Innovations in Orbit:
Commercial Crew and Cargo AIAA Symposium
June 18 2009
Washington, DC

The following are notes taken by Clark Lindsey (of HobbySpace.com and RLVNews.com) during the Innovations In Orbit: Commercial Crew and Cargo Symposium that was held in Washington, DC on 18 June 2009. Following these notes, I've included the flier that advertised this event.

Introduction

Klaus Dannenberg - Intro. comments

- NASA stimulus funding for commercial space has stimulated controversy.

- Lots of issues involved and lots of mis-perceptions

- Augustine committee - several members said they were surprised at progress by the commercial launch efforts.

Industry Panel:

- Mike Gold (Bigelow)
- George Sowers (ULA)
- Max Vozoff (SpaceX)
- Frank Culbertson (Orbital)

Moderator: Patti Grace Smith (Former AST administrator) Smith:

- There was a big battle back in first Bush admin. between Depts. of Commerce and Transportation

over where commercial space reg.and promotion should be located. Transportation won.

- US losing the space race.

- Challenged in multiple areas by multiple global players

- Many students in US aerospace programs return to their native countries.

- Students want to work on exciting programs such as SS2, Falcon 9, etc.

- Obama wants a forceful, innovative NASA program.

- Will we support the entrepreneurial commercial space sector?

- Need a real public-private partnership, e.g. commercial providers for LEO, NASA doing deep space

Mike Gold (Bigelow):

- Likes AIAA meetings - can get engineers to listen to a lawyer. :-)

- Describes Genesis modules in orbit.

- Goal is to drastically decrease costs of manned orbital activities.

- Expandable space habitats - initially developed by NASA but not past Powerpoint level.

- Genesis demonstrator - scaled but sizable

- Launch from Russian missile base involved lots of complications

- Video of launch

- Video from external cameras on Genesis I

- Important that they could quickly build upon Genesis I progress with Genesis II.

- Launched just one year later.

- Video documentary report on Genesis II

- Video of launch taken from hotel

- Genesis II pictures.

- Modules are doing well.

- From time the project was started in 1998, human spaceflight has actually regressed rather than moved forward with lower cost access.

- Now working on Sundancer crew capable module. Can support 3 astronauts.

- It's a demonstrator for full module - BA-330.

- How do we get crew to orbit? Great concern

- When Shuttle retired, only Russia and China will have human spaceflight capability.

- Billions of dollars to Russia for access to ISS

- NASA's failed initiatives - NAP, X-33, X-38, etc.

- No successful human spaceflight system development in 30 years.

- Ares/Orion tech flaws.

-- 4 passengers way too small.

- Ares/Orion non-tech issues

-- Timing

-- Cost - way too much; Ares/Orion will cost $230B over 2 decades

- Lots of blame to go around.

- Not sufficient wherewithal in Congress to back programs.

- Serious questions about Ares/Orion from engineers in NASA

- Need Plan B, and Plan C

- Bigelow has never depended on a sole source provider in his general contracting.

- Excited about both SpaceX and ULA

- Commercial space is not a fantasy as Shelby said.

- Commercial systems are in orbit.

- Tell Congress - "Don't dismiss commercial"

- At last minute, Genesis II engineers decided glare from S-band antenna would cause glare on cameras. So covered it with duct tape. Has worked fine. Difference between commercial and govt. approaches: Go from red tape to duct tape!

G. Sowers (ULA):

- Dinosaurs vs mammals. When both existed together, mammals were considered prey!

- Reviews commercial space history

- Commercial 1.0 - 1980s driven by telecom. Not a success for launch companies.

- Commercial 2.0 - 1990s - Big LEO constellation projects failed.

- Commercial 3.0 - 2000s Bigelow and other projects.

- Creating a market

-- big investments, big risks

- Govt can help stimulate the market.

-- Establish infrastructure.

-- Commit to buying services; anchor tenant.

-- Is there true commercial demand?

- Commercial LEO delivery

-- Bigelow habitats

-- Propellant depots - service to deliver propellant could open up competitive market

-- ISS cargo and crew delivery

- EELV launch of human spacecraft

-- human rating straight forward for EELV

---- Add emergency detection system

---- Need separate VIT/MLP or pad with crew ingress/egress

-- Low non-recurring ($400M) and recurring ($130M/launch)

-- Delta IV crew system ready in 4 years

-- Disputes the 5.5-7 year figure from Aerospace Corp study

- Bullish about Commercial 3.0. Need to learn lessons from previous efforts at commercial space.

