



The Earth Observer

An EOS Periodical of Timely News and Events

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EDITOR'S CORNER

EARTH DAY

Public enthusiasm for our "mission" has been building for many reasons other than the realization that we *now* have the opportunity to obtain a better understanding of the complex processes that interact to cause our planet to change. Sometimes we get public support because there is deep concern about issues that are mostly cosmetic, i.e., dirty landfills, polluted streams, or sinister-looking human garbage in a natural wildlife setting. Sometimes 'they' support us because they have heard of "nuclear winter" or have been frightened by the "ozone hole." Some of 'them' are just interested in the juicy battle among scientists about whether or not we have detected global warming. Whatever the motive, there is a current healthy tidal wave of interest in understanding how the Earth works.

Our job is not merely to sit back and enjoy their support. Now we have the responsibility to educate the 'public' about the interactive nature of the elements that influence our climate, the dynamic events that affect ecological patterns, and the evolutionary nature of biological diversity. Earth Day is a milestone for celebration of public awareness. We must seize the high ground and explain that our quest goes far beyond the current "issue of the day." We are pioneering a whole new field of science on a planetary scale.

Jerry Soffen

Message from EOS Project Office

A MAN FOR ALL SEASONS

The Goddard Space Flight Center has announced that we will be getting a new Center Director on July 1 — Dr. John Klineberg. At the last IWG, our current Director, 'Jack' Townsend, presented the opening welcome address accentuating the Center's strong support for EOS. Many of us have come to realize just how important Dr. Townsend's interest in EOS has been. Behind the scenes, he has been working tirelessly using his influence in the "right places" to assure support for the mission.

Dr. Townsend grew up around Goddard, and in the 60's came to understand the power of a team working together on a flight project. His subsequent years at NOAA prepared him with an appreciation of the difficulties of making Earth science measurements. His stint at Fairchild gave him insight into the capability of American industry. We have been beneficiaries of the actions and thoughts of this visionary Director.

In the same way that we are observing global change, we have seen our Center change. We are entering a sophisticated period dominated by high scientific stakes, social consequences, very complex instruments and a colossal data bank. Jack Townsend set the stage!

Pete Burr

SEC Meets

The Science Executive Committee of the EOS Investigators Working Group (IWG) met March 22, 1990, at the Sheraton Greenbelt Hotel, following the final plenary session of the IWG. Topics discussed were the newly conceived science reviews, spacecraft crossing times and orbits, payload concerns, the "grand themes" and related science plan, and the IWG draft charter.

Earlier discussions referenced the Critical Science Reviews (CSRs) that might supplement the Conceptual Design and Cost Reviews (CDCRs) scheduled to begin this spring. It was decided to call the new reviews 'Conceptual' Science Reviews and to hold them in the fall, after the instrument selections for Platform A have been made.

Piers Sellers, speaking for the Land Biosphere Panel, spoke in favor of a 10:30 a.m. crossing time for the EOS-A platform, noting this would minimize problems with cloudiness. Other EOS investigators prefer a higher orbit to provide better coverage.

Stan Wilson will solicit contributions to the Science Plan being developed in response to the 'grand themes' presented at the IWG.

The IWG draft charter was approved with minor changes by the SEC members and will be submitted to the IWG membership for approval at the next IWG meeting (November 6-9 at the Langley Research Center).

Berrien Moore presented the status of Payload Panel concerns. Priorities for the Violet payload on the A platform are to add CO measurement, STIKSCAT, HIRDLS, and EOSP.

The next SEC meeting will be held August 31, following the Payload Advisory Panel meeting in New Hampshire on August 28, 29 and 30. Descoping may become an issue at that meeting.

