

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

*Dr. Steven W. Squyres, Chair*

April 16, 2015

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 2015 at NASA Headquarters in Washington, DC, April 9-10, 2015.

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 five Council findings and three Council recommendations 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,

A handwritten signature in black ink, appearing to read 'S. Squyres', with a long horizontal line extending to the right.

Steven W. Squyres  
Chair

Enclosures

## NASA Advisory Council Finding

### Asteroid Redirect Mission and Solar Electric Propulsion

**Name of Committee:** NASA Advisory Council

**Chair of Committee:** Dr. Steven Squyres

**Date of Council Public Deliberation:** April 9-10, 2015

**Short Title of Finding:** Asteroid Redirect Mission and Solar Electric Propulsion

**Finding:** High-performance solar electric propulsion (SEP) will likely be an important part of an architecture to send humans to Mars. NASA's current plan is to demonstrate a large SEP stage by using it to maneuver a boulder that has been lifted from the surface of a small asteroid, and to move the boulder to cis-lunar space.

Maneuvering a large test mass is not necessary to provide a valid in-space test of a new SEP stage. We therefore find that a SEP mission will contribute more directly to the goal of sending humans to Mars if the mission is focused entirely on development and validation of the SEP stage. We also find that other possible motivations for acquiring and maneuvering a boulder (e.g., asteroid science, planetary defense) do not have value commensurate with their probable cost.

Instead of relocating a boulder from an asteroid, we suggest that a more important and exciting first use of this new SEP stage would be a round trip mission to Mars, flying it to Mars orbit and then back to the Earth-Moon system and into a distant retrograde lunar orbit.

## NASA Advisory Council Finding

### Humans to Mars and the Evolvable Mars Campaign

**Name of Committee:** NASA Advisory Council

**Chair of Committee:** Dr. Steven Squyres

**Date of Council Public Deliberation:** April 9-10, 2015

**Short Title of Finding:** Humans to Mars and the Evolvable Mars Campaign

**Finding:** The Council finds that developing an executable exploration strategy with plausible costs leading to humans on Mars in the 2030's would help NASA build the consensus necessary for such a program. In addition, creating a well articulated and costed plan will allow independent assessment of progress toward landing humans on Mars and create a framework for international and commercial partners to participate.

The horizon goal of sending humans to Mars has been well established by many studies, including the 2014 National Research Council report *Pathways to Exploration*. Several Administrations have adopted this goal. The Council finds that setting a goal is necessary but insufficient. A long term strategy and corresponding plans must also be developed. By this statement, the Council means a set of notional milestones, launches and hardware developments that are sufficiently defined so as to allow a cost assessment.

NASA has articulated their near term approach (~5 years) for development of plans to land humans on Mars with the Evolvable Mars Campaign (EMC) study. The Council is concerned that waiting to lay out the options for the longer term plan for humans on Mars will miss the current opportunity of emerging public enthusiasm and create uncertainty in decision makers as well as potential partners.

**NASA Advisory Council Finding**  
**NASA Workforce Gender Diversity**

**Name of Committee:** Technology, Innovation and Engineering Committee

**Chair of Committee:** Dr. William Ballhaus

**Date of Council Public Deliberation:** April 9, 2015

**Short Title of Finding:** NASA Workforce Gender Diversity

**Finding:** The recent Office of Chief Engineer Tech Fellows selection resulted in only 1 female out of 15 Fellows. The Council finds that a gender diversity issue extends beyond the Office of Chief Engineer Tech Fellows. There is a need for NASA to follow best practices for future selections and to determine what additional steps should be taken to effect a more gender-diverse workforce.

Supporting data:

- Out of 138 Science and Engineering ST/SL, 86% are male
- For Science and Engineering SES, 81% are male
- For Science and Engineering GS-15, 75% are male

## NASA Advisory Council Finding

### NASA Science Mission Directorate/ Human Exploration and Operations Mission Directorate Collaboration

**Name of Committee:** Science Committee/Human Exploration and Operations Committee (*joint finding*)

**Chair of Committee:** Dr. David McComas/Mr. Kenneth Bowersox

**Date of Council Public Deliberation:** April 10, 2015

**Short Title of Finding:** NASA Science Mission Directorate/Human Exploration and Operations Mission Directorate Collaboration

**Finding:** Through the series of joint meetings that the NAC Science Committee and Human Exploration and Operations Committee have had, we have seen productive collaboration between science, engineering and operations within NASA, and also between NASA and academia. We find that this collaboration leads to broader understanding and better outcomes for both Human Exploration and Science. We see opportunity for more synergy, and encourage enhanced and more formal and informal collaboration between these organizations.