Max Vozoff (SpaceX)

- Asteroid coming in to blast the status quo.
- Not just real but imminent
- Overview of SpaceX
-- Up to 750 people.
-- Founded in 2002 with intention of carrying people to space.
-- Facilities in CA, FL, TX
- Manifest - 24 future paying flights currently
- F1 is a learning exercise for F9
- Build most systems, components internally.
- Gives strong control over costs and schedule
- F9 will arrive at pad in Oct. 09,
- Designed from inception with crew capability
- Pictures of Merlin tests,
- Tests of multi-engine firings to prove the engines work OK together.
-- Full duration firing.
- Pictures of structures tests, flight articles in assembly, etc.
- SLC-40 development status
-- horizontal prep of vehicle.
-- assembly building nearly ready
- Dragon status
-- First qualification testing 90% finished.
-- First flight hardware in fabrication
-- Designed for crew capability.
-- For second flight of F9
-- 15 m^3 volume
-- Fully recoverable
-- Trunk, 16 m^3
-- Total payload capacity - 5500kg to ISS orbit
- Every design decision on F9/Dragon was made with crew capability in mind.
- Launch Escape System is the missing component needed; 2.5 year development
- Life-boat Dragon option would involve 1.5years

- Could have crew system by 2012 if funding turned on now.
- F9-Heavy - 2012.
- DragonLab - commercial micro-gravity platform.
-- Strong positive response from researchers.
-- Book two missions so far.
- Evolution paths to rendezvous and inspection, boost deorbit, space tourism, etc.
- Longer term - deep space capabilities
- Reusability

Culbertson (Orbital):

- In existence longer than the other guys on the panel.
- True entrepreneurial company
- Began flying Pegasus just a few years after its founding
- Describes Orbital's COTS systems
-- Cygnus vehicle, Taurus II
- Taurus II legacy goes back to Pegasus via Minotaurs and Taurus vehicles
- Uses both sold and liquid propulsion.
- Stage 1 engines from Aerojet (originally Russian)
- Now including pressurized cargo modules with Cygnus.
- Carry standard NASA cargo containers.
- No return capability but can take trash away.
- Plea to industry and govt to support US in LEO and deep space activities.
- Don't give up on aerospace industry.
- Need incremental goals that can be achieved and built upon.

Q&A:

- Two top option requests to the President?
-- Gold: must include commercial crew and cargo funding;
--- Budgets are going down. Have to take advantage of lower cost options.
-- Sowers: commercial crew should be an option; use EELVs for exploration launches
--- Develop synergy between commercial and military launch programs
-- Vozoff: Agree with previous guys.
--- Big cuts after a long design process requires cuts in requirements.
--- Cuts in Constellation have led to de-scoping of Orion.

--- Let commercial guys rise to the challenge of LEO launch service.

--- This reduces requirements on NASA, which can focus on deep space.

--- Commercial should be integrated into Constellation throughout.

-- Culbertson:

--- Concurs with previous remarks. Need to build other markets besides govt.

--- Need a quick decision on long term plans for ISS.

--- Set realistic goals for agency with realistic budget.

- How to make case to President/Congress that space can boost current economic situation.

-- Gold: In the end, jobs are the big question. US has lost commercial space race.

--- Need to get US back in commercial game.

-- Smith: Need to make case that space is a bread and butter issue.

-- Often had trouble convincing Congress staff that there was a commercial space industry outside of NASA.

- Ways to stimulate Commercial space.

-- Culbertson: development of markets.

--- Mutual support among industry members but as things get tighter this can fall apart.

-- Vozoff: COTS includes substantial private investment. Multiplicative factor on NASA"s funding. Believes there is a commercial market outside of ISS.

-- Sowers: need markets beyond govt.

-- Gold: We provide a market if NASA would just help fund commercial crew capability.

--- Customers are not a problem. Got lots of them waiting but need orbital access.

- Where will be in 20 years?

-- Gold: Could be we'll see only Chinese being spoken in LEO.

-- Culbertson: Even just a slow down, rather than a cut back, will leave US far behind.

--- Depots of propellants and supplies would be good idea.

--- Need LEO infrastructure. Can't go beyond in a robust manner without it.

-- Sowers: Just 3 Bigelow modules will exceed ISS volume.

-- Vozoff: Hard to think 5 years ahead, much less 20 years.

--- In 5 years, several countries are planning landers on the Moon.

