

**Earth Science Subcommittee Report**  
**June 12-13, 2007 Meeting**  
**NASA Headquarters**

**From:** The NASA Earth Science Subcommittee – Daniel J. Jacob (chair, [djacob@fas.harvard.edu](mailto:djacob@fas.harvard.edu)), Roni Avissar, John R. Christy, Lisa Curran, Jonathan Foley, James Hansen, Gregory Jenkins, John Jensen, Patricia Matrai, Julian McCreary, Jean-Bernard Minster, Michael Ramsey, Kamal Sarabandi, Mark Simons, Konrad Steffen, Edward Zipser

**To:** Edward David, Jr. (Chair, NAC Science Committee)

**Cc:** Greg Williams (NAC Science Committee Executive Secretary), Michael Freilich (ESD Director), Bryant Cramer (ESD Deputy Director), Jack Kaye (ESD Associate Director for Research), Theodore Hammer (ESD Associate Director for Flight Program), Teresa Fryberger (Associate Director for Applied Sciences). Lucia Tsaoussi (ESS Executive Secretary)

**Date:** June 28, 2007

Dear Dr. David:

The Earth Science Subcommittee (ESS) met on June 12-13, 2007 at NASA Headquarters. We received updates on ESD (Michael Freilich) and NPOESS (Bryant Cramer), and briefings on (1) the suborbital program (Andy Roberts), (2) the technology program (Amy Walton), and (3) the upcoming community workshops aimed at defining the first wave of satellite missions from the NRC Decadal Survey. We reviewed and graded the FY2007 Earth Science Performance and Accountability Report, and discussed the Lunar Science Workshop Report as well as the response of the NAC to our March 2007 recommendation for an Earth Science Initiative.

The central recommendation from our March 2007 letter to the NAC was for an Earth Science Initiative to enable ESD to implement the program of missions designed by the NRC Decadal Survey (DS) and which we fully endorsed. We pointed out that the bleak long-term outlook for ESD funding does not allow for implementation of the DS and recommended that resources for an Earth Science Initiative be found, either within or outside NASA, in order to implement the DS – corresponding to a 30% increase of ESD budgets, i.e., a return to 2000 funding levels. We were disappointed that the NAC decided not to forward the recommendation to the Administrator, despite the support from the NAC Science Committee, on the grounds that requesting new funding was outside the charter of the NAC. But this apparent technicality leaves unsolved the problem of how NASA is to respond to the DS. At a time of great public concern over global change, NASA cannot just bury its head in the sand.

The DS calls for 14 strategic missions (typically in the ~\$500M range) to be launched over the 2010-2020 period. It also calls for a new class of Venture missions in the \$100-200M range to foster the development of new ideas. The ESD budget outlook going out to 2014 offers opportunities for just two strategic missions, and has no line for Venture missions. ESS scrutinized the ESD budget and received briefings on all its major components. We do not see how the current budget could be reconfigured to enable more effective implementation of the DS. The hard truth is that the 30% budget cut that ESD has

suffered since 2000 incapacitates it from developing new initiatives. The DS indicates that its slate of 14 missions would be fully doable if ESD funding were restored to 2000 levels. Implementation of the DS requires new resources from an Earth Science Initiative to start in FY09 at the latest.

We are concerned that NASA may feel that it has properly responded to the DS if it launches say the first wave of four DS missions over the next decade. In fact, the ensemble of 14 missions for the next decade put forth by the DS represents a carefully crafted synergistic ensemble, and the DS specifically warns against piecemeal selection of missions. The DS Executive Summary states: *“In the event of budget shortfalls, re-evaluate the entire set of missions given an assessment of the current state of international global Earth observations, plans, needs, and opportunities. Seek advice from the broad community of Earth scientists and modify the long-term strategy rather than dealing with one mission at a time”*. We will face this situation in FY09 unless an Earth Science Initiative is implemented. We remain hopeful that resources for such an Initiative will be found, either through the Congressional allocation of FY08 or through the Administrator’s request in FY09.

**We ask the NAC to advise the Administrator that in the absence of an Earth Science Initiative in place by FY09 to implement the NRC Decadal Survey, NASA will have defaulted on its implementation of the DS and will need to re-think its whole Earth science strategy with input from the broad scientific community. This would represent a major failure and we remain hopeful that positive action will be taken over the next year.**

The current NPOESS debacle has further heightened the crisis for Earth observation from space. The NPOESS climate sensors TSIS, APS, OMPS-Limn, ERBS, and ALT were de-manifested as part of the recent Nunn-McCurdy Certification. CMIS was partly maintained but with reduced capability – if it loses its capability to measure microwave surface temperatures (that was not clear to us), then it will be of little use as a climate sensor. A positive development is that OSTP tasked NASA and NOAA to examine options for recovering the ensemble of NPOESS climate measurements through other means. As we have stated in previous letters, long-term, continuous, well-calibrated measurements of key climate variables from space are critical for monitoring climate variability and change and for testing our understanding of the same. ESD shared with us four options presently under consideration in their joint discussions with NOAA. Options 1 and 4 involve restoration of the climate sensors on later NPOESS satellites, while options 2 and 3 abandon the association with NPOESS and instead rely on “climate free-flier” satellites to carry the climate sensors. Options 2 and 3 seem to us the best choices cost-wise and to avoid being hostage to the NPOESS program. **We recommend that long-term monitoring of climate variables from space be conducted from “climate free-fliers” (options 2 and 3 of the NASA/NOAA White Paper) for reasons of both reliability and cost.**

ESD will hold community workshops over the next month to better define each of the four notional missions representing the first wave (2010-2015) of DS missions (CLARREO, SMAP, ICESat-II, DESDynI). The workshop chairs briefed us on their plans. We were impressed by their dedication and by the dynamic that these workshops represent for implementing the DS. We have two major comments for their consideration.