**NASA Advisory Council Finding**  
**Astronaut Insurance and Health Care**

**Name of Committee:** Science Committee

**Chair of Committee:** Dr. David McComas

**Date of Council Public Deliberation:** April 10, 2015

**Short Title of Finding:** Astronaut Insurance and Health Care

**Finding:** The NASA Advisory Council finds it unacceptable that NASA is not able to provide free life insurance for astronauts while they are in space nor lifetime health care after their service. This is through no fault of the Agency. Human spaceflight is an intrinsically risky endeavor both while in space and potentially from space-related effects long after returning to Earth. The Council believes that the Nation has a responsibility to our men and women that we send into space, and that the present arrangement that makes astronauts responsible for buying their own life insurance for space missions and health care after they retire from the Astronaut Corps is simply unacceptable and not befitting our space agency or a great nation.

## NASA Advisory Council Recommendation

### Sample Retention Requirement 2015-02-01 (SC-01)

**Name of Committee:** Science Committee

**Chair of Committee:** Dr. David McComas

**Date of Council Public Deliberation:** April 10, 2015

**Short Title of Recommendation:** Sample Retention Requirement

**Recommendation:** The Council recommends that NASA establish a requirement for retention of a large fraction (e.g., 75% has been used historically) of the samples obtained by all sample return missions, robotic and human, for future scientific studies.

**Major Reasons for Proposing the Recommendation:** This recommendation preserves precious extraterrestrial samples for future analysis by a broad spectrum of investigators using-as-to-be developed technologies. A requirement to retain 75% of samples already applies to Discovery and New Frontiers mission Announcements of Opportunity and has proved to be critical in maximizing science return. Exceptions from the policy should be justified (e.g., renewable sampling, planetary protection requirements that cannot be otherwise met, etc.).

**Consequences of No Action on the Proposed Recommendation:** Missed opportunities to apply new analytical technologies and preserve samples as baseline for future reference.

## NASA Advisory Council Recommendation

### Over-Application of Travel Restrictions 2015-02-02 (SC-02)

**Name of Committee:** Science Committee

**Chair of Committee:** Dr. David McComas

**Date of Council Public Deliberation:** April 10, 2015

**Short Title of Recommendation:** Over-Application of Travel Restrictions

**Recommendation:** The Council finds that there continues to be a major problem with travel restrictions on science contractors and recommends NASA reconsider Recommendation 2015-01-02 (SC-01) and stop including science programs funded through contracts with the travel restrictions externally mandated for Civil Servants.

**Major Reasons for Proposing the Recommendation:** NASA's decision to include Contractors in externally mandated tracking and approval of Civil Service travel is substantially harming NASA science. The effectiveness of our missions depends on dissemination of the results to other scientists and open communications at scientific meetings are absolutely essential for the scientific enterprise.

**Consequences of No Action on the Proposed Recommendation:** Significant harm to NASA science and continued additional work, higher costs, lower workforce morale and less productivity.



## NASA Advisory Council Recommendation

### Radiation Risk for Human Mars Missions 2015-02-03 (SC/HEOC-01)

**Name of Committee:** Science Committee/Human Exploration and Operations Committee (*joint recommendation*)

**Chair of Committee:** Dr. David McComas/Mr. Kenneth Bowersox

**Date of Council Public Deliberation:** April 10, 2015

**Short Title of Recommendation:** Radiation Risk for Human Mars Missions

**Recommendation:** The Council recommends that NASA openly communicate the radiation risks while proceeding with preparations to send humans to Mars in the 2030s. As part of the mission development process, NASA should continue its work to mitigate radiation risks through improved knowledge and technology. In particular, there may be additional means of investigating the full extent of the radiation problem (for example, stellar observations, geologic record, further understanding of the heliospheric environment). Synthesizing expertise from both human exploration and science is essential to achieving this goal. Furthermore, we encourage NASA to initiate a long-term medical care program for astronauts which includes long-term astronaut health monitoring to mitigate long duration exposure health consequences, and build a baseline for future long-term health and engineering decisions.

