

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

General Lester L. Lyles (USAF, Ret.), Chair

December 18, 2018

Mr. James F. Bridenstine
Administrator
National Aeronautics and Space Administration
Washington, DC 20546

Dear Administrator Bridenstine:

The NASA Advisory Council held its third public meeting of 2018 at NASA Headquarters, Washington, DC, on December 10-11, 2018.

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 recommendations and four Council findings for your consideration (enclosed). The Council also approved six Committee findings for consideration by the NASA Associate Administrators. Copies of the latter also are enclosed for your information and awareness. If you have any questions or wish to discuss this further, please do not hesitate to contact me.

I look forward to discussing these recommendations and findings with you in the future.

Sincerely,



Happy Holidays!

General Lester L. Lyles (USAF, Ret.)
Chair

Enclosures

NASA Advisory Council Recommendation

Export Control Reform – Extending International Space Station Export Control Relief

Name of Committee:	Regulatory and Policy Committee
Chair of Committee:	Mr. Michael Gold
Date of Council Public Deliberation:	December 10-11, 2018
Short Title of Recommendation:	Export Control Reform – Extending International Space Station Export Control Relief

Recommendation:

NASA should make it a priority to lead an effort in collaboration with the Department of State and the Department of Commerce to expand the exceptions to the U.S. Munitions List (USML) and special provisions within the Commerce Control List (CCL) provided to the International Space Station (ISS) to explicitly include the Lunar Gateway, commercial habitats within the ISS program, NASA-led missions, and private sector platforms, regardless of location, including suborbital, orbital, cislunar, and deep space, which would benefit from the same relief from export control provisions that the ISS enjoys.

Major Reasons for the Recommendation:

This recommendation will avoid problematic export controls on habitats attached to the ISS, commercial space station(s), the Lunar Gateway, and other NASA missions. Such relief will bolster investment in and the safe operation of future space systems.

Consequences of No Action on the Recommendation:

Failure to act on the recommendation could have a chilling effect on investors otherwise willing to back commercial space activities and would hinder the operations and safety of Gateway and other future NASA missions.

NASA Advisory Council Recommendation

Export Control Reform – Avoiding Unilateral Export Controls in Support of Space Policy Directive 2 and the 2018 National Defense Authorization Control Act

Name of Committee:	Regulatory and Policy Committee
Chair of Committee:	Mr. Michael Gold
Date of Council Public Deliberation:	December 10-11, 2018
Short Title of Recommendation:	Export Control Reform – Avoiding Unilateral Export Controls in Support of Space Policy Directive 2 and the 2018 National Defense Authorization Control Act

Recommendation:

Per the 2018 National Defense Authorization Act ^[1], when asked to review export control licenses or Commodity Jurisdiction Requests, NASA should strive to avoid unilateral controls whenever possible.

Major Reasons for the Recommendation:

Unilateral export controls hurt both the economy and national security. Per Space Policy Directive 2 (SPD 2), NASA should eliminate counterproductive regulatory burdens. Moreover, the 2018 National Defense Authorization Act requires that the application of unilateral controls should be limited to protecting specific national security and foreign policy interests.

Consequences of No Action on the Recommendation:

Failing to act on this recommendation will perpetuate obsolete export control policies that will raise NASA's costs while reducing the Agency's capabilities.

^[1] *Export Control Reform Act as P.L. 115-232 §1752(6): "Export controls applied unilaterally to items widely available from foreign sources generally are less effective in preventing end-users from acquiring those items. Application of unilateral export controls should be limited for purposes of protecting specific United States national security and foreign policy interests."*

NASA Advisory Council Recommendation

COSPAR

Name of Committee: Regulatory and Policy Committee

Chair of Committee: Mr. Michael Gold

Date of Council Public Deliberation: December 10-11, 2018

Short Title of Recommendation: COSPAR

Recommendation:

NASA should establish a multi-disciplinary task force of experts from industry, the scientific community, and relevant government agencies, to develop U.S. policies that properly balance the legitimate need to protect against the harmful contamination of the Earth or other celestial bodies with the scientific, social, and economic benefits of public and private space missions. The recommended multi-disciplinary task force should be tasked with producing a detailed policy, provided to a joint session of the NAC Regulatory and Policy Committee, the Science Committee, and the Human Exploration and Operations Committee, that will describe best practices for the Administration, the science and research community, and private sector, to protect against harmful contamination and adverse changes in the environment of the Earth. The multi-disciplinary task force should also explore the use of the term 'Planetary Protection' relative to other terms utilized in the Outer Space Treaty.

