U.S. Department of Transportation
Federal Aviation Administration

Federal Aviation Administration

Office of Commercial Space Transportation, FAA AST
Commercial Space Transportation Advisory Committee (COMSTAC)
September 17, 2014 - Meeting Minutes

OPENING REMARKS BY THE CHAIRMAN

– Michael N. Gold, COMSTAC Chair, Bigelow Aerospace

Designated Federal Officer and COMSTAC Executive Director Mike Beavin called the meeting to order at 8:30 a.m. He reminded those assembled that the meeting was being webcast. He introduced COMSTAC Chairman Mike Gold.

Chair Gold welcomed those assembled. He introduced two new COMSTAC members: Samantha Marquart and Dan Hendrickson. Member Marquart is currently a PhD student at The George Washington University. She holds an MA from the same institution and a BS from the Massachusetts Institute of Technology. Member Hendrickson currently is employed by Astrobotic. He holds a BS from the Florida Institute of Technology and an MA from The George Washington University. Chair Gold offered his congratulations to SpaceX and Boeing, following the official announcement by NASA the day before, as the winners of the next phase of the commercial crew program to provide transportation services for NASA astronauts to and from the International Space Station (ISS).

DARPA SPACE UPDATE

– Pamela Melroy, Deputy

Pam Melroy, Deputy Director of DARPA's Tactical Technology Office provided the update. She said she was honored to be asked to address the COMSTAC. DARPA's mission is to prevent strategic surprise, and so works at the high-risk end of the portfolio looking for outsized impact. DARPA is organized into six technical offices: Biology, Technology, and Complexity; Defense Sciences; Information, Innovation, and Cyber; Microsystems Technology; Strategic Technology; and Tactical Technology. This is a time of great challenge and opportunity for the exploitation of space technology and resources. DARPA believes its greatest impact in space technologies will be gained by focusing on affordability, while looking to create flexibility and increased access. DARPA focuses on resilience, as well as affordable and routine access to space. DARPA is working to create abilities in aircraft-like space access, the launch of novel payloads on short notice, rapid deployment of small satellite constellations, Geosynchronous Earth Orbit (GEO) space robotics, and real-time space domain awareness.

DARPA has several programs in its space systems portfolio: Phoenix, Experimental Spaceplane 1 (XS-1), ALASA (Airborne Launch Assist Space Access), Orbit Outlook, and the Space Surveillance Telescope.

The Phoenix program is built on three pillars: advanced GEO space robotics, spacecraft morphology, and the Payload Orbital Delivery System (PODS). Launch costs tend to dominate investment, but satellite buses are also very expensive. Modular satellite designs could dramatically lower costs for vehicle design, launch, and maintenance. DARPA recently issued a

Request for Information to explore a joint public-private partnership to develop GEO capabilities.

XS-1 will also lower launch costs and provide increased flexibility in access to space, targeting the 3,000-5,000 pound class of launch vehicles. DARPA seeks a $5 million launch capability in this program, the ability to "fly ten times in ten days", and the demonstration of Mach-10 capability. Spin-off technologies from XS-1 are expected to be rich and far-reaching. XS-1 is focused on development of a reusable first stage launch platform.

ALASA's goal is to provide more affordable, routine, and reliable access to space. Just as Moore's Law dictates the miniaturization of electronic equipment, satellite design in the future will follow a trend of decreased mass and volume. The goal is to launch a 100 pound payload into low earth orbit (LEO) for $1 million, inclusive of range and integration costs. Frequent exercise of the program concepts will demonstrate a learning curve. ALASA is focused on reducing costs in the second stage of launch.

Other transaction authorities (OTA) constitute one third of DARPA's contract awards annually. Benefits of this mechanism include the ability to work with smaller and non-traditional companies, as well as reduced acquisition requirements. Payments are generally made upon completion of milestone achievements. DARPA Deputy Director Scott Ulrey is considered an expert in the government's use of other transaction authority and is available for consultation.

Member Karika said the Atlas V and Delta IV platforms were developed with use of OTA. Chair Gold said COMSTAC frequently focuses on NASA, but DARPA has enabled so many technologies over its years of service that many capabilities enjoyed now would not have been possible without it.