(1) The CLARREO presentation implied that CLARREO should be considered as a sustained measurement, but this would have cost implications beyond those estimated by the DS. **An important decision to be made at the CLARREO workshop is whether or not**

**the mission entails a long-term commitment to spectrally resolved thermal IR measurements, as this will greatly affect the cost of the mission. If long-term commitment is required, there should be a strategy for transition from research to operations that will enable projection of the long-term impacts on ESD budgets.**

(2) Consideration should be given to different configurations of the DESDynI and ICE-Sat-II sensors. The DS combined the surface deformation InSAR and vegetation structure laser altimeter into one notional mission (DESDynI), but called also for further analysis of whether this combination was viable and whether a better combination might be achieved with the ICE-Sat-II laser altimeter. There will be differences in the optimal orbits for each of these instruments, but is it possible to settle for a less-than-optimal orbit in order to enable joint launch at considerably lower cost? These issues should be addressed at the DESDynI and ICE-Sat-II workshops. **We recommend that ESD keep an open perspective on the opportunities for different configurations of the L-band InSAR, the vegetation laser altimeter, and the ice surface altimeter onto common satellite platforms for purposes of cost reductions. We encourage cross-participation in the ICESat-II and DESDynI community workshops.**

We reviewed the outcomes of the February Lunar Science Workshop and in particular the recommendations for Earth Science. We were pleased to see a strong statement in the workshop report that recommendations for missions enabled by the lunar architecture must be vetted through a NRC Decadal Survey or similar process. We were pleased to see a strong affirmation of the value of Earth science observations from the Moon. As noted in the report, the current proposed site for the polar base is an issue because of its limited view of the Earth, and an outpost at Mt. Malapert with much better Earth viewing capability would address this issue. **We wish to emphasize that satellites at the Earth-Moon L1 point supporting lunar operations would also represent ideal platforms for observing the Earth.**

We received a briefing on the ESD suborbital program from manager Andy Roberts. We had expressed concern in the past that this important program was lacking direction. We were pleased to see a strong articulation of the main purposes of the suborbital program within ESD: (1) satellite cal/val including science-directed, (2) new sensor development, (3) process studies. We were pleased to see the value of the UAS (Unmanned Airborne Systems) expressed in terms of their scientific purpose (endurance, extended low-altitude flight) instead of abstract and likely unaffordable technological goals. We were impressed by the educational vision of the suborbital program, recognizing aircraft missions as a unique means to provide students with hands-on experience and train future leaders. We remain concerned that the core aircraft (both manned and UAS) are underutilized and that this represents a substantial cost burden to the program. Hopes from cost-sharing by non-NASA customers have not materialized. **We recommend that the suborbital program take a hard look at its needs for core aircraft to determine whether significant cost savings could be achieved at minimal loss for science by decommissioning one of the aircraft.**

We were impressed by the briefing on the ESD technology program from manager Amy Walton. The program has a clear focus and balance, including in particular the development of cross-cutting and targeted technologies aimed at implementing the DS. A concern expressed by Walton was how to support the development of targeted technologies (directed at one specific mission) without creating a non-competitive pipeline for subsequent

selection of the mission. **We recommend that at least two competing approaches or groups be supported in the development of any targeted technology in order to maintain competition at the subsequent level of mission selection.**

We were asked to review and grade the ESD FY07 Performance and Accountability Report, but we were not satisfied by the process under which we were asked to carry out the review. The performance report submitted to us was very uneven across areas. We would, for example, have liked to see for each area *i)* the number of scientists actively carrying out research, *ii)* a list of publications, *iii)* perhaps abstracts of selected publications, and *iv)* some synthesis paragraphs that provide an overview of activities, accomplishments, and hindrances. We were not clearly told what readership was targeted by the report. Our own charge was not clear – simply rate each outcome as green, yellow or red? Provide critical comments on the supporting text? **We ask that the procedure for reviewing the ESD Performance Evaluation and Accountability Report be improved next year, and that the material submitted to ESS for review be more informative.**

We include as Appendices for specific action by the NAC our recommendations that (1) the Administrator be advised that NASA will default on its response to the DS and have to rethink its Earth Science Program if funding for an Earth Science Initiative does not materialize by FY2007; (2) climate free-flyer satellites be used in lieu of NPOESS for long-term monitoring of key climate variables, (3) the Earth-Moon L1 point be recognized as the optimum platform for observing the Earth from the Moon as part of the Lunar Exploration Architecture. Our other recommendations may be best considered at the level of the ESD leadership.

