Commercial Space Transportation Advisory Committee
May 24, 2006
MEETING MINUTES

COMSTAC Chair John Vinter, International Space Brokers, Inc., Rosslyn, Virginia, convened the meeting at 8:43 a.m. He began by welcoming the Committee members and guests. He acknowledged the work of John Sloan from the FAA's Office of Commercial Space Transportation, Lisa Hague with The Boeing Company, and the members of the Forecast Team, on the 2006 Commercial Space Transportation Forecasts, under the direction of the COMSTAC Technology and Innovation Working Group, chaired by Dr. Alex Liang of The Aerospace Corporation.

AST Activity Report

Patricia Smith, FAA Associate Administrator for Commercial Space Transportation, provided an update on the activities of FAA's Office of Commercial Space Transportation (AST) since the October 2005 meeting. She expressed appreciation to the COMSTAC members for giving their time to the Committee. She reported that since the October meeting there have been four successful ELV launches, one notice of proposed rulemaking (NPRM) on human space flight requirements issued in December 2005 and a second NPRM on experimental permits for reusable suborbital rockets, issued in March 2006. She also reported on the Finding of No Significant Impact issued by the FAA to the Oklahoma Spaceport at the beginning of May, AST's work with NASA on the Commercial Orbital Transportation Services (COTS) demonstrations and with the X Prize Cup for the October 2006 event in Las Cruces.

Ms. Smith noted that the February 2006 Commercial Space Transportation Conference was the most heavily attended AST conference ever, an indication of the growing number of companies entering the space business. She also reported on the first FAA/Air Force summit for entrepreneurial RLV providers, which took place in Colorado Springs in April.

Legislative Update

Jeff Bingham, Staff Director for the Subcommittee on Science and Space in the Senate Committee on Commerce, Science, and Transportation, provided an update on the current legislative activities for space. He discussed the NASA Authorization Bill, noting that it includes provisions for commercialization, commercial space exploration with emphasis on remote sensing, and a report requirement for human space flight. He pointed out that his Subcommittee is very interested in seeing the NASA COTS program work, noting that if it is successful, it could lead to the development of a new industry. He reported that the Bill also includes provisions for secondary payloads, with a report requirement on the feasibility of establishing a National Free Flyer Launch Coordination Center, and

he discussed the provision in the Bill that designates the Space Station as a national laboratory.

COMSTAC member George Whitesides asked whether the Senate would take a stand to protect the funding for COTS and Mr. Bingham replied that Senator (Kay Bailey) Hutchison would be supportive. COMSTAC member Livingston Holder asked how the transition of the Space Station into a national laboratory would affect small commercial users. Mr. Bingham replied that there are provisions in the plan for the national laboratory that will open up opportunities for the small commercial users. COMSTAC member Billie Reed asked whether there has been real activity under the clause that calls for cooperation between NASA and the Department of Defense. Mr. Bingham responded that there has been some activity from the aeronautic side but not enough across the board. COMSTAC member Frank Culbertson asked whether there is sufficient support for and understanding of what the FAA/AST is doing and for its funding and resources. Mr. Bingham responded that there is not a clear appreciation of what is going on at the FAA, but that there is growing awareness of the results of commercial space transportation activity and that he would do his part bring about awareness of how those two things are connected.

Transportation Market Forecasts: GSO Forecast Report

Lisa Hague, Director of Strategic Planning, Boeing Launch Services, presented the ***2006 COMSTAC Commercial Geosynchronous Orbit Launch Demand Model***, which covers the years 2006 to 2015. She reported that the average annual demand is similar to the 2005 forecast (10-year demand for 208 satellites vs. 205 satellites in 2005, and 167 launches vs. 164 launches forecasted in 2005). The 2006 report provides updates on the estimate of a "realization" of demand; the growth in satellite mass and transponders per satellite; respondents' views on the factors affecting demand; and industry developments that may affect demand. To gather data, the Forecast Team sent out approximately 85 letters and received inputs from 6 U.S. and 3 international manufacturers and launch service providers, 11 individual demand inputs from satellite operators, and 16 questionnaires from satellite operators responding to questions on how various factors affected plans to procure satellites.

Ms. Hague explained the two-part methodology of the forecast, noting that the long-term forecast covers 2009-2015, and is an average of the comprehensive domestic forecasts by mass categories. The near-term forecast is a bottoms-up forecast of launch opportunities by name that covers the years 2006-2008. She said that the working group looked at addressable commercial payloads only, i.e., those that are open for internationally competitive launch service procurement broken down by mass category, including smallsats (less than 2,200 kilograms). She pointed out that using this methodology allows for a comparison of forecasts, and that the trend toward larger satellites seen since 2004/2005 is primarily because the satellites are higher powered with more transponders. She also pointed out that the forecast has been "flat" for the last three years, but the Team feels that the demand won't decrease much in the future.

