

**Earth Science Subcommittee Report  
November 17 and 18, 2010  
NASA Headquarters**

**From:** The NASA Earth Science Subcommittee – Byron Tapley (Chair, NAC ESS), Daniel Jacob, (Vice Chair NAC ESS), John Christy, Judith Curry, James Hansen, Raymond Hoff, Gregory Jenkins, William Large, Patrick McCormick, Anna Michalak, Jean-Bernard Minster, Steve Running, Robert Schutz, David A. Siegel, Hank Shugar, Mark Simons, Konrad Steffen, Charles Vorosmarty, Efi Foufoula-Georgiou

**To:** Wes Huntress (Chair, NAC Science Committee)

**Cc:** Jens Feeley (NAC Science Committee Executive Secretary), Michael Freilich (ESD Director), Peg Luce (ESD Deputy Director), Jack Kaye (ESD Associate Director for Research), Stephen Volz (ESD Associate Director for Flight Programs), Lawrence Friedl (Associate Director for Applied Sciences), Lucia Tsaoussi (Earth Science Subcommittee Executive Secretary)

Dear Wes:

The Earth Science Subcommittee (ESS) met on November 17 and 18, 2010 at NASA Headquarters. The main objective of the meeting was to review plans for the DESDynI mission, discuss the recent ASAG committee meeting and the resulting report and review the NRC geodetic networks report and ESD plans in response plans. Michael Freilich, ESD Director, gave a comprehensive briefing on the status of the ESD program in the context of the FY 2011 Presidential Budget Submission, including an update on the details of the new climate initiative, Eric Ianson, SMD Program Executive and Jared Entin, SMAP Program Scientist, provided an overview of the SMAP mission. Stephen Volz, and John LaBrecque briefed the ESS on the mission concept and design for the Deformation, Ecosystem Structure and Dynamics of Ice (DESDynI) mission. Lawrence Friedl, ASP Associate Director described the ASP's goals and planned actions and Raymond Hoff, ASAG Chair, reported on the ASAG activities. Bernard Minster summarized a recent NRC Report, which described the requirements for precise geodetic observation system and John Labrecque described ESD plans for responding to the NRC report. In the following discussion, our summary recommendations and findings are presented in bold.

Based on the briefing on the state of ESD, as given by Michael Freilich, the ESS notes that, under the President's FY11 Proposed Budget, a number of the concerns described in previous ESS reports are alleviated. The plan would implement all foundational missions, most national need missions and a larger subset of the mission suite recommended by the 2007 NRC Earth Science Decadal Survey. The plan calls for implementation of the Orbiting Carbon Observatory-2 (OCO-2) mission to replace OCO-1. All four Tier-1 missions, that were recommended in the Decadal Survey, are planned for launch by 2017, the Venture-class program will be expanded and accelerated and, under the Climate Initiative, the first suite of missions charged with maintaining long term climate related observations, (Sage-III, GRACE FO and PACE), will be initiated. The ESD Climate Initiative plan, including both satellite missions, and data analysis elements, was described. In response to previous concerns expressed by the ESS, meaningful collaborations with the European Space Agency (ESA), India, France, Canada, Argentina, Japan, Germany, and Brazil were summarized. It was reported that the ESA decision to adopt a more open data access policy has allowed the possibilities for collaboration on more comprehensive science campaigns. In the interagency arena, a very successful collaboration with both NOAA and USGS was noted. Finally the extensive division activities in the emerging area of hazard response was summarized This included discussion of ESD activity in responding to natural hazards such as the Haitian and Chilean earthquake, and the Gulf Oil spill.