Renny Greenstone

IWG Meets in Greenbelt

The EOS Investigators Working Group (IWG) met March 20 at the Sheraton Greenbelt Hotel. Adopting a new format, the individual science panel meetings were held first, followed by the plenary sessions and ending with an afternoon meeting of the Science Executive Committee on March 22. John Townsend, Director of Goddard Space Flight Center, welcomed the group. Shelby Tilford said that he favored having science reviews in addition to the customary Conceptual Design and Cost Reviews (CDCRs) that NASA holds for spacecraft instruments. (The proposed science reviews are now being called 'Conceptual Science Reviews' (CSRs).) Dr. Tilford urged that the CSRs be held in the fall, after the selection of instruments for the EOS-A platform. Dr. Tilford also discussed NASA's budget issues and said that the budget for the EOS science instruments and platforms is based on the President's request to Congress and will not be resolved until after the House/Senate Appropriations Committees have completed their mark-ups, which may not occur until after October 15.

Dr. Tilford discussed planning for instruments and spacecraft. The Europeans have yet to decide on their instrument complements, but they have selected CERES and the NOAA operational suite. The Japanese ITIR is to fly on an EOS platform, and the U.S. LAWS instrument will fly on a Japanese platform. Funding for three EOS attached payloads on Space Station Freedom is in the EOS budget. A new start for EOS SAR is planned for FY 94.

Stan Wilson presented seven 'grand themes' to serve as the focal point of EOS science, and proposed Earth System Models as the unifying theme. The seven themes identified by Wilson are: Climate and Radiation Balance, Circulation of the Oceans and Atmosphere, Hydrological Cycle, Biogeochemical Cycles, Ecosystem Dynamics, Atmospheric Chemistry and Ozone, and Geology and Geophysical Processes. Wilson enlisted the support of IWG members in contributing to the EOS 'Science Plan,' which will be built around the grand themes. The plan is to be in final form by September 1.

Jerry Soffen commented on the progress made by EOS since the first meeting of the IWG at Goddard one year ago. Significant events include: formation of the Science Executive Committee (SEC), including 14 science panels; reformulation of EOSDIS to be less centralized; and organization of the Remote Active

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Archive Centers (RAACs). Dr. Soffen noted that the Payload Advisory Panel is now in the process of evaluating and making final recommendations for instruments that will fly on EOS-A and B. He announced that the next meeting of the IWG will be at the Langley Research Center, November 6, 7 and 8.

Jeff Dozier reported that Dr. Fisk mandated that EOSDIS begin immediately. Efforts to identify and access existing data sets will begin in FY91. Following is a 'strawman' list of ten RAACs that will initially be working with the Earth science data: Alaska SAR Facility, JPL, CIESIN (Michigan), GSFC, LaRC, MSFC, NCAR, NSIDC, EROS Data Center, and the University of Wisconsin. The RFP for the C/D phase of EOSDIS is to be released in February 1991, with the winner scheduled to be under contract by May 1992. Software will be provided to international participants in EOS along with 1 megabyte links to provide access to EOSDIS.

Wayman Baker stated that the Facility Instruments Panel tried to develop a list of unique data products for each instrument, but concluded this was not feasible since different instruments observed the Earth on substantially different spatial, vertical, and temporal scales. Some concerns brought to the attention of the Facility Instrument Panel have been the potential for data packet loss, the need to establish timeliness requirements for delivery of data, and the need expressed by the ALT team to maintain the ± 1 km repeat-trace capability. Also, the GLRS team urges minimizing the time gap between the A and B platforms to maintain synergism between cloud observations made by imagers on the A platform, and GLRS measurements made from the B platform.

Rod Heelis announced that the Particles and Fields Panel adopted a more appropriate designation - Solar Terrestrial Relations Panel. He pointed out that the instruments under the purview of the Panel give EOS the unique opportunity to make the connection between the global magnetospheric configuration, solar activity, and specific energy inputs which can modify atmospheric processes.

Mous Chahine stated that the Calibration/Data

Product Validation Advisory Panel now has six working groups according to the type of sensor: VNIR, TIR, passive microwave, active microwave, particles and fields, and time-of-flight systems.

Piers Sellers noted that the Land Biosphere Panel believes that four sounding passes and two imaging passes are needed each day in order to resolve the diurnal cycle of temperature, humidity, winds, and cloud forcing. A mid-morning overpass with an imager of the MODIS-N class is needed. (Morning overpasses will tend to minimize cloud interference with observations.)