She noted that the GSO forecast includes an historically-based "realization factor," which is an estimate of the number of satellites actually launched; e.g., in 2005, 22 satellites were forecasted to be launched but only 16 were actually launched. The actual number launched was within the predicted realization band of 13 to 19 launched. She explained that launches are delayed due to factors such as launch failures, launch vehicle delays, manifesting delays, manufacturing delays, satellite component issues, and regulatory delays. She also discussed the factors affecting demand, including economic factors which are now improving because of increased access to low-cost capital, although insurance availability is still an issue; rollout of new services such as HDTV, broadband services, MSS systems and digital audio radio systems; and satellite operator consolidation. Ms. Hague summarized the report findings:

- The average satellite demand for the period 2006-2015 is 20.8 per year;
- Near-term demand is 23 satellites in 2006 (expected realization is 13-20)
- Forecasted satellite demand by mass category shows a continued trend toward heavier satellites and decrease in demand for satellites less than 2,200 kilograms;
- The ability to obtain licenses and affordable insurance, as well as consolidation of service providers, negatively impacting satellite demand;
- The success of HDTV, DARS, and new broadband services may spur growth in demand in the coming years.

Chairman Vinter commented that insurance is now less of a negative impact than previous years. COMSTAC member Chris Kunstadter asked how the forecast would change if non-addressable launches were included and Ms. Hague responded that it would probably increase by three to five launches per year. COMSTAC Member Debra Lepore commended Ms. Hague's work as the Forecast Team Lead and expressed her preference that small satellites remain as part of the forecasts. COMSTAC member Frank Culbertson agreed and asked whether there would be a resurgence in smallsats. Ms. Hague replied that she didn't think that there would be. Chairman Vinter asked for adoption of the report by the Committee and it was unanimously adopted.

Transportation Market Forecasts: Non-Geosynchronous Orbits (NGSO) Forecast
John Sloan, senior policy analyst in AST's Space Systems Development Division, provided the briefing on FAA's *2006 Commercial Space Transportation Forecast for Non-Geosynchronous Orbits*. Mr. Sloan pointed out the potential for increase in NGSO launch activity, and that the NGSO forecast uses payloads that are open to internationally competed launch services procurement and other commercially sponsored payloads, including payloads that generate launch demand, and no secondary or dummy payloads. He reported the following Forecast results:

Satellite Forecast: 160 satellites for 2006-2015, an average of 16 per year (11% higher than the 2005). This includes international scientific and other satellites (61%); telecommunications satellites (21%), and commercial remote sensing satellites (12%).

Launch Forecast: 69 total launches for 2006-2015 (8% increase compared to last year, i.e., 64 launches in 2005, 51 in 2004 and 2003, 63 in 2002). This is an average of 6.9

launches per year including 3.6 medium-heavy launch vehicles and 3.3 small launch vehicles. By sector, this includes 48 scientific/other satellite launches; 14 remote sensing satellites launches; and 7 telecommunications satellite launches.

Mr. Sloan described a " near-term pile up" as launches that are scheduled for this year (and for 2007) that will actually launch and listed several factors causing it, including an increase in the number of governments, companies, and organizations that want to enter into the space business and have interest in small satellites; the availability of low-cost launch vehicles for small satellites; financial and technical delays that cause backups on the manifest; and "a confluence" of planned replacements for commercial remote sensing satellites and telecom systems, e.g., ORBCOMM, which is planning to launch a system in the future, after a long-period of not launching.

Mr. Sloan described the near-term proposals and noted that many of them are new technology demonstrations. He highlighted other characteristics of the NGSO market--more satellites and launches in the near term, the increase in the 2006 forecast deriving mostly from international science and other satellites, fading market visibility four years ahead (with some zeros in 2010and 2011); an increase by one launch per year over last year's forecast (+2,268 kg to LEO for medium-heavy class) for the number of medium-to-heavy launches; and a 2.3 to 1 ratio of satellites to launch vehicles. He also discussed trends in the market, including an increase in "other" (non-traditional) satellites such as 5 synthetic aperture radar satellites-Lupe radar satellites from the German Defense Ministry and 4 demonstration launches from Bigelow; several systems making progress toward entering future forecasts, e.g., Globalstar, Iridium, and Satellite Radio for Europe; and he emphasized that it is still too early to forecast launches for the commercial human spaceflight sector; however programs such as COTS and America's Space Prize are pushing the market forward. He predicted that there may be an increase in government purchasing of satellite phones based on the usage after Hurricane Katrina.

