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NASA

Reply to Attn of 420

SEP 24 1991

TO: Goddard Space Flight Center
Attn: 900.6/EOS Project Scientist

FROM: 420/CERES Principal Investigator, Radiation Sciences Branch, ASD

SUBJECT: Cost Estimates for EOS Payload Options

The CERES Science Team considers it critical that we have cost estimates at the Payload Panel meeting for the "Dozier payload" (i.e., the payload you presented at the start of the Seattle EOS meeting), as well as the "Seattle Payload" which was presented near the end of the meeting. The two payload strategies are given on the attached page. There are several reasons for costing the "Dozier" option.

First, the "Dozier Payload" is similar to one of the scenarios presented at the EOS Engineering Review (Frieman Committee), whereas the "Seattle Payload" was not. Thus, a failure to cost the Atlas and Delta scenario would create an impression that NASA was again failing to live up to some clear signals from the community on the need for smaller individual satellites

Second, the Seattle "Payload" appears to violate the clear directions you gave us; we cannot afford to do several of the large instruments within the Senate budget profile. It is clear that the "Seattle Payload" with the afternoon launch first is almost certain not to fit within the budget constraints.

Third, the "Seattle Payload" does not seem consistent with the priorities of the Committee on Earth and Environmental Sciences (CEES) and Inter-governmental Panel on Climate Change (IPCC). For clouds and radiation, there are two main tasks that must be accomplished for us to assist policy makers: (1) validation of the General Circulation Model (GCM) cloud and radiation parameterizations and (2) climate change monitoring, including regional changes.

Validation of GCM parameterizations of clouds and their radiative effects requires simultaneous measurements of radiative fluxes and cloud properties. For EOS, these measurements are provided by the instantaneous combination of MODIS-N (most cloud properties), CERES (radiation), and MIMR (precipitation, cloud liquid water). The AVHRR-like cloud imagers on Tropical Rainfall Measuring Mission (TRMM) and European Space Agency (ESA) present serious limitations for cloud observations. In particular, they are poor for sensing boundary layer cloud amount, cloud particle size and phase, cirrus cloud height, and multiple-level cloud systems. In contrast, MODIS-N was designed from past experience with cloud imagers and aircraft radiometers to provide:

- infrared sounding capability to give good cirrus height determinations
- 1-6- and 2.1-um channels for accurate water phase and particle-size determination during daylight

- 3.7-, 8.5-, 11-, and 12-um channels for somewhat less accurate particle size/phase estimation at night.

- 1/4-km pixel size for boundary layer cloud amount determination and identification of clouds over snow and ice (texture measures)

- carefully calibrated radiances and a standard to "calibrate" the more error prone VIRSR and VIRS cloud property estimations.

Thus, we consider MODIS-N measurements with CERES as required to meet the IPCC and CERES objectives. If not for the severe cost difficulties presented by the recent Congressional delibrations, we would strongly back the flight of MODIS-N/CERES in both a.m. and p.m. orbits. Certainly, we expect that the second series of satellites for EOS would have MODIS-N/CERES/MIMR class instruments simultaneously flying in three orbits (a.m., p.m., 55-degree inclined).

We also note that climate monitoring requires accurate long-term measurements. Without consistent and reliable cloud identification, our ability to detect climate change is substantially limited.

A delay in the afternoon launch of the "Seattle Payload" raises three additional concerns relative to climate monitoring:

- The TRMM lifetime of 3 years will mean that a rain radar will not be available to calibrate MIMR measurements of rainfall rates

- Diurnal sampling errors will be unacceptably large in our estimates of precipitation (simulation studies suggest that a three-satellite precipitation constellation could be achieved by TMS on TRMM, SSM/I in the a.m. DMSP orbit, and MIMR on EOS-A in the p.m. orbit)

- Angular sampling errors in the radiation measurements will continue to dominate, since neither ESA nor TRMM carry the second CERES scanner required to produce angular models of the appropriate accuracy.

The "Dozier Payload" scenarios with Atlas IIA(S) plus Delta launches appear to meet the scientific priorities of the CEES and IPCC, as well as the budgetary flexibility requirements much more squarely than does the suggested "Seattle Payload." Thus, we need to have its cost impact for our deliberations at the upcoming Payload Panel meeting.

Bruce A. Wielicki

Enclosure

cc:
EOS Panel Chairman
CERES Science Team
NASA--SED/Dr. Robert Schiffer
NASA--SED/Dixon Butler
NASA--SE/Dr. Stan Wilson

Enclosure

Set science priorities of EOS based on IPCC and CEES report on global warming needs for policy decisions:

1. Clouds / Radiation / Precipitation: (i.e., energy and water cycle) - Answer questions concerning magnitude of climate change and effect on precipitation.

2. Oceans: (i.e., heat transport, air-sea interation, sources, and sinks of CO_2, SO_4 - Answer questions concerning the timing of climate change and magnitude of CO_2/ SO_4 increases

3. Tropospheric/ Lower Stratospheric Chemistry: (i.e., Ozone, Methane)

4. Land Hydrology and Ecosystems

5. Polar Ice Sheets

The following two stawman payloads fit within the Senate budget guideline through the year 2000.

1. Dozier Payload
Presented at the start of the EOS Seattle meeting

Launch	12/98	6/00	3/01	12/01	12/02
Interval (months)		18	9	9	12
Orbit	1:30	1:30	1:30	10:30	1:30
Vehicle	AtlasIIAS	AtlasIIA	Delta	AtlasIIAS	Delta
Satellite name	EOS-A	EOS-B	EOS-C	EOS-D	EOS-E
Instruments	CERES	AIRS	SALT	ASTER	TES
	MODIS-N	AMSU	TMR	MODIS-N	
	MIMR	MHS	GPS	MISR	
	SAGE III	MOPITT		SOLSTICE	

2. Seattle Payload
Presented at the end of the EOS Seattle meeting

Launch	12/98	6/00	??	??
Interval (months		18		
Orbit	10:30	1;30	1:30	1:30
Vehicle	AtlasIIAS	Titan III	Delta	Delta
Satellite name	EOS-A	EOS-B	EOS-C	EOS-D
Instruments	ASTER	CERES	SALT	TES
	MODIS-N	MODIS-N	TMR	
	MISR	MIMR	GPS	
	MOPPITT	AIRS/AMSU/MHS	SOLSTICE	
	SAGE III	HIRDLS	ACRIM	