

NATIONAL SPACE COUNCIL



USERS' ADVISORY GROUP

EXPLORATION AND DISCOVERY SUBCOMMITTEE REPORT

Fourth Public Meeting
October 21, 2019

EXPLORATION AND DISCOVERY SUBCOMMITTEE

Membership

Chair:

- General Lester Lyles (USAF, ret.)

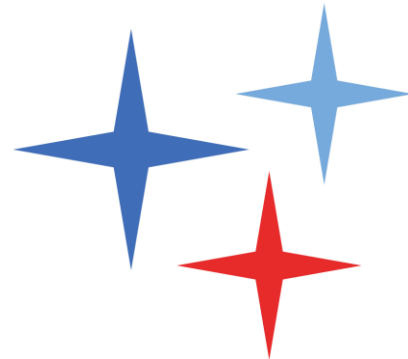
DFO:

- James J. Miller

Members:

- Tory Bruno
- Mary Lynne Dittmar
- Marillyn Hewson
- The Honorable Kay Ivey (Governor of Alabama)
- Dennis Muilenburg
- Fatih Ozmen
- Gwynne Shotwell

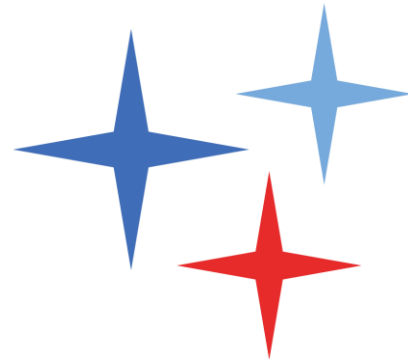
- Eric Stallmer
- David Thompson
- Pamela Vaughan
- Kathy Warden
- Stuart Witt



EXPLORATION AND DISCOVERY SUBCOMMITTEE

Scope

- Focus
 - “Assess current efforts and identify areas for further work by NASA on defining a Lunar exploration architecture to accelerate the return of Americans to the Moon ... Depending on information provided by NASA, consider recommending an independent evaluation of the lunar exploration architecture ...”
- Approach
 - “... the UAG will form a temporary special Task Force to assess the NASA architecture approach ... to illuminate and understand the following”
 - a. NASA’s specific vision and goals to return Americans to the Moon by 2024
 - b. Assumptions and alternatives examined
 - c. Target features and elements included in the architecture
 - d. Notional 2024 campaign
 - e. Acquisition strategy and timelines
 - f. Risk factors and potential mitigations

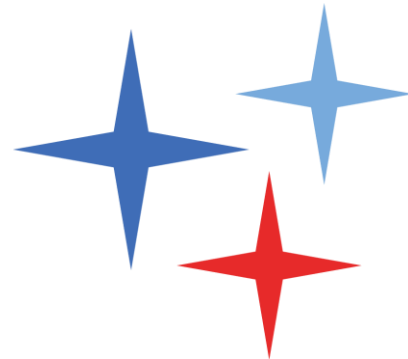


EXPLORATION AND DISCOVERY SUBCOMMITTEE

Activities

Numerous meetings and telecons with NASA to prepare for a UAG Task Force meeting(s)

- .. determine Task Force membership
- .. determine need for a 'Non-Disclosure Agreement'
- .. determine briefing content

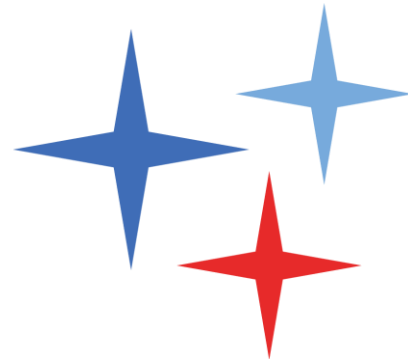


EXPLORATION AND DISCOVERY SUBCOMMITTEE

Final Work Plan

Ask NASA to brief the entire E&D Subcommittee to address the items requested in the Terms of Reference

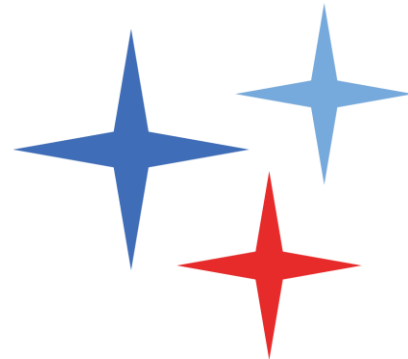
- ... allow E&D Subcommittee members to ask questions related to the items briefed – but, not get into proprietary information, or ongoing source selection information
- ... if there are specific questions or concerns raised that may involve such information, convene a subset of the E&D subcommittee (preferably UAG / SGE members) to discuss details with NASA to address these questions.

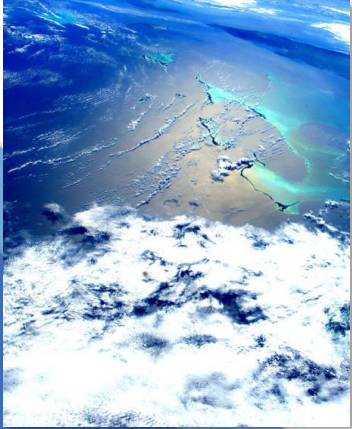


EXPLORATION AND DISCOVERY SUBCOMMITTEE

Topics of Focus

- Complete TASK FORCE - Terms of Reference
 - .. brief assessment of the 2024 Lunar Architecture to the full UAG
 - .. brief 2024 Lunar Architecture to the National Space Council
- Review ‘Regulatory and Policy’ recommendations from the NASA Advisory Council
 - .. for information of the UAG, or
 - .. for possible endorsement to the NSpC





NATIONAL SPACE COUNCIL



USERS' ADVISORY GROUP

OUTREACH & EDUCATION SUBCOMMITTEE REPORT

Fourth Public Meeting
October 21, 2019

OUTREACH & EDUCATION SUBCOMMITTEE

Membership

Chair:

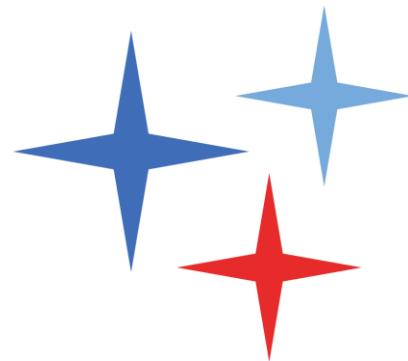
- Col. Eileen Collins (USAF, Ret.)