COMSTAC member John Logsdon suggested including all NGSO launches and identifying those that are commercial. He also asked whether COTS launches would be included and Mr. Sloan replied that they would not be included unless the company paid for most of the flight. Dr. Logsdon also commented that many licensed launches are not included in the forecast because they are U.S. Government launches and asked how suborbital launches purchased by an individual would be treated in the forecast. Mr. Sloan replied that a new methodology is needed to include those types of launches.

COMSTAC member Debra Lepore praised Mr. Sloan's work on the NGSO and GSO forecasts and commented that the NGSO Forecast is particularly useful in gauging the market and identifying trends. She added that it will be useful to monitor the market and that it may be time to develop new definitions for all of the new proposals opening up. COMSTAC member Livingston Holder also praised Mr. Sloan's work and expressed his opinion that it would be useful to include other launches along with the commercial launches in the forecast. COMSTAC member Alex Liang commented that if civil launches are included should military launches, in turn, be included. Mr. Holder suggested including launches that compete for commercial service, excluding Shuttle and EELV launches.

Chairman Vinter suggested this may be an issue for one of the Committee's working groups.

Remarks by The Honorable Marion C. Blakey, Administrator, Federal Aviation Administration

Ms. Blakey addressed the group and praised the work of the COMSTAC members and representatives of the U.S. commercial space transportation industry, stating that they have, like Copernicus, "opened the universe to a wider audience." She acknowledged COMSTAC members Lou Gomez and Mike Kelly for their work on the annual X Prize Cup event and Jeff Greason of XCOR Aerospace, the recipient of the second FAA license for reusable launch vehicle operations. She remarked that while speaking at recent commencements ceremonies, she has urged students to consider space as an opportunity for business ventures, pointing out that in 2004, commercial space launch brought about $98 million in economic activity and half a million jobs. She closed her remarks by emphasizing the enthusiasm which Secretary of Transportation Norman Mineta has for commercial space transportation and highlighting FAA's efforts in developing seamless integration of future space traffic into the air traffic system.

The Office of Space Commercialization

Ed Morris, Director of the Office of Space Commercialization, National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, discussed the mission and objectives for the Office since his recent appointment. Mr. Morris pointed out that the Office of Space Commercialization was established in 1988, and administratively placed in NOAA in FY 2004, to continue its support in commercial space activities primarily commercial remote sensing. He emphasized the role of the office as more "space commerce" versus "commercialization of space," describing space commerce as those areas where space provides the unique capability to contribute to commerce in the U. S., including relationships with international partners and utilizing space as a unique medium to benefit the U.S. economy. He noted that the mission statement for the office is the promotion of a robust and responsive commercial space industry, i.e., an industry more responsive to government needs and the government more responsive to industry through advocacy (assisting with providing access to new opportunities) and policy (using the policy framework to make government a better customer).

He reported that the Office is still heavily involved in GPS through its advocacy and policy role as well as hosting the coordination office for the Positioning, Navigation, and Timing Executive Committee, under the auspices of the Deputy Secretary of Commerce, who is a member of the Committee. He noted that the functions of remote sensing, space transportation, and space exploration are in direct alignment with the national space policies. He concluded that he, along with staff member, Jason Kim, are developing a strategic plan which will outline, in detail, the policy and advocacy roles of the Office, and the support of entrepreneurs and established entities. He encouraged COMSTAC members and all other industry representatives to provide input to his Office for the plan.

Commercial Space Launch Perspectives from OSTP

Damon Wells, Senior Policy Analyst in the Technology Division of the White House Office of Science and Technology Policy, discussed the current policy landscape and its relation to commercial space transportation, reporting that the current draft policy is in senior coordination. He reported that the policy specifically calls for "encouraging and facilitating a U.S. commercial space transportation industry in support of U.S. national security, civil space and economic objectives," and maintaining a timely and responsive regulatory environment, with the Government purchasing commercial launch services whenever possible and not competing with commercial.

Mr. Wells discussed how the industry has evolved and the innovation that is currently taking place including proposals for crew and cargo services to the International Space Station (ISS), more operational responsive launch capability, and suborbital launches for space tourism. He also discussed the regulatory activities taking place within the FAA in the areas of commercial human spaceflight, experimental permits for suborbital RLVs, and licensing and safety requirements for launch. He emphasized that the importance of the U.S. commercial space transportation industry is reflected in the national policy.

COMSTAC member Mike Kelly asked whether OSTP felt that the Prize model has spurred the development of new orbital launch systems. Mr. Wells responded that OSTP feels that the Prize model has already been very useful and will continue do be so.

