

National Aeronautics and Space Administration

Commercial Space Committee
of the
NASA Advisory Council

April 26, 2010
Johnson Space Flight Center
Houston, Texas

Meeting Minutes

John Emond
Executive Secretary
Commercial Space Committee

Bretton Alexander
Chair, Commercial Space Committee

*Meeting report prepared by
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Committee members present:

- Bretton Alexander, Chair
- Bernard Harris
- Donald Hard
- Lon Levin
- John Michael Lounge
- Patti Grace Smith
- John Emond, Executive Secretary

Opening Remarks

Mr. John Emond opened the afternoon session. He announced that the afternoon session was a public meeting, subject to the Federal Advisory Committee Act regulations, and he summarized its requirements. He introduced Mr. Bretton Alexander, the Committee Chair. Mr. Alexander thanked everyone for coming to the meeting and noted that this would be the Committee's third meeting. He expressed appreciation to the Johnson Space Center for hosting the meeting and introduced Ms. Melanie W. Saunders, Johnson Space Center Assistant Director. She welcomed the Committee and guests to the Center and expressed the Center's excitement over supporting commercial space.

Commercial Vehicles—Collaboration for Vehicle Design & Crewed Operations

Mr. Alexander introduced Dr. Peggy A. Whitson, Chief, Astronaut Office. Dr. Whitson stated that it is imperative that NASA's broad experience in human spaceflight be used as a resource to expedite the transition to the commercial market. Vehicle traffic to and from the International Space Station (ISS) is complicated. Factors to be considered include international agreements and commitments, launch and landing windows, and docking opportunities. They are looking for an order of magnitude safety improvement over the Space Shuttle during ascent, with a predicted loss of crew (LOC) equal to 1/1000. This is based on a 1/100 loss of vehicle and depends upon a booster with high ascent reliability and an abort system for crew escape. They want to have a full envelope abort/escape capability with no "black holes." This requires protection against fire, decompression and toxic atmosphere. Dr. Whitson explained that during powered flight, a region in the ascent trajectory from which an abort is not survivable is a black hole. She provided several examples of the trade-offs that are involved.

Dr. Whitson described the basic requirements that must be met by the commercial crew providers. The ISS must have a continuous U.S. presence onboard. The provider must be able to transport a four person crew. There must be an assured crew return capability and a safe haven. Finally, each crew must have two people trained to pilot the vehicle. She described two possible operations philosophy concepts. One is the "rental car," where the ISS crew serves as vehicle operators. This minimizes the need for consumables and leverages NASA's operating experience in close proximity operations to the ISS. The other concept is the "taxi," where the commercial operator ferries the ISS crew members. This uses valuable up/down mass to support the dedicated commercial operator(s) and adds costs for additional equipment and training. It also requires an additional vehicle to be flown at the program's beginning if the Assured Crew Rescue (ACR) vehicle is the same vehicle.

Dr. Whitson described several key design drivers. The ACR vehicle for ISS crewmembers must be a ready vehicle attached to the ISS as a lifeboat. One option is to leave the crew transportation vehicle docked to the ISS for the full expedition. The other option is to use two vehicles; one for transport and one for rescue. The ACR serves as a

safe haven for debris in close proximity to the ISS, for emergency situations on-board the ISS, and for medical emergencies. Mr. Alexander asked whether the same design would be used for each vehicle. Dr. Whitson responded that a short duration “taxi” would not have to be hardened for an extended stay in orbit. The expedition lengths will be similar to Soyuz-- around six months. This is the most efficient duration based on experience as the astronauts require time to adjust to the environment of the ISS, and beyond six months there is increased hardship in separation between the astronauts and their families. Another design driver is the number of ISS docking/berthing ports. The U.S. has two docking ports and two berthing ports. A dedicated ACR will fill one docking port. If the ACR is a separate vehicle, it and the transport vehicle will occupy two ports. The vehicle’s design, therefore, should allow flexibility for relocating the vehicle to other docking ports. Gen. Hard observed that ports are valuable real estate. Dr. Whitson explained that ports on the Russian side are not available because the Russians move around frequently and their ports will be decreasing from four to three. Dr. Whitson described what takes place during a crew handover. If all U.S. ISS crewmembers are rotated on the same vehicle, a direct handover is involved and will require an on-orbit overlap time of seven to ten days. Other options are feasible, but must be designed to ensure the U.S. presence. Fewer crew should be changed at any one point in time, but more crew transport vehicle launches will be needed. Ms. Whitson discussed the training challenges. There is greater efficiency if the ACR is the same vehicle as the transport vehicle. It is expected that the FAA Office of Space Transportation and NASA will collaborate in determining rules and regulations for commercial licensing. Currently, the FAA covers space flight range safety only. Ms. Smith advised that the FAA’s authority is broader and covers public safety, not just range safety. Mr. Alexander added that the FAA has regulatory authority for the non-NASA human side of space flight. Dr. Whitson described NASA’s human ratings requirement, NPR 8705.2b, as a first attempt by NASA to consolidate its various human ratings into one requirement and noted that the Aeronautics Safety Advisory Panel (ASAP) says that these don’t cover the full gamut of what needs to be covered. It is the closest thing NASA has at this point to indicate what a safe vehicle is supposed to be.