DFO:

- John Gaine

Members:

- Homer Hickam
- Fred Klipsch
- Pamela Vaughan
- Mandy Vaughn
- Stuart Witt

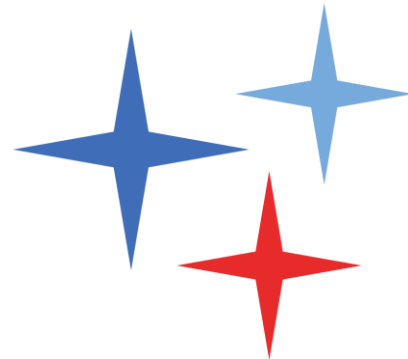


OUTREACH & EDUCATION SUBCOMMITTEE

Scope

Mission Statement

- To explore and recommend ways to improve our country's education system in an effort to strengthen technical expertise which will allow the United States to retain its preeminent global space programs.
- To collaborate with space program stakeholders to insure the National Space Council has access to the information and conditions that contribute to strong United States leadership in space. The subcommittee will chronicle the interactions between its members and the stakeholder community.

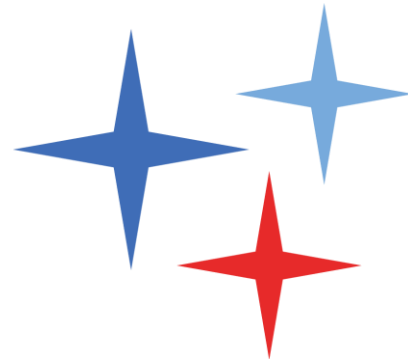


OUTREACH & EDUCATION SUBCOMMITTEE

Summary Of Activities

Activities since April 2019 Meeting:

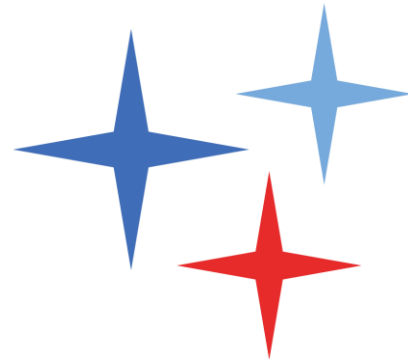
- **July 17:** National Conference of State Legislatures (NCSL)
 - Focused on secondary education issues
- **July 18:** Supported Purdue University UAG event
- **Aug 1:** Lewis-Burke: The NASA-University Enterprise
 - Focused on government-university collaboration
- **Sep 18:** Committee review/discuss/prepare findings and recommendations
- **Oct 10:** Office of Science and Technology Policy and NASA Office of STEM Engagement
 - Administration focus on five year STEM education plan



OUTREACH & EDUCATION SUBCOMMITTEE

Recommendation

We recommend the National Space Council write a Space Policy Directive concerning STEM education in the United States with the intent to prepare the future space industry workforce.

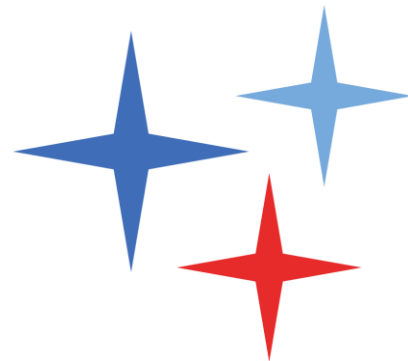


OUTREACH & EDUCATION SUBCOMMITTEE

National Conference of State Legislatures (NCSL)

Findings:

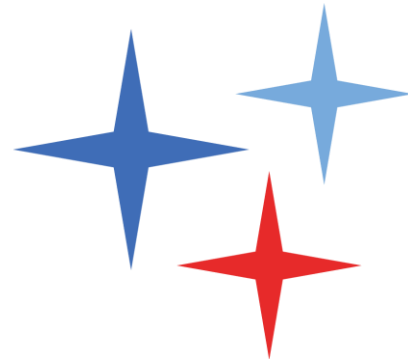
1. Lack of quality and quantity of educators in STEM field
2. Slipping in ability of students to apply new concepts
3. Lack of trained employees to fill current available workforce positions in the space industry
4. Space is a great motivator: upcoming Artemis program, Space Force and Commercial Crew



OUTREACH & EDUCATION SUBCOMMITTEE

Lewis-Burke: The NASA-University Enterprise

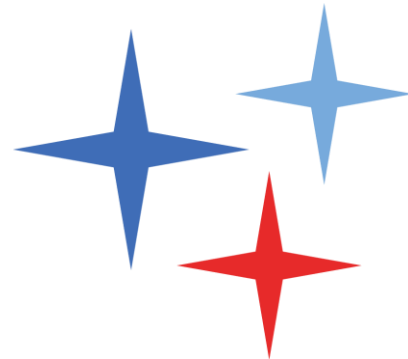
- Discussed numerous examples of government-university collaboration
- **Findings:**
 5. The successful NASA-university collaboration can be used as a model for other government agencies to emulate.