KEY ISSUES FACING AST AND INDUSTRY

- Dr. George C. Nield, Associate Administrator for Commercial Space Transportation

Dr George Nield, the FAA Associate Administrator for Commercial Space Transportation, said NASA's announcement concerning SpaceX and Boeing has "put us well on the way to regaining our ability to launch our astronauts into orbit on American rockets from American soil." These missions will be jointly overseen by FAA and NASA.

One hundred six years to the day prior to this meeting, Army Second Lieutenant Thomas Selfridge, the first military officer to pilot an aircraft, flew with Orville Wright in a demonstration of the Wright Model A. One of the plane's propellers suffered a catastrophic stress fracture, which caused the vehicle to crash and resulted in extensive injuries to Mr Wright and the death of Lieutenant Selfridge. His was the first fatality to come about as the result of an

airplane accident. The Wrights' analysis of the crash brought about improvements to the plane's design and the development of the Wright Military Flyer. Army regulation following the crash mandated the use of helmets by airmen.

Space transportation is inherently risky. Continued success in this arena will be predicated on continual improvements in safety performance. Dr. Nield said, for him, the key question is: what is the best way for government and industry to work together to advance the cause of space flight safety? In passing the Commercial Space Launch Amendments Act (CLSAA) of 2004, Congress was concerned that FAA would become overzealous in its regulation, and thus included an eight-year (plus a three-year extended) moratorium on the promulgation of new spaceflight regulations, expiring in October 2015.

FAA and stakeholders have created a document entitled "The Recommended Practices for Human Spaceflight Occupant Safety." Its primary purpose is to facilitate ongoing safety discussions between government, industry, and academia. The document provides a framework for industry to create its own consensus standards, and may serve as a starting point should the government decide to promulgate regulations in this area. The crafters of the document hoped to encourage technological innovation while minimizing the likelihood that occupants would be exposed to avoidable risks. The document seeks to encompass the wide range of missions and designs in current and future use. The primary guide for the document was NASA's requirements for its commercial crew program. Developers evaluated the helpfulness of these requirements for use with respect to commercial spaceflight programs. Sub-orbital and orbital mission profiles are covered. Public safety and mission assurance are not directly addressed. The recommended practices have been vetted by a wide range of government stakeholders, including NASA, COMSTAC, and FAA's offices. Different risk levels are appropriate in different occasions. Several levels of care are addressed to protect safety-critical spaceflight participants. Participants should enjoy a reasonable chance of survival in the event of an emergency. Safety concerns should be addressed in an integrated fashion over the entire lifecycle of a system. Recommendations are broadly written, largely performance-based, and eschew hard performance limits. Industry is encouraged to develop its own set of standards for use in this area. Medical consultation for spaceflight participants is included in the document, but not in the form of performance standards. The document will evolve as industry evolves. FAA does not plan to initiate rulemaking in this area following the end of the regulatory moratorium next year. Open dialogue will help ensure that commercial spaceflight is as safe an endeavor as possible.

Dr. Nield thanked COMSTAC for its service, its continuing advice and counsel, and its willingness to provide FAA with feedback on its performance. He recognized Mr. Marvin Esterly, Director of the Midland International Airport. Midland is the ninth FAA-licensed spaceport, and the first Part-139 certificated airport to have a collocated spaceport.

Member Facktor Lepore asked for comment on the views of Next-Gen, FAA and DOT in the rise of commercial space activity. Dr Nield said commercial spaceflight is in the spotlight, and there are challenges. However, the FAA Administrator is very supportive of the effort and will consider how to integrate new users. Member Garcia emphasized the importance of airports sharing spaceport licenses in terms of interoperability and network capabilities. He offered his congratulations on development of the document.

NASA SPACE TECHNOLOGY MISSION DIRECTORATE

– Dr. Michael Gazarik, Associate Administrator, Space Technology Mission Directorate

Dr. Michael Gazarik, NASA Associate Administrator for the Space Technology Mission Directorate (STMD), provided the update. He said STMD is the newest directorate at NASA, a little over a year old. NASA created STMD to provide a renewed focus on technology as new missions develop. Economic drivers as a result of technological investment were also considered. Connections with academia will be rebuilt through a variety of activities. The mission may be divided into four simplistic elements: travel, landing, life-support, and observation. Technologies need to be matured and developed. High-power solar-electric propulsion and its many uses are an area of early focus and investment. STMD participates in all levels of development from early-stage grants to flight demonstrations. Entry, descent, and landing capabilities are being developed. New knowledge has already been developed in the areas of inflation dynamics, autonomous rovers, and materials. The directorate is working to better align with the needs of industry. STMD funds 500 activities at over 130 universities through a variety of mechanisms. Developments are afoot for the Flight Opportunities program. STMD recognizes the evolving nature of so many of the actors in the field of space technologies.

