

**Commercial Space Transportation Advisory Committee**  
**October 30, 2003**  
**MEETING MINUTES**

COMSTAC Chair, Livingston L. Holder, Jr., vice president, Space Systems, Andrews Space and Technology, convened the meeting at 8:35 a.m., and welcomed COMSTAC members and guests. Mr. Holder announced that he would be stepping down as Chair and handing the leadership of the Committee over to John Vinter, president and chief executive officer, International Space Brokers, Inc., Rosslyn, Virginia. Mr. Holder discussed the current state of the U.S. commercial space transportation industry. He pointed out that, although the prospects for traditional commercial space transportation markets are not bright, a few companies and individuals are still working hard to produce new launch vehicles and technology and AST is working to develop a regulatory environment for future launch operations. He noted that this is because of

*...Faith that there will be ... a better way to be more inclusive of the broader marketplace. Robust businesses serve broad and diverse markets. Our current commercial marketplace is narrow and fragile. Hiccoughs ripple like tidal waves. The future envisioned by the new commercial entrepreneurs is broad and inclusive. They have an undying belief that if space can be made accessible to a broader population, then a true marketplace will develop. .... As we go forward in the future, our small band of faithful, or shall we call them visionaries, will collaborate and compete, and one day, perhaps 100 years from now, an advisory meeting of the Federal Aerospace Administration, they might be recalling the names of some in this room who kept the faith to create an industry as commercial and robust as aviation is today.*

Mr. Holder acknowledged the support that he received from Committee members and the Federal Aviation Administration (FAA).

**Remarks by U.S. Department of Transportation Secretary Norman Y. Mineta**

Secretary Mineta greeted Committee members and meeting attendees and acknowledged the outgoing and new Committee chairmen, Mr. Holder and Mr. Vinter. He pointed out his past experience as the Co-Chair for the Congressional Space Caucus while serving as a Representative from California and his knowledge of the possibilities for U.S. commercial space transportation. He also mentioned the emerging market for passenger flight aboard suborbital reusable launch vehicles (RLVs) and acknowledged the critical role that the \$10 million X Prize is playing to provide incentives to the companies producing suborbital RLVs, comparing the X Prize to the Orteig Prize awarded to Charles Lindbergh (in 1927). He acknowledged the work of the Committee and thanked the members for giving their time to participate in the Committee.

**Report on AST Activities**

Patricia G. Smith, associate administrator for Commercial Space Transportation, FAA, began her presentation by presenting a plaque to Mr. Holder for his outstanding work as

COMSTAC Chair for the last four years and welcomed Mr. Vinter as the new Committee Chair. She then reported on AST activities since the May 2003 COMSTAC meeting, including the increase in the amount of work on suborbital RLVs within AST. She reported that AST's Licensing and Safety Division is working with Scaled Composites and XCOR Aerospace both located in California and Armadillo Aerospace of Texas to review their applications for launch licenses and with the Mojave Airport in California on its application for a launch site operator's license. She acknowledged XCOR Aerospace as the first company to achieve a sufficiently complete license application and presented XCOR president, Jeff Greason, with a letter from AST which indicates that the XCOR application is now under the 180-day time limit for review, with an expected completion date of April 23, 2004.

Ms. Smith also reported that AST developed definitions for suborbital launch vehicles and suborbital trajectory with FAA's Associate Administrator for Regulation and Certification (AVR); AST is continuing to work with the Air Force on Common Launch Safety Standards, and is developing an independent cost assessment to assist in addressing specific industry concerns about the supplemental Notice of Proposed Rulemaking (Licensing and Safety Requirements for Launch). She noted the increased activity by states to develop spaceports or other space activities for the purposes of economic development, including Oklahoma, New Mexico and Texas.

#### **FAA Commercial Space Transportation Safety Office**

AST staff member Al Wassel updated the group on the Commercial Space Transportation Safety Office, located at Patrick Air Force Base (AFB) in Florida, which was established on November 4, 2002. Mr. Wassel, program manager for the Office, outlined the responsibilities of the Office and discussed the activities and accomplishments for the Office during its first year of operation. He also introduced Lt. Col. Austin Jameson, who will be filling the Air Force liaison position within AST in Washington. He discussed several primary duties including: working with the Eastern Range in support of the FAA/Air Force Memorandum of Understanding (MOU); supporting the Common Standards Working Group (CSWG); and interacting with industry representatives. He noted that the FAA (AST) had entered into an MOU with the 30<sup>th</sup> Space Wing but would not be opening an office there in the near future.

