

NASA ADVISORY COUNCIL  
National Aeronautics and Space Administration  
Washington, DC 20546  
Hon. Harrison H. Schmitt, Chairman

January 18, 2008

The Honorable Michael D. Griffin  
Administrator  
National Aeronautics and Space Administration  
Washington, DC 20546

Dear Dr. Griffin:

Attached please find the NASA Advisory Council recommendations agreed to in a public meeting on October 18, 2007 held in Langley, VA. Prior to the meeting, members received a tour of the Langley Research Center and also used Center facilities to hold fact-finding meetings. Ms. Lesa Roe and her staff should be commended for their hospitality and hard work. The enclosed recommendations include two from the Aeronautics Committee, one from the Human Capital Committee and three each from the Science and Space Operations Committees. The Council had a very productive meeting with many recommendations we believe will be of assistance as NASA continues its implementation efforts of the Vision for Space Exploration.

A summary of each recommendation is below with background for each enclosed.

Aeronautics Committee

- 1) **Flight Data Collection on Remaining Shuttle Orbiter Missions:** The Aeronautics and Space Operations Committees recommend that NASA approve the use of the remaining shuttle orbiter flights to collect relevant flight data to make in-flight determinations of flow field and boundary layer transitions that would be applicable to the general field of high hypersonic aerodynamics.
- 2) **ARMD Analysis of Critical Path ESMD EDL Needs:** Recommend that NASA's Aeronautics Research Mission Directorate (ARMD) ensures that it is pursuing entry, descent and landing (EDL) activities that are on the critical path for NASA's Vision for Space Exploration.

Human Capital

- 1) **Provide Matching Funding for Scholarships:** Provide matching funding to non-profit organizations that have successful scholarship programs that encourage the academic pursuit of degrees in science, technology, engineering, and math. These programs provide NASA with an opportunity to leverage the success of existing programs.

Science

- 1) **Maintaining Cost Discipline on Missions:** Continue efforts to develop management approaches that maintain fiscal responsibility from the formulation of missions thru their development and launch.
- 2) **Re-examine the "Scientist Astronaut" Designation for Lunar Exploration:** It is recommended that NASA re-examine the methods used in prior Scientist-Astronaut selections, improve where possible (but retain the designation previously used) and fully incorporate those selected with other Pilot-Astronauts any Mission Specialists in the Astronaut Office cadre.
- 3) **Creation of a Small Bodies Analysis Group:** Recommend that the Administrator approve the formation of a Small Bodies Assessment Group under the Planetary Sciences Subcommittee.

Space Operations

- 1) **Early Investment in Technologies for Stabilizing the Lunar Regolith:** Apollo experience has shown the serious impact of dust on lunar surface systems and disturbance of local soils by EVA and rover traffic. Constellation planners should investigate and make an early investment in technologies for stabilizing the lunar regolith on surfaces such as landing zones, outpost roads, habitat areas, work sites, etc.
- 2) **Plan for a Robust Supply Capability in Support of the Lunar Outpost:** In light of the looming ISS logistics shortfall (due to shuttle retirement), the Constellation program should plan for a robust supply capability in support of the lunar outpost.
- 3) **Ensure a Competitive Commercial ISS Cargo Delivery Capability:** With shuttle retirement less than three years away, NASA should pursue aggressively all alternatives to ensure a competitive commercial ISS cargo delivery capability and increase the probability of success of the COTS program.

If there are any questions on these recommendations, please contact me.

Best Regards,



Harrison H. Schmitt  
Chairman  
Enclosures

**NASA Advisory Council**  
Council Recommendation  
[Tracking Number A-07-01](#)

Committee Name:           Aeronautics Committee  
Chair:                       General Lester L. Lyles, USAF (Retired)  
Date of Public Deliberation:   October 18, 2007  
Date of Transmission:       January 18, 2008

Short title of the proposed recommendation

Flight data collection on remaining shuttle orbiter missions

Short description of the proposed recommendation

The Aeronautics and Space Operations Committees recommend that NASA approve the use of the remaining shuttle orbiter flights to collect relevant flight data to make in-flight determinations of flow field and boundary layer transitions that would be applicable to the general field of high hypersonic aerodynamics.

