FEDERAL AVIATION ADMINISTRATION

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COMMERCIAL SPACE TRANSPORTATION ADVISORY COMMITTEE

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SPRING MEETING

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THURSDAY
APRIL 28, 2016

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The Commercial Space Transportation Advisory Committee met in the National Transportation Safety Board Conference Center, 429 L'Enfant Plaza, SW, Washington, DC, at 9:00 a.m., Michael N. Gold, Chair, presiding.

PRESENT
MICHAEL N. GOLD, Chair
MICHAEL LOPEZ-ALEGRIA, Vice Chair
BRETTON ALEXANDER, Member
CHRISTINE ANDERSON, Member
DANIEL COLLINS, Member
RICHARD DALBELLO, Member
DEBRA FACKTOR LEPORE, Member
OSCAR GARCIA, Member
JEFFREY KENNETH GREASON, Member
LIVINGSTON HOLDER, Member
JANET KARIKA, MEMBER
BILL KHOURIE, Member
CHRISTOPHER KUNSTADTER, Member
SAMANTHA MARQUART, Member
CHARLES PRECOURT, Member*
FRANK SLAZER, Member
JENNIFER WARREN, Member

ALSO PRESENT

JIM BRIDENSTINE, U.S. House of Representatives Committee on Science, Space, and Technology, Committee on Armed Services

DEREK KILMER, U.S. House of Representatives Committee on Appropriations
STEVE KNIGHT, U.S. House of Representatives Committee on Science, Space, and Technology, Committee on Armed Services
DAVA NEWMAN, Deputy Administrator, NASA
GEORGE NIELD, Associate Administrator for Commercial Space Transportation, FAA
MICHAEL ROMANOWSKI, Director of Space Integration, FAA
SAM SCIMEMI, Director, ISS, NASA

* Present by telephone

Welcome/Opening Remarks by the Chairman: Michael Gold, Chairman

The COMSTAC meeting convened at 9:00 am. Chair Gold welcomed everyone and thanked COMSTAC's working group chairs and members for a productive meeting the day before. He then described the BEAM program and how it exemplifies advancement in space through the coordinated efforts of different agencies and industry members.

Key Issues Facing AST and Industry: Dr. George C. Nield, Associate Administrator for Commercial Space Transportation, FAA

This is a very dynamic period for the commercial space industry. Last November, President Obama signed into law the Commercial Space Launch Competitiveness Act, which, among other things, officially defined government astronauts and articulated a U.S. policy for space resource utilization. The Act also required that 12 reports be written to inform Congress on various issues in the commercial space field. The FAA has been tasked with playing a lead role in the creation of six of these reports, something that will be a priority in the coming year.

NASA has announced the Sierra Nevada Corporation as a third partner for their Commercial Cargo Program. The Program's other partners, SpaceX and Orbital ATK, have recovered from their respective mishaps and are back in business. SpaceX's recent success in the safe recovery of the first stage of a launch system is exciting for the field of reusable launch vehicles. Reusable launch vehicles can not only lower the cost of future missions, but can also give researchers the information needed to improve the design of launch systems. Blue Origin's recent successful flights indicate that they will soon begin commercial operations. Boeing and SpaceX are working hard to develop vehicles for NASA's Commercial Crew Program and could begin the FAA certification process as soon as 2017.

Bob Cabana and staff at the Kennedy Space Center are looking for under-utilized government spaces and resources that can be repurposed for private industry. OneWeb recently announced that it will be building a satellite factory outside the gate of the Kennedy Space Center, which it expects to open in 2017. They plan to use an assembly line model with the goal of being able to produce 15 satellites in a week. In 2018 SpaceX plans to land a Red Dragon on the surface of Mars, demonstrating that space exploration is not the sole purview of the federal government.