Major Reasons for the Recommendation:

The COSPAR regulations are becoming obsolete and do not properly account for the possibilities of human spaceflight and private sector missions. Creating a multi-disciplinary team to craft a balanced policy that can be implemented by NASA (and eventually COSPAR itself) will help to encourage new, innovative, human spaceflight, robotic, and private sector missions to Mars and other celestial bodies. The more of these missions that take place the more science, exploration, and commerce can be conducted.

Consequences of No Action on the Recommendation:

If NASA adopts the COSPAR guidelines without any review or revisions they will have a chilling effect on robotic, human spaceflight, and private sector missions. The costs and complexity of conducting space missions will not be moderated and could become problematic. The result will be less science, exploration, and commercial activities, harming both national and global interests.

NASA Advisory Council Recommendation

Logos

Name of Committee:	Regulatory and Policy Committee
Chair of Committee:	Mr. Michael Gold
Date of Council Public Deliberation:	December 10-11, 2018
Short Title of Recommendation:	Logos

Recommendation:

The Council recommends that NASA conduct a comprehensive review of its contracts, Space Act Agreements (SAAs), and other legal vehicles to identify programs and partnerships wherein i) the contractor/partner should be permitted and encouraged to use the NASA logo in association with any publicity related to the activity, and ii) NASA should be permitted and encouraged to use the contractor's logo in association with any publicity related to the activity.

Major Reasons for the Recommendation:

The broader use of the NASA logo could help to inspire youth and STEM education. Moreover, utilizing the NASA logo on high-profile missions such as commercial crew and cargo will increase awareness of NASA's activities leading to enhanced visibility and public support for the Agency.

Consequences of No Action on the Recommendation:

If no action is taken NASA's role in numerous programs and public-private partnerships will remain hidden or unclear. This scenario will result in continued public confusion relative to many of the Agency's activities and a missed opportunity to leverage NASA's logo to inspire STEM education.

NASA Advisory Council Recommendation

Promotional Activities

Name of Committee:	Regulatory and Policy Committee
Chair of Committee:	Mr. Michael Gold
Date of Council Public Deliberation:	December 10-11, 2018
Short Title of Recommendation:	Promotional Activities

Recommendation:

The Council recommends that NASA examine the possible public benefits and any risks of space-based promotional activities on rockets, spacecraft, hardware, and/or modules, taking into account historical insights.

Major Reasons for the Recommendation:

NASA has an extraordinarily powerful brand and could leverage promotional activities to help inspire youth to pursue careers in STEM. Moreover, by engaging in promotional activities, NASA can leverage its 'soft power' to support U.S. interests and core values.

Consequences of No Action on the Recommendation:

If NASA does not review its policies a substantial opportunity could be lost to leverage NASA's globally recognized brand to inspire youth to pursue careers in STEM and leverage the Agency's soft power influence to benefit U.S. interests and humanitarian goals.

NASA Advisory Council Finding

Lunar Orbiting Platform

Name of Committee:	Human Exploration and Operations Committee
Chair of Committee:	Mr. Kenneth Bowersox
Date of Council Public Deliberation:	December 10-11, 2018
Short Title of Finding:	Lunar Orbiting Platform

Finding: Space Policy Directive 1 (SPD 1) tasks NASA to lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and to bring back to Earth new knowledge and opportunities. It also tasks NASA with returning to the moon for long-term exploration and utilization, followed by human missions to Mars and other destinations.

To meet the exploration and science requirements which flow down from SPD 1, NASA has formulated a plan based on establishment of a lunar orbiting platform that will enable international and commercial partnerships, reusability of hardware to transport crews to and from the lunar surface, allow critical access to the lunar polar regions, reduce risk for lunar exploration crews by providing a safe haven, improve communications with spacecraft on the lunar surface, and provide valuable opportunities for scientific investigations, while expanding the knowledge base in the area of deep space maneuvering and solar electric propulsion required for travel to Mars.

The Council strongly endorses NASA's plan for achieving the goals set forth in SPD 1.