Mark Schoeberl summarized the findings of the Atmospheres Panel, which recommended: fly a CO-measuring instrument and HIRDLS on the A platform. TES should fly on B, possibly de-scoped to its most essential measurements. Other Atmospheres Panel recommendations were: fly SAGE III as soon as possible in a non-polar orbit and consider flying SAGE III on EOS-A as an adjunct to HIRDLS; fly SOLSTICE as soon as possible; fly MLS and SAFIRE to determine at least 11 'useful' species; and fly SWIRLS and HIRDLS to obtain winds and high-resolution temperatures and trace gas measurements.



John Townsend addresses IWG

The study of cloud radiative feedback questions requires that CERES, MISR, MODIS, and HIMSS fly together; determination of boundary layer water fluxes requires that STIKSCAT, HIMMS, AMSU-B, and AIRS/AMSU-A fly together. Every member in attendance at the Atmospheres Panel meeting preferred an 824-km orbit to a 705-km orbit to improve synoptic sampling of atmospheric phenomena. (Changing orbital altitudes was discussed later by Byron Tapley.)

Jim Richman stated that the Oceans Panel gives top priority to adding STIKSCAT to EOS-A to allow simultaneity with the rainfall measurements from HIMSS and, thereby, improve the accuracy of the wind retrievals. The ALT team believes that the maneuvers required to achieve the ± 1 -km repeat-track capability will not be strongly disruptive. They urge that ALT fly on the A platform to minimize the data gap that may follow the end of the TOPEX/Poseidon mission.

Berrien Moore reviewed the Payload Advisory Panel's draft letter to Dr. Fisk regarding a prioritization scheme for EOS instruments, and listed unresolved issues requiring further study by the Project and other IWG panels. The letter indicated areas of required cooperation with the European and Japanese polar observatory programs, the NASA Earth Probes program, and the EOS SAR. In reference to a proposed back-up strategy, the letter states, "no measurement is so critical that it requires a *hot spare* or a *back-up launch on demand*."

The lead-off speaker for the second day of the IWG Meeting was Dave Glover, representing the Biogeochemical Panel. The Panel has recommended that HIRIS, TRACER/MOPITT, and STIKSCAT fly on EOS-A, emphasizing that HIRIS is critical and needs to fly with MODIS. The A and B platforms should fly in 'synchronism' with ten's of minutes separation. TES should fly on B for tropospheric ozone, and the GLRS altimeter would be useful for determining canopy structure and vertical distribution of aerosols. There should be coordinated ground/airborne missions for algorithm development and sensor calibration.

Eric Barron reported that the Physical Climate/Hydrology Panel is developing a science priorities document and has identified the following critical measurements: soil moisture (from SAR), precipitation (from TRMM), and ocean surface winds (from STIKSCAT).

Bryan Isacks stated that the Solid Earth Panel had reached conclusions on several of the EOS candidate instruments of special interest to the Panel. SAR requires strong support, MISR's stereo capability could be valuable to topography, GOS deserves support and should be preceded by Earth Probes including MFE/MAGNOLIA and ARISTOTELES, and ALT will be use-

ful for geoidal determinations. The Panel believes ITIR will be useful for digital elevation modeling; it must fly with AIRS for atmospheric corrections; it will be critical to characterize volcanic plumes; and the three spectral components of ITIR should be flown as a unit.

Jim Drummond said that the PI Instrument Panel has updated its instrument products tables and now has a table that relates the instruments and their products to general EOS science objectives. Another table gives parameters measured by each instrument; and a third table gives measurements that are 'unique' to particular instruments.

Byron Tapley reported that the Precision Orbit Determination/Mission Design (POD/MD) Panel has been considering orbit-determination techniques, diurnal sampling requirements, implications of changing the orbital altitude, and other requirements. The Panel will be surveying the IWG membership for their views on the consequences of changing the orbital altitude and will provide map projections of the different coverages possible to those who want them.

Bob Dickinson stated that the Modeling Panel wants to develop an overall strategy for the development of global change models. A key use of the models will be to assimilate the EOS data. More researchers should apply themselves to the problems of assimilation.