Major reasons for proposing the recommendation

Individuals in the aeronautics and space community have raised concerns over the difficulty in prediction of flow field and boundary layer transition around entry vehicles at hypersonic speeds both in Earth and Mars atmospheres. This results in uncertainties in lift drag ratios, trim angle of attack, and aerothermodynamic characteristics and heat flux profiles. The shuttle orbiter flies through a substantial part of these difficult flight regimes, however, there is a short window of opportunity with which data can be gathered from the remaining flights, and once this window is closed, this opportunity will be lost.

Consequences of no action on the proposed recommendation

Continued difficulty in prediction of flow field and boundary layer transition around entry vehicles at hypersonic speeds in various atmospheres and added risk for future missions.

**NASA Advisory Council**  
Council Recommendation  
Tracking Number A-07-02

Committee Name: Aeronautics Committee  
Chair: General Lester L. Lyles, USAF (Retired)  
Date of Public Deliberation: October 18, 2007  
Date of Transmission: January 18, 2008

Short title of the proposed recommendation  
ARMD analysis of critical path ESMD EDL needs

Short description of the proposed recommendation  
The Aeronautics Committee recommends that NASA's Aeronautics Research Mission Directorate (ARMD) ensures that it is pursuing entry, descent and landing (EDL) activities that are on the critical path for NASA's Vision for Space Exploration.

Major reasons for proposing the recommendation  
At the last meeting, the Committee was briefed on numerous activities within ARMD's portfolio that are in support of the efforts of NASA's Exploration Systems Mission Directorate. The Committee would like to ensure that ARMD is putting emphasis on its EDL activities that are on the critical path for NASA's future space exploration missions.

Consequences of no action on the proposed recommendation  
Some ARMD EDL activities deemed critical by ESMD are not pursued or are given lower priority to other activities not on the critical path.

**NASA Advisory Council**  
Council Recommendation  
[Tracking Number HC-07-01](#)

Committee name: Human Capital Committee

Chair: Dr. Gerald L. Kulcinski

Date of Public Deliberation: October 18, 2007

Date of Transmission: January 18, 2008

Short title of the recommendation

Provide matching funding for scholarships.

Short description of the recommendation

Provide matching funding to non-profit organizations that have successful scholarship programs that encourage the academic pursuit of degrees in science, technology, engineering, and math (STEM). These programs provide NASA with an opportunity to leverage the success of existing programs.

Major reasons for the recommendation

There are a number of non-profit organizations that have been awarding scholarships to high achieving undergraduate and graduate students pursuing careers in STEM with remarkable success over time. These students will help meet NASA's future workforce needs.

Consequences of no action on the recommendation

Failure to match funding for existing scholarship programs will be a missed opportunity to leverage the success of existing programs which could impact the availability of new hires to meet the needs of NASA's future workforce.

NASA Advisory Council  
Council Recommendation  
[Tracking Number S-07-04](#)

Committee Name: Science Committee

Chair: Dr. Ed David

Date of Public Deliberation: October 18, 2007

Date of Transmission: January 18, 2008

Short title of the proposed recommendation:

Maintaining Cost Discipline on Missions

Short description of the proposed recommendation:

Continue efforts to develop management approaches that maintain fiscal responsibility from the formulation of missions thru their development and launch.

Take necessary actions throughout mission development to assure that projects maintain a proper balance between requirements and funding, including proper reserves.

Report to the Science Committee on the efforts to maintain fiscal discipline, including studies to identify the drivers responsible for cost growth.

Major reasons for proposing the recommendation:

Over the past five years, cost increases on NASA science missions totaled over \$5 billion. This translates into fewer missions now in formulation and development, and partially accounts for the “trough” in mission launches in the 2010 time frame.

Consequences of no action on the proposed recommendation:

The science community and the nation is depending on NASA to conduct a broad range of exciting new missions in space, as defined and prioritized in National Research Council decadal surveys. Without rigorous cost discipline, programs now in development will squeeze down opportunities for new missions to begin.