Charting a Course For Success: America's Strategy For STEM Education

Released: December 2018

- A report by the Committee on STEM Education of the National Science & Technology Council (OSTP)
- <https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf>



Goals of the OSTP STEM Education Plan

Plan Vision Statement

All Americans will have lifelong access to high-quality STEM education and the United States will be the global leader in STEM literacy, innovation, and employment.



**Build Strong
Foundations
for STEM
Literacy**

**Increase
Diversity,
Equity, and
Inclusion in
STEM**

**Prepare the
STEM
Workforce
for the Future**

Agency Participation

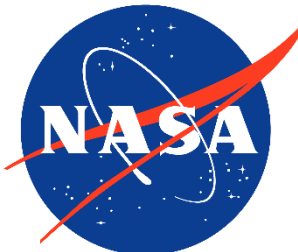


- Department of Agriculture
- Department of Commerce
- Department of Defense
- Department of Education
- Department of Energy
- Department of Health and Human Services
- Department of the Interior
- Department of Labor

- Department of State
- Department of Transportation
- Environmental Protection Agency
- National Aeronautics and Space Administration
- National Science Foundation
- Smithsonian Institute



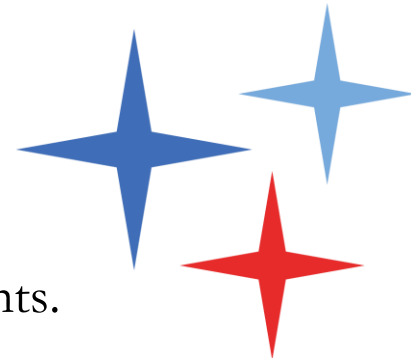
Smithsonian



OUTREACH & EDUCATION SUBCOMMITTEE

Aligning to Administration Commitments

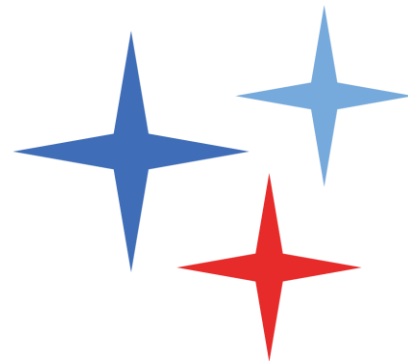
- The **Presidential Cybersecurity Education Award** will be presented for the first time in the spring 2020 to recognize great teachers in this fast growing STEM field.
- **\$123 million** was awarded in September 2019 to 41 school districts, nonprofits, and state educational agencies encouraging grantees to “Rethink Education”, 85% of funding focused on **STEM** or specifically on **computer science**.
- Through the President’s newly established, **National Council for the American Worker**, more than 300 companies and organizations have pledged to expand programs that educate, train, and reskill American workers from high school age to near retirement.
- President Trump signed the reauthorization of the **Carl D. Perkins Career and Technical Education Act** to support career and technical education programs for American students.
- In June 2017, President Trump signed a presidential memorandum directing the **Department of Education** to make STEM and computer science education a top priority and set a goal of devoting at least **\$200 million per year toward STEM education**. In FY 2018, the Department spent \$279 million in discretionary STEM grants.

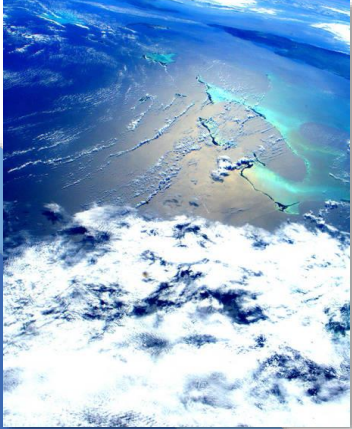


OUTREACH & EDUCATION SUBCOMMITTEE

Recommendation

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NATIONAL SPACE COUNCIL



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SPACE POLICY AND INTERNATIONAL ENGAGEMENT SUBCOMMITTEE REPORT

Fourth Public Meeting
October 21, 2019

SPACE POLICY AND INTERNATIONAL ENGAGEMENT

Membership

Chair: Dr. David Wolf

DFO: Neal Newman

Members:

Col. Buzz Aldrin (USAF, Ret.)

Dean Cheng

Mary Lynne Dittmar

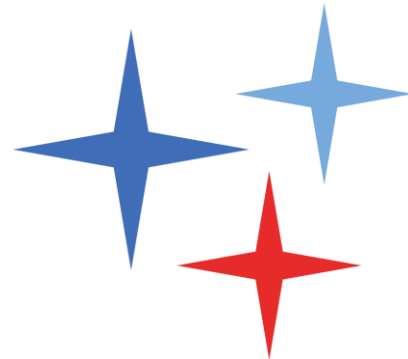
Adm. James Ellis, Jr. (USN, Ret.)

Fred Klipsch

Col. Pamela Melroy (USAF, Ret.)

Dennis Muilenburg

Eric Stallmer

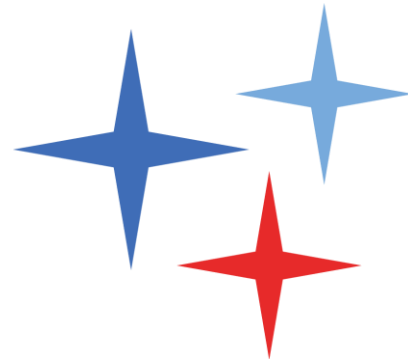


SPACE POLICY AND INTERNATIONAL ENGAGEMENT

Scope

The SPIE has been tasked to:

“Provide findings and recommendations on how the U.S. can most effectively continue to lead international space efforts so as to advance both U.S. national and ally/partner interests, broadly construed. In particular, address how the U.S. should respond to growing international and potentially adversarial space capabilities.”