Wayman Baker reported on progress being made by the LAWS team. Signal processing improvements have lowered the useful detection threshold by an order of magnitude. Also contributing to the potential for LAWS performance is the determination that cirrus clouds will contribute to the necessary signal (in addition to the aerosols on which the LAWS concept has rested).



Shelby Tilford, Dixon Butler, and Stan Wilson at the Recent IWG Meeting

Renny Greenstone

Panel Reports

Atmospheres Panel

The second large meeting of the Atmospheres Panel took place on Monday, March 19, at GSFC. This meeting focused on the lower atmospheric processes, clouds, and radiation. The first presentation was by Dr. Chahine on the AIRS/AMSU package. It was quite clear from his presentation that there is important instrument synergism between AIRS and AMSU, especially in cloudy regions (there was some debate about what "cloudy" means, however). Dr. Chahine also presented material on estimates of the rms error from AIRS under different conditions. Dr. Chahine's presentation answered many questions raised about the instrument at the first panel meeting.

The panel also learned about the GGI temperature measurement capability. While GGI is primarily a navigational instrument, as the GPS satellites rise and set, the radio occultation can be used to retrieve density and compute temperature. The best GGI estimates of temperature will be in the stratosphere.

Wayman Baker discussed the LAWS wind instrument. Most of the discussion concerned the lifetime of the laser in orbit and the technological requirements for the laser. Since LAWS is planned for the J-POP platform, and not coincident with EOS-A, the data will probably be most useful in conjunction with data assimilation modelling.

The panel then heard a discussion of the STIKSCAT instrument, which measures the ocean surface stress (vector) from which surface winds can be derived. The STIKSCAT instrument requires a microwave measurement of total water for correction (from HIMMS, for example). Furthermore, the HIMMS instrument can cross check the STIKSCAT stress since it can independently measure the magnitude of the stress. Thus HIMMS and STIKSCAT are both instrumentally and scientifically synergistic.

The panel then heard about CERES, MISR, EOSP and HIMMS. There is an important relationship between CERES and MISR in that MISR can measure bi-directional flux which helps in interpreting the CERES radiation measurements. Furthermore, there is an interconnection between MODIS, MISR, and EOSP cloud and aerosol measurements. Each

measures a different property of aerosols. HIMMS measurements of total water are also necessary for interpreting the CERES data.

Dennis Hartmann talked about the requirements for climate modelling. He emphasized that to get the sea surface fluxes of water and heat, good surface measurements of temperature, humidity, and winds are required. This science requirement suggests that the combination of AIRS/AMSU, HIMMS, and STIKSCAT is needed on the first platform. The issue was raised then about water vapor profiling which is done by AIRS and AMSU-B. Unfortunately, no one had any information on AMSU-B. Hartmann also noted that climate radiation measurements require good identification of clouds and radiational fluxes. This requirement meant MODIS, CERES, AIRS/AMSU and MISR were needed. Hartmann also pointed out that EOS in a sun synchronous orbit could not adequately sample the diurnal cycle in cloudiness. Also, fluxes of heat and moisture could not be obtained over land (lacking surface winds) except through data assimilation.

In the final presentation, Bill Rossow suggested that the 705 km orbit for EOS precluded synoptic sampling (translating asynoptic data into synoptic data by space-time transforms like Kalman filtering). The panel decided to look into this issue further.

Mark Schoeberl, Chairperson

The Earth Observer is a monthly publication of the EOS Project Science Office, Code 900, NASA/Goddard Space Flight Center, Greenbelt, MD 20771, telephone (301) 286-8228, FAX (301) 286-3884. Correspondence may be directed to Charlotte Griner at the above address. Articles, contributions to the meeting calendar, letters to the editor, and suggestions are welcomed. Contributions to the meeting calendar should contain location, person to contact, and telephone number. Deadline for all entries is the 20th of each month.

