NASA Advisory Council
National Aeronautics and Space Administration
Washington, DC 20546

Dr. Steven W. Squyres, Chair

August 4, 2014

Mr. Charles F. Bolden, Jr.
Administrator
National Aeronautics and Space Administration
Washington, DC 20546

Dear Administrator Bolden:

The NASA Advisory Council held its second public meeting of 2014 at NASA Langley Research Center in Hampton, Virginia, July 30-31, 2014. We appreciated very much the time you spent with the Council and its five Committees earlier in the week as part of our annual all-hands meeting.

As a result of our deliberations, and in accordance with our "two-tier" approach for transmitting recommendations and findings to the NASA leadership, the Council approved four Council recommendations and one Council finding for your consideration (enclosed). The Council also approved three Committee findings for consideration by the respective NASA Associate Administrators. Copies of the latter also are enclosed for your information and awareness.

If you have any questions or wish to discuss further, please contact me.

Sincerely,

Steven W. Squyres
Chair

Enclosures

NASA Advisory Council Finding

NASA Human Exploration Strategy

Name of Committee:	Human Exploration and Operations Committee
Chair of Committee:	Mr. Kenneth Bowersox
Date of Council Public Deliberation:	July 31, 2014
Short Title of Finding:	NASA Human Exploration Strategy

Finding: The Council has serious concerns with important aspects of NASA's human exploration plans, and has provided three specific recommendations to address those concerns. However, the Council would also like to endorse the following aspects of NASA's current approach to Human Exploration as presented by the Human Exploration and Operations Mission Directorate (HEOMD) Deputy Associate Administrator at the July 30, 2014 meeting of the Council:

- Mars as a horizon goal for human space exploration.
- Intermediate missions to cis-lunar space that will allow development of systems that can later be used for more distant exploration of the solar system.
- An approach that emphasizes affordability and allows re-use of system components.
- Early investment in enabling technologies.
- Involvement of external partners to reduce the total amount of U.S. Government funding.

NASA Advisory Council Recommendation

Mismatch Between NASA's Aspirations for Human Space Flight and Its Budget
2014-02-01 (Council-01)

Name of Committee:	NASA Advisory Council
Chair of Committee:	Dr. Steven Squyres
Date of Council Public Deliberation:	July 31, 2014
Short Title of Recommendation:	Mismatch Between NASA's Aspirations for Human Spaceflight and Its Budget

Recommendation: The mismatch between NASA's aspirations for human spaceflight and its budget for human spaceflight is the most serious problem facing the Agency. NASA should carefully consider what steps would have to be taken in the years ahead in order to meet the national goal of sending humans to Mars in the 2030s with a realistic budget. The Agency should be prepared to articulate these steps publicly.

Using the best available information for Humans to Mars selected from the past 40+ years of studies, NASA should identify the "minimum path" of only those technologies and capabilities absolutely required, and perform internal and independent cost estimates of this minimum path. The result should be compared to a notional 25-year budget that only grows with inflation. The resultant shortfall should be used to address what combination of budget increase, added partnerships, and/or adjustments to NASA portfolio scope would be necessary to attain the goal.

Addressing this important issue will be an ongoing process. We request that the Agency brief us regarding the implementation of this recommendation at our next meeting, and at subsequent ones.

Major Reasons for Proposing the Recommendation: The Council agrees with the recent NRC report on pathways for human exploration[1] that sending humans to Mars is an appropriate "horizon goal" for NASA. We also agree with the report's conclusion that a budget that does not grow above inflation will never allow that horizon goal to be achieved. The only ways to address this mismatch are to: (1) increase the NASA budget over projections; (2) adjust NASA's portfolio of activities; (3) offset costs with new efficiencies and/or contributions by outside partners; or (4) adopt a different horizon goal for the Agency.

Consequences of No Action on the Proposed Recommendation: If this fundamental mismatch is not addressed in a serious way, the Agency runs the risk of squandering precious national resources on a laudable but unachievable goal.