At the 32nd Space Symposium Dr. Nield made contact with the Director General of the European Space Agency, Johann Worner, to express COMSTAC's support of a moon village and to offer the idea that private industry, along with government entities, could be involved in its creation. Dr. Nield and Director General Worner plan to discuss this further at the upcoming International Astronautical Congress meeting. Additionally, at this symposium Congressman Bridenstine presented the American Space Renaissance Act. This Act has various provisions that would work to increase the involvement of commercial space players in interagency policy discussions and decisions regarding commercial space and to increase government funding for different FAA AST programs and grants. Congressman Bridenstine does not believe that this Act will necessarily be accepted in its entirety, but hopes that its introduction will lead to widespread discussions by different stakeholders about the needs of the commercial space field.

Dr. Nield directed COMSTAC's attention to two key issues. He first asked how the FAA and COMSTAC can enable new, non-traditional operations in space. The Outer Space Treaty requires that the appropriate state party authorize and supervise the activities of non-governmental entities in space. However, the U.S. currently does not have a regulatory framework in place to do this for non-traditional operations, and industry innovation is suffering from this regulatory uncertainty. One idea for a framework that is not too burdensome for private industry but still complies with this international treaty is to introduce mission licenses, in which individual missions would be reviewed for their adherence to foreign and domestic policies and regulations before they could begin. The Office of Science and Technology Policy (OSTP) has recently submitted a report to Congress recommending that the Secretary of Transportation be authorized to grant authorizations for missions in outer space. The authorization process used would be modeled on the payload review process currently used by the FAA for launch licenses and would not be required for activities already licensed by the FCC and NOAA.

The second key issue is how information can be provided to civil, commercial, and international satellite operators to minimize the probability of collisions in space while allowing the Department of Defense to focus on its national security mission, and whether it is feasible for a civil agency to process and release safety-related space situational awareness data consistent with the national security interests and public safety obligations of the U.S. The FAA believes that this is feasible and recommends the development of an implementation plan that would transfer the responsibility of collecting and disseminating safety-related space situational awareness data from the Air Force to the FAA. This would not require that the FAA operate radars and telescopes but rather that the Air Force share its data with the FAA. Although there are some skeptics of the plan, senior Air Force and DoD leadership support it. Dr. Nield proposed a six-month pilot program as a way to answer remaining questions and concerns about the plan.

Questions from the COMSTAC

Member Greason commented that many services in the space transportation market do not have a price, and brought up the possibility of establishing a market in which services are priced so that market need could be better addressed. Dr. Nield felt that this was an excellent insight and recommended that Member Greason discuss this with Sam Scimemi of NASA.

Operations Working Group: Ms. Janet C. Karika, Chair

The Operations Working Group (OWG) has generated several OFRs in response to presentations given the previous day. On the topic of space support vehicles, COMSTAC observes that the American Space Renaissance Act supports the use of vehicles for commercial compensation for training of space flight participants. COMSTAC also observes that the U.S. Commercial Space Launch Competitiveness Act (CSLCA) includes two reports that are in process to address this issue; the studies are ongoing, and industry is invited to provide input. COMSTAC recommends that the FAA AST facilitate a briefing to the OWG once the studies are completed. This briefing should happen by COMSTAC's next meeting, after which COMSTAC could make further recommendations if needed. COMSTAC would not be expected to

contribute industry input but would compile input from individuals and companies in its report to Congress. The recommendation passed after a vote by COMSTAC.

In the space surveillance and situational awareness data OFR, COMSTAC observes that the CSLCA requests the FAA AST to study the feasibility of processing and releasing safety-related space situational awareness data and information to any entity consistent with national security interests and public safety obligations of the United States, in concurrence with the DoD and others. The COMSTAC recommends that the FAA AST facilitate a briefing to the OWG once the study is completed. The recommendation passed after a vote by COMSTAC.

In the space traffic management OFR, COMSTAC observes that the American Space Renaissance Act proposes to authorize the Department of Transportation to provide space situational awareness services and information to customers including the federal government, foreign countries, and commercial entities. COMSTAC finds that there are a range of options available, from a USG-operated architecture to a system that incorporates existing commercial sensors and data processing. The COMSTAC makes two recommendations: that the FAA AST advocate for commercial interests to be incorporated into any potential plans FAA AST is building into space traffic management throughout the planning process and that the FAA AST brief the OWG on approved provisions of the American Space Renaissance Act that implement elements of space traffic management. The COMSTAC members debated whether the recommendations should be modified to include a recommendation that the FAA AST provide a cost estimate and evaluation of a potential space traffic management system. Those in favor of the idea argued that such an evaluation would provide a much-needed sense of the cost and structure of implementing this legislation, while those opposed argued that it would be difficult to do this type of evaluation without the data provided by the studies. Members also opined that the recommendations should include commercial entities, but others countered by arguing that the recommendation should not presuppose a solution. As a result of this discussion, COMSTAC made a third recommendation that FAA AST begin the process of scoping the work required up to and including cost estimates for a space traffic management system. The three recommendations passed after a vote by COMSTAC.

