National Aeronautics and Space Administration
Commercial Space Committee
of the
NASA Advisory Council

March 30, 2010
NASA Headquarters
Washington, DC

Meeting Minutes

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John Emond	Bretton Alexander
Executive Secretary	Chair, Commercial Space Committee
Commercial Space Committee	

Meeting report prepared by
Jill Hacker

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Committee members present:

- Wilbur Trafton
- Lon Levin
- Bretton Alexander, chair
- Patti Grace Smith
- John Michael Lounge
- Bernard Harris
- John Emond, executive secretary

John Emond opened the afternoon session at 1:07 pm. Mr. Emond introduced Michael Hecker.

The New Era of Space Exploration
Michael Hecker, Exploration Systems Mission Directorate (ESMD)

Exploration Research and Development
Mr. Hecker spoke about initiatives under way in ESMD in response to the President's FY11 budget request. The new budget request sets a new direction for exploration. The goal remains to extend human presence throughout the Solar System, especially Mars, but other points have been added. The program has been reshaped to provide a set of capabilities and make investment in technologies for a sustainable and affordable exploration capability for the long term. To support the plan, the President has requested $6B, of which ESMD will see increase of $0.5B in FY11. It has an increased emphasis on commercial capability, specifically for low-Earth orbit (LEO).

ESMD's strategy is two-tier: to invest in technology and enable capabilities, and to undertake exploration activities sooner rather than later. The near-term budget is focused on developing more robust and sustainable capability.

ESMD's new research and development activities include exploration technology demonstrations, heavy-lift and propulsion technologies, and exploration precursor robotic missions.

The Constellation project has been proposed to be canceled for FY11. At present, the program is proceeding per the 2010 appropriation. The Constellation transition, once authorization is given to proceed, is expected to take 18 to 24 months. ESMD is trying to sustain its human resources through the Constellation cancellation, maximizing the use of the civil service workforce.

To plan future exploration, 10 teams have been established. These teams are pre-formulating new programs and assessing the Constellation transition. Three teams look at cross-cutting issues.

The pre-formulation teams are building a plan to build a plan: They are doing early pre-formulation work, looking at top-level requirements and the technologies that may meet those requirements – the type of work that can be handed over to program office once authorization has been given to proceed.

Technologies are also being developed by Office of Chief Technologist. These are broad-brush, game-changing technologies, reaching across the Agency. ESMD works closely with the Office of the Chief Technologist to ensure that the technologies align and that there are no gaps.

Mr. Hecker explained that the capabilities developed by the Enabling Technology Development and Demonstration support reach multiple destinations. NASA has long seen the need to develop such technologies, but until now they were low priority, because technology investments were focused on Constellation's needs. The focus now is on a broader set of technologies.

Mr. Hecker explained that flagship technology demonstrations are to be carried out in primary areas, enabling capabilities that provide for future architecture. Once ESMD is authorized to proceed, flagship missions are to be initiated in FY 11.

For exploration precursor robotic missions, the main emphasis is to go forward and explore; robotic explorations may be followed up later with human exploration. Candidate missions are to the Moon and Mars. The goals are to understand the hazards and to use resources in situ. There is an effort to provide opportunities for academia and international partners to participate, and to bring in the public.

Mr. Levin asked whether NASA reaches out to partners, or expects potential partners to come to NASA. Mr. Hecker replied that ESMD is trying to do some of the outreach, but there have not yet been robust discussions about outreach.

Commercial Spaceflight

In the area of Commercial Crew and Cargo, the FY11 budget includes an additional $312M for cargo. NASA is trying to turn the effort over to commercial industry and make itself a customer. NASA is seeking the insight/oversight model that allows it to ensure crew safety but is still commercial.

In commercial acquisition strategy, ESMD's goal is not to dictate how to build a solution but to specify only what is necessary. The team is working on set of human rating requirements; a request for information (RFI) is planned, possibly as early as April but no later than June.

The question of the taxicab model v. the rental car model is under discussion. As part of that discussion, a proposal has been developed for human rating and concepts of operations on how to conduct missions. That is being reviewed in conjunction with

Administrator Bolden's reports. That will generate an RFI, to be sent out for industry comment and review.