Member Isakowitz asked for comment on STMD business practices to make it easier to work with industry. Dr Gazarik said that the Space Act Agreements are the first method commonly used and will be increased in the next few years. Partnership opportunities are out there, and alignment will be important.

IMPLICATIONS OF INTERNATIONAL AGREEMENTS TO U.S. COMMERCIAL SPACE TRANSPORTATION

– Kenneth Hodgkins, Director, Office of Space and Advanced Technology, Department of State.

Mr. Ken Hodgkins, Director, Office of Space and Advanced Technology (OSAT), provided the briefing. He thanked COMSTAC for inviting him. He said a number of United States companies have recently announced plans for unprecedented activities in outer space. Such activities implicate the international legal framework for space in novel ways. The Department understands industry's desire for legal clarity, especially since it is so important to attracting

investment. The Department works to build support for these new programs by both legal and diplomatic means, and to ensure that such activities comply with the United States international obligations. Article 6 of the Outer Space Treaty is of special interest to commercial space organizations, which creates obligations of authorization and supervision for the home nations of companies engaged in space operations. In the US, these obligations are overseen by FAA, FCC and NOAA. It is not clear that the Treaty is adequate for all newly contemplated commercial space activities. A sufficient regulatory framework will strengthen the Department's case as it builds international support for the new activities. This is especially true as it pertains to resource exploitation. Dialogue between the Department and entities contemplating new space activities ought to continue.

Member Marquart asked how the United States government will delineate between private and government activities under the Outer Space Treaty, especially with respect to object registration. Mr. Hodgkins said registration has already been complicated by the proliferation of multi-national ventures. In such cases, the United States has stated it will oversee objects over which it has control and jurisdiction, even if it was not also the launching state. The United States expects that other states will oversee their objects despite launching from the United States. Providing for activities that take place on other celestial bodies requires further consideration.

Member Kunstadter asked how the Department is working with foreign partners with respect to Article 6. What are the next steps and what can COMSTAC do to help that process? Mr. Hodgkins said the United States government must determine what its various arms are prepared to do with respect to Article 6. Once this is established, the Department will explain the government's view to other space-faring countries and seek their support. COMSTAC could help by promoting the understanding that United States activities of commercial actors will be more easily dealt with under the treaty than those activities which do include foreign aspects. Member Kunstadter said that commercial investment will come more quickly as resolutions to legal issues become clear.

Member Garcia asked, inasmuch as the speed of business greatly exceeds the speed of regulatory interpretation, has the OSAT considered restructuring itself or the Outer Space Treaty to more expeditiously meet the needs of investment and industrial communities. Mr. Hodgkins said the existing treaty framework does not necessarily need to be changed. Changing the treaty would take a lot of time in its own right, and the bars to amendment are high.

Chair Gold asked what issues COMSTAC should consider in light of the recent announcement of SpaceX's and Boeing's increased role in crewed missions. Mr. Hodgkins said the new operations raise "a whole slew of international issues." How to deal with contingencies, e.g.,

what about when a commercial vehicle lands in foreign territory? International conversation will continue to be necessary during the era of commercial space operations.

Member Sundahl asked how the United States government concluded it still had control over space objects not launched from the United States. Mr. Hodgkins said this conclusion was arrived at somewhat by accident in the lead-up to the launch of Globalstar/Iridium, US-owned satellites launched from Russia. Conversations with international partners ensued and the partners decided the course was the most rationale and the most likely to control liability.

Chair Gold asked for comment on continued interaction with Russia in this area. Mr. Hodgkins said a number of conversations have been suspended. Steve Casazza of the Sierra Nevada Corporation asked what the Department thinks with respect to export issues in advance of launch from foreign sites. Mr. Hodgkins said such conversations have not taken place, but pertinent offices have been informed that they will need to examine these issues.