In the streamlining commercial space launch activities OFR, COMSTAC observes that the CSLCA requests that the FAA assess the current process for the license/permit application and approval for commercial launch and reentry; describe current efforts to streamline, reduce duplication, etc.; and recommend legislation that may further streamline/consolidate, in consultation with the DoD, NASA and others. COMSTAC recommends that the FAA AST facilitate a briefing to the OWG once the study is completed. The recommendation passed after a vote by COMSTAC.

In the Air Force commercial range requirements OFR, COMSTAC makes two observations: that the commercial space launch providers' requirements at the federal ranges are increasing and becoming more complex and that the Air Force Space Command is examining requirements at their federal launch ranges to meet all user requirements efficiently while maintaining range safety. COMSTAC finds that commercial launch providers need strong advocates within the federal government to communicate their unique commercial requirements at the federal launch ranges. COMSTAC recommends that the FAA AST continue to work with NASA, the Air Force, and other relevant departments and agencies to

communicate unique commercial launch provider requirements to the federal launch ranges and FAA – licensed spaceports as appropriate. The recommendation passed after a vote by COMSTAC.

In the spaceport catalog OFR, COMSTAC observes that there is sufficient support within industry, government and Congress for the creation of a spaceport catalog. COMSTAC finds the proposed catalog is useful for commercial companies (and possibly governmental agencies) in need of spaceport services. COMSTAC recommends that the FAA AST should include the catalog on its website and that the COMSTAC and the FAA AST should work collaboratively to develop the process for updates. The recommendation passed after a vote by COMSTAC.

In the FAA AST funding OFR, COMSTAC observes that the FAA AST needs increased resources to fulfill its mission in an efficient and timely manner and that the FAA AST's budget was flat, approximately $17 million, in both FY15 and FY 16. COMSTAC recommends that the FAA AST provide information on the impacts of funding below the President's Budget Request level, $19.8 million, to the COMSTAC. Although there was some discussion about revising the recommendation to give a more specific funding level, COMSTAC ultimately decided to make no revisions. The recommendation passed after a vote by COMSTAC.

NASA Speaker: Mr. Sam Scimemi, Director, ISS, NASA

Mr. Scimemi began by addressing Member Greason's earlier comment regarding space transportation market pricing. NASA intends to turn the commercialization and market of low Earth orbit (LEO) and commercial crew over to private industry. Although NASA has tried commercialization activities over the years, commercialization has been difficult because the shuttle and space station systems were built on government principles rather than commercial principles. Mr. Scimemi hopes that private industry will develop a definition and vision for commercialization of space, which NASA can then enable.

NASA's vision for the commercialization of LEO is sustained, broad-based economic activity in LEO enabled by human space flight and driven by private and public investments, in which value could be created and traded to earn a profit and the Earth could benefit from research and technology creation; all of which would occur through private industry supply and be based on private and public demand. NASA would purchase services and capabilities to meet its demand for research or other human space flight goals. The expectation is that the private sector would drive the majority of the demand and that this would take place within a regulatory framework that enables this development. NASA hopes to move its focus and resources to cislunar space and Mars and allow private industry to take its place in LEO.

