presentations were made in order to assess the current status for the benefit of possible future applications.

A review of aircraft experiments conducted with a laser altimeter over Greenland in the late summer of 1991 was presented by Robert Thomas (NASA HQ), Jack Bufton (GSFC), and Bill Krabill (Wallops). Preliminary results presented by Krabill showed excellent laser altimeter performance on repeated tracks, including tracks that followed ERS-1 tracks. Input for control of the aircraft flight path was obtained from differential GPS between ground-based receivers and aircraft receivers.

Jay Zwally (GSFC) discussed a concept for an ice-and-cloud-experiment satellite proposed to be a precursor mission to the EOS GLAS. The concept was presented to the Workshop on Global Change Small Satellites. A precursor launch would enable early evaluation of mass changes on the major ice sheets through comparison of results with the EOS/GLAS instrument.

The status of aircraft flights at Goddard in support of ranging experiments was given by Jim Abshire (GSFC) and Jan McGarry (GSFC). Some returns have been obtained and several additional flights are scheduled. Two-color experiments using the RME satellite were summarized by T. Zagwodzki (GSFC), however, he noted that problems had surfaced in the control of spacecraft attitude.

Bernard Minster (U. Calif./SD) reviewed experiments conducted at Scripps by V. Otero on the degradation of optical characteristics of glass subjected to a variety of environmental factors. The study included electron microscope examination of the contaminating factors.

The development of a GLAS altimeter receiver simulator was described by Jim Abshire. The simulator enables analysis of altimeter waveform as a function of the waveform response to different surfaces. In addition, the instrument performance can be characterized as a function of system parameters.

A review of GLAS science rationale by Bob Thomas reiterated the ice

sheet and atmosphere applications. The primary application of the instrument to glaciology is the determination of ice sheet mass change as a function of time. Jim Spinhirne (GSFC) reviewed the cloud and aerosol requirements and discussed the contributions of GLAS to polar clouds and haze measurements.

Dave Harding (GSFC) presented GLAS applications to land topography. He described applications to solar irradiance flux studies, vegetation canopy height structure, and geodetic control.

Tom Herring (MIT) summarized current studies of atmospheric delay modeling. His studies show that assumed values for the GLAS atmospheric delay should be achievable, but additional study is required for the Arctic regions.

Recent studies of the GLAS error budget were described by Bob Schutz. The problems and prospects for determining the GLAS orbit using ground-based laser ranging as well as GPS were discussed. Possible calibration experiments were summarized.

The next meeting of the GLAS Team will be held in the September time period. ❑

Science Data Plan Available

The Science Data Plan (SDP) for the EOS Data and Information System covering EOSDIS Version 0 (V0) and beyond is now available. The SDP is the high-level plan for archiving data in the EOSDIS, and for the data services to be provided to the user community by the V0 EOSDIS. It presents inventory listings of the V0 DAAC data holdings, and maps the data to the objectives of the U.S. Global Change Research Program (GCRP).

This SDP presents the EOSDIS planning for Earth observations data to be available through the EOSDIS data archival system. The SDP initially covers the EOSDIS V0 time-frame through Fiscal Year 1994, when V0 is scheduled to be operational as a working prototype. This document will be periodically expanded to cover planning for additional data holdings beyond 1994, eventually extending to the operational EOSDIS, which will contain data from both the U.S. EOS and international EOS spacecraft.

The document can be obtained by contacting:

EOS Project Library
Code 420
Goddard Space Flight Center
Greenbelt MD 20771
Attn: Librarian
Telephone: 301-286-5641
Fax: 301-286-4098

Earth Observer — Mailing Lists

The EOS Investigators Working Group (IWG) has established electronic mailing lists for its Panels. Mail is transmitted through Internet, and the lists are accessible from any electronic mailing system. The lists are:

E-Mail address	Panel
iwg@eos.ucsb.edu	IWG (team leaders and PIs)
iwg-sec@eos.ucsb.edu	Science Executive Committee (panel chairs)
iwg-atmospheres@...	Atmospheres Panel
iwg-biogeochem@...	Biogeochemical Cycles Panel
iwg-calval@...	Calibration/Validation Panel
iwg-eosdis@...	EOSDIS Advisory Panel
iwg-hydrology@...	Physical Climate & Hydrology
iwg-instruments@...	Instruments Panel
iwg-land-biosphere@...	Land Biosphere Panel
iwg-mission@...	Mission Design Panel
iwg-modeling@...	Modeling Panel
iwg-oceans@...	Oceans Panel
iwg-payload@...	Payload Panel
iwg-solid-earth@...	Solid Earth Panel
iwg-everybody@...	(Union of the above lists)

To be added to or removed from a panel, send to iwg-request@eos.ucsb.edu. We try to keep these lists updated.

To access these mailing lists from OMNET, NASAMAIL, or GSFCMAIL, you must use the 'nicknames' command. Follow the menu. The 'ADMD' is 'telemail'; 'PRMD' is 'internet'. Type of address is 'domain-defined attribute', whose 'type' is 'RFC-822' and whose 'value' is (for example) iwg-sec(a)eos.ucsb.edu (note the replacement of '@' by '(a)'). Please use these lists to send electronic mail to an appropriate sub-group of the EOS investigators.