NASA COMMERCIAL CREW PROGRAM UPDATE

– Philip McAlister, Special Assistant, Office of Program Analysis and Evaluation, NASA

Phil McAlister, NASA Special Assistant for Program Analysis in the Office of Program Analysis and Evaluation, provided the briefing. He said NASA embarked on commercial human space travel in 2010 with the establishment of philosophy on how they would operate the program. NASA decided to create partnerships with companies to foster the growth of the LEO industry, which would be good for ISS, NASA, and the nation. The Augustine Commission laid out a compelling argument for the development of commercial space travel capabilities. NASA will certify programs for ferry services to the ISS; FAA will regulate and license other operations. NASA has thus far partnered with eight companies in the effort. The Commercial Crew Transportation Capability (CCtCAP) companies which succeed in certification will be awarded two launches with an option for four more. NASA is purchasing a service, but will not dictate how the market evolves, and needs sister agencies to ensure a seamless regulatory environment for its partners. The contracts awarded have maximum values of $2.6 billion for SpaceX and $4.2 billion for Boeing.

Member Karika asked whether FAR Part 15 contract arrangements are still compatible with CCtCAP. Mr. McAlister replied, yes. Public-private partnerships usually are guided by contracts and/or MOUs. Member Marquart asked for comment on the public and industry reaction to the announcement of the contract awards. Mr. McAlister says NASA's PAO office finds that the response has been "overwhelmingly positive." Everyone seems to support the notion of American access to space. Member Facktor Lepore asked for comment on NASA's position with respect to more flexible contract arrangements in areas beyond commercial space transportation. Mr. McAlister said there are opportunities going forward, "but we'll just have to

wait and see." Member Lopez-Alegria asked about the visibility of milestone achievement. Mr. McAlister said this has not yet been determined. Chair Gold asked about funding from Congress moving forward. Mr. McAlister said NASA will work with congressional interests to ensure that budgets are accurate, transparent, and understandable. Member Isakowitz asked what the CCtCAP's top three challenges are. Mr. McAlister said he has not considered this question since contract award, though budgets are always a challenge for NASA. In response to an audience question, Mr. McAlister said other companies not part of the initial award may be brought in through an "on-ramp" process. In response to an audience question, Mr. McAlister said the contracts do not stipulate a taxi or rental-car model; these decisions are up to the provider. Chair Gold asked whether the amounts awarded were close to those proposed. Mr. McAlister said answers to that question will be found in the Source Selection Statement.

CONGRESSIONAL PERSPECTIVE – EXPORT CONTROLS AND THE ROLE OF COMMERCIAL SPACE IN THE INTELLIGENCE AND DEFENSE COMMUNITIES

– Representative C.A. Dutch Ruppersberger, Ranking Member, Permanent Select Committee on Intelligence, U.S. House of Representatives

Congressman Ruppersberger, Representative of Maryland's Second District to the US Congress, said he appreciated the opportunity to address COMSTAC. The Congressman noted the need to start promoting space and letting the average citizen know how important it is suggesting to Members that a greater public marketing campaign should take place. The US became so strong because it controlled the skies. A report initiated by the Committee on Technical and Tactical Intelligence found that the space industry was in need of invigoration, which means money. ITAR (International Traffic in Arms Regulation) was an issue in need of a solution. Progress is being made as a result of the work of a lot of people. Launch schedules in the US have historically been too long for commercial involvement. The US should not be forced to rely on Russia and its rocket engines. We want an engine that everyone can use. Many members of the younger American generations are interested in working on cyber issues; we should work to interest more of them in space. Speaking off the top of his head, he suggested a competition between China and the US to race robots to the Moon. Such an effort would invigorate research at American universities.

Member Garcia said the policies guiding space programs were drafted in another time with different needs and priorities; shouldn't we consider updating them to contemplate commercial operations? Mr. Ruppersberger replied, yes. When the system is set up properly, government should be able to get out of the way. Chair Gold asked for comment on NASA's asteroid retrieval mission. Mr. Ruppersberger said NASA cannot define its mission in this area. If it's a danger, the American people will want an answer. He added that the government will operate under a continuing resolution until December. Member Facktor Lepore asked whether members of Congress understand the value of space. Mr. Ruppersberger replied, no, adding that we as a

country will be a weaker country if our space program fails. An audience member said there is public support for an American return to the Moon. Mr. Ruppersberger said "competition has a lot to do with it."