Mr. Wassel reported that AST had completed the effort to examine the compliance of the Atlas V and the Delta IV with the FAA regulation and that the Pegasus and Taurus will be undergoing the same examination. He discussed an upcoming review of the issue of streamlining range activities and cutting costs by making the flight termination system government-furnished equipment and also by using excess Titan equipment. He also reported that AST conducted a workshop on maximum probable loss (MPL) in September to answer specific questions by the Air Force, and that AST and the Eastern and Western ranges were working on a matrix that traces the FAA rule, 127-1, and 91-710 (the Air Force Space Command Handbook). Mr. Wassel also reported on the CSWG's Shadow Operations for relief from common launch safety requirements; the implementation of the FAA/Air Force/National Transportation Safety Board Mishap Investigation Memorandum of Agreement; training activities on the ranges for AST

safety inspectors including launch decision authority and mission flight control training; and work on aviation issues, including the activation of a temporary flight restricted area for all ELVs and the development of a coordinated air space position for international space operations.

COMSTAC member Alex Liang commented that industry would probably have concerns about having a GFE flight termination system.

### **The Post-Columbia World: Implications for Other Space Sectors**<sup>1</sup>

Dr. John Logsdon, COMSTAC member and director of the Space Policy Institute, George Washington University and Dr. Paul Wilde, aerospace engineer in AST's License and Safety Division provided a report on the work of the Columbia Accident Investigation Board (CAIB) and the post-Columbia implications for all space sectors. Dr. Logsdon served as a member of the Board and Dr. Wilde was a member of the Independent Analysis and Support Team. Dr. Logsdon provided an overview of the Board's findings, and stated that NASA did not want to fly the ill-fated Columbia mission but was pressured by the microgravity science community and the National Academy of Sciences, and it was delayed 13 times over two years. He identified the other Board members<sup>2</sup> and he provided the technical cause statement that stated without qualifications that the accident was caused by foam hitting the Orbiter. He highlighted the major factors identified by the Board that led to the Columbia tragedy:

- NASA operated the Shuttle as a routine operational launch vehicle instead of a test vehicle;
- In the 90s, the Shuttle was treated as a "going out of business" program to make way for new space transportation programs, i.e., budgets and personnel were cut (40% reduction of personnel), reducing, in turn, the amount of testing and evaluation;
- The effect of foam hitting the Orbiter was never investigated;
- The Shuttle was characterized as a mature, reliable system and the Shuttle program, including NASA's safety and engineering responsibilities, was, consequently, turned over to United Space Alliance, the contractor;
- The NASA organizational culture was found to be resistant to external advice on how to improve performance and consistently exhibited flawed decision-making, self-deception, introversion, and diminished curiosity;
- The Columbia mission was under schedule pressure;
- The mission management team did not meet everyday as required;
- NASA management dismissed the concern regarding damage to the Orbiter due to foam even though the crew knew that the Orbiter had been hit.

Dr. Logsdon also emphasized that the Shuttle program had insufficient checks and balances (e.g., one person with the responsibility for schedule, budget, and safety) and that NASA has never developed in-orbit repair capability for the Orbiter tiles or for reinforced carbon carbon. He reported that the Board came up with 29 recommendations:

<sup>1</sup> For complete CAIB report: [www.caib.us](http://www.caib.us)

<sup>2</sup> For Board Members: [http://www.caib.us/board\\_members/default.html](http://www.caib.us/board_members/default.html)

15 for *return-to-flight* and 14 for *if the Shuttle continues to fly*. He also reported that all Board members recommended that human space flight should continue; that NASA should decide on a new system to replace the Shuttle very soon; that, for now, the Shuttle should continue to be used, especially for completion of the Space Station; and that the U.S. should continue to invest in technology.

Dr. Wilde discussed findings and their implications regarding the Columbia tragedy:

- ❑ Space launches are risky – the implications are that accidents should be expected, emergency response, investigation and return-to-flights plans should be prepared, and information that is collected during an investigation should be effectively distributed by the use of interface with the media and other organizations.
- ❑ Past success does not provide future success – the implications are that anomalies are often early warnings that should be investigated and understood through examination of data and technical rigor in all requirements, rationales, and validations. An anomalous event that doesn't end in tragedy doesn't mean that it is solved (repeated hits by foam).
- ❑ Informal processes are not effective – the implications are that roles and rules should be clearly defined, design structure to promote communication, minority opinions should be addressed; and communication needs to flow up and down the command chain.
- ❑ Standards and formal structure can help – the implications are that formal standards help define an anomaly and can provide such benefits as burden of proof for safety and identify the responsible party. Formal documents and peer reviews promote better decisions and inform future generations.
- ❑ Independent technical authorities are valuable – the implications are that safety vigilance is challenging. High reliability organization verify compliance through independent organization, i.e., independent of the operational programs.