Dr. Whitson explained that NASA representation at the commercial developer’s facility will be encouraged. A balance between insight/oversight and flight testing will be needed. This represents a departure from the standard government acquisition strategy and will require close monitoring to ensure success. She distinguished the Soyuz model, where NASA accepted risks associated with less insight/oversight because the vehicle has a good flight history. She recommends crew collaboration between commercial crew and NASA crew in the design process for both operability and habitability. In response to a question from Ms. Smith, Dr. Whitson stated that the change from insight to oversight and transition to FAA regulation will be very complicated. There will need to be at least one vehicle simulator located at JSC for astronaut proficiency. The program opportunities are: reduced dependency on foreign assets; new ideas from new partners; and a rethinking on how NASA applies requirements. The program concerns are: what would happen if the commercial provider quits if profitability is not enough to justify the risk; the increased complexity if a separate ACR vehicle is used in addition

to a crew transport vehicle; the unknown risk management processes for safety assessment; the effect that the International Traffic in Arms Regulation (ITAR) will have; and the need to define the training for proximity operations. Dr. Whitson concluded by stating that a strong NASA-Commercial relationship is needed for the expeditious transition to a commercially developed, human-rated launch system. She added that the transition entails much that is unknown and requires taking a lot of risks. She would rather do it stepwise instead of all at once because that approach would provide more assurances.

Mr. Alexander thanked Dr. Whitson for her presentation.

Commercial Crew to ISS

Mr. Alexander introduced Mr. Michael Suffredini, ISS Program Manager. Mr. Suffredini described what commercial crew means to the ISS. It will give the U.S. the capability to transport crew members to the ISS. It will provide a dissimilar redundancy for crew transportation in case one vehicle type has to stand down to address a systemic issue. It brings the potential to reduce costs through competition and commercial innovation. It also presents an opportunity for NASA to reassess, streamline, and restate its requirements. He explained that the ISS program is working to consolidate the crewed vehicle requirements from numerous policies and documents into two documents: a Services Requirements Document (SRD), and an ISS Interface Requirements Document (IRD). The SRD will contain service criteria and safety and health requirements for the non ISS attached mission phase. The IRD will contain physical requirements to interface with the ISS, joint operation requirements, and safety requirements for the approach and attached mission phase. He expects these to be ready sometime this summer.

Mr. Suffredini described the commercial crew requirements. It must safely transport up to four ISS crew members to ISS every 180 days and return them safely. NASA will require early access to crew to provide medical care and perform human research data collections. It must provide an anytime crew rescue function. He noted, however, that on April 15, 2010, the President announced plans for a dedicated rescue vehicle based on the Orion design that would launch without crew. Mr. Suffredini described the costs and impacts on engineering, operations and crew time, associated with vehicles visiting the ISS. He reviewed graphs showing crew rotation and traffic baselines. In response to a question from Mr. Alexander, Mr. Suffredini stated that the NASA would require four seats every six months, with a ten day overlap for crew rotation. The ISS can support either the taxi or rental car options. Mr. Levin noted that each visit affects research by consuming ISS crew time. Mr. Suffredini stated that it amounts to 25 hours for each vehicle or ten percent of the national lab crew time. Mr. Levin suggested that for the sake of the research labs, it would be better for only Soyuz to provide the service. Mr. Suffredini noted that the Soyuz seats cover everything, including search and rescue functions. Mr. Suffredini concluded that the reason to use commercial providers is not to save money, but to create redundancy.

Mr. Alexander thanked Mr. Suffredini for his presentation.

ISS Utilization

Mr. Alexander introduced Dr. Julie A. Robinson, ISS Program Scientist. Dr. Robinson described the research objectives on the ISS. There are three main customers: NASA, the international partners, and the ISS National Laboratory. In response to a question from Mr. Alexander, Dr. Robinson explained that the reason NASA is not part of the National Laboratory is simply an historical artifact. Mr. Levin observed that there is no longer a focal point for marketing the ISS. Dr. Robinson commented that there never had been a focal point. She described the NASA research infrastructure on the ISS. She reviewed a chart showing that there are three resource dimensions that affect the capacity for each other: upmass, downmass, and crew time. For example, automated experiments weigh more and cost more, but rely less on crew time. She described the resource constraints for research on the ISS. Dr. Robinson described the major factors that influence research use on the ISS: resource limitations regarding upmass, downmass, and crew time; flight delays; operational problems; transportation costs; payload development costs; NASA funding; non-NASA funding; and research breakthroughs. In response to a question from Mr. Alexander, Dr. Robinson stated that users only need to provide the payload development funding. Mr. Levin observed that other budgets are providing the experiments and ideas on how to use the ISS. Dr. Robinson concurred and stated that it is consistent with other research and development in the country. In response to a question from Mr. Levin, Dr. Robinson stated that demand has increased and that the threat to have to buy upmass is affecting demand.

Dr. Robinson introduced Ms. MaryBeth Edeen, National Lab Manager. Ms. Edeen reviewed a chart showing the various entities having Memoranda of Understanding (MOU) or Space Act agreements with NASA for research on the ISS. In response to Mr. Alexander's request, Ms. Edeen described the process that NASA follows in approaching other agencies about utilizing the ISS. They visit the agencies, describe the research capabilities on the ISS, and explain topically things that may interest the agency. In response to a question from Mr. Levin, Ms. Edeen stated that there are no budgets attached to the activities described in her chart and that she does not track the amount that the agencies might expend. She could not give a total due to spending by the Department of Defense and the Defense Advanced Research Projects Agency. Mr. Levin noted that NASA was not charging for anything. Ms. Edeen concurred, adding that charges would kill the market. Mr. Levin observed that NASA is subsidizing the market in order to develop the market and asked when it might develop sufficiently to stand on its own. Ms. Edeen replied that it depends on the accomplishments and might begin with pharmaceuticals.

Mr. Alexander thanked Dr. Robinson and Ms. Edeen for their information.

Commercial Crew & Cargo Program Status

Mr. Alexander introduced Mr. Alan Lindenmoyer, Manager, Commercial Crew & Cargo Program.

Mr. Lindenmoyer described the status of the Commercial Orbital Transportation Services (COTS) program. He noted that when the program began there was an immediate shortfall in the ability of the U.S. to meet its obligations for upmass. This led to a strong desire to purchase cargo services and eventually crew from a commercial U.S. provider. They did not exist, however, so the question became: if NASA invested seed money and offered its infrastructure of facilities and lessons learned, could the development of commercial providers be accelerated? That became the experiment of COTS. The essence of the model is enabling commercial partnerships, leading to the ability to purchase commercial service.

Mr. Lindenmoyer reviewed the status of the contract with Orbital Sciences Corporation. Orbital has completed 14 out of 19 milestones and has earned payments to date of \$140M out of \$170M. The Taurus II Castor 30 (ATK) engine successfully tested at AEDC. The NK-33 engine, which is the primary engine for the first stage, was successfully re-tested in Russia. The Static Test LO2 Tank is being built in the Ukraine. The Pressurized Cargo Module (PCM) is being fabricated in Italy. Orbital will be launching from the Wallops Flight Facility in Virginia. Steady progress is being made. The agreement with Orbital was renegotiated last year when they decided to switch from an unpressurized carrier demonstration to one that is pressurized. They are planning to fly a demonstration flight to the ISS in June 2011. Mr. Lindenmoyer reviewed the status of the contract with Space Exploration Technologies (SpaceX). SpaceX has completed 16 out of 22 milestones and has earned payments to date of \$248M out of \$278M. All their engine work is complete. The inaugural flight of the Falcon 9 is ready to launch in May. The vehicle shown in the presentation is not NASA's; it belongs to another SpaceX customer. This agreement had been renegotiated due to a change in engines. Mr. Lindenmoyer stated that a similar model was used for the Commercial Crew Development (CCDev) agreements. Last year, \$50M in stimulus funding was received, which was enough to get a number of companies started on long lead items, reducing risks and keeping them proceeding toward the goal of commercial crew. He discussed the status of CCDev projects with Blue Origin, Boeing, Paragon, Sierra Nevada Corporation, and United Launch Alliance.

Mr. Lindenmoyer discussed the President's budget request. It includes \$5.8B for Commercial Crew and \$312M for Commercial Cargo. He explained that a commercial human-rating plan is under review in preparation for a RFI (Request for Information) release to seek comments from industry on the technical requirements and general approach to Commercial Crew development. Recovery Act funds were used to get a head start on this. The most challenging part of the job was to collect the hundreds of specifications, procedures and policies into a set that would be mandatory

requirements to fly NASA personnel on a commercial vehicle. This includes health, medical, engineering and safety standards. It is in addition to NPR 8705, which represents the core requirements for human rating. The draft is under review right now. In response to a question from Mr. Lounge, Mr. Lindenmoyer stated that the CCDev program will be handled in the Exploration Systems Mission Directorate (ESMD). The funds will be used to cover only the development effort. KSC will be the program manager and JSC will be the deputy program manager.

Mr. Alexander thanked Mr. Lindenmoyer for his presentation.

ISS Commercial Resupply Services

Mr. Alexander introduced Kathryn Lueders, Manager, Transportation Integration Office, ISS Program.

Ms. Lueders briefed the Committee on the history and status of the ISS Commercial Resupply Services (CRS) Contract. She explained that the ISS assembly has been completed and the priority now is on fully utilizing the asset. That requires safe and reliable transportation. With the retirement of the Space Shuttle, commercial cargo services have become a key aspect of ISS upmass/return capability. The ISS has contracted services from Roscosmos for cargo delivery and disposal and for crew transportation through 2011. Other providers will be the European Space Agency (ESA), the Japan Aerospace Exploration Agency (JAXA), and the CRS providers. The ISS Program is working with the COTS partners and the Commercial Crew and Cargo Program Office to integrate the new commercial vehicles. The goal is to allow as much flexibility as possible while ensuring the safety of the ISS. This has been implemented through the CRS contract development and award. The CRS contract is a new way to provide resupply capability for the ISS. Rather than procuring a vehicle, the ISS program procured an end-to-end resupply service to the ISS. It encompasses all work required for launch, orbital vehicle integration, and cargo services. The launch is supervised by the FAA. A hybrid oversight model is used. The contract is a fixed price contract for internal (pressurized) cargo upmass, external (unpressurized) cargo upmass, cargo return, and cargo disposal. NASA awarded two CRS contracts on December 23rd, 2008. One contract calls for SpaceX to provide twelve missions with pressurized, unpressurized, and return capabilities. The other calls for Orbital to provide eight missions with pressurized and disposal capabilities. The current plan is to have four SpaceX and three Orbital missions in flow by the end of FY10. Ms. Lueders described the SpaceX and Orbital technical approaches and provided charts showing the major program reviews for their upcoming missions. The contractors will be held responsible for launch vehicle mission success, but NASA will still do a technical assessment of the readiness and risk posture of the launch. Two contracts were awarded to mitigate the risk of being dependent on a single contract. Both contractors are proceeding in their development process through the COTS Space Act process. The ISS is responsible for the ISS integration and ensuring that the visiting vehicle can interface safely. Insight into milestone progress is required as part of the contractors'

compliance to the contract requirements. NASA has built some margins into planning to mitigate against likely schedule slips.

Mr. Alexander noted that the contracts under Federal Acquisition Regulation (FAR) are for flights, not mass. Gen. Hard observed that the requirements work out to four or five flights per year. In response to a question from Mr. Lounge, Ms. Lueders stated that the contractor will get paid the same, regardless of the mass actually uplifted; the task orders are for missions. Mr. Alexander observed that the contract Task Order proposes a per kilogram cost. Mr. Lounge stated that the mission is paid for even if the number of kilograms is not reached. Mr. Lounge asked whether the same model for multiple awards to ensure a robust supply will be used for commercial crew. Ms. Lueders responded that it is not certain. Gen. Hard asked whether each contractor has the capacity to handle the entire manifest if the other one failed. Ms. Lueders responded that they can get close. There is a three to four month launch pad turnaround. Mr. Lounge noted that the Space Act agreements spend a few million dollars and he asked whether the same scale would work for commercial crew, where a few billion dollars will be spent. Mr. Lindenmoyer responded that it would be practical and