--- Could be an out cry in US as other countries are showing lunar activities.

--- Could do a COTS type program for lunar projects.

Government Panel:

- Geoff Yoder (Com. Crew & Cargo, NASA)
- Ken Davidian (AST/FAA)
- Chan Lieu (Staff, Senate Comm. on Commerce, Science & Trans.)
- Jeff Bingham (Advisor, Senate Comm. on Commerce, Science & Trans.)
- Michael Beavin (analyst, Office of Space Commercialization,Commerce)

Beavin (OSC, Commerce):

- Reviews activity of OSC

- space.commerce.gov

- small office of about 8 people.

- Questions:

- Is there a communication gap over COTS and CRS programs with Congress?

G. Yoder (NASA):

- Review of commercial crew and cargo projects

- Reviews NASA direction from original space act, authorizations, etc.

- Objectives of NASA CC&C:

- For FY06-10, allocated $500M for COTS demo program

-- COTS in 2 phases

-- First round competion in award in Aug.2006; second round in Feb 2008

-- Phase 2 - contract for resupply awarded in Dec. 2008

- 4 levels:

-- A. Unpressurized cargo

-- B. Pressurized cargo

-- C. Return Cargo

-- D. Crew

-- Only A-C were funded.

- Reviews SpaceX and Orbital systems

- Two unfunded space act agreements with

-- PlanetSpace

-- SpaceDev.

- Stimulus funding:

-- $400M allocated to Exploration

-- $150M for CC&C.

-- If approved by Congress, funding would support

--- development of crew technologies, docking system interfaces, improved reliability,

--- and human-rating requirements.

Ken Davidian (Office of Commercial Space Transportation (AST) at FAA):

- Involved in the industry promotion side of AST's role but with safety as top priority

- When AST first started, it dealt only with ELVs.

- This has since expanded to RLVs, reentry vehicles, etc.

- Support of NASA's COTS program by evaluating systems wrt safety, operations, etc.

- Commercial services to ISS will fly under AST/FAA framework.

- Providing market analyzes

- Need common lexicon. E.g. commercial (govt services) vs "true commercial" (non-govt markets)

Chan Lieu (Senate Commerce Committee)

- Discusses areas covered by the committee.

- Issue of balance between promotion vs safety is important

- COTS was a great idea.

- Hope NASA can get out of LEO flights.

- Wonders why COTS isn't supported even more strongly.

-- Fixed price milestone approach is a great deal for the public.

Jeff Bingham (Senate Committee Commerce)

- Impressed by previous panel.

- Strong progress being made.

- See real potential.

- Here to listen. Consumer of ideas. Need a lot of them.

- Running out of time. Augustine review should have started 6 months ago.

- Heading for cliff in human spaceflight.

- Originally there was going to be a law against having a gap! Changed to be just a "policy" of no gap.

- Have had a policy based on budget rather than a budget based on policy.

- Originally fully funded Constellation but that wasn't in the budget request.

- Review is crucial to reset connection between policy and budget.

- Cut ribbon on opening completed ISS and next day can't get there.

- Paying for transport to ISS and for emergency vehicle at Station.

- Billion dollars added to NASA in Senate a couple of years ago was removed by House.

- NASA can't give up utilization of ISS for Moon missions.

- ISS has to be used till at least 2020. Must be for broad based research.

- Extended ISS crucial to long term plans and investments by the cargo/crew providers.

Q&A:

Is COTS taking money away from Constellation?

- Lieu

-- The zero-sum perception is there but not really true.

-- Comparing apples and oranges.

-- Orion for Moon. COTS systems for LEO.

-- Should be funding for both.

- Davidian

-- Augustine said he was surprised how far along the commercial guys were and they needed to do their home work.

-- Need to do a better job of educating the public about commercial developments.

COTS for deep space shouldn't be forbidden.

- Lieu

-- COTS as a model for other project is fine. Was referring just to the 2 current projects

Multi-year appropriations:

- Lieu

-- Virtually a non-starter. Just very difficult politically.

- Bingham

-- A Congress can't bind a future Congress.

-- A consensus policy can act like multi-year authorization.

- Davidian

-- Even anchor customer is difficult because of all the requirements in law.

How to narrow gap between authoriziers and appropriators.

- Lieu

-- Appropriators have more constraints. They are involved with authorizers.

-- Administration needs to follow through after they sign off on authorization.

-- WRT the $150M, it was originally intended that the $400M go to Constellation.