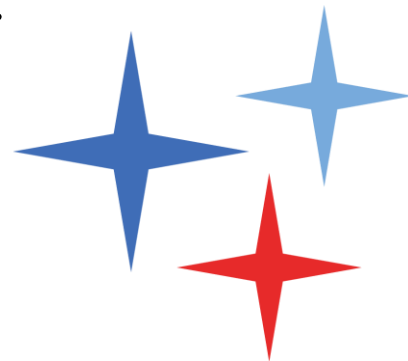


SPACE POLICY AND INTERNATIONAL ENGAGEMENT

Summary Of Activities

Since the last UAG meeting, the “SPIE” subcommittee has focused on the following;

- Obtaining approval of Finalized Terms of Reference
- Acquiring initial background material (Dept. of State / United Nations - related)
- Briefed by the Dept. of State, Bureau of Arms Control, Verification, and Compliance (Eric Desautels), on U.S. efforts with the UN Office of Disarmament Affairs, Conference on Disarmament (CD), in developing international recommendations for **Transparency and Confidence Building Measures in Outer Space Activities** (UN TCBM’s)
- Reviewing work by the Dept. of State, Bureau of Oceans and International Environmental and Scientific Affairs, efforts with the UN Committee on the Peaceful Use of Outer Space (UNCOPUOS) in enhancing the **Guidelines for the Long-term Sustainability of Outer Space Activities**.
- Initial Observation - although voluntary, these form comprehensive and effective norms of advantage to National Security, Commercial, and Civil / Exploration Space

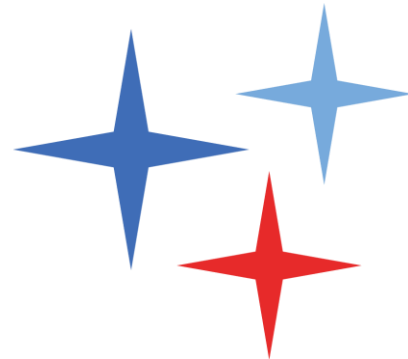


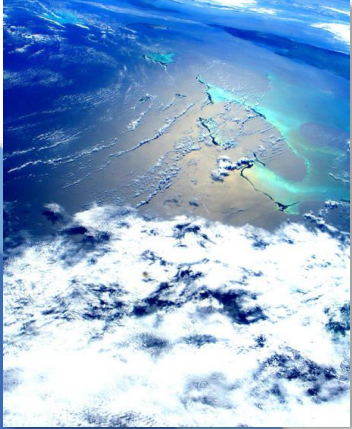
SPACE POLICY AND INTERNATIONAL ENGAGEMENT

Topics Of Focus

We anticipate public discussion on how these and other measures:

- Become fully adopted by the UN
- Need adjustment as implementation of the Space Policy Directives (SPD's) progress
- Although “voluntary”
 - Contribute to advancing an attractive and globally inclusive Space Enterprise
 - Prevent adversarial and hostile uses of outer space (in favor of the above)
- Promote “norms of behavior” promoting peaceful high value uses of Space by the international community as opposed to adversarial purposes
- Mitigate the vulnerabilities, promote verification, and defeat deception
- Establish references to determine response to adversarial space activity
- Prevent unintended negative consequences (misperceptions...)
- *Our subcommittee is open to suggestions from the public* hq-uag@mail.nasa.gov





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NATIONAL SECURITY SUBCOMMITTEE REPORT

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NATIONAL SECURITY SUBCOMMITTEE

Membership

Chair:

- Adm. James Ellis, Jr., USN (Ret.)

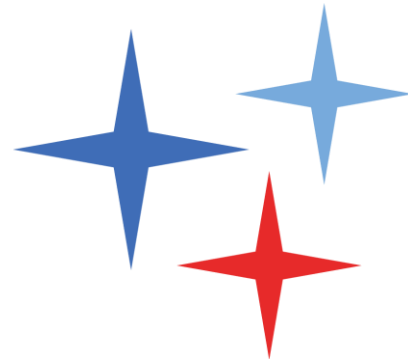
DFO:

- Jolene Meidinger

Members:

- Tory Bruno
- Dr. Dean Cheng
- Tim Ellis
- Marillyn Hewson
- Gen. Lester Lyles (USAF, Ret.)
- Col. Pamela Melroy (USAF, Ret.)
- Dennis Muilenburg
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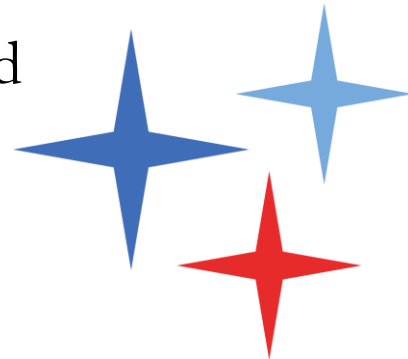


NATIONAL SECURITY SUBCOMMITTEE

Scope

The scope of national security space issues within the purview of the Subcommittee includes:

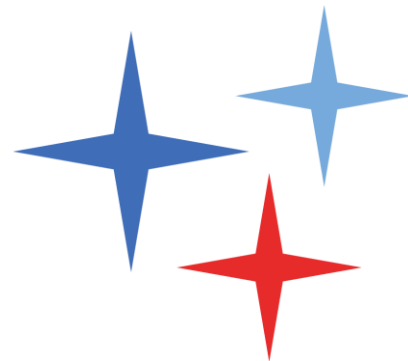
- Reviewing national security considerations relevant to National Space Policy and National Security Space Strategy including:
 - Space systems, space capabilities, and space architecture
 - Future national security space requirements
 - System resiliency, robustness, and interoperability
 - Interagency collaboration/cooperation
 - The evolving national security space threat environment
- Making recommendations on national security considerations to the UAG affecting coordination, cooperation, and technology and information exchange among the civil, national security, commercial, and international space sectors
- Assisting other UAG subcommittees in reviewing classified elements within the scope of their efforts