**Major Reasons for Proposing the Recommendation:** The Council's Science Committee and Human Exploration and Operations Committee were impressed by the breadth and depth of the radiation research presentations and progress being made for understanding the nature of the deep space radiation environment, its implications for human space flight and the ethical issues that arise. The overarching message was that radiation for deep space flight is indeed a serious issue to be addressed as technology and understanding evolve. It was also clear that it is not likely we can mitigate all radiation risks to fully meet current radiation health standards. Therefore, some level of risk must be accepted (mission risk and long-term astronaut health risk) within the broader context of all risks associated with a mission to Mars. Because knowledge of key components continues to move forward, it is difficult to quantify the overall risk. For example, it is not clear how accurately we can define mission risk and long-term astronaut health risk based on our current understanding of heliophysics and human biology. Still, based on current estimates of the radiation risk, sending humans to Mars seems to be reasonable at this time.

**Consequences of No Action on the Proposed Recommendation:** Accurate information regarding the Agency's planned approach to the critically important issue of radiation safety will not be adequately provided to all the relevant stakeholders.

**NASA Advisory Council – Committee Finding**

**Technology, Innovation and Engineering Committee Finding  
to NASA Associate Administrator for  
Space Technology Mission Directorate**

**Impact of Congressionally Mandated  
Small Business Innovation Research (SBIR)/  
Small Business Technology Transfer (STTR)  
Funding Increases**

**Name of Committee:** Technology, Innovation and Engineering Committee  
**Chair of Committee:** Dr. William Ballhaus  
**Date of Council Public Deliberation:** April 9, 2015  
**Short Title of Finding:** Impact of Congressionally Mandated SBIR/STTR  
Funding Increases

**Finding:** The Technology, Innovation and Engineering Committee finds that the SBIR/STTR management/budgets are consolidated and well managed in the NASA Space Technology Mission Directorate (STMD). However, as the STMD planned budget increases have not materialized, and as SBIR/STTR allocations have increased as mandated by Congress, STMD’s primary programs have been severely impacted.

Supporting data:

	<u>FY 2012</u>	<u>FY 2015</u>
Total STMD Budget	\$574M	\$596M
SBIR/STTR	\$172M	\$191M
Core Space Tech Programs	\$402M	\$405M

**NASA Advisory Council – Committee Finding**

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

**Commitment to Aviation Safety Research**

**Name of Committee:** Aeronautics Committee

**Chair of Committee:** Mr. John Borghese, Vice Chair  
*(for Ms. Marion Blakey, Chair)*

**Date of Council Public Deliberation:** April 9, 2015

**Short Title of Finding:** Commitment to Aviation Safety Research

**Finding:** The Aeronautics Committee endorses the approach that the NASA Aeronautics Research Mission Directorate (ARMD) has taken to maintain its commitment to Aviation Safety research even though it will no longer exist as a standalone program in the current organization structure. The Committee finds that ARMD has taken a thoughtful approach to embed Aviation Safety research across the other programs, and has maintained those areas especially critical to national needs, such as research in verification and validation.

**NASA Advisory Council – Committee Finding**

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

**NASA Aeronautics Research Mission Directorate (ARMD)  
Strategic Implementation Plan**

**Name of Committee:** Aeronautics Committee

**Chair of Committee:** Mr. John Borghese, Vice Chair  
*(for Ms. Marion Blakey, Chair)*

**Date of Council Public Deliberation:** April 9, 2015

**Short Title of Finding:** NASA ARMD Strategic Implementation Plan

**Finding:** The Aeronautics Committee strongly supports the strategic approach toward research portfolio management that ARMD has put in place and as reflected by the ARMD Strategic Implementation Plan (SIP). The Committee finds that the SIP is extremely well thought out and forward leaning, and will enable ARMD to approach research portfolio management in a more comprehensive and deliberate manner. In particular, the Committee feels that the SIP addresses the broad range of research efforts in the ARMD portfolio in a balanced manner, including both fundamental and integrated research such as rotorcraft and supersonic aircraft.