Dr. Wilde also addressed the public safety implications noting that the expected casualty rate due to an Orbiter break-up was low, but NASA needs to implement a public risk acceptability policy. He also pointed out that civil aviation operations represent greater collective public risks than space operations and the one in a million risk to individuals is a recognized benchmark for space and civil aviation operations.

COMSTAC member Lou Gomez asked whether a recommendation regarding foam had come as a result of the Rogers Commission and if so had NASA ignored. Dr. Logsdon replied that he was unsure about specific recommendations regarding foam; however, a review had indicated that NASA has ignored Shuttle recommendations in the past. Chairman Holder followed up by asking whether there were other “smoking guns” being ignored. Dr. Logsdon and Dr. Wilde both agreed that there were several and because of that the CAIB recommended that the Shuttle fleet should be completely recertified if it is to operate beyond 1010. COMSTAC member John Vinter asked about the 2 to 5 percent probability of failure and Dr. Wilde explained that it came from totaling the number of unsuccessful launches for the entire history of a specific launch vehicle. Dr. Liang inquired about the type of follow up that will be used to ensure compliance with the

Board's recommendations. Dr. Logsdon answered that a separate committee has been assigned to ensure compliance with return to flight recommendations and that the CAIB may reconvene in a year to review compliance. He emphasized that the CAIB recommendations addressed on the NASA human space flight program, (Johnson, Kennedy, and Marshall).

### **Suborbital Issues**

Herb Bachner, manager for AST's Space Systems Development Division, briefed the Committee on the emerging markets for suborbital vehicles, and identified various types of suborbital rockets, including ELVs with reusable stages; various types of RLVs, e.g., aircraft-boosted spaceplanes with capsules or wings, crewed or uncrewed; vehicles with partially or totally reusable stages; and vehicles with a single reusable stage. He identified emerging commercial markets, science, and national security as the three major groups for using suborbital rockets. He also identified the categories of suborbital payloads: 1) engineering for testing vehicle performance, components and payloads; 2) science for atmospheric sampling, astronomical observations, remote sensing, microgravity experiments and measuring geomagnetic fields; and 3) education for promoting rocketry and space, and he noted the launch sites for conducting suborbital launches: Wallops Flight Center, Virginia; Cape Canaveral, Florida; Barking Sands, Hawaii; Fort Wingate, New Mexico; Kwajalein Atoll, Pacific Ocean; Point Magu, California; Arecibo, Puerto Rico; Poker Flat, Alaska; Wake Island, Pacific Ocean; and White Sands Missile Range, New Mexico.

Under commercial markets, Mr. Bachner discussed the potential use of suborbitals for media, advertising, and sponsorship, commercial remote sensing and military surveillance, adventure space travel, fast package delivery, and point to point high speed transportation. For science, he discussed the use of suborbitals for microgravity and atmospheric research; and for national security, he talked about suborbitals for surveillance and intelligence gathering applications.

Dr. George Nield, FAA's Deputy Associate Administrator for Commercial Space Transportation, discussed the suborbital definitions developed by FAA, explaining that the definitions were needed because some RLVs have characteristics of both an airplane and a launch vehicle, developers of such vehicles are uncertain about the regulatory regime needed, i.e., launch licensing or aircraft certification, and that this uncertainty may impede the ability to obtain financial backing for vehicle development. He noted that several options were considered as criteria to differentiate between airplanes and suborbital rockets: whether or not the vehicle has wings; what kind of propulsion system is used; what altitude the vehicle can attain; whether the crew wears a pressure suit; and whether the vehicle has a reaction control system; however, these options also presented uncertainties, e.g., the Pegasus and the Shuttle have wings but are launch vehicles. He added that establishing a minimum altitude for "space" was also considered but that was also problematic since several kinds of aircraft can fly above controlled airspace.

Dr. Nield explained that physics was the basis for the final definitions, specifically, does the vehicle in question maintain its desired trajectory primarily by relying on the lift

generated by its wings, or does it mostly use the thrust from its rocket engines? He provided the final definitions:

- suborbital rocket – a rocket propelled vehicle, intended for flight on a suborbital trajectory, whose thrust is greater than its lift for the majority of the powered portion of its flight; and
- suborbital trajectory – the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof, whose vacuum instantaneous impact point<sup>3</sup> does not leave the surface of the Earth.