The procurement vehicle to be used is still under discussion. Since the program's scope is being expanded, ESMD is considering the range of possibilities. Mr. Alexander asked whether transport to and from the International Space Station should be separated – either physically or contractually – from return vehicle function. Mr. Hecker said he would check with Geoff [Geoffrey Yoder], but so far there has not been much discussion on the matter.

The teams have been in place for 6 or 7 weeks. Most of ESMD's products are going through internal review; next they will discussed with the Office of Management and Budget and Congress.

Mr. Alexander asked whether the fuel depot demonstration is necessary before a vehicle is sized. Mr. Hecker responded generally that ESMD is starting to understand dependencies; work on the fuel depot process is being done in parallel with sizing and a decision will be made later on what enables what.

Mr. Hecker, who runs the integration team, is creating technology roadmaps to show the progression across the relevant technologies. The integration team brings the other teams together programmatically to see if their work leads to a decision point; it coordinates technology solutions. At present there is no program office in place because Congress has not yet authorized one.

Mr. Alexander commented that the coming RFI for Commercial Crew and Cargo will contain many different elements, including human rating requirements and program requirements. The RFI is a starting place for the dialogue with industry. He wondered if putting so many things into one document would delay it. Perhaps it would be better to issue the RFI in pieces in order to start the dialogue sooner. Mr. Hecker replied that the goal is to issue the RFI quite soon in any case. He did not think the RFI's contents were holding up its release.

Mr. Levin asked if any missions require international cooperation, or cooperation by anyone other than NASA. Mr. Hecker replied that NASA must work within budget constraints; therefore, not pursuing cooperation could mean fewer projects. Mr. Levin replied that if there is going to be a partnership, then NASA has to find partners. He asked how that effort is being structured. Mr. Hecker replied that the teams have been assuming that NASA will use assets of its own and from U.S. industry, providing entry points for academia and other nations to participate later on. More detailed planning for cooperation cannot happen until there is a program office.

Mr. Alexander thanked Mr. Hecker for the presentation.

Mr. Emond said today's presentation materials would be posted on the Innovative Partnerships Program (IPP) website. The Commercial Space Committee February briefing to the NASA Advisory Council (NAC) is on the NAC website: http:www.nasa.gov/offices/nac/home/index.html.

Space Operations Mission Directorate Budget Briefing
Toni Mumford, Assistant Associate Administrator, Resources Management and Analysis Office

Overview
Ms Mumford reviewed high-level priorities and challenges for space operations.

The plan is to phase out the Constellation program by 2012. There is a fear of attrition due to the Constellation cancellation; not much attrition has been seen yet, but staff are uncomfortable not knowing what they will be assigned to do. Ms Smith asked what kind of planning – e.g., assessments of skills – is being done to prepare to reassign people. Ms Mumford replied that these issues are being discussed; she said she would follow up with details.

Ms Mumford expressed concern about transportation to the International Space Station (ISS). For the near future, besides the Shuttle, there are Soyuz, Automated Transfer Vehicle (ATV), and H-II Transfer Vehicle (HTV). And there will be Commercial Resupply Services (CRS) cargo, but crew transportation is still being developed. NASA had assumed that Constellation would be its crew capability. Now that Constellation is being canceled, an alternative is needed.

Space Shuttle
The Space Shuttle is funded to fly only through FY10. The program has a 50% to 72% chance of completing its flights within that time. Funding of $600M has been requested for FY11 in case it is needed for the required flights to be completed. Contract reductions and work force reductions have begun; some operations staff will remain on board until the last flight. The plan is to end the Space Shuttle transition and retirement (T&R) process in FY12; the Constellation cancellation could create complications in reaching this goal.

International Space Station
ISS plans for FY10 include completion of the assembly and demonstration of the SpaceX and Orbital commercial cargo transport systems. FY11 plans include Russian Soyuz crew and Progress cargo flights, HTV and ATV flights, and the start of CRS flights, as well as demonstrations for commercial cargo transport systems in November (SpaceX), February (SpaceX), and March (OSC). Mr. Levin asked Ms Mumford to confirm these dates because they are coming soon. Ms Mumford said she would confirm them with a staff member in the program office, who works with SpaceX and Orbital on a daily basis.