CONGRESSIONAL PERSPECTIVE – COMMERCIAL SPACE LAUNCH ACT, ASTEROIDS ACT, AND NASA REAUTHORIZATION

– Representative Lamar Smith, Chairman, Committee on Science, Space, and Technology, U.S. House of Representatives

Lamar Smith, Representative of Texas' Twenty-first District to the US Congress, said he appreciated the opportunity to exchange ideas. Human history is punctuated by great advancements in the exploration of the world around us. Accomplishments in space travel boost the US economy and help keep the country competitive in the global marketplace. Americans are fascinated by the cosmos, and largely support space exploration and NASA. The NASA Reauthorization Act passed the House by a vote of 401-2, but awaits action in the Senate. These are anxious times for our space program. He said one of his top priorities is to get American astronauts launched on American rockets from American soil as soon as possible. The Administration stumbled in cancelling the Constellation program and standing up the Commercial Crew program. This program, however, is our best bet for ending reliance on Russian ferry services. Congress typically funds NASA at levels greater than Presidential requests. The legal framework for exploitation of celestial resources needs to be established. Updating the CSLA is a priority next year.

Chair Gold asked for comment on the asteroid retrieval program. Mr. Smith said "we can do better." We should develop a mission that will seize the imagination of the American people, and which will advance the capability of a Mars mission. We should set the goal of 2021 for a flyby mission to Mars. In response to an audience question, Mr. Smith said the Commercial Space Launch Act is not entirely non-controversial; "we recognize the need to do a lot."

OPERATIONS WORKING GROUP REPORT

– Janet Karika, Chair

Member Karika, Chair of the Working Group, provided the report. The Working Group met on September 16, 2014, the day prior to the full Committee meeting. The Working Group reviewed its previous set of operations, findings and recommendations; received a briefing from TSgt Wil Lugo of Space Command headquarters on the Consolidated Launch Schedule Review Board (CLSRB); received a briefing from Robert Consolo from the Embry Riddle University on the possible creation of an FAA space port guide; the FAA's Randy Repcheck discussed the "The Recommended Practices for Human Spaceflight Occupant Safety"; and discussed proposed initial commercial spaceflight standards. The current CLSRB scheduling process meets Air

Force's needs, but the commercial potential of the Air Force ranges is unknown. COMSTAC agreed with the proposed observations and findings. The Working Group will conduct further discussions with respect to the Recommended Practices document. The Working Group recommends that FAA AST and COMSTAC work together to further define the recommended practices, to which the COMSTAC agreed. An amended recommendation pertaining to medical certificates was agreed to by COMSTAC. With respect to commercial spaceflight standards, the Working Group recommends that the FAA AST and industry, via COMSTAC, engage in an ongoing dialogue on the development of human commercial spaceflight industry standards and establish a process through which a prioritized list of these standards will be established. Dr. Nield challenged industry to populate the Recommended Practices with real numbers and verification methods. He supports the proposed process. Member Lopez-Alegria said the challenge has been found in prioritization; tell us where that is so we can get out in front of it. Following the discussion, COMSTAC agreed to the recommendation.

BUSINESS/LEGAL WORKING GROUP REPORT

– Chris Kunstadter, Chair

Member Kunstadter, Chair of the Working Group, provided the report. This working group also met on September 16, 2014. The Working Group is eager to work with Congress on issues surrounding the CSLA. The first portion of the day's meeting focused on the ASTEROIDS Act, received reports from Attorney-Advisor Brian Israel of the Department of State, private attorney Athina Balta, and Peter Marquez of Planetary Resources, Inc. Investment in space is going to require certainty. The Working Group received reports from Duane Ratliff of CASIS, Jeff Manber of Nanoracks, and Gordon Roesler of DARPA. The Working Group recommends that FAA AST study the development of a mission license for commercial space activities in and beyond LEO that are not already regulated by other federal agencies and would serve either in tandem with or independently of an FAA-issued launch or reentry license, to which the COMSTAC agreed. The Working Group recommends that the FAA AST support the ASTEROIDS Act, to which the COMSTAC agreed.

SYSTEMS WORKING GROUP REPORT

– Livingston Holder, Chair

Livingston Holder, Chair of the Working Group, provided the report. The Systems Working Group will be retired, to be replaced by the Standards Working Group. In its meeting on September 16, 2014, the Working Group discussed the DARPA XS-1 program, receiving reports from Jess Sponable of DARPA, Dennis Poulos of Masten Space, and Doug Young of Northrup Grumman. The Working Group generated an observation: The XS-1 program as presented by DARPA and industry represents great potential to advance commercial spaceflight capabilities. The XS-1 program is focused on integrating near-term and available technologies to dramatically

lower launch costs through reusability and reductions in facility and launch team requirements and dramatically shorten vehicle turnaround times. These attributes will be directly applicable to and strengthen the business viability for commercial spaceflight activities. The COMSTAC agreed to the observation.