NASA Advisory Council  
Council Recommendation  
Tracking Number S-07-05

Committee Name: Science Committee

Chair: Dr. Ed David

Date of Public Deliberation: October 18, 2007

Date of Transmission: January 18, 2008

Short title of proposed recommendation:

Re-examine the “Scientist Astronaut” designation for lunar exploration

Short description of proposed recommendation:

It is recommended that NASA re-examine the methods used in prior Scientist-Astronaut selections, improve where possible (but retain the designation previously used) and fully incorporate those selected with other Pilot-Astronauts any Mission Specialists in the Astronaut Office cadre.

Major reasons for proposing the recommendation

Background: Some four decades ago, the special skills possessed by some NASA applicants for space flight were recognized in their selection as Scientist-Astronauts. Only two groups were selected in this category, in 1965 and 1967. They made very notable contributions to NASA programs in the Apollo, Skylab, and Shuttle programs on many flights.

The breadth of their backgrounds in a number of scientific disciplines and their commitment to the highest quality of research has been often recognized by their fellow astronauts whose background may have been in piloting, test flight, and other operational areas. The working relationship and mutual respect between these disciplines has been a valuable asset to several flight programs.

Consequences of no action on the proposed recommendation

Selection of astronaut candidates will not match the plan for use of the majority of crew time on the Moon for science and exploration activities.

NASA Advisory Council  
Council Recommendation  
[Tracking Number S-07-06](#)

Committee Name: Science Committee

Chair: Dr. Ed David

Date of Public Deliberation: October 18, 2007

Date of Transmission: January 18, 2008

Short title of the proposed recommendation  
Creation of a Small Bodies Analysis Group

Short description of the proposed recommendation

The Science Committee recommends that the Administrator approve the formation of a Small Bodies Assessment Group under the Planetary Sciences Subcommittee.

Major reasons for proposing the recommendation

There is a large community of space scientists who focus their research on the smaller bodies of the solar system, including asteroids, comets, meteorites and their parent bodies, dust particles, irregular satellites, Trojans, Centaurs, and Trans-Neptunian Objects (TNOs). The interests of this community have been represented, to date, by the Outer Planets Assessment Group (OPAG); however, the interests of OPAG focus on the giant planets and their major satellites. Comparatively few representatives of the small-bodies research community have participated in OPAG deliberations.

Representing a self-organized steering committee, PSS member Hal Weaver presented a proposal for adding a Small Bodies Assessment Group (SBAG) to the mix of analysis and assessment groups that provide input to the Planetary Sciences Subcommittee and, through PSS, to the NAC. The scope of SBAG would encompass all small bodies that orbit the Sun, as well as meteorites, dust, and the irregular satellites (including Phobos and Deimos). Following NAC and NASA approval of an SBAG, a Small Bodies Workshop will be planned to develop an organizational structure, to draft an outline for a white paper laying out a strategy for the exploration of small solar-system bodies, and developing a community web site. Establishment of an SBAG will ensure the full participation in NASA planning of the solar-system small-bodies community.

Consequences of no action on the proposed recommendation

Lack of an assessment group focused on the solar system's small bodies precludes organized and full participation in NASA planning processes of the subset of the space science community that is engaged in the exploration of small bodies in the solar system.

**NASA Advisory Council**  
Council Recommendation  
[Tracking Number SO-07-01](#)

Committee Chair: Space Operations Committee

Chair: Dr. Paul Robinson

Date of Public Deliberation: October 18, 2007

Date of Transmission: January 18, 2008

Short title of the proposed recommendation

Early Investment in Technologies for Stabilizing the Lunar Regolith

Short description of the proposed recommendation:

Apollo experience has shown the serious impact of dust on lunar surface systems and disturbance of local soils by EVA and rover traffic. Constellation planners should investigate and make an early investment in technologies for stabilizing the lunar regolith on surfaces such as landing zones, outpost roads, habitat areas, work sites, etc.

Major reasons for proposing the recommendation:

Lunar dust will be a major engineering challenge for lunar explorers and outpost designers. At the Apollo landing sites, just three days of foot traffic stirred up the local regolith to a depth of ~ 10 cm or more, and this situation would be exacerbated by vehicle and extended EVA operations at an outpost. Loosened regolith and dust would present a constant contamination and abrasion hazard in the high traffic areas around the outpost.