EOS Science Calendar

July 20-22	EOS Investigators Working Group Meeting, Keystone, CO. Contact J. Dozier at (301) 286-8228 or G. Asrar at (202) 453-1759.
July 28-30	LAWS Science Team Meeting, Cape Cod, MA. Contact W. Baker at (301) 763-8005.
August 17	MISR Cloud Masking Workshop, Montreal, Canada. Contact R. Davies at (514)398-3663.
September 14-18	EOS Calibration Panel Meeting, Logan, Utah. Contact Bruce Guenther at (301) 286-5205.
October 13-15	TES Meeting, Atmospheric & Environmental Research, Boston. Contact Reinhard Beer at (818) 354-4748.
October 24-25	MODIS Oceans Meeting, University of California, Santa Barbara, CA. Contact Dave Herring at (301) 286-9515.
October 27-29	MODIS Science Team Meeting, University of California, Santa Barbara, CA. Contact Dave Herring at (301) 286-9515
October (TBD)	CERES Science Team Meeting, NASA/Langley Research Center. Contact Jim Youngblood at (804) 864-5667

Global Change Meetings

• 1992 •

July 19-Aug. 8	A NATO Advanced Study Institute, *Remote Sensing and Global Climate Change*, 7th Dundee Summer School in Remote Sensing, University of Dundee, Scotland, U.K. Contact Robin Vaughan. Phone: (0382) 23181, ext. 4557/4912; FAX: (0382) 202830; Telex: 9312110826 DUG.
July 20-24	Synthetic Aperture Radar Technology and Applications, a five-day short course, offered through Engineering Conferences at the University of Michigan. Contact Dr. Robert Shuchman. Phone: (313) 994-1200, ext. 2590.
August 2-14	XVII Congress of the International Society for Photogrammetry and Remote Sensing (ISPRS), Washington, D.C. Concurrent with the ISPRS Congress, two other meetings will be held nearby: the ASPRS and the American Congress on Surveying and Mapping (ACSM) will conduct a conference on Global Change; the International Geographical Union will convene its 27th International Geographical Congress (IGC) during the second week. For more information contact XVII ISPRS Congress Secretariat, P. O. Box 7147, Reston, Virginia 22091.
August 17-20	Satellite Remote Sensing for Resource Management, Environmental Assessment, and Global Change Studies: Needs and Applications of Developing Countries, Boulder, Colorado. Contact Theresa Schwerin, Reference: UN/ISY Conference WT Chen & Company, Inc., 1745 Jefferson Davis Highway, Suite 500, Arlington, Virginia 22202. Phone: (703) 769-1800; FAX: (703) 769-1803.
August 17-21	Eleventh International Conference on Clouds and Precipitation, Montreal, Canada, sponsored by the International Commission on Clouds and Precipitation. Contact: Conference Office, McGill University. Phone: (514) 398-3770, FAX: (514) 398-4854.
August 24-28	The 1992 STEP Symposium-COSPAR Colloquium No. 5, Johns Hopkins University. Contact Dr. Michael Teague. Phone: (301) 286-4232; FAX: (301) 286-9803.
August 31-September 3	COSPAR Symposium on Global Change and Relevant Space Observations, Washington, D.C., World Space Congress. Contact J. Fellows/OMNET; FAX: 33 1 45087867; Telex: 214674; Phone: 33 1 45087648. (Call for papers available from World Space Congress, AIAA, The Aerospace Center, 370 L'Enfant Promenade, S.W., Washington, D.C. 20024-2518. Phone: (202) 646-7451; FAX: (202) 646-7508.
September 16-18	Digital Geographic Information Systems, Washington, D.C. For further information, contact Darold Aldridge at (202) 994-8518 or toll free at (800) 424-9773 (within the U.S.), (800) 535-4567 (within Canada).
October 12-16	Workshop on Synthetic Aperture Radar System and Its Application in Natural Resources, ITC, Enschede, The Netherlands. Contact Dr. Yousif Ali Hussin, ITC, 350 Blvd 1945, P.O. Box 6, 7500 AA Enschede, The Netherlands. Phone: (31)(53)874-444; Telefax: (31)(53)874-400 or (31)(53)874-399; Telex: 44 525 ITC NL.
November 2-6	Sixth Australasian Remote Sensing Conference, *Remote Sensing and Spatial Information,* Michael Fowler Centre, Wellington, New Zealand. Contact Stella Belliss, DSIR Physical Sciences, P. O. Box 31-311, Lower Hutt, New Zealand. Phone: +64-4-5666919, extension 8693; FAX: +64-4-5690067.
December 4-6	Computer Science for Environmental Protection, 6th Symposium, Munich, Germany, sponsored by German Computer Soc. Contact Siemens Nixdorm Information System. Phone: 49 89 636 48466.
December 7-11	American Geophysical Union Fall Meeting, Civic Auditorium/Brooks Hall, San Francisco, California. Contact Karol Snyder. Phone: (202) 939-3205 or 1-800-966-2481; FAX: (202) 328-0566.
December 8-12	Natural Hazards Induced by Environmental Changes Int'l Conference, (Zurich) Davos, Switzerland. Sponsored by European Foundation Commission of European Communities. Contact Dr. Josip Hendekovic, European Science Foundation, 1 quai Lezay Mamesia, F-67000, Strasbourg, France.

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