**Finding: Although concerns remain, the ESS finds a substantial improvement in the mission implementation status with the Presidents proposed Budget and the ESS commends ESD on the development of the comprehensive Climate Initiative Plan.**

During the past decade there has been ongoing concern about the inability of NASA to implement long-term measurement sequences. Continuing measurements, such as the important satellite altimeter measurements of global sea level and the scatterometer measurements of the surface winds over the ocean, have required a difficult transition to other agencies, which do not have the observation mandate of NASA missions with regard to measurement accuracy and stability. In an important component of the FY11 budget, NASA ESD was given the task of developing Climate Continuity Missions to prevent significant gaps in key variables deemed vital for generating scientific understanding of the Earth System. The ESS strongly supports this effort and notes that an assessment should be made to determine which additional data sets are candidates for a long-term national commitment for climate monitoring, what should be the role of NASA vs. other agencies in this monitoring, and how this affects the execution by NASA of other planned missions. We note that implementation of the long term measurement sequences could impact the currently-planned ESD goals such as those of the Decadal Survey and collaboration with both national and international partners.

**Finding: The committee finds that the change to allow ESD to maintain some critical long-term measurements for supporting climate studies is a significant and long needed change. This change allows ESD the option of working with other national agencies to ensure an orderly transition of critical climate measurements.**

In the review of SMAP and DESDnyI, the two Tier 1 missions presented at this meeting, both missions were presented as redesigned under the a newly adopted ESD cost allocation. In this approach, the missions produce the best science product that can be provided, given the prescribed budget constraint. The ESS believes that this is an important step in attempting to gain control of the mission cost growth.

SMAP is a Tier 1 NRC Decadal Survey mission scheduled for launch in November 2014. The science objective is a global, high-resolution mapping of soil moisture and its freeze/thaw state. Its measurements will be used in applications that range from agriculture to human health. SMAP will enable a better understanding of the processes that link the terrestrial water, energy and carbon cycles. It will be used to estimate global water and energy fluxes at the land surface and will be vital for climate and global change science. The SMAP Flight System design and implementation has been simplified to stay within a specified cost allocation; an in action that is consistent with previous ESS recommendations on maintaining cost control for large missions.

The DESDnyI mission is a dual satellite mission that will make contemporaneous measurements of the Earth's surface using L-Band radar and Lidar measurements. DESDnyI's unique Lidar-radar fusion will open new options for surface change science and will focus on the rapid changes in the coastal ice sheets in Antarctica and Greenland, map global forest structure, biomass and disturbance, support global carbon modeling and studies of biodiversity and habitat and aid in the study of the physics of earthquakes and volcanoes. The original mission cost exceeded the available funding resources and the mission has been redesigned to fit within a specified ESD cost cap. In the process, the science objectives were reformulated to a set of Baseline and Threshold mission science requirements. The Baseline performance satisfies the full mission that NASA plans to implement. The Threshold performance is proposed as a reduced, but acceptable mission that NASA will implement if unexpected difficulties arise in the baseline mission development.

Based on the Threshold Mission Science Requirements, the ESS was asked by the Earth Science Division (ESD) to evaluate the science goals by providing an answer to the following question:

*Does the DESDnyI mission, as presented, represent a scientifically viable mission? Will its measurements likely enable advances in our scientific understanding commensurate with the cost and schedule of the mission?*

**Finding: The ESS concluded that the Threshold Mission, as presented, is scientifically viable, the measurements will likely enable important advances in our understanding of the earth's dynamical systems and the advancements in our scientific understanding are likely to be commensurate with the cost and schedule of the mission.**

It was noted that the redesigned mission would be implemented using a 13 day ground track repeat. Based on a number of previous agency and NRC studies, a shorter ground track repeat is preferred. Specifically, the NRC Decadal Survey calls for a ground track repeat of half this baseline repeat period. An additional factor noted was the recent recognition of the potential utility and importance of low latency satellite SAR observations for disaster response. The conclusions from the discussion lead to the following finding.