Mr. Alexander commented on the plan for NASA to buy a number of seats on Soyuz, something very different from the current five Shuttle flights a year amounting to roughly 40 seats. He asked if the plan was to transport only the ISS crew, or to include surges of a larger number of people on station for a short duration. Mr. Alexander asked the committee to consider what it means to operate the ISS beyond 2015 (The plan was for the Shuttle to be operated only until 2015, but that is being extended), what full utilization is, and what the optimum number of people at the ISS at one time is. Ms Mumford replied that these

questions are all under consideration as part of the FY12 budget process. In addition, an independent assessment by National Research Council (NRC) of the crew office is going to be requested. That study will look at NASA's astronauts in light of the loss of Constellation and the coming of commercial crew. Ms Mumford explained that $2.5B is being added to the budget through FY15 to extend ISS until 2020 or beyond.

When NASA first entered into arrangements with national labs (the National Institutes of Health and the U.S. Department of Agriculture), the labs were required to pay for their own transportation to the ISS. Later NASA included transportation to and operations on the ISS as part of its budget. Participating researchers retained responsibility and costs for payload development, flight qualification and their engagement in flight safety reviews, etc.

In response to a question by Mr. Levin, Ms Mumford explained that funding several years ahead is important so that agencies considering bringing their research to ISS will know that ISS is still available. The purpose of ISS is research and full utilization. A user's "investment" in the ISS means not a financial return on investment but rather having ISS available for the conduct of R&D using the unique environment of space/Low Earth Orbit.

Mr. Levin asked if it is NASA's view that without the ISS there is not a future cargo transportation market. Ms Mumford replied that while she cannot speak for NASA, there is no other ongoing research destination in Low Earth Orbit at this point. Mr. Emond gave two examples – the University of Colorado Boulder/BioServe Space Technologies and Space DRUMS facility for containerless materials processing in space, of non-NASA Space Station users. Mr. Levin said his sense is that NASA is hoping ISS usage will grow so that it can be defended from a budget standpoint. Ms Mumford said that the U.S. portion of the ISS is about 50% utilized.

Additional funding has been provided through 2015 to sustain functionality. The goal is to improve the efficiency and effectiveness of the ISS's facilities, in order to have more research on the station and have the astronauts have time to do the research. Mr. Alexander commented that $1.3B budgeted for functionality seems like a lot. Ms Mumford replied that this includes funding for independent non-profits to manage ISS research being carried out by entities other than NASA. She said content definition is ongoing; she could provide more details in a month or two. Dr. Harris asked if this involved the National Space Biomedical Research Institute (NSBRI). Ms Mumford replied that she was not aware that it did. Mr. Emond commented that NSBRI is at Johnson Space Center (JSC); there may be an opportunity for them to brief the committee at the April meeting at JSC.

One criterion for selecting ISS projects is that they can provide useful research results despite the retirement of the Shuttle; such as downloading data rather than the requirement for sample return to Earth. Mr. Lounge noted that for past projects there was a concern about loss of payloads that had to go back to Earth to have value. Ms Mumford commented that that concern may not have changed.

Ms Mumford explained that funding for "enabling" supports the goal of utilizing the station fully. Although there are not yet enough experiments to do so, much interest has been

expressed, some of it by entities with which NASA has agreements already in place. The goal is to have the capacity when the experiments come about. Users are expected to pay for their own payload development. In most cases NASA will pay for the laboratory space and the flights.

Mr. Lounge asked if there is commercial allocation in CRS contracts for carrying cargo to station. Ms Mumford replied that the current CRS flights are 100% NASA, but NASA would not rule out carrying national laboratory payloads if the space is available. The discussion touched upon the possibility of a dedicated reimbursable flight arrangement: if someone is capable of paying and has enough payload to dedicate a flight to the ISS, NASA may consider a flight opportunity for a dedicated flight with payment/reimbursement back to the agency. For the most part, however, it is understood that flights to the ISS will involve a range of payloads and organizations conducting the research rather than a dedicated mission. Some organizations, like universities, cannot afford the cost of space transportation to send their experiments to station; for them NASA will pay for transportation. The goal is to fully utilize the ISS, so NASA is doing what it can to promote the ISS.