NATIONAL SECURITY SUBCOMMITTEE

Activities

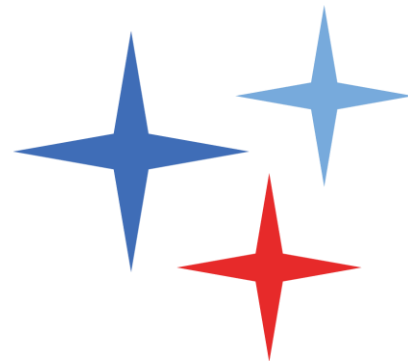
- Members of the National Security Subcommittee of the UAG received a classified informational briefing from the Office of the Secretary of Defense on the status of preparations to establish a United States Space Force when approved by Congress and in full compliance with the law
- Briefers included: Deputy Secretary of Defense Stephen Kitay, Planning Task Force lead Major General Clint Crozier, and participating representatives from OSD, the Intelligence Community (IC), and the Joint Staff



NATIONAL SECURITY SUBCOMMITTEE

Space Force Discussion Areas

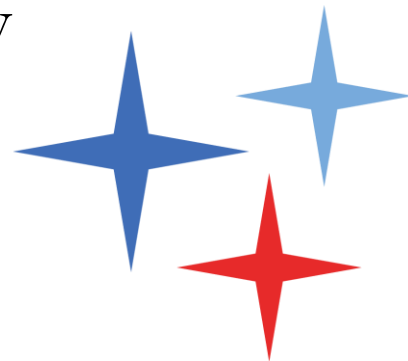
- Part I – Strategic Context
 - Strategic Environment
 - Problem Statement
 - A New Approach
- Part II – United States Space Force
 - Role and Mission of the Space Force
 - Functions and Authorities of the Space Force
 - Organization of the Space Force
 - Key Relationships
 - Transition Plan
 - Personnel and Budget Summary



NATIONAL SECURITY SUBCOMMITTEE

Key Takeaways (Unclassified)

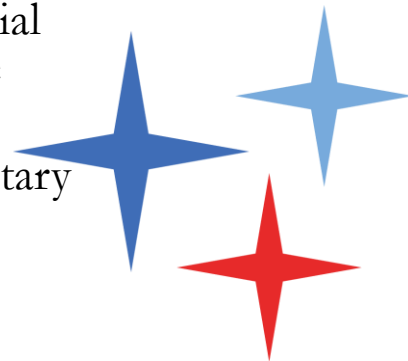
- Focus is on real warfighting capabilities
- Space systems are increasingly important and increasingly vulnerable
- Must protect critical infrastructure
- Must guard against unnecessary bureaucracy
- Must be capable AND cost effective
- Operates within the Department of the Air Force (akin to DON/USMC)
- DoD is ready pending Congressional approval and consistent with law
- Incremental approach from 2020 to 2025
- DoD welcomes UAG review after legislation on establishment is approved



NATIONAL SECURITY SUBCOMMITTEE

Potential UAG Areas Of Exploration from 2019 Schriever Space Wargame

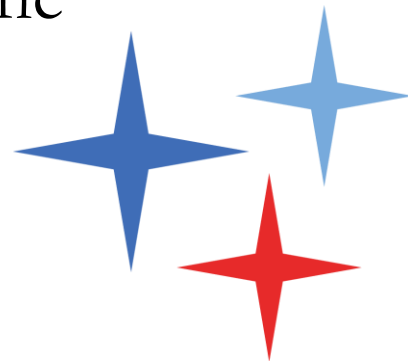
- Schriever Wargame remains an incredibly valuable forum for improving the integration of the commercial space sector into realistic U.S. and allied military planning and operations
- There were numerous lessons-learned from this year's wargame, with a few overarching themes noted below:
 - Commercial Participation: It remains highly advantageous to U.S. military space interests to continue leveraging robust commercial participation in the Schriever Wargames
 - Commercial Integration: Truly integrated and combined force planning and operations could be more "holistic" and reflect the reality that a preponderance of space orbital assets are commercial versus government "owned"
 - Capabilities and Innovation: The rate of development of new commercial capabilities - such as satellite communications, geospatial information, responsive launch and commercial on-orbit operations - challenged the ability of military planners to evaluate and incorporate them into U.S. and combined force operations
 - Business Motivations and Imperatives: The Wargame demonstrated how critically the commercial sector relies on military security and safety to conduct global business in and through the "space commons"
 - Advance Planning: Advance planning and implementation will greatly improve commercial-military integration and operations. This advance planning should extend beyond the U.S. military, to include "whole of government participation" and allied participants, many of whom oversee or field their own commercial space capabilities.



NATIONAL SECURITY SUBCOMMITTEE

Recommendation

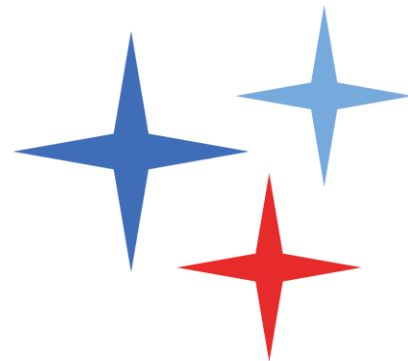
The UAG National Security Subcommittee supports a “whole of government” approach to ensure that commercial entities are well understood, integrated and leveraged into war fighting planning and doctrinal debate. This only becomes more important as we embark on the creation of the Space Force – this whole of government discussion may result in suggested changes to authorities for the new acquisition process and personnel, requirements definition and possibly planning and budgeting guidance or legislation to ensure the Space Force provides the war fighter with the appropriate space-based or space-“backed” services our cutting edge technological warfighters and systems require to project lethal force.