Dr. Nield noted that the definitions were published in the Federal Register and included in the Commercial Space Act of 2003. He emphasized that the use of these definitions should provide companies with a clear identification of the regulatory regime necessary for their vehicles, adding that some vehicles under certain circumstances may have to comply with both regulations for airplanes and launch vehicles.

COMSTAC members Alex Liang and Mike Kelly raised the issue of vehicles such as Pegasus, which is launched from an airplane and vehicles that have a suborbital stage and an orbital stage. Dr. Nield responded that in some cases, the launch licensing may start at a certain point, that vehicle operators need to declare in advance that they are doing a launch attempt, and that, for now, regulatory decisions will probably on a case by case basis. A meeting attendee asked if the definitions are currently in effect. Dr. Nield replied that they are currently being used.

#### **FAA's Joint Planning Office**

Andy Anderegg, chief of staff for FAA's Joint Planning Office (JPO), discussed the purposes of that office and its primary duties and responsibilities. He reported that the office is charged with presenting a plan to the Administration and Congress outlining the overall strategy, schedule, and resources needed to develop and deploy the nation's next generation air transportation system within a year. He emphasized the JPOs work with industry and other government agencies to bring about a transformation of the aviation industry to keep the U. S. in the forefront of aviation, noting that transformation is needed to drive productivity and enhance economic growth, deliver capacity to accommodate future demand, expand flexibility while improving system security, retain U.S. technological leadership, and create good government.

Mr. Anderegg explained that the JPO works under a Policy Committee made up of the Secretaries of Transportation, the Air Force, Commerce, and Homeland Security and the FAA Administrator, who is spokesperson for JPO, the Administrator of NASA, and the DOT Under Secretary for Policy. He reported on some of the activities of the office, including the development of draft plans for a National Vision for 2025, a socio-economic demand forecast, goals and policy, operational concepts and a transition roadmap, and research requirements and plans. He also talked about the research

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<sup>3</sup> "Instantaneous impact point" is a term used by trajectory specialists to identify the place where a vehicle would hit the ground if its engines were to stop at that particular moment. If the instantaneous impact point never leaves the ground, the vehicle never reaches orbital velocity.

challenges for the office and noted that the office is planning to develop the first edition of a National Plan in 2004.

## **WORKING GROUP REPORTS**

### **Reusable Launch Vehicle Working Group (RLVWG)**

Mike Kelly, RLVWG Chair, reported on the RLVWG meeting held on Wednesday, October 29, which included presentations on AST's R&D activities, AST draft crew flight guidelines, flight safety systems and integrated vehicle health management, RLV safety validation and verification, and AST's development of Consensus Standards for RLV safety critical systems. He reported that the working group also discussed the issue of licensing RLV research and development flights and the need to ameliorate peripheral regulations, especially environmental regulations that don't apply to other types of R&D testing.

### **Risk Management Working Group (RMWG)**

John Vinter, president and CEO of International Space Brokers, Inc. and chair of the RMWG, provided an update on the issue of extending commercial launch indemnification in current legislation. He reported that a bill, S. 1260, introduced by Senator John McCain provides for an extension of the sunset from 2004 through 2009 and the House legislation, H.R. 3245, proposed by Congressman Dana Rohrabacher extends the sunset to 2007, adding that H.R. 3245 was referred to the House Committee on Science. He noted that legislative focus is currently on potential suborbital human space flight. He also reported briefly on the state of the insurance market for commercial space transportation, noting that the market hasn't gotten worse or better, that coverage is available but is very expensive.

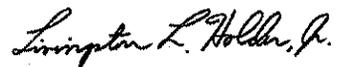
### **Technology and Innovation Working Group (TIWG)**

Dr. Alex Liang, general manager for Vehicle Systems Division, The Aerospace Corporation, reported that Dave Pollock from Rocketdyne will lead the team for the 2004 GSO Forecast. Dr. Liang also discussed the use of the realization factor and the uncertainty bounds in the GSO forecast, noting that those two factors would be refined for the 2004 report to make the forecast more accurate and useful. He introduced Mr. Pollock to the Committee.

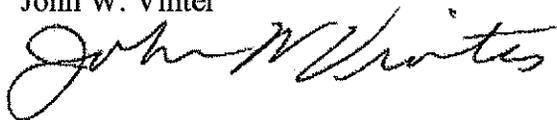
**New Business and Wrap Up**

For new business, Mr. Holder officially turned the chair over to Mr. Vinter. Since there was no additional new business, Mr. Vinter adjourned the meeting at 2:31 pm.

Livingston L. Holder, Jr.

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John W. Vinter

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