Ms Smith asked how much of the government is utilizing the ISS. Ms Mumford replied that not much of the government is. She promised to provide a list of government people who have expressed interest.

Under the CRS program as well, NASA will pay for transportation for entities that are non-government, unless those entities are taking the majority of the payload. Mr. Levin commented that that means a legitimate company, university, or government agency will get a free ride as long as it can do the research. It is a question of space available, but, Ms Mumford explained, users must meet many criteria. Ms Smith added that the decision is case by case; users who are able to pay may be expected to do so.

Ms Mumford reviewed the Space Ops budget for ISS research as well as for crew cargo services.

Twenty-First Century Space Launch Complex

Funding has been provided to establish a twenty-first century space launch complex at Kennedy Space Center (KSC). NASA is working with the U.S. Air Force and the Federal Aviation Administration. A team at KSC is leading this effort, working with the space user community. The intent is to shift KSC from being vehicle-centric to accommodating multiple configurations, and working more efficiently. There will be an RFI identifying projects and priorities as well as a draft plan about how NASA will work together with various government entities. NASA is currently developing requirements and does not have much detail about this yet.

Launch Services

Mr. Alexander explained that it is the Launch Services Program (LSP) that launches weather satellites and other non-human flights. Typically the vehicles are of the same sort that can be used for cargo.

Ms. Mumford explained that in this program SOMD both advises the program offices (NASA science offices, NOAA, and the ISS program) and initiates contracts for the launch vehicles for the science mission. SOMD does not fund launch vehicles – the science office pays for those. SOMD manages the contract.

Ms Mumford discussed FY11 plans. Her viewgraph indicated NASA will support launches by the U.S. Department of Defense; she will verify this.

Ms Mumford explained that the CRS contract is SOMD's contract, but the launch is ESMD's responsibility. SOMD/ISS is advising because they have the experience.

Mr. Alexander wondered about commercial crew and interactions between NASA and FAA. He expressed his opinion that there was a need for more clarity on what LSP's role is in relationship to the ISS office.

Committee Deliberations

Mr. Alexander opened a discussion about planning for the next committee meeting, scheduled for April 26 at JSC in Houston, Texas. At that meeting the committee would deliberate on observations and recommendations, to submit to the NAC at their meeting on April 28. Mr. Alexander asked committee members to suggest topics for discussion. Specifically, he suggested a discussion about the commercial crew effort: Is it a good thing for NASA to undertake? Can it be executed? Is it a good thing for the nation and for NASA?

Ms Smith asked whether the question Mr. Alexander had raised was an appropriate one for the committee. She asked whether instead NASA might ask, given the direction, what are some suggested thoughts, recommendations for how to about it. Mr. Alexander replied that the committee should raise questions for NASA leadership that they need to consider, like whether the present is the right time is right for commercial crew.

Referring to A. Thomas Young's recent Congressional testimony that commercial crew is a "colossal mistake," Mr. Trafton commented that in an area like commercial space there may be no middle ground; therefore it is appropriate for this committee to state an opinion on a question as big as whether the whole effort is appropriate.

Mr. Levin suggested that the committee provide specifics on the tenets of commercialization. For example, the committee might ask how many commercial flights can be sustained in this environment.

Mr. Lounge suggested a discussion about the scope of the vision. NASA is focused on Station and Station support. There is a danger that that will be completely separate from the overall exploration architecture, the context of how this commercial effort fits in. The long view goes beyond ISS, which has been the focus so far. How big is the market? Mr. Trafton agreed that the essential question is what the market is.

Mr. Alexander suggested that one approach the committee might take would be to agree with the general direction of commercial space and say something like "We believe the commercial space industry has developed or can develop the capability to provide safe, reliable access to space but its ultimate success depends on how the program is structured by NASA; therefore NASA should do/look at the following things," considerations such as defining the market clearly and understanding whether companies are basing business plans solely on NASA/ISS as a market. The committee, Mr. Alexander said, has discussed the possibilities of NASA being an anchor market and using the commercial market as leverage to lower its own cost; he pointed out that if that commercial market does not materialize then that model does not work. He suggested that the committee say something about that and about the linkage to exploration activities. He suggested that the committee list five or six things that NASA should look at to make the program successful. In each of these programmatic areas there would be discussion about balancing different considerations. Committee members agreed that this would be a good approach.