**Concern: There is a need for DESDnyI measurements with a short repeat period. We encourage the project to search for ways to reduce the SAR ground track repeat time from the currently planned 13 days to 7 or 8 days.**

*Following the ESS meeting, the release of the FY 2012 budget plan announced the cancelation of the DESDnyI Lidar and the deferral of the DESDnyI Radar until it is affordable. Given the significance of the DESDnyI measurements to the goals of the ESD program, the ESS support of the mission expressed in the previous paragraphs and the role that DESDnyI was assigned in the recommendations of the 2007 NRC Decadal Survey, the ESS will schedule further consideration of this topic at it's next meeting.*

The ESD Applied Sciences Program (ASP) plays an important role in extending the NASA satellite observations from scientific research to societal benefit. The goals of the Applied Science Program are to advance the use of NASA Earth Science products in policymaking, resource management and planning, and disaster response and to interact with the NASA's flight missions to develop a comprehensive set of applications for the mission data.

*The Applied Sciences Advisory Group (ASAG) was mandated in the 2005 NASA Authorization Act and reports to the NAC through the ESS. The ASAG provides advice on all phases of the applied sciences program. The ASAG met on October 21-22, 2010 and the ESS was briefed on the meeting results.*

In the briefing by the ESD Director, the ASP and the ASAG, important applications of the data from the suite of orbiting satellites were reported. These include the ESD response to multiple disasters that occurred in 2010, i.e., the Haiti and Chilean earthquakes, the eruption of Eyjafallajokull in Iceland, and the Gulf of Mexico oil spill. NASA's efforts have been important and visible. Currently, NASA applications have been based on a largely serendipitous application of existing observations. In some cases, requirements were met by a rapid dissemination of products from the existing observation and analysis capabilities. In other cases, unique observation and dissemination requirements may be required.

A review of the program plans and status led to the following finding. The ASAG reported that the Applied Sciences Program has made progress during the last year in consolidating a financially and scientifically manageable program that aids in the transition of NASA science into operational use at the Federal, State and local level. The ASAG believes that the ASP is understaffed and financially challenged for the breadth of societal benefit areas it needs to address. It believes that additional resources must be made available in the out years to meet the many requirements. The ASAG also noted that the different requirements for application related data products require continued attention and effort to fully capitalize on the opportunities for contributions. The requirements are best met by considering them during the early phase of mission planning.

In an important management decision, the ESD has mandated that application interest will be represented in all phases of the mission, including mission planning, implementation and the mission life cycle phases. This will be facilitated by involving members from the research applications community in the science and mission formulation teams. The ESS believes that this is an important step in improving the science applications program.

**Finding: Explicitly recognizing and strengthening NASA's role in disaster response will clearly (1) benefit society - including providing support of UN resolution 41/65 Principle XI "Remote sensing shall promote the protection of mankind from natural disasters", (2) strengthen an important external constituency at all levels of domestic (local/state/federal) and international government, and (3) promote follow-on missions.**

The ASAG notes that the requirements for forging successful partnerships with external agencies are now understood. The strategies that have been laid out in the ASP Plan should both protect NASA's interests and encourage the utilization of NASA science and remote sensing data in a cost effective manner. The need for a formalized ESD plan for responding to disasters was discussed. This includes the need for near real time data distribution as well as special purpose processing of the data. The importance of this activity to the NASA ESS societal benefit was noted. The need for developing appropriate arrangements for partnering with the commercial sector was discussed. Finally, the ASAG reported a concern related to the public perception that the Applied Sciences Program may be still in a state of transition and that this may weaken support, both within NASA and external to NASA, for this Program. As background, the prior Associate Director of Applied Sciences resigned in October 2009 and since that time the Program has had an Acting Associate Director. The ASAG understands that it is their role to advise NASA on threats to the ASP that arise from the external perception that the program remains in a state of flux and this issue is one example.