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[1] *Pathways to Exploration – Rationales and Approaches for a U.S. Program of Human Space Exploration, National Research Council, 2014.*

NASA Advisory Council Recommendation

Asteroid Redirect Mission
2014-02-02 (Council-02)

Name of Committee:	NASA Advisory Council
Chair of Committee:	Dr. Steven Squyres
Date of Council Public Deliberation:	July 31, 2014
Short Title of Recommendation:	Asteroid Redirect Mission

Recommendation: The Council recommends that NASA should conduct an independent cost and technical assessment of the Asteroid Redirect Mission (ARM). NASA should state clearly in advance what the cost and technical criteria are for implementing the mission. These criteria should include affordability within currently projected budgets. The independent assessment should be performed before the downselect between Options A and B. The possible outcomes of this process are: fly Option A, fly Option B, or (if the projected cost is unacceptable) fly neither.

Major Reasons for Proposing the Recommendation: NASA's current Asteroid Initiative has three elements: (1) the search for and identification of Near Earth Asteroid (NEA) targets; (2) redirection of one NEA target to near-lunar orbit; (3) astronaut crew to cis-lunar space to rendezvous with the target and conduct operations. The cost of the second element (asteroid redirect, e.g., ARM) is poorly defined at present. The other elements of the Asteroid Initiative (target search and flights to cis-lunar space) still have merit even if the redirect mission does not take place. It must also be noted that ARM is not a substitute for a mission to an asteroid in its native orbit, which appears to be possible at a lower launch energy than previously believed based on recent data[2-4]. Such a long duration deep space mission would be a logical step toward the horizon goal of humans to Mars. We have concerns that the ARM mission as currently defined may pose an unacceptable cost and technical risk. A prudent response to such concerns is to conduct and independent cost and technical assessment prior to selection.

Consequences of No Action on the Proposed Recommendation: A mission of significant cost and technical risk may be implemented without a full understanding of the potential for significant cost overrun or schedule slip.

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[2] *NHATS: Near-Earth Object Human Space Flight Accessible Targets Study.* http://neo.jpl.nasa.gov/nhats/

[3] *Barbee, B. (2014). NASA Small Bodies Assessment Group (SBAG) Science Nuggets.* http://www.lpi.usra.edu/sbag/science/NHATS_Accessible_NEAs_Summary.png

[4] *Barbee, B., Abell, P.A., Adamoc, D.A., Alberdinga, C.M., Mazanek, D.D., Johnson, L.N., Yeomans, D.Y., Chodas, P.W., Chamberlin, A.B., Friedenseng, V.P. (2013). "The Near-Earth Object Human Space Flight Accessible Targets Study: An Ongoing Effort to Identify Near-Earth Asteroid Destinations for Human Explorers." Planetary Defense Conference 2013 IAA-PDC13-04-13.*

NASA Advisory Council Recommendation

Minimum Space Launch System (SLS) Flight Rate
2014-02-03 (HEOC-01)

Name of Committee:	Human Exploration and Operations Committee
Chair of Committee:	Mr. Kenneth Bowersox
Date of Council Public Deliberation:	July 31, 2014
Short Title of Recommendation:	Minimum Space Launch System (SLS) Flight Rate

Recommendation: The Council recommends that NASA conduct a trade study to determine a minimum launch rate for SLS with respect to cost, safety, mission success and performance.

Major Reasons for Proposing the Recommendation: Current Agency plans for SLS show a flight rate of one mission every other year, while preliminary mission planning for future exploration missions shows that a much higher launch rate may be necessary for mission success. The experience of many members of the Council would suggest that the currently planned launch rate is less than optimal for maintenance of the supplier base, and the ability of the engineering, production, launch and operations teams to make appropriate risk decisions in a timely fashion.

Consequences of No Action on the Proposed Recommendation: Increased likelihood that SLS will be unable to meet its exploration objectives due to cost, safety or mission success issues.