Mr. Emond asked whether that discussion would be more appropriate in the April meeting or in the July meeting, to allow more time to gather information. Mr. Alexander replied that because requirements are being set now the committee should discuss these matters at the April meeting to be able to submit their recommendations to the NAC at the NAC's April 28 meeting. Mr. Alexander said he would create a draft before the April meeting, for a basis for the committee's discussion. After the meeting the committee should have something final to forward to the NAC.

Mr. Alexander asked members for suggestions for specific topics.

Ms Smith suggested a discussion of interagency coordination.

Mr. Levin suggested discussion of how large the NASA anchor tendency is for flights, and whether there is a level of guarantee that those flights will take place. Should NASA state that there will be flights? Potential users want some certainty to reduce risk.

Mr. Lounge suggested that this matter comes under the umbrella of defining the market. Mr. Alexander explained that the underlying rationale is tied to the market. A program goal to fulfill a government need will result in a different program structure than will a program goal to enable commercial markets. A program to enable a commercial market will require private investment and a low price per seat.

Ms Smith asked what is commercial and suggested that NASA provide a definition of *commercial* for this vision, so that in the context of supporting the commercial market in order to rely upon it, the committee is clear about what it is discussing. Mr. Alexander replied that NASA had asked the committee for that definition in item #4 of the work plan, so the committee is responsible for providing a definition. He reminded the committee that they had discussed this question – specifically, they had discussed attributes of what is commercial – in the February meeting. He said he would draft an observation or recommendation on this topic before the next meeting.

Mr. Levin asked how NASA reduces risk for companies and whether NASA should guarantee the market. Mr. Emond commented that there needs to be skin in the game and investment by industry; the question is what the right balance is. Mr. Levin said industry will be willing to invest more money if the risk is low. A lot of oversight by NASA forces companies to respond to NASA and adds cost to the program, adding to financial risk. Another risk factor is how much NASA will guarantee they will buy. Any uncertainty is a risk. NASA has a role to reduce those risks. Mr. Alexander added that clarity reduces risk. Mr. Levin added that guarantees and more money up front also reduce risk.

Mr. Alexander said he would write up these suggestions. He asked members to send him any more thoughts they might have, and to do so soon, because he would be doing his part soon.

Mr. Lounge said he would write something for the next meeting on the related question of lessons learned; he would send a draft to Mr. Alexander. Mr. Alexander replied that he would look for a way to incorporate the concept. He would send out materials before that next meeting. The committee cannot deliberate outside of meetings, but they can start to think about the discussion items.

It was decided that the April 26 meeting would end at 6 pm.

Mr. Emond thanked committee members for volunteering their time and adjourned the meeting at 4:53 pm.

Appendix A
Agenda
Commercial Space Committee
March 30, 2010

1:00-5:00 NASA BRIEFINGS UNDER FACA, i.e. open to public

1:00-3:45 Budget and programmatic briefings by NASA

1:00-2:15 Exploration Systems – Michael Hecker

- Exploration Research and Development
  - Heavy Lift and Propulsion Technology
  - Exploration Technology and Demonstrations
  - Exploration Precursor Robotic Missions
  - Human Research
- Commercial Spaceflight
  - Commercial Cargo
  - Commercial Crew

2:15-2:30 Break

2:30-3:45 Space Operations – Toni Mumford

- Space Shuttle (including transition and retirement)
- International Space Station (including Crew Cargo Services)
- 21st Century Space Launch Complex
- Launch Services

3:45-4:00 Break

4:00-5:00 Committee Deliberations

5:00 Adjourn

Appendix B
Committee Membership

Bretton Alexander, Chair
President, Commercial Spaceflight Federation

John Emond, Executive Secretary
Collaboration Program Manager, NASA Innovative Partnership Program

Bernard Harris
Former astronaut; CEO, Vasalius Ventures

Donald Hard
Retired major general, U.S. Air Force

Lon Levin
Founder, XM Satellite Radio

John Michael Lounge
Former astronaut; Consultant

Patti Grace Smith
Former FAA Associate Administrator for Commercial Space Transportation

Wilbur Trafton
Former NASA Associate Administrator for Space Flight