Unlike a government-driven LEO platform, a fully private LEO platform would have market-driven capabilities and services, risk carried by both government and private entities, and the ability to move beyond policy to leverage government and private investment. However, in order to obtain private investments, the government needs to consider what actions they can take in order to make the ISS and LEO viable investment options for private entities. Another challenge in developing a fully private LEO platform is working across international partners. Some of these partners don't have any government policies in place to encourage private industry and other non-space agencies to utilize the ISS, and

others have policies that discourage this altogether. Although a fully private LEO platform is not achievable at this time, Mr. Scimemi hopes that in the next decade the U.S. and others will be able to drive the percentage of government investment in the ISS to half or less. By freeing up these resources, NASA would be able to concentrate on cislunar space and Mars. In order to reach this vision, the entire industry needs to be restructured to serve private industry rather than government customers. This requires thinking beyond flight hardware and transitioning on-the-ground investments such as those involving operations, planning and training.

Questions from the COMSTAC

Member Collins asked if the U.S. would be able to reach out to international partners whose policy discourages private utilization of ISS. Mr. Scimemi responded that some of these partners are interested in getting private industry onto the ISS, but feel that they are unable to change their domestic policies to do so. The U.S. is encouraging these partners and their home countries to change these policies so as to enable private utilization of ISS. Member Greason asked if NASA and other government entities have any sort of road map as to what their future demand will be so that private industry can prepare to meet these demands. Mr. Scimemi responded that no such list currently exists but that NASA and others will work to define this in the coming years. Member DalBello asked for clarification on the relationship between NASA's commercial objectives in LEO and the NextSTEP BAA. Mr. Scimemi responded that through their BAAs, NASA is exploring the intersection of their ambitions for cislunar space and Mars and private industry's ambitions for LEO; namely, technology that allows people to live in space.

Congressional Speaker: Rep. Derek Kilmer, U.S. House of Representatives Committee on Appropriations

Representative Kilmer appreciates the space industry because of how it benefits the U.S. economy, creates jobs and sustains the U.S.'s reputation as a home for innovation. Both private and government entities in the space industry are utilizing the increasing sophistication and decreasing cost of technology to democratize space, and Representative Kilmer believes the U.S. should capitalize on these advancements in three main areas. First, policies that seek to lower the cost of access to space should be pursued. Although the cost of the technology itself has decreased, the expense of putting this technology into orbit hinders innovation and entrepreneurship in space. Second, the U.S. should work to strengthen its commercial space ecosystem. U.S. companies are setting the pace for technological development and experimentation in space, and so Congress should support the U.S.-based commercial space industry and supplier networks. Congress can do this through reassessing U.S. regulations and trade policies and by ensuring that government entities in the space industry have the resources they need to operate. Third, the government needs to explore how it can best be an effective partner for the commercial space industry. Although the government should still lead in goals they uniquely hold, such as deep space exploration, Representative Kilmer believes the U.S. government should understand areas in which private industry can innovate faster and allow the commercial space industry to take over these areas. When possible, the civilian and defense communities should partner with the commercial space industry to meet joint space goals.

Questions from the COMSTAC

Chair Gold asked how Representative Kilmer expects the election year to impact the upcoming appropriations cycle. Although Representative Kilmer hopes that Congress will get back to having regular budgets and appropriations bills, he expects that a continuing resolution will be issued. Member Garcia wanted to bring attention to companies that operate at the suborbital level, who are developing technology that can benefit the rest of the space industry as well as transportation on Earth.

International Space Policy Working Group: Jennifer Warren, Vice-Chair

The International Space Policy Working Group (ISPWG) has had four teleconferences since the past COMSTAC meeting. These calls focused on topics such as the lunar village, Indian launch services, export controls, and non-interference on celestial bodies. COMSTAC has already adopted a couple of the OFRs created by this working group, such as one advising Dr. Nield to speak with the ESA regarding the idea of a lunar village and another advising the U.S. government to take a cautious approach to Indian launch services.

The ISPWG proposed an OFR regarding non-interference on celestial bodies. The observation in this OFR is that the FAA AST is going to use its existing launch licensing authority to encourage private sector investments in space activities. An important part of this is that non-interference is somehow assured. The finding is that industry would benefit from a clearer understanding of the expected scope of non-interference for the private sector. The COMSTAC recommends that in compliance with international regulations, specifically the Outer Space Treaty, the FAA AST, within the bounds of its jurisdiction, support the principle of non-interference in a broad and robust fashion and ensure that private sector companies will be able to conduct their operations free from interference by other entities. The recommendation passed after a vote by COMSTAC.