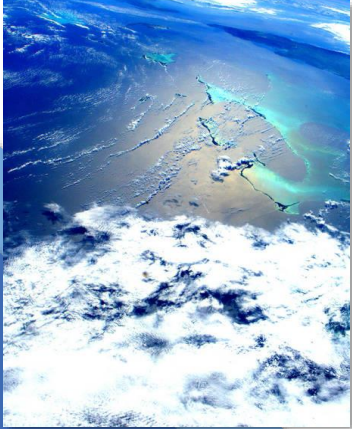


NATIONAL SECURITY SUBCOMMITTEE

Topics Of Focus

- Assigned
 - Assess and recommend options for the organizational structure of the uniformed Space Force, to include a future Department of the Space Force. In addition to implementation timelines, authorities, and skills required, areas of potential consideration include organizational / functional relationships, rank structure, officer/enlisted ratios, and other personnel considerations. The UAG would have necessary information and access, as appropriate, to the Department of Defense and other relevant organizations.
- Proposed
 - Appropriately participate in the growing number of venues, including classified, focusing on National Security Space. Use these opportunities to gather perspectives, identify potential issues, and provide inputs to the National Space Council.
 - Working with other UAG Subcommittees, consider the issues that may lie at the seams of national security and commercial /civil space





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TECHNOLOGY AND INNOVATION SUBCOMMITTEE REPORT

Fourth Public Meeting
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TECHNOLOGY & INNOVATION SUBCOMMITTEE

Membership

Chair: Col Pamela Melroy (USAF, ret)

DFO: Taylor Weeks

Members:

Dean Cheng

Tim Ellis

The Hon. Kay Ivey

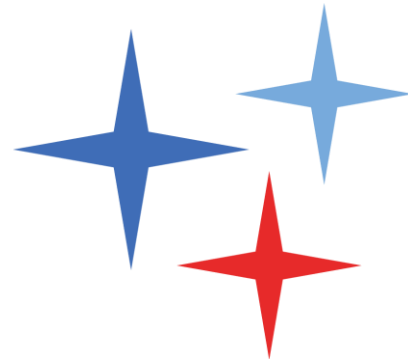
Gen Lester Lyles (USAF, ret)

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Dr. Eric Schmidt

Harrison Schmitt

David Wolf, M.D.



TECHNOLOGY & INNOVATION SUBCOMMITTEE

Scope

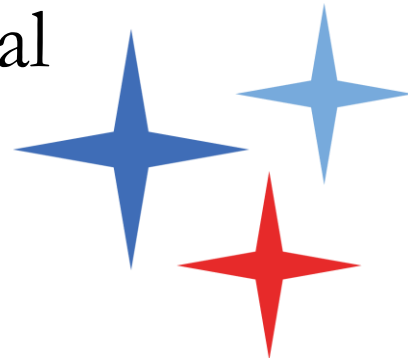
- Reviewing new technologies and new applications of technology, as well as business innovation practices and new business models, and
- Making recommendations relevant to these topics on national policy, technology and operations architectures, and inter-department and agency coordination.



TECHNOLOGY & INNOVATION SUBCOMMITTEE

Summary Of Activities

- Held 4 administrative/preparatory telecons to develop Terms of Reference, identify potential topics of focus, and develop a work plan
- Distributed available technology roadmaps for awareness/review
- Held one-on-one discussions between chair and individual members to refine issues



TECHNOLOGY & INNOVATION SUBCOMMITTEE

Topics of Focus

- Space technology roadmap review. Review U.S. Government department and agencies space technology roadmaps to uncover synergies, overlaps, and inconsistencies that could be better aligned for national impact
- Space data as a U.S. government capability vs buying as a service: Evaluate and recommend best practices for U.S government on owning data capability vs buying data commercially (Earth Observation, Space Situational Awareness, weather). Discussion initially focused on Space Situational Awareness as this will support SPD-3, National Space Traffic Management Policy. White paper with recommendations for each data area as outcome to include findings and recommendations.

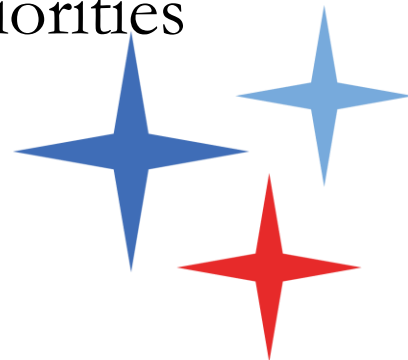


TECHNOLOGY & INNOVATION SUBCOMMITTEE

Topics of Focus

Space technology roadmap review

- Committee has noted that under SPD-1 and direction from Vice President Pence, NASA has updated its Moon to Mars planning. Under Artemis program, plan is to return to the surface of the Moon by 2024, an aggressive timeline.
- NASA's last technology roadmap update in 2015 with review by National Academies in 2016; roadmap and review closely aligned with exploration plans at the time (across the NASA enterprise, not solely focused on the human exploration)
- The committee notes that a clear roadmap with the proper priorities will:
 - Ensure the timeline is met
 - Ensure resources are used effectively
 - Support architecture and requirements decisions