NASA Advisory Council Finding

Office of STEM Engagement

Name of Committee:	STEM Engagement Committee
Chair of Committee:	Dr. Aimee Kennedy
Date of Council Public Deliberation:	December 10, 2018
Short Title of Finding:	Office of STEM Engagement

Finding: The Council finds that the Office of STEM Engagement is identifying and amplifying NASA's unique achievements. Information has been presented and progress has been made on the following topics:

- Space STEM forum
- Website redesign
- Aligning with and co-funding STEM activities with the Space Technology Mission Directorate (STMD)
- Consolidation of program management of Minority University Research and Education Program (MUREP), Established Program to Stimulate Competitive Research (EPSCoR) and Space Grant for the express purpose of increasing knowledge sharing across the programs.
- Integration of STEM engagement activities across the three programs above – and NextGen STEM

NASA Advisory Council Finding

Federal STEM Plan

Name of Committee:	STEM Engagement Committee
Chair of Committee:	Dr. Aimee Kennedy
Date of Council Public Deliberation:	December 10, 2018
Short Title of Finding:	Federal STEM Plan

Finding: The Council endorses the NASA Office of STEM Engagement's participation in the Federal STEM Plan (*Charting a Course for Success: America's Strategy for STEM Education, December 2018*). As a result of its work, NASA has a unique opportunity to inspire the country, and to broaden participation in the future STEM workforce. The agency has extensive involvement in leadership of the plan. Administrator Bridenstine co-chairs the Committee on STEM Education (Co-STEM), and Associate Administrator Kincaid co-chairs the Federal Committee on STEM (FC-STEM). As a Federal agency, NASA is required to participate in the Federal STEM Plan, and NASA agreed to be a contributor for three of the nine objectives in the Plan.

NASA Advisory Council Finding
Office of STEM Engagement – Statute

Name of Committee:	STEM Engagement Committee
Chair of Committee:	Dr. Aimee Kennedy
Date of Council Public Deliberation:	December 10, 2018
Short Title of Finding:	Office of STEM Engagement – Statute

Finding: The Council finds that the statute that governs the NASA Office of STEM Engagement appears to limit its ability to nationally scale their programs and outreach. The majority of the budget allocated to the Office of STEM Engagement is partitioned to specific categories of institutions and programs. The NAC STEM Engagement Committee plans to learn more about the current efforts of the Office to achieve national scale, and recognizes that understanding evidence-based practices for sparking STEM engagement and motivation is a critical first step in the discussion around scale.

NASA Advisory Council – Committee Finding

**Science Committee Finding
to NASA Associate Administrator for
Science Mission Directorate**

**Implementation of Inter-Divisional Initiatives
in the Context of National Academies' Reports**

Name of Committee:	Science Committee
Chair of Committee:	Dr. Meenakshi Wadhwa
Date of Council Public Deliberation:	December 11, 2018
Short Title of Finding:	Inter-Divisional Initiatives and National Academies' Reports

Finding: The NAC Science Committee finds that it is important to balance disciplinary depth and inter-disciplinary breadth in the NASA Science Mission Directorate (SMD) implementation of each of the National Academies' decadal surveys on astrophysics, planetary science, heliophysics and Earth science. Core to this is to determine how to acknowledge and reward those who undertake SMD inter-divisional and inter-disciplinary collaboration. In support of excellence and innovation, the Science Committee also recognizes the potential value of commercial partnerships, inter-agency partnerships and international partnerships to achieving the priorities within the decadal surveys.

NASA Advisory Council – Committee Finding

**Science Committee Finding
to NASA Associate Administrator for
Science Mission Directorate**

Diverse Teams and Safe Environments

Name of Committee:	Science Committee
Chair of Committee:	Dr. Meenakshi Wadhwa
Date of Council Public Deliberation:	December 11, 2018
Short Title of Finding:	Diverse Teams and Safe Environments

Finding: The NAC Science Committee commends the NASA Science Mission Directorate (SMD) for the effort it is undertaking on the serious matters of diverse and inclusive teams and safe environments. Given that follow-through is key, the Committee appreciates SMD's commitment to translate intention into action. The Committee has formed an informal team and will deliver information on best practices and lessons learned from other organizations that SMD can utilize.

NASA Advisory Council – Committee Finding

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

Rotary Vertical Lift Technology

Name of Committee:	Aeronautics Committee
Chair of Committee:	Mr. John Borghese
Date of Council Public Deliberation:	December 11, 2018
Short Title of Finding:	Rotary Vertical Lift Technology

Finding: The NAC Aeronautics Committee applauds the Rotary Vertical Lift Technology (RLVT) project initiative with a focus on the two most critical areas needed for acceptance of Urban Air Mobility (UAM): noise and safety. The Committee offers the following suggestions. The ability to accurately model noise generation and its mitigation is particularly important in the design development of rotors for wide range of operations. There is a significant amount of work being performed around the world including by Original Equipment Manufacturers on noise modeling and design for low noise. NASA could leverage this effort. A particular area in which NASA could add differential value is in understanding and assessing public acceptance and perception of noise generated by air vehicles that will be used in UAM. For example, what is the most annoying part of the noise when there are many rotorcraft flying simultaneously in the vicinity. This topic could present an opportunity to engage K-12 students possibly as part of a NASA grand challenge.