The ISPWG recently met with a representative from ICAO who presented ICAO's global safety plan. Currently, commercial operations are planned to be in segregated airspace for the next five years and so do not pose a threat to the air transportation community. The plan will be reviewed again in 2019, so the ICAO recommends that no action be taken until then unless there is a violation of this segregated airspace.

Business/Legal Working Group: Mr. Chris Kunstadter, Chair

The Business/Legal Working Group presented two OFRs, the first of which was about the use of excess ICBM motors for commercial launch. In this OFR, the COMSTAC observes that, over the last 20 years, consistent and bipartisan space policies have resulted in billions of dollars of private investment in creating and maintaining a robust domestic commercial space industry. The COMSTAC finds that by changing the policy on the use of ICBMs, the government could discourage new investment and undermine the market's confidence in the emerging small space launch sector. Therefore, the COMSTAC recommends that, in its interactions with Executive Branch agencies and Congress, FAA AST support the maintenance of existing policy with respect to the use of excess ICBM assets in order to sustain the continued growth of the commercial U.S. launch sector. Member Precourt suggested that the COMSTAC meet with other industry members for further discussion before voting on this OFR because of new data. Namely, he sees a gap in the market for launch services for satellite providers, and

believes that allowing the use of excess ICBM assets as a temporary solution for this gap could keep these providers from moving overseas for launch services, thereby helping the U.S. commercial space industry. In the ensuing debate, some were in favor of this meeting and others argued that such a meeting would be harmful because of the time sensitivity of the issue and unnecessary because of how long this policy has already been debated by the government. Some members also raised the point that private industry has already been working to address these service gaps, and so any reversal of the existing policy could discourage private industry members from investing in a solution. Ultimately the full OFR passed after a vote from the COMSTAC. The Working Group will still have a discussion with private industry members at a later date.

The second OFR was about the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space (COPUOS). In this OFR, COMSTAC observes that, during the April 2016 meeting of the Legal Subcommittee of COPUOS, the U.S. was accused of violating the Outer Space Treaty of 1967 by adopting a unilateral approach to the extraction and utilization of extraterrestrial resources through adoption of the CSLCA. The COMSTAC finds that, throughout the development of the CSLCA, industry, Congress and the Executive Branch explicitly crafted the legislation to ensure and bolster U.S. conformity with the Outer Space Treaty, creating a system that can serve as a model for other nations to adopt. The COMSTAC recommends that, in its interactions with the Department of State and other Executive Branch agencies, FAA AST advocate for the U.S. government to express – at COPUOS and through other international and domestic forums – that the CSLCA is an example of national legislation that supports multilateral, international obligations, and that the CSLCA specifically implements U.S. obligations under the Outer Space Treaty. The full OFR passed after a vote by COMSTAC. Chair Gold clarified that private industry will be participating in this advocacy because they helped draft the legislation.

Congressional Speaker: Rep. Steve Knight, U.S. House of Representatives Committee on Science, Space, and Technology, Committee on Armed Services

Congress, NASA and other members of the space industry have worked together to identify areas that the space industry should focus on, such as hypersonics, low boom supersonic airplanes, and airplanes that are faster and more economical. The Aerospace Innovation Act will work with a number of different organizations to prioritize and have a plan for programs and research in these areas. Representative Knight believes that the government's role should be to get out of the way of innovation and support it as needed, and hopes that the Act will help the U.S. stay on the cutting edge of space technology and research. Representative Knight believes doing so is a matter of national security.