**Observation: The ASAG concern leads to the Recommendation in Appendix A**

The briefing on the report from the NRC's Committee on National Requirements for Precision Geodetic Infrastructure noted that the geodetic measurements provide the essential reference frame for measuring climate related signals related to mass change, height change and surface deformation and, in addition, benefits society in a number of applications such as real-time positioning, precision agriculture, surveying and floodplain mapping, forest mapping and biomass estimation, monitoring and early warning for natural hazards, and sea level change. The geodetic infrastructure requires the Global Geodetic Observing System (GGOS), which is an essential component of The Global Earth Observation System of Systems (GEOSS). The realization of GGOS requires international collaboration, but NASA leadership has been essential in developing and implementing the required measurement capabilities. However, following several decades of neglect, the NRC panel concludes that the requisite geodetic infrastructure is in danger of collapse

Following the briefing on the NRC report, the proposed ESD plans for responding to the NRC report and to the requirements outlined in the report NRC's Decadal Survey were summarized. The plan as presented underscored the concerns expressed in the NRC report related to both the timeliness and the magnitude of the response as well as issues of coordination with other national agencies. The committee will want to follow the actions of ESD in responding to this report at subsequent meetings.

***Finding: The ESS noted with concern the reports of the national and international geodetic infrastructure collapse and will want further insight into the development of plans for responding to this concern at future meetings.***

We were pleased to hear of ESD's initiatives to engage international space partners in the execution of ESD satellite missions, and we take note of significant progress in that regard. We note that ESD has made efforts to engage international partners in DESDynI and that these efforts have not met with success. This suggests that international engagement needs to be sought not just at the tactical implementation level but also at the strategic level.

**Finding: We commend ESD for its efforts to engage international partners in the execution of NASA priority missions. This effort in the future needs to take place at the strategic as well as at the tactical level. We recommend that future strategic visions for ESD be developed in cooperation with international partners in order to produce an international portfolio of priority missions.**

In relation to the ongoing concern by the ESS about the NPOESS implementation, the ESD director reported that the Joint Agency Satellite Division (JASD) has been established within NASA's Science Mission Directorate (SMD) to manage reimbursable satellite and instrument development and that the Joint Polar Satellite System (JPSS) is being managed under this program. The details of data processing and data products are still evolving. The ESS noted that the measurement suite from the JPSS is cited as a foundation for the set of measurements recommended by the 2007 NRC Decadal Survey. The ESS is seeking to understand the procedures for obtaining the climate variables from the ongoing operational activities of JPSS. It is also concerned that there has been no response to a previous recommendation that

procedures for communicating with the JPSS be established.

**Finding: The ESS reaffirms it's concern about the process for understanding how communication with the JPSS will occur and is awaiting a follow up to our previous recommendation to the Science Committee on ESD science oversight of JPSS.**

The next ESS meeting is planned for May 11 and 12 2011.

Sincerely,

The Earth Science Subcommittee

Byron Tapley, Chair

**Appendix A: Recommendation to the NAC Science Committee**

Subcommittee Name: Earth Science Subcommittee

Chair: Byron Tapley

Date of Public Deliberation: November 17-18, 2010

Date of Transmission: January 11, 2011

Short Title of Proposed Recommendation: **Securing Applied Sciences Program Leadership**

Short Description of Proposed Recommendation:

The Applied Sciences Advisory Group (ASAG) has noticed a public perception that the Applied Sciences Program may be still in a state of transition and that this weakens support, both within NASA and external to NASA, for this Program. As background, the prior Associate Director of Applied Sciences resigned in October 2009 and since that time the Program has had an Acting Associate Director. The ASAG has been fully informed of the issues in re-staffing the position in a permanent rather than Acting manner. However, the ASAG feels that it is their role to advise NASA about impacts to that program arising from the external perception that the program remains in a state of flux and the impact that this perception has on forging collaboration with external agencies

Recommendation: The ASAG recommends, and the ESS forwards the recommendation, that NASA Management find a mechanism to make the Associate Director of Applied Sciences (ADAS) a permanent position with a charter that allows the ADAS to effectively supervise and manage the applications portfolio.

Consequences of No Action on the Proposed:

The ASAG will continue to encounter reservations about the ability of the Applied Sciences Program to act as a long-term partner in operational use of NASA data. This will risk the involvement of external partners with NASA.