NASA Advisory Council Recommendation

Technology Infusion in Small to Medium Class Science Missions
2014-02-04 (TIEC-01)

Name of Committee:	Technology, Innovation and Engineering Committee
Chair of Committee:	Dr. William Ballhaus
Date of Council Public Deliberation:	July 31, 2014
Short Title of Recommendation:	Technology Infusion in Small to Medium Class Science Missions

Recommendation: The Council recommends that the Space Technology Mission Directorate (STMD) Associate Administrator and Science Mission Directorate (SMD) Associate Administrator engage with each other and their communities to determine how policies and procedures could be modified to allow the infusion of new mission-enabling and mission-enhancing technologies developed by Principal Investigators, STMD or others in small to medium class missions. Once appropriate policies and procedures have been defined, formulate an implementation plan that assures that the selection decision process is consistent with those policies and procedures.

Major Reasons for the Recommendation: In highly competitive program solicitations, such as Discovery and Explorer, there is a disincentive to propose new technology because of the perceived risk. As a result, NASA may be missing an opportunity to leverage scientifically beneficial technology through small and medium science missions. In the long-term, this could erode NASA's scientific and technical capabilities. If the Agency wants to encourage and infuse appropriate new technologies in its small and medium class missions, it must develop a policy that provides a pathway to the inclusion of these technologies in the solicitation release.

Consequences of No Action on the Recommendation: Erosion of NASA's science and technical capabilities.

NASA Advisory Council – Committee Finding

Aeronautics Committee Finding
to NASA Associate Administrator for Aeronautics Research
Mission Directorate

Advanced Composites Project

Name of Committee:	Aeronautics Committee
Chair of Committee:	Ms. Marion Blakey
Date of Council Public Deliberation:	July 31, 2014
Short Title of Finding:	Advanced Composites Project

Finding: The Committee believes the Advanced Composites Project is a particularly high value initiative and endorses the approach that the NASA Aeronautics Research Mission Directorate (ARMD) is taking to establish a management and technical plan. The Committee feels that the research goal of reducing the development and certification timeline of composites is an important one that, if successful, will provide benefits to both the aerospace industry and the National economy. The Committee recognizes that there are challenges implementing the collaboration aspects of the project (other government agencies – Federal Aviation Administration and Department of Defense, academia, industry, and the consortium implementation) that breaks new ground but find that the approach by ARMD is well thought out. The Committee looks forward to continuing to work with ARMD to provide guidance and advice as the project continues to develop.

NASA Advisory Council – Committee Finding

Science Committee Finding
to NASA Associate Administrator for Science
Mission Directorate

James Webb Space Telescope (JWST) Funding Wedge

Name of Committee:	Science Committee
Chair of Committee:	Dr. David McComas
Date of Council Public Deliberation:	July 31, 2014
Short Title of Finding:	James Webb Space Telescope (JWST) Funding Wedge

Finding: The Science Committee encourages the Science Mission Directorate (SMD) Associate Administrator to review the history and evolution of the JWST funding wedge within SMD. The Science Committee believes it would be valuable to SMD to assess the relative contributions toward JWST from all of its divisions and their impacts to developing a Directorate-wide science strategy the optimizes post-JWST SMD science within the available resources, taking into account the relevant decadal surveys and a balanced portfolio.

NASA Advisory Council – Committee Finding

Science Committee Finding
to NASA Associate Administrator for Science
Mission Directorate

Science Mission Directorate (SMD) Education and Communications

Name of Committee:	Science Committee
Chair of Committee:	Dr. David McComas
Date of Council Public Deliberation:	July 31, 2014
Short Title of Finding:	Science Mission Directorate (SMD) Education and Communications

Finding: The Science Committee commends SMD for the establishment of the new Education and Communications group within the SMD front office. The Science Committee continues to stress the absolute criticality of such activities as part of the ongoing work of Earth and space sciences at NASA. We look forward to tracking progress in this area, and in particular, learning how the program maintains a diversity of size of education and communications programs and how they couple with mission scientists, engineers and others.