Questions from the COMSTAC

Dr. Nield asked if Representative Knight has considered what the government can do in procurement, acquisition and investment to support innovation. Representative Knight agreed that financial support is important and hopes that NASA would use additional government funding to take over actions and areas that those in private industry don't want to do or invest in, thereby freeing up innovators to focus on other research and development. Chair Gold asked Representative Knight for his thoughts on lunar settlement. Representative Knight answered that he believes the moon needs to be included in any

discussion of deep space exploration, because having a place to learn and do experiments in space is essential for this exploration. Member Holder asked how Representative Knight would address the issue of Congress' lack of consistency in supporting different aerospace programs, because it is difficult for members of the space industry to get involved or invest in a program if they can't be assured that it will continue. Representative Knight agreed that lack of consistent support has been a problem and that while his office will always be committed to aeronautics and space, it can be difficult for Congress at large to agree on their priorities. Member Warren identified predictable access to radio-frequency spectrum as a critical resource for aerospace innovation and noted that it is often overlooked in funding. Representative Knight agreed that this is a problem and commented that it can be tied back to issues in prioritization.

Standards Working Group: Oscar Garcia, Chair

The Standards Working Group (SWG) presented four OFRs, the first of which was about CSLCA Section 111 reporting. The finding in this OFR is that the COMSTAC/SWG will provide FAA AST and IDA-STPI responses and proactive inputs on occupant safety industry standardization areas and also "readiness metrics" to transition to an evolved oversight framework beyond the current moratorium/learning period. Occupants include space flight participants, government astronauts and crew. Although there is a favorable view on current reporting mechanisms from private industry to FAA AST, the upcoming quantity of reports requires a more direct input approach. Therefore, the COMSTAC/SWG recommends that the FAA/AST enable effective channels to receive timely industry inputs for required H.R. 2262 Section 111 Congressional Reports. For instance, industry website dedicated sections, feedback forms, and relevant AST and/or its consultants' email addresses. The finding and recommendation passed after a vote from COMSTAC.

The second OFR focuses on the development of a human space flight occupant safety standards development roadmap. The SWG created a task group to independently address industry and different stakeholders and brainstorm possible ways forward. The finding is that the COMSTAC/SWG agrees with the FAA AST's two potential regulatory roadmap milestones. Milestone 1: industry standards developed as a precursor to human space flight occupant safety licensing. Milestone 2: routine commercial space travel activity as a precursor to potential new safety frameworks, for example, certification of vehicles and operators or others. Member Greason clarified that both the expiration of the moratorium and the development of industry standards are viewed as precursors to an occupant safety licensing regime. The finding passed after a vote from COMSTAC.

The third OFR centers on the development of human space flight occupant safety standards and recommended practices (SARPs) and a related committee. Member DalBello asked if these voluntary consensus standards would be under the purview of the Commercial Spaceflight Federation (CSF) or ASTM. Vice Chair Lopez-Alegria responded that this has not yet been decided. The scope of the committee shall be the development and maintenance of voluntary consensus standards and recommended practices for the commercial space flight industry. Areas to address in standards include, but are not limited to, design, manufacture and operational use of vehicles used for human and unmanned space flight. A principle objective of the committee is to improve the safety of crew,

government astronauts and space flight participants. The finding is that the COMSTAC supports industry's efforts through the CSF's leadership role in the formation and structuring of a new commercial space flight committee. The new committee will develop, amongst other items, voluntary consensus SARPs under the auspices of ASTM. The COMSTAC and SWG recommend that the FAA AST join the new industry-led ASTM commercial space flight committee. The finding and recommendation passed after a vote from COMSTAC.

The finding in the final OFR is that the COMSTAC SWG and the ISPWG support DARPA's interest in working with industry to develop voluntary industry-driven consensus standards for technical and operational safety to encourage commercial servicing and on-orbit construction capabilities. Such voluntary, industry-driven consensus standards could benefit industry by avoiding incidents, accidents, and misunderstandings arising from a lack of knowledge of such activities. The finding passed after a vote from COMSTAC.

NASA Speaker: Dr. Dava Newman, Deputy Administrator, NASA

Commercial space is a key part of NASA's vision for the future. Over the past year NASA has reached many commercial milestones, such as announcing the crew for the commercial vehicle's first test flight to expanding the commercial cargo resupply. These early successes indicate that NASA's approach to exploring LEO is effective. NASA hopes to use these approaches as well as other industry best practices to travel to Mars in the 2030s. Boeing and SpaceX are both completing testing and equipment modifications needed for human space flight in NASA's Commercial Crew Program, with the goal to run test flights in 2017. Both companies have service contracts with NASA for crew missions that will go into effect if they successfully pass certifications. Orbital ATK and SpaceX had recent successes in carrying commercial cargo.