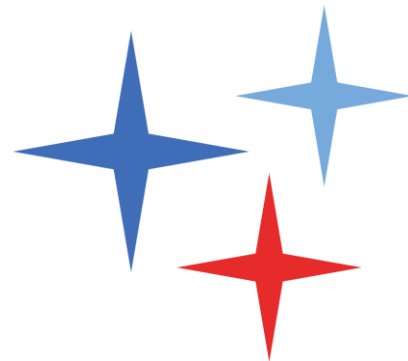


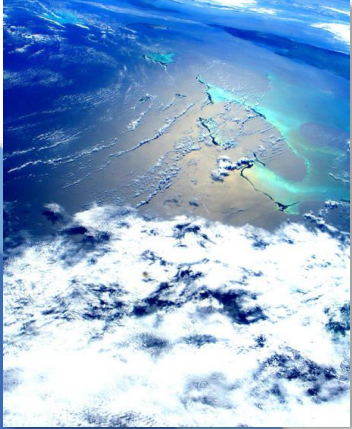
TECHNOLOGY & INNOVATION SUBCOMMITTEE

Topics Of Focus

Draft recommendation for discussion:

- The committee recommends that NASA update their technology roadmap in light of the Artemis and Moon and to Mars program, provide a briefing to the UAG, and fund a brief external review





NATIONAL SPACE COUNCIL



USERS' ADVISORY GROUP

ECONOMIC DEVELOPMENT AND INDUSTRIAL BASE SUBCOMMITTEE REPORT

Fourth Public Meeting
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ECONOMIC DEVELOPMENT & INDUSTRIAL BASE SUBCOMMITTEE

Membership

Chair(s):

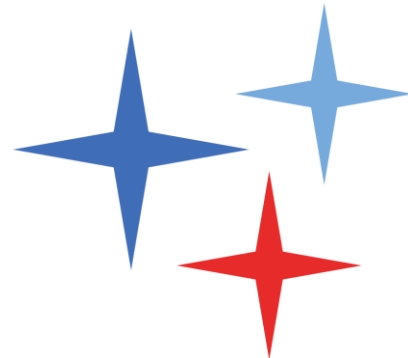
- Dr. Mary Lynne Dittmar
- Eric Stallmer

DFO:

- Nate McIntyre

Members:

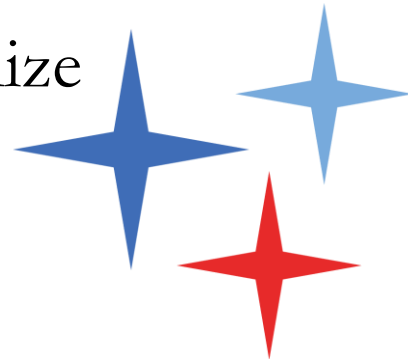
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- Steve Crisafulli
- Tim Ellis
- Gwynne Shotwell
- Dr. Bob Smith
- David Thompson
- Stuart Witt



ECONOMIC DEVELOPMENT & INDUSTRIAL BASE SUBCOMMITTEE

Spectrum Activities

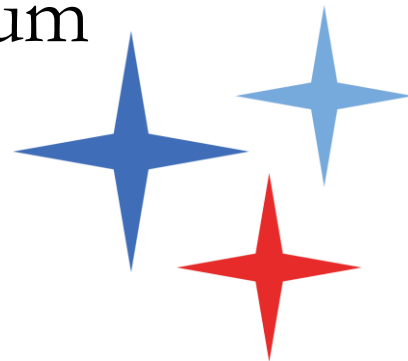
- Held 4 administrative/preparatory telecons to develop Terms of Reference, identify potential topics of focus, and develop a work plan
- Consulted with National Space Council staff
- Consulted with several stakeholders
- Discussed plan with subcommittee members most recently during telecon on 3 October; updated the TOR to reflect a change in scope
 - Provide inputs to a study of spectrum management and allocation
 - Recommend National Academy of Public Administration to conduct study
- Followed up with UAG Chair Admiral Ellis on 10 October to finalize approach



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Spectrum Background (from Spectrum TOR)

- **Spectrum** is a critical but scarce natural resource. Spectrum allocated for space activities in the U.S. is being constantly revised, and in some cases constrained, yet it is necessary for all aspects of space, and activities shared globally.
- Given the long lead investments and long-term business models, the U.S. space industry requires regulatory certainty and stability to ensure access to spectrum at both the national and international levels. Current uncertainty in today's spectrum policy is jeopardizing U.S. technology leadership.



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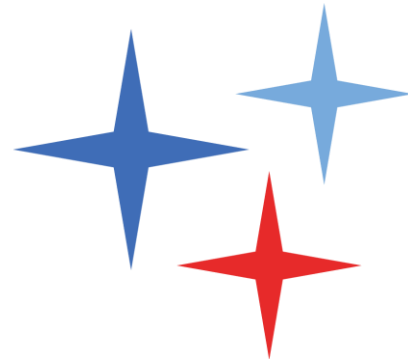
Spectrum Management Review

- **Finding**

- The current regulatory situation for spectrum management is absent certainty, stability and reliability, creating significant challenges to U.S. technology leadership
- The U.S. governance model for spectrum requires review to assure alignment with 21st century needs and objectives

- **Recommendation**

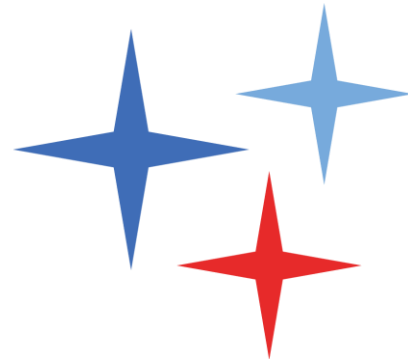
- The National Space Council will direct the UAG to define the scope of a study to be conducted by the National Academy of Public Administration, reviewing U.S. regulatory jurisdiction and governance (domestic) v. a goal of technology leadership across spectrum related technology sectors
- The study should also address an assessment of the current U.S. governance model for spectrum v. alignment with multiple national technological leadership and capabilities priorities