Technology investment should begin now to develop technologies that can stabilize the regolith in high-traffic areas. These might include microwave paving technologies, regolith sorting and mechanical compaction, and new concepts. Explorers should arrive back on the Moon with tools and techniques in hand that can produce a stabilized surface that creates minimal dust when traversed by crewmembers and vehicles.

Benefits will include longer-lived spacesuit systems, vehicles, deployed equipment, and reduced introduction of dust into the airlock and habitat areas, with improvements to the living environment for the crew.

**NASA Advisory Council**  
Council Recommendation  
[Tracking Number SO-07-02](#)

Committee Chair: Space Operations Committee

Chair: Dr. Paul Robinson

Date of Public Deliberation: October 18, 2007

Date of Transmission: January 18, 2008

Short title of the proposed recommendation

Plan for a Robust Supply Capability in Support of the Lunar Outpost.

Short description of the proposed recommendation:

In light of the looming ISS logistics shortfall (due to shuttle retirement), the Constellation program should plan for a robust supply capability in support of the lunar outpost. That logistics capability might include:

- Design lander hardware for dual use, reuse or recycling (e.g. habitable fuel tanks)
- [Early use of in-situ resource utilization to reduce long-term resupply requirements](#)
- Upgrade of ISS-derived regenerative life support systems
- Innovative, bio-regenerative life support systems (greenhouse, etc)
- International partner and commercial logistics delivery capability

Major reasons for proposing the recommendation:

Between 2010 and 2015, cargo shipments to ISS will fall 54 metric tons short of projected requirements. Cargo vehicles from Russia, ESA, and Japan will not be able to solve the logistics shortfall. Unproven commercial services are the only short-term solution on the horizon.

Given the projected investment in a lunar outpost and its existence for a decade or more, cargo delivery capability will be critical for safe and efficient operation. Planned Constellation transportation systems will rely on the Ares V or other government vehicles, with the usual limitations. A launch or landing accident, for example, could shut down cargo shipments for a year or more, forcing abandonment of the outpost or sharply curtailed operations.

Each pound of mass delivered to the Moon requires 125 pounds of propellant and hardware to be launched from Earth. NASA should take a multi-pronged approach to reducing supply requirements and creating a robust cargo supply line to the Moon. Cargo requirements may be reduced by dual-use designs, converting fuel tanks, for example, to habitable crew space. Consumable demands may be reduced sharply over the long term by using lunar-derived water and oxygen; early use of lunar resources will effect the maximum reduction on supply demands. Regenerative life support systems, derived from ISS experience, will further reduce consumable requirements. Early introduction of bio-regenerative systems, like a greenhouse, will reduce oxygen, water, food, and waste-disposal requirements at the base. In-situ resource use, even at small throughput levels, and closed loop life support are essential at outpost inception to reduce expensive logistic requirements.

With establishment of the outpost, NASA should also plan to have operational a commercial cargo delivery capability, and encourage international partners to develop their own transportation and lander systems. Alternatives will lower costs and lower the likelihood that a single systems failure will cut off the outpost from critical supplies.

**NASA Advisory Council**  
Council Recommendation  
[Tracking Number SO-07-03](#)

Committee Chair: Space Operations Committee

Chair: Dr. Paul Robinson

Date of Public Deliberation: October 18, 2007

Date of Transmission: January 18, 2008

Short title of the proposed recommendation

Ensure a Competitive Commercial ISS Cargo Delivery Capability.

Short description of the proposed recommendation:

With shuttle retirement less than three years away, NASA should pursue aggressively all alternatives to ensure a competitive commercial ISS cargo delivery capability and increase the probability of success of the COTS program.

Major reasons for proposing the recommendation:

One of the two commercial firms receiving NASA seed money for the Commercial Orbital Transportation Services program has withdrawn. NASA should immediately reprogram the remaining funds to develop other commercial cargo providers. Competitive development will maximize the chances that at least one commercial provider will be able to deliver ISS cargo following shuttle retirement in 2010. This COTS capability is essential for continued operation of the ISS.