NASA's Space Technology Mission Directorate has recently solicited industry proposals through Tipping Point Technologies and Announcements of Collaborative Opportunities (ACO), with the goal of finding proposals that utilize collaboration and new and emerging technologies to the mutual benefit of private industry and government. Topics for the proposals include robotic in-space manufacturing, small spacecraft systems, remote sensing instrumentation, and advanced thermal protection on system development. Twenty-two proposals were received and include partnerships with various companies such as Orbital ATK, Aerojet Rocketdyne, and Northrop Grumman. NASA will release a new Tipping Point Technologies solicitation late in FY16 and a new ACO in FY17. NASA's second NextSTEP BAA was released on April 19th and seeks to identify and facilitate development of habitation capability in cislunar space and the concepts that can support extensive human space flight.

Questions from the COMSTAC

Chair Gold asked Ms. Newman for her thoughts on the transition in LEO from government-owned to privately-owned and operated facilities. Ms. Newman responded that NASA is in the beginning stages of making this transition and is working with international partners, other U.S. agencies and private industry to better understand commercial demand and what commercialization of LEO could and should look like. When asked if the government would be willing to be a customer in missions where the

destination is decided by private industry, Ms. Newman responded yes, provided that the proper capabilities are in place. Member Garcia asked about NASA's views and future outlook on aerospace high-speed transportation beyond hypersonics. Ms. Newman responded that NASA has focused a lot on supersonics and hypersonics but hasn't really thought beyond hypersonics. She added that universities should not dichotomize the fields of aeronautics and orbital research, but rather present them as members of the aerospace spectrum.

Chair Gold asked Ms. Newman for NASA's thoughts on what role the moon will play in human space flight and operations. She responded that NASA welcomes collaboration with private industry and other nations to land on the moon and further deep space exploration. NASA also wants to work with international partners to develop standards to facilitate safe space activity in the commercial sector. When asked for specifics about NASA's plan to journey to Mars, Ms. Newman responded that this plan has broken the journey into three phases: the ISS, cislunar space and finally Mars. This plan still has some flexible architecture that will evolve as more data is collected.

NTSB Update: Dr. Michael Romanowski, Director of Space Integration, FAA

Dr. Romanowski presented on lessons learned from recent mishap and accident investigations. NTSB leads the investigation of accidents, while FAA AST or the launch operator will lead investigations on mishaps. Since August 2014, there have been nine investigations, one of which was for an accident. The NTSB has found that this framework is effective and that private industry can be trusted to conduct robust and credible investigations. However, the NTSB also came to the conclusion that the regulatory definitions of accident and mishap need to be revised so that they better reflect FAA's public safety mission, while still ensuring easy translation between NASA and USAF's mission assurance-based definitions. The current regulatory definition of mishap is extremely broad and the definitions of both accident and mishap have a low threshold in terms of monetary damage to property. These definitions need to be revised in a way that doesn't stifle private industry but allows necessary investigations to be conducted.

The NTSB has by and large accepted FAA's response and actions in the SpaceShipTwo accident investigation. The FAA will continue to submit annual updates to the NTSB until the recommendations are closed out. The NTSB has made eight recommendations, several of which focus on how the FAA works with private industry. The recommendations focus on the development of human factors guidance for operators, the manner in which evaluations and the experimental permit process are conducted, and how human error is addressed and mitigated. The FAA's response to these recommendations is driven by the fact that the FAA has to protect public safety while encouraging continuous development in occupant safety. In August 2014 the FAA released the Recommended Practices for Human Space Flight Occupant Safety. These standards are a good starting point for the development of voluntary consensus standards and could be used as a way to develop a means of compliance to the current regulations. The FAA feels that the experimental permit regulations need to be modified to help industry address the requirements in a more straightforward way and that at a minimum the guidance for the human factors requirements needs to be improved. Mr. Romanowski

believes that a current project to identify the best practice considerations for small winged commercial space flight vehicles will feed a lot of this standards and guidance work.