Sincerely,

The Earth Science Subcommittee

## APPENDIX 1: Proposed Recommendation for the NAC Science Committee

Subcommittee Name: Earth Science

Chair: Daniel J. Jacob

Date of Public Deliberation: June 12-13, 2007

Date of Transmission: June 28, 2007

Short Title of Proposed Recommendation: **Action on NASA Earth Science Initiative Needed by FY09**

Short Description of Proposed Recommendation:

We ask the NAC to advise the Administrator that in the absence of an Earth Science Initiative in place by FY09 to implement the NRC Decadal Survey, NASA will have defaulted on its implementation of the DS and will need to re-think its whole Earth science strategy with input from the broad scientific community. This would represent a major failure and we remain hopeful that positive action will be taken over the next year.

Outline of the Major Reasons for Proposing the Recommendation:

The central recommendation from our March 2007 letter to the NAC was for an Earth Science Initiative to enable ESD to implement the program of 14 missions for 2010-2020 designed by the NRC Decadal Survey (DS) and which we fully endorsed. The NAC decided not to forward the recommendation to the Administrator on the grounds that requesting new funding was outside its charter. This technicality leaves unsolved the problem of how NASA is to respond to the DS. At a time of unprecedented public concern over global change, NASA cannot just bury its head in the sand. As explained in our letter, the current ESD budget outlook completely defaults on the DS. Piecemeal implementation of the DS is not an option. Implementation of the DS requires new resources from an Earth Science Initiative to start in FY09 at the latest. In the absence of such an Initiative, NASA will need to totally re-think its long-term strategy for Earth Science.

Outline of the Consequences of No Action on the Proposed Recommendation:

This is best stated by the DS Executive Summary: *“In the event of budget shortfalls, re-evaluate the entire set of missions given an assessment of the current state of international global Earth observations, plans, needs, and opportunities. Seek advice from the broad community of Earth scientists and modify the long-term strategy rather than dealing with one mission at a time”*.

## **APPENDIX 2: Proposed Recommendation for the NAC Science Committee**

Subcommittee Name: Earth Science  
Chair: Daniel J. Jacob  
Date of Public Deliberation: June 12-13, 2007  
Date of Transmission: June 28, 2007

Short Title of Proposed Recommendation: **Free Flier Satellites for Climate Monitoring**

Short Description of Proposed Recommendation:

We recommend that long-term monitoring of climate variables from space be conducted from “climate free-flier” satellites (options 2 and 3 of the NASA/NOAA NPOESS White Paper), rather than through the NPOESS suite, for reasons of both reliability and cost.

Outline of the Major Reasons for Proposing the Recommendation:

The current NPOESS debacle has heightened the crisis for Earth observation from space. The NPOESS climate sensors TSIS, APS, OMPS-Limn, ERBS, and ALT were de-manifested as part of the recent Nunn-McCurdy Certification. CMIS was partly maintained but with reduced capability. OSTP tasked NASA and NOAA to examine options for recovering the ensemble of NPOESS climate measurements through other means. ESD shared with us four options presently under consideration in their joint discussions with NOAA. Options 1 and 4 involve restoration of the climate sensors on later NPOESS satellites, while options 2 and 3 abandon the association with NPOESS and instead rely on “climate free-flier” satellites to carry the climate sensors. Options 2 and 3 are the best choices for reasons of both cost and reliability.

Outline of the Consequences of No Action on the Proposed Recommendation:

As we have stated in previous letters, long-term, continuous, well-calibrated measurements of key climate variables from space are critical for monitoring climate variability and change and for testing our understanding of the same. NPOESS has demonstrated its failure in commitment to climate monitoring. Long-term climate observations should not be held hostage to NPOESS’s other priorities. We stand at risk of losing critical continuity in measurements of climate variables.

### **APPENDIX 3: Proposed Recommendation for the NAC Science Committee**

Subcommittee Name: Earth Science  
Chair: Daniel J. Jacob  
Date of Public Deliberation: June 12-13, 2007  
Date of Transmission: June 28, 2007

Short Title of Proposed Recommendation: **Earth Observation from the Earth-Moon L1 point**

Short Description of Proposed Recommendation:

We ask the Lunar Exploration Architecture to recognize that satellites at the Earth-Moon L1 point supporting lunar operations would also represent excellent platforms for observing the Earth.

Outline of the Major Reasons for Proposing the Recommendation:

The current proposed polar site for the lunar base is not adequate for Earth observation because of its limited view of the Earth. An outpost at Mt. Malapert with much better Earth viewing capability would address this issue, but the best and most cost-effective viewing point would be on lunar operations satellites at the Earth-Moon L1 point.

Outline of the Consequences of No Action on the Proposed Recommendation:

A viewing site on the Earth-facing side of the surface of the Moon would also be adequate for Earth Science but we are concerned about the infrastructure and costs involved, particularly if such a site is not associated with the main lunar base. The Earth Science community has a lot to gain from viewing platforms associated with Lunar Exploration and input from that community should continue to be sought.