

ESS Meeting 10-11 January, 2017

Earth Science Subcommittee Report Kennedy Space Center

From: The NASA Earth Science Subcommittee – Steven W. Running (Chair, swr@ntsg.umd.edu), Roland Burgmann, Greg Carmichael, Andrew Dessler, Efi Foufoula-Georgiou, S. Prasad Gogineni, Kathleen Green, Thomas Herring, Ian Joughin, Chris Kummerow, William Large, Anna Michalak, Mahta Moghaddam, Anne Nolin, Richard B. Rood, Raymond W. Schmitt, J. Marshall Shephard, Herman H. (Hank) Shugart, Jr. and David A. Siegel

To: Dr. Brad Peterson (Chair, NAC Science Committee)

Cc: Elaine Denning (NAC Science Committee Executive Secretary), Lucia Tsaoussi (Earth Science Subcommittee Executive Secretary), Michael Freilich (ESD Director), Sandra Cauffman (ESD Deputy Director), Jack Kaye (ESD Associate Director for Research), Eric Ianson (Acting ESD Associate Director for Flight Program), Lawrence Friedl (Associate Director for Applied Sciences).

Date: January 27, 2017

Dear Dr. Peterson:

The Earth Science subcommittee met at the Kennedy Space Center at Cape Canaveral on 10-11 January 2017. The following is our report.

Observations, Findings, and Recommendations

1. The Earth Science Subcommittee (ESS) was informed of a change in committee structure. The ESS will be dissolved at the end of January and replaced by the Earth Sciences Advisory Committee (ESAC), a Chartered FACA Committee. Instead of reporting to the NASA Advisory Council (NAC) Science Committee, the ESAC will directly advise the Earth Sciences Division (ESD) Director. The new charter generally maintains the current programmatic breadth for ESD and will also provide reviews of Senior Review and Science Definition Team documents.

Finding: The ESS appreciates the opportunity for direct reporting to the ESD and involvement with the senior review process.

2. The ESS received an update and overview of recent ESD activities, presented by Dr. Freilich
 - Mission is to understand the Earth as an integrated system and to provide societal benefit.
 - 4 elements of ESD: Research, Applied Science, Technology, Flight
 - Current budget split between Flight and Non-Flight is roughly 62-38% but subjective optimum split might be closer to 50-50%. Stable and slightly increasing budget since 2007. ESD budget is about 10% of NASA's total budget.
 - Venture Class overview. EV program is proceeding as planned. About 10% of budget.

Finding: We find stability and continued success in both Flight and Non-Flight elements. Venture Class missions are moving forward as planned, realizing success.

3. ESS received an overview of ESD Advances in Science and Technology relating to constellations and various aspects of small satellites/CubeSats
 - a) Constellations
 - Heterogeneous constellations (e.g. A-train)
 - Homogeneous constellations (e.g. CYGNSS, TROPICS)

Finding: Constellations demonstrate successful implementation of all 4 ESD areas. Smallsat/cubesat constellation approach holds promise as part of a broad mission portfolio. The Smallsat budget is small relative to the total Flight budget.

- b) In-Space Validation of Earth Science Technologies (InVEST): on-orbit *CubeSat-based* technology validation and risk reduction that could not otherwise be fully tested using ground/airborne systems. Competitively selected, 3-year solicitation cadence, ~10 projects selected to date, frequent launch opportunities using NASA CubeSat Launch Initiative (CSLI) and Venture Class Launch Services (VCLS).

Finding: ESS supports the continued effort of ESD Technology for advancing miniaturization of instruments and satellite components. In addition, ESS supports continued efforts to improve instrument technologies to create more affordable options, to refine risk, and to facilitate faster mission development.

4. Small Satellite Constellation Initiative (SSCI)

Data buy: *If appropriated*, data buys of Earth-relevant data and information products from private sector and derived from small-satellite *constellations*; for evaluation by NASA researchers to determine value for advancing the ESD mission.

Finding: ESS finds this a cost-efficient strategy for advancing NASA Earth Science.

5. Venture Class Launch Services (VCLS): Joint program between ESD and NASA Launch Services to invest in new, low-cost (< \$15M/launch), commercial launch vehicles capable of orbiting small payloads to LEO – science control of launch schedule and orbits. Enables launches for small sats/CubeSats; develops flexible, affordable launch options; promotes evolution of the market. There are currently three selectees.

Finding: ESS recognizes that developing lower cost launch alternatives with VCLS will increase the opportunities of the ESD to put new research payloads into space.

6. Satellite Needs Working Group (SNWG): A USGEO working group through which multiple federal agencies are involved in discussions aimed at identifying satellite-based observation needs that ESD might be able to *efficiently* address.

Recommendation: ESS recommends continuing this interagency dialog on a regular basis as a means to better understand and respond to relevant space-based needs from the other agencies.

7. CubeSat Launch Initiative: CSLI provides launch opportunities to US educational institutions, non-profit organizations, and NASA Centers who build small satellite payloads that fly as auxiliary payloads on previously planned launches or commercial missions or as International Space Station deployments. "CubeSat 101" is a set of instructions for creating a CubeSat mission.

Finding: Diverse groups have already been active participants in CSLI and the interactions with universities are excellent. CSLI is run by HEO but ESS benefits from CSLI and has made focused contributions.

8. ESS GPRA report: Purpose of the report is to provide sufficient material to the ESS to perform an external review of science accomplishments of the research program; focus is on key science findings and accomplishments. Current report is ~100 pp., is published online. ESD distills this into a summary report which ultimately goes to Congress.

Finding: The Congressionally required GPRA report is valuable as a review and assessment document.

Recommendation: ESS suggests a new template with focus on a) key findings/accomplishments; b) explanation with regard to the ESD research performance indicators. ESS recommends that GPRA section authors hold initial fact-finding telecons with selected ESS members relevant to each focus area as text is drafted. The assembled draft will then be presented to the ESS for formal review.

9. ESS heard a presentation on a framework for formulating the socio-economic value of improved Earth observations from space. The framework was presented using the example of the cost of improved observations of Earth radiation balance relative to the cost of socio-economic impacts. Deferred impacts and immediate costs need to be considered in the framework. Applied Sciences has issued a contract with Resources For the Future to develop a consortium to assess the socio-economic values of Earth observations from space.

Finding: ESS supports efforts to better assess socio-economic implications of improved Earth observations from space. Related to this topic, ESS supports efforts to improve integration between Applied Sciences and Research, and the creation of the consortium to assess socio-economic values of improved Earth observations from space.

As reported above, the ESS will be dissolved at the end of January 2017, and be replaced by the Earth Sciences Advisory Committee (ESAC), a Chartered FACA Committee.

Sincerely,

A handwritten signature in blue ink, appearing to read "Steven W. Running". The signature is fluid and cursive, with a long horizontal stroke at the end.

The Earth Science Subcommittee
Steven W. Running, Chair