RLV Technology Development

Jess Sponable, Chief Engineer for the Air Force Research Lab (AFRL) at Wright Patterson Air Force Base, provided a briefing on the types of space access developments taking place to enable "operational responsive launch," explaining that the AFRL Air Vehicles Directorate identifies a suite of "common technologies" that have high Delta V, high energy, high mass fraction, integrated thermal structures, and air frame. He noted that since there is a need for vehicles that can fly routinely and reliably through reentry environments, i.e., very hot thermal regimes and hypersonic flight environments, the AFRL is developing enabling technologies, including thermal protection systems, light weight structures and external thermal protection systems, that are strong and that can be removed quickly through the use of magnetic attachments. He also discussed high ops tempo rocket propulsion, air breathing propulsion technologies, high angle of attack, advanced guidance, navigation, and control, and aircraft-like operations and future systems, which include hypersonic cruise space access, global transport, rapid troop insertion, worldwide reconnaissance, and long range strike and space control missions.

Mr. Sponable discussed the small launch vehicle (SLV) program, which includes the Falcon SLV, an Air Force Space Command DARPA program, which is developing a reusable first stage under a project called Affordable Responsive Space Access and working toward fully reusable systems in the long term. He reported that DARPA and Air Force Space Command issued nine contracts, eight of which went to small entrepreneurs (including SpaceX and Air Launch) and one went to a major prime contractor. He described the Air Launch concept, a "gravity assisted launch" dropped

from a C-17 and the ARES "hybrid" launch vehicle which has a reusable first stage to Mach 7, with an expendable upper stage capable of placing 10,000 to 15,000 pounds to low Earth orbit.

Mr. Sponable pointed out that the AFRL reusable upper stage concept is comparable to the launch concepts currently proposed by the commercial sector for space tourism suborbital flights making this a perfect time for the U.S. Government to work with the commercial sector in developing these concepts which is consistent with the provisions in the National Space Policy to "capitalize on the entrepreneurial spirit of the U.S. private sector." He pointed out historical parallels with the aviation industry and the U.S. Government investment in that industry and the emerging industry consensus for space due to the synergy between entrepreneurial space access and military requirements and the credible emerging space transportation companies supported by billionaires. He added that it is in the interest of U.S. national security to expedite the growth of the entrepreneurial companies and he noted that there is an industry consensus document which recommends reducing "dual-use" technology risk, providing government infrastructure to industry, using prizes to incentivize DOD goals, and buying goods and services from industry.

He concluded by announcing the RASTE 2006 Conference (Responsive Access to Space Technology Exchange), July 18-19 in Dayton, Ohio, which will emphasize "NACA-like" cooperation and reach out to the entrepreneurial launch companies, pointing out that DOD is developing launch technology, that roadmaps to future capabilities are in place, and some demonstration technologies are funded, but more are needed.

COMSTAC member Alex Liang asked if there is any oversight of technology development by the government. Mr. Sponable explained that the AFRL is working on reusable access to space and assisting DARPA with expendable technologies, adding that the oversight may come from the Office of the Deputy Under Secretary of the Air Force in the future.

COMSTAC member Don Pettit asked whether the AFRL is working with NASA and Mr. Sponable replied that they are working with NASA's Marshall Space Flight Center on expendable technologies. COMSTAC member George Whitesides inquired about the Marine Corps' interest in the AFRL work. Mr. Sponable explained that the Marine Corps is interested in the technology because of their need for high speed global mobility.

WORKING GROUP REPORTS

Risk Management Working Group (RMWG)

Chris Kunstadter, Vice President, XL Insurance, provided a report on the RMWG meeting on Tuesday, May 23 and other RMWG activities since the October 2005 meeting, noting that the focus of the group has been the liability/risk-sharing regime, authorized by PL 108-428 and which is scheduled to expire in 2009. He reported on the working group's March 17th meeting with Jim Vedda of The Aerospace Corporation, chief author of a study on the

current regime, which the FAA commissioned The Aerospace Corporation to conduct, noting that the report will identify alternatives and compare the current U.S. regimes with other international regimes. He reported that the recommendations in the draft report in March were generally consistent with the views of the RMWG, emphasizing the importance of the current regime, stating that it promotes commercial use of space transportation and allows more unencumbered growth of commercial space activity. Mr. Kunstadter added that the RMWG is ready and willing to take on tasks and generate output for the COMSTAC, the FAA and the space industry.