INTERNATIONAL SPACE POLICY WORKING GROUP REPORT

– Dr. Mark Sundahl, Chair

Mark Sundahl, Chair of the Working Group, provided the report. The Working Group discussed the International Standards Organization's standard-setting process, and received reports from Kevin Wolf and Christopher Nelson of the US Department of Commerce, John Sloan of FAA/AST, Benedetto Marasa of the Italian Civil Aviation Authority. The Working Group also discussed recent developments in the IAASS. The Working Group recommended that FAA AST keep ISO's TC20 Technical Advisory Committee members informed of developments in the FAA/AST human spaceflight standards. Member Lopez-Alegria said FAA AST does not develop standards. COMSTAC decided to table discussion on this recommendation. The Working Group recommended that FAA AST encourage the aviation authorities of foreign countries to create a separate office for the licensing of commercial space transportation vehicles, to which the COMSTAC agreed. The Working Group recommended that FAA AST oppose the proliferation of standards that follow the current approach taken by the IAASS, to which the COMSTAC agreed.

NEW BUSINESS

– Mr. Michael N. Gold, COMSTAC Chair

Mr. Beavin, COMSTAC Executive Director, reported that ISPWG Chairman Mark Sundahl and COMSTAC Chairman Mike Gold had recently been approved by the Department of State to serve as industry observers to the United Nations Committee on the Peaceful Uses of Outer Space.

PUBLIC COMMENT

- Mr. Michael N. Gold, COMSTAC Chair

No public comments were provided.

ADJOURNMENT

– Mr. Michael N. Gold, COMSTAC Chair

Chair Gold welcomed Mike Beavin to COMSTAC, having come from the Department of Commerce. Industry often takes for granted the support offered by FAA/AST. He thanked Dr Nield for everything he has done in provision of this support. The 18th Annual FAA Commercial Space Transportation Conference will be held on February 4 and 5, 2015. He recommended attendance to those assembled. Future COMSTAC meetings will hopefully be conducted in the course of a single day, rather than two. This change will likely create the need for increasingly active working groups in the form of teleconferences and other interactions.

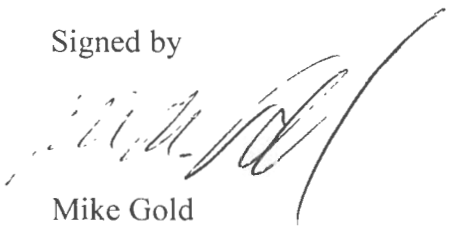
COMSTAC Members Present

1. Mike Gold, Bigelow Aerospace, Chairman
2. Michael López-Alegría, Commercial Spaceflight Federation, Deputy Chair
3. Charles Precourt, ATK Launch Systems, Systems Working Group
4. Janet C. Karika, Jacobs-NASA, Operations Working Group
5. Chris Kunstadter, XL Insurance, Business/Legal Working Group
6. Mark Sundahl, Cleveland State University, International Space Policy Working Group
7. Debra Facktor Lepore, Ball Aerospace
8. Patricia Cooper, Satellite Industry Association
9. Jennifer A. Warren, Lockheed Martin Washington Operations
10. Samantha Marquart, George Washington University
11. Christine Anderson, New Mexico Spaceport Authority
12. Daniel Hendrickson, Astrobotic Technology Inc.
13. Timothy Hughes, Space Exploration Technology Inc.
14. Oscar Garcia, Interflight Global Corp.
15. Livingston Holder, Holder Aerospace
16. Steven Isakowitz, Virgin Galactic
17. Michael Griffin, Schafer Corporation
18. Ray Johnson, The Aerospace Corporation
19. Bill Khourie, Oklahoma Space Industry Development Authority

Federal Aviation Administration Representatives

1. George C. Nield, Associate Administrator, FAA AST
2. Randy Repscheck, Deputy, Regulations & Analysis Division, FAA AST
3. John Sloan, International, FAA AST

Signed by



Mike Gold
Chairman, COMSTAC