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Global Change Meetings

- May 7-11 22nd International Liege Colloquium on Ocean Hydrodynamics, Liege, Belgium. Contact Jacques C. J. Nihoul, Modelenvironment, University of Liege, B5, Sart Tilan, B-4000, Liege, Belgium.
- May 20-24 10th IEEE-GRS/URSI International Geoscience and Remote Sensing Symposium, (IGARSS) "Technologies for the 90's," University of Maryland. Contact James A. Smith, (301) 286-7282.
- May 28-
June 1 Climate Variability: Causes and Consequences, Victoria, B.C. Contact Rick Marsden (604) 380-4333.
- May 29-
June 1 AGU Spring Meeting, Baltimore.
- June 4-8 Nonlinear Phenomena in Atmospheric and Oceanic Sciences, Minneapolis, Minn. Call (612) 624-6066.
- June 11-15 International Conference on the Role of the Polar Regions in Global Change, Fairbanks, Alaska. Contact Gunter Weller (907) 474-7954.
- June 12-14 AGU Chapman Conference on Hydrologic Aspects of Global Climate Change, Lake Chelan, Wash. Call (202) 462-6900.
- June 18-21 Global Environmental Hydrology and Hydrogeology, Leningrad, Russia. Call (612) 579-1030.
- July 9-13 International Symposium on Assimilation of Observations in Meteorology and Oceanography, Clermont-Ferrant, France. Call 45 29 12 25.
- June 19-23 4th CERES Science Team Meeting (tentative). Contact Jim Youngblood (804) 864-4509.
- July 16-20 Earth System Science Center Workshop on Atmospheric Oxygen Variation Through Geologic Time, Penn State University. Contact Eric Barron (814) 865-1073.
- Sept. 3-7 5th Conference on Satellite Meteorology and Oceanography, London, England. Contact Dr. Paul Twitchell (301) 263-8976 (home) or AMS in Boston, Massachusetts at (617) 227-2425.
- Sept. 5-11 7th International Symposium of the Commission on Atmospheric Chemistry and Global Pollution, Chamrousse, France. Fax 76 51 32 48.

Future EOS Science Meetings:

- June 11-15 ESA Meeting on MIMR and CIIS, Noordwijk
- July 17-20 SAFIRE Team Meeting, Langley Research Center, Virginia
- August 28-30 Payload Advisory Panel Meeting, Durham, New Hampshire
- August 31 SEC Meeting, Durham, New Hampshire
- August TBD LAWS Team Meeting, Boulder, Colorado
- Sept. 11 Calibration Advisory Panel Meeting, University of Arizona, Tucson, Arizona
- November 6-9 IWG, Langley Research Center, Hampton, Virginia
- November 7-9 4th CERES Science Team Meeting, Langley Research Center, Hampton, Virginia

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EOS Science Meetings - 1990

	Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun	
A P R I L	2 ← AMSR Review - Tsukuba, Japan →	3	4	5 ← HIRDLS Meeting Princeton, N.J. →	6 ← CERES Princeton, N.J. →	1 7 8	
	9	10 ← MODIS - GSFC →	11	12	13	14 15	
	16	17	18	19	20	21 23	
	23	24	25 ← HIRDLS Review - Oxford University →	26 ← ITIR Meeting - GSFC →	27	28 29	
	30	1	2	3	4 ← CERES CDCR LaRC →	5 6	
M A Y	7	8 ← MOPITT CDCR GSFC →	9	10 ← EOSDIS Advisory Panel - GSFC →	11	12 13	
	14	15 ← IPEI CDCR GSFC →	16	17 ← HIMSS CDCR GSFC →	18	19 20	
	21	22 ← ENACEOS CDCR GSFC →	23	24	25	26 27	
	28	29	30 ← ITIR CDCR GSFC →	31	1	2 3	
J U N E	4	5 ← MISR CDCR GSFC →	6 ← GGI CDCR GSFC →	7 ← STIKSCAT CDCR GSFC →	8 ← SCANSCAT CDCR GSFC →	9 10	
	11	12 ← Physical Climate and Hydrology Meeting - Lake Chelan, Washington →				15	16 17
	18	19 ← CERES CDCR GSFC →	20 ← TRACER CDCR GSFC →	21 ← SAGE III CDCR GSFC →	22 ← ICWG Meeting - Frascati, Italy →	23 24	
	25	26	27	28 ← EOSP CDCR GSFC →	29	30	

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