The NTSB has also recommended the development of a pre-application coordination/consultation process. This program would require the development of a compliance plan between a company and the government in which all parties would understand the relevant rules and regulations, especially as they relate to any new or unique technologies being licensed. This would benefit private industry by reducing regulatory risk, thereby improving a company's ability to plan programs and resources. The FAA has issued guidance on this process internally and a compliance checklist to industry, and is drafting a new advisory circular that factors in the improvements made to the existing guidance. Finally, the NTSB has asked the FAA to set up a lessons learned database in which industry would make voluntary submissions. Beginning in September 2014, the FAA has conducted an internal study of the feasibility of such a project, finding that there would be many challenges in implementing this database. Challenges include the de-identification and protection of proprietary data, creation of a non-punitive environment, and the availability of data mining and analysis systems. The FAA would likely take a multi-year step approach in creating this database and focus mainly on the sub-orbital human space flight area. The FAA has two data mining and analysis tools that it is interested in expanding to include space data and would like to partner with industry members to explore what would be gained by extending these tools.

Questions from the COMSTAC

Member Garcia commented that data mining for space safety programs and quality assurance is a challenge because of how small the industry is. However, he is hopeful that government and industry will be able to work together to find an appropriately sized solution that can grow with the industry. Member Warren suggested that the FAA research the Department of Homeland Security's CII sharing scheme for information on how to protect shared data.

Congressional Speaker: Rep. Jim Bridenstine, U.S. House of Representatives Committee on Science, Space, and Technology, Committee on Armed Services

Ten of the American Space Renaissance Act's national security provisions have been adopted in the House of Representative's FY17 National Defense Authorization Act (NDAA). These provisions include the authorization of funding for various programs and services that serve national security interests as well as private industry interests and the modification of the Wideband Satellite Communications Analysis of Alternatives to fully consider commercial technologies and service models and ensure an apples-to-apples cost comparison between MILSATCOM and COMSATCOM. The NDAA also authorizes the creation of a pilot program within the Department of Defense to purchase weather data to be used in numerical models for weather prediction and forecasting. This program is not meant to replace government weather systems such as JPSS, but rather augment them with commercially-sourced data. The NDAA still has to complete floor action in the House of Representatives and might change as a result.

Questions from the COMSTAC

Dr. Nield asked Representative Bridenstine for his opinion on the feasibility of a civil agency taking over safety-related space situational awareness functions. Representative Bridenstine responded that making this transition is essential for national security. The JSpOC's purpose is to fight wars and ensure national security, but because of its unique capabilities it has acquired additional day-to-day responsibilities that interfere with this purpose. Representative Bridenstine believes the FAA should take over these day-to-day operations, which include monitoring and managing space debris.

Member Holder observed that although the COMSTAC can make recommendations related to this topic, the FAA AST needs authority and funding to be able to act on them, and asked how Congress could help in this situation. Representative Bridenstine responded that he and others are already working to advocate for and find funding, and his senior legislative assistant Christopher Ingraham stressed that in order to obtain this funding, it's essential to demonstrate commercial space's potential for innovation and growth. This is difficult because many members of Congress are thinking of transportation in terms of roadways and waterways. Chair Gold opined that much of the pushback on this funding stems from the belief that it will be used to create more regulations that will burden private industry, and argued that this funding would actually help private industry by making the regulatory process faster and more efficient. Representative Bridenstine agreed and added that the potential consequences of a collision in space are too serious to not take action now. He also commented that Congress can't always act even when it wants to because of government uncertainty in the authority of different agencies.

When asked about challenges and opportunities in the remote sensing field, Representative Bridenstine responded that two big challenges are how long it takes to get a license and how licenses can be revoked with no reason given after a business has already capitalized on it. To address this second challenge, the American Space Renaissance Act states that businesses should be compensated if their remote sensing license is revoked and be given a reason as to why it happened. Audience member Jim Muncy asked why a remote sensing licensing regime is even necessary when the ability to generally collect information is so ubiquitous. Representative Bridenstine did not know the answer but will look into it.

New Business and Public Comments: There was no new business or public comments.

Adjournment: Chair Gold adjourned the meeting at 4:50 pm.