Public expectations for NASA to stay within budget

- Bingham:

-- NASA purchasing power hasn't changed since 1990. Public thinks NASA budget

-- is much bigger than it actually is.

Why isn't NASA looking at reusable launch systems?

- Yoder

-- Still looking at reusability. NASA hasn't given up.

- Davidian:

-- Commercial guys ARE looking at RLVs because costs are so crucial. NASA needs big payloads delivered now rather than later so this pushes for ELVs now.

Why not COTS-D:

- Lieu:

-- Funding just not there. Not against it.

How to move to a true passenger space transport system?

- Bingham:

-- Role of govt is to enable that, not implement it. Commercial guys have to show up.

-- What are obstacles that need to be removed.

- Davidian:

-- AST/FAA trying to enable commercial space.

Lieu:

-- Difficult to keep roles of regulation and promotion separate.

- Davidian

-- These are not in conflict because safety and health of industry are not separate.

- Smith

-- Safey comes first and this promotes the industry.

-- An accident could kill the industry.

What is being done wrt insurance/indemnification?

- Davidian:

-- Indemnification is always a big debate.

-- Needs to be renewed next year.

- Bingham:

-- Indemnification involves various philosophical/partisan issues and is debated each time.

Final Presentation, Charles Miller, NASA HQ IPP

- NACA as a model for public-private parthership for stimulating commercial spaceflight capability.

- Now a senior adviser for commercial space at NASA IPP.

- Resigned position at Constellation Space Services

- Not stating policy.

- Reviews of history of NACA and how it benefited aviation.

- After airplane invented in US, leadership quickly moved to Europe.

- Americans concentrated on fighting over patents.

- Major security problems in WWI

- NACA created to support industry and make it best in world.

- Coordinated research and efforts among many Army, Navy, etc.

- Facilitated cross-licensing of patents

- Encouraged cooperative partnerships.

- Advocated air mail services.

- Encouraged insurance availability for industry.

- Later NACA support led to a number of technical successes.

-- But these technical breakthroughs benefited industry.

- There was not a national consensus on priorities until NACA led the effort to build a consensus.

- Today there is no consensus on human spaceflight.

- A NACA approach does not mean picking winners and losers.

- The National Defense Research Committee grew out of NACA in WWII and developed many technologies (e.g. sonar, radar, etc

that were crucial to winning the war.

- Interested in developing ideas for a NACA approach to commercial human spaceflight.

Q&A:

Could the COTS approach be taken farther within NASA.

- Miller: No one he has met within NASA is antagonistic towards COTS.

INNOVATIONS IN ORBIT:

An Exploration of Commercial Crew and Cargo Transportation

A half-day event exploring a broad array of exciting commercial crew and cargo concepts designed to service both government and private sector needs in low Earth orbit

Agenda

1:00 pm **Welcoming Remarks**

Klaus Dannenberg, *Deputy Executive Director, AIAA*

1:15 pm **Industry Panel**

Featuring

Mike Gold, *Director, Washington, D.C. Area Office, Bigelow Aerospace*

George Sowers, *Vice President, Business Development and Advanced Programs, United Launch Alliance*

Max Vozoff, *Director, Civil Business Development, Space Exploration Technologies*

Frank L. Culbertson, *Senior Vice President, Human Space Programs, Orbital Sciences Corporation*

Moderated by

Patti Grace Smith, *Former FAA Associate Administrator for Commercial Space Transportation and Aerospace Consultant*

3:00 pm **Government Panel**

Featuring

Valin Thorn, *Deputy Program Manger, Commercial Crew & Cargo Program, NASA*

Ken Davidian, *"Encourage, Facilitate, and Promote" Program Lead, FAA/AST*

Chan Lieu, *Senior Professional Staff, U.S. Senate Committee on Commerce, Science, and Transportation*

Jeff Bingham, *Senior Advisor on Space and Aeronautics for the Minority, U.S. Senate Committee on Commerce, Science, and Transportation*

Moderated by

Michael Beavin, *Senior Program Analyst, Department of Commerce Office of Space Commercialization*

4:30 pm **Closing Remarks**

Charles Miller, *Senior Advisor for Commercial Space, NASA Innovative Partnerships Program, NASA HQ*

09-0442

Thursday, June 18th, 2009

Hyatt Regency Washington on Capitol Hill
Capitol Room A, Lobby Level
400 New Jersey Avenue NW
Washington, DC 20001

This unique event is free and open to the public, however, if you plan to attend please RSVP to commspace_panel@aiaa.org.

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