RLV Working Group (RLVWG)

RLVWG Chair Mike Kelly provided a summary of the RLVWG meeting on Tuesday, including the presentations at that meeting and the action items for the working group. He reported that the RLVWG met with AST in December 2005 for a "lessons learned" meeting on the first X Prize Cup and that the working group submitted two research topics to AST and continues to work on the ITAR issue, specifically collecting data. He reported on the meeting with Ann Ganzer of the Defense Trade Controls Policy Office within the State Department and discussed the potential for ITAR restrictions in the area of human spaceflight and international passengers, foreign investment insurance, and other areas. He noted that the RLVWG would be working on the issue of space and air traffic management and would continue to work on ITAR issues.

Launch Operations and Support Working Group (LOSWG)

LOSWG Chair Don Pettit, Aero Thermo Technology, Inc., reported on the May 23rd meeting presentations, including a briefing on space and air traffic management and FAA's efforts in that area; an update on commercial requirements for launch and the role of the LOSWG in that process; a report-out on the FAA/Air Force Entrepreneurial Commercial RLV Summit held in April in Colorado Springs, and a report on the Florida Commission on Space by Brig. Gen. (Retired) Greg Pavlovich, former commander of the Eastern Range. He also discussed the R & D submissions to AST, and range issues and the related planning process, and reported on the briefings on space operations by Virginia and Florida, indicating that he would like to have other spaceport representatives attend the LOSWG and provide updates in the future.

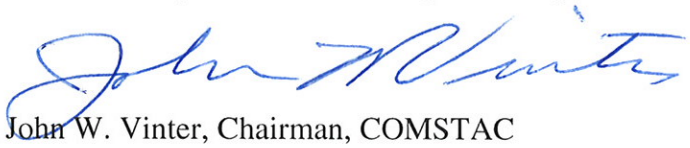
Gen. Pettit listed issues for future consideration, including recovery of reentry capsules on land and water and cargo operations support at spaceports. He also listed the action items for the LOSWG, including identification of airspace requirements and soliciting inputs for commercial requirements for range support.

Technology and Innovation Working Group (TIWG)

Alex Liang, The Aerospace Corporation, TIWG Chair called for volunteers from the commercial launch providers, satellites manufacturers, and industry leaders to participate in the TIWG and work on the GSO Forecast. COMSTAC member Mike Kelly commented that the Forecast takes a lot of work and seconded Dr. Liang's appeal for volunteers and support from companies. Dr. Liang also brought up the issue of including additional categories of launches in the next Forecast and emphasized the need for volunteers.

New Business and Wrap Up

Chairman Vinter commented that there are signs of hope since, as reported in the 2006 GSO forecast, numbers may be stabilizing. He added that companies will continue to build big satellites to last as long as possible but that the insurance community will not be as much of an impediment as one or two years ago. Ms. Smith commented that she believes that there is still a lot to be done to make legislators aware of commercial space launch activity and the FAA's role and encouraged COMSTAC's assistance in increasing awareness, and Chairman Vinter agreed. Since there was no additional new business, Mr. Vinter adjourned the meeting at 12:49 p.m.



John W. Vinter, Chairman, COMSTAC

ATTENDEES

COMSTAC Members/Alternates

John Vinter, COMSTAC Chair, International Space Brokers, Inc.
Louis Gomez, New Mexico Office of Space Commercialization
Livingston Holder, Holder Consulting Group
Frank L. Culbertson, Jr., Science Applications International Corporation
Edward Hikida, ATK Thiokol, Inc.
Michael Kelly, X Prize Cup
Christopher Kunstadter, XL Insurance
Debra F. Lepore, Air Launch LLC
Dr. Alex Liang, The Aerospace Corporation
Dr. John Logsdon, George Washington University
Don Pettit, Aero Thermo Technology, Inc.
Dr. Billie Reed, Virginia Commercial Space Flight Authority
Janet Sadler, AIG Europe (UK) Limited
George T. Whitesides, National Space Society
Tim Hughes, Space Exploration Technologies (Alternate for Elon Musk)
Robert Bocek, Boeing/Sea Launch Company (Alternate for Sea Launch LLC)
Lisa Hague, The Boeing Company (Alternate for Dan Collins)
Elaine David, Lockheed Martin Corporation (Alternate for Mark Albrecht and Thomas Marsh)
Randall Clague, XCOR Aerospace (Alternate for Jeff Greason)
Charles Precourt, ATK Thiokol, Inc. (Alternate for Edward Hikida)

Federal Aviation Administration
The Honorable Marion C. Blakey, Administrator
Patricia G. Smith, Associate Administrator for Commercial Space Transportation
Dr. George Nield, Deputy Associate Administrator for Commercial Space Transportation