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Development of Space Ecosystem

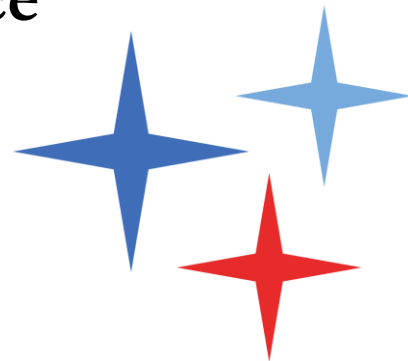
- Held 3 exploratory telecons to discuss issues and identify scope regarding economic development of low Earth orbit (LEO) and Cislunar space, and the region between them
- Identified several of focus for potential findings and recommendations. Closed one, the others are ongoing.
- Discussed plan with subcommittee members most recently during telecon on 3 October
 - Focused on USG initiative to stimulate space economy
 - Discussed proposal for Space Strategic Propellant Reserve
- Followed up with UAG Chair Admiral Ellis on 10 October to finalize approach



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Developing a Space Economy: Background

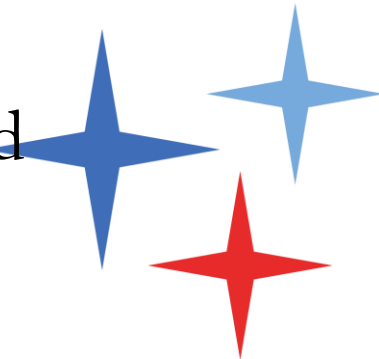
- **USG Investment In Infrastructure can enable space commerce**
- Overarching enabler for commercial activity is **Affordable Transportation**
 - Earth To Cislunar transportation costs \$10,000 To \$50,000 per kg today
- Driving cost of in-space transportation is **Propellant**
 - The majority of a rocket's mass is fuel
- Propellants sourced in space avoid cost of lifting from Earth's gravity well
 - 60% to 70% of energy required to reach cislunar destination is spent on Earth-to-LEO
- **USG can stimulate a large space economy by facilitating in-space propellant availability**
 - Ice Mining
 - Propellant Manufacture
 - Storage



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Approach

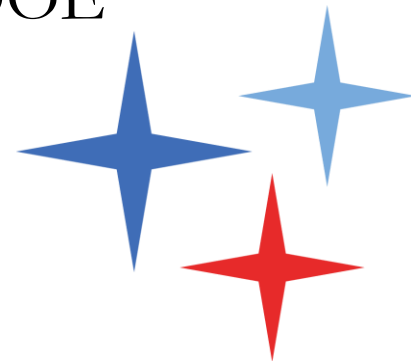
- **The USG maintains strategic reserves to sustain and grow economy and protect citizenry and commerce**
 - **Strategic Petroleum Reserve**
 - Defense Logistics Agency Strategic Materials (Industrial Metals)
 - Strategic National Stockpile (Medicines)
 - Strategic Helium Reserve
 - Bill Emerson Humanitarian Trust (Grain)
- The **USG** can establish a requirement to create and maintain **Strategic Reserve of Propellant sourced in space**
 - Modeled on the US Strategic Petroleum Reserve (SPR)
- Creation of the Reserve would establish propellant production and storage infrastructure
 - Also protects future economic activity from supply interruptions



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Strategic Petroleum Reserve (Reference)

- **Purpose:** Store emergency supplies of crude oil, owned by the U.S. government
- **Capacity:** 727 million barrels
- **Governance:**
 - Energy policy and conservation act (EPCA)
 - International energy agency (IEA)
- **Required Storage:**
 - 90 days of import protection (minimum)
 - The SPR holds the equivalent of 143 days of import protection today
- **Management:** Use of oil authorized by President, administered by DOE
- **Value:** About \$25.7 Billion
 - Construction of facilities: \$5 Billion
 - Acquisition of crude oil: \$20.7 Billion
 - Now generally self-funding (sales)

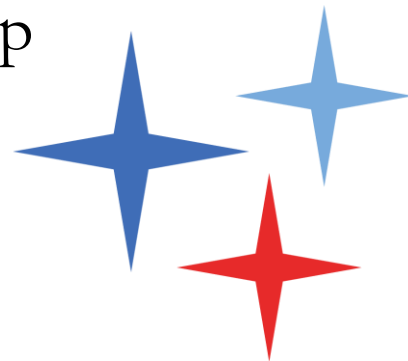


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Next Steps: Finding

- **Finding**

- LEO and cislunar space are regions of strategic vital interest to the United States. Development of a space economy requires a whole-of-government approach together with investment in infrastructure to enable commerce and economic development. While NASA plays an early and critical role, the nature of economic development and assurance of the strategic interests of the United States fall outside the purview and budget of any one agency. The overarching enabler for space commerce is affordable transportation. The USG can stimulate development, ensure stability, and assure global leadership of the space economy for decades to come by facilitating the availability of in-space propellant.



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Next Steps: Recommendation

- **Recommendation**

- The National Space Council should direct the UAG to develop a white paper, outlining and scoping a study of the means to establish and maintain a U.S. Strategic Space Propellant Reserve modeled on the U.S. Strategic Petroleum Reserve (SPR). The white paper should identify variables important to establish reference requirements, such as: (a) the size and location of initial reserves needed to stimulate sufficient infrastructure to support an eventual \$1T space economy; (b) technical means; (c) identification of markets that could be enabled; and (d) models for funding, and others. It is anticipated that a detailed study undertaken by the National Academies of Sciences, Engineering and Medicine would follow initial scoping by the UAG.