Safety of vehicles in UAM is of critical importance and NASA could play a significant role in this area. The Committee suggests performing a Failure Mode Effects and Criticality Analysis (FMECA) including probabilities by component on several reference vehicle architectures. One project could be the analysis of the propulsion system starting with a tiltrotor and including the complete powertrain with and without cross winds. Determining the safety level that not only ensures safety but also meets the public's perception on what is required on safety would benefit the industry. The development of a model that allows analysis of various parameters like safety and noise would allow designers to test innovative designs of air vehicles for UAM.

NASA Advisory Council – Committee Finding

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

Subsonic Technology

Name of Committee:	Aeronautics Committee
Chair of Committee:	Mr. John Borghese
Date of Council Public Deliberation:	December 11, 2018
Short Title of Finding:	Subsonic Technology

Finding: The NAC Aeronautics Committee recognizes that there are thermal management opportunities where NASA can contribute as one of the biggest new challenges in designing all-electric or hybrid-electric aircraft is heating and cooling of the electric powertrain components. The Committee suggests NASA consider the innovation that currently exists in the automotive industry in terms of tools. There is a gap in tools and this an opportunity for innovation that NASA could fill. The Committee believes that this might be a good area for collaboration with universities and industry. Another important area is battery cell/pack architecture and how it connects to vehicle-level high voltage architecture to meet aviation standards. Additionally, all-electric aircraft will require innovative design work to make battery packs that are lightweight with adequate thermal management. Other methods for electric energy storage, including fuel cell technology, for example, should also be considered. Universities could be of help in the development of needed tools and models and the rapid testing of their fidelity through measurements on additive manufactured parts. Issues that could shape the future of subsonic flight, such as predicted climate change-induced atmospheric behavior should also be examined.

NASA Advisory Council – Committee Finding

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

Autonomy

Name of Committee:	Aeronautics Committee
Chair of Committee:	Mr. John Borghese
Date of Council Public Deliberation:	December 11, 2018
Short Title of Finding:	Autonomy

Finding: Autonomous aircraft and related airspace operations and management enable emerging aviation capabilities in areas where the United States needs to maintain global leadership. The NAC Aeronautics Committee offers the following suggestions:

- NASA can assume a fundamental role as the conduit between industry and the Federal Aviation Administration (FAA) for certification requirements and the verification and validation approach.
- Engage FAA early because autonomy is a disruptive concept to the standard DO-178C software certification process.
- Develop cyber security requirements which are not being addressed sufficiently by industry and are needed for safe operation.

The Committee expressed concern about the flow of talent from aerospace and universities to the broader tech industry. Engineers with autonomy and artificial intelligence backgrounds need to be enticed to enter and remain in the aerospace arena. The excitement generated by emerging urban air mobility where NASA is working is an area that generates interest to attract and retain these engineers in aerospace.

NASA Advisory Council – Committee Finding

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

Air Traffic Management eXploration (ATM-X)

Name of Committee:	Aeronautics Committee
Chair of Committee:	Mr. John Borghese
Date of Council Public Deliberation:	December 11, 2018
Short Title of Finding:	Air Traffic Management eXploration (ATM-X)

Finding: The NAC Aeronautics Committee applauds NASA in exploring the future of air traffic management needed to be viable for the significant increase in air travel in both conventional routes, new air mobility solutions, and unmanned air vehicles. The Committee recommends exploring the potential of federated systems operated by third party service organizations. The NASA Grand Challenge is an opportunity to test some of these ATM-X approaches. Transition from the existing, very safe air traffic management system to potential future ATM-X concepts needs to be examined as well. The Committee suggests that the design of the system take into account seamless integration into the current system.

The project “Integrated Demand Management” (IDM) has shown promising results to the Federal Aviation Administration (FAA) and industry allowing a path to transition. IDM is the type of NASA research that is not well known outside of the aerospace sector but offers benefits to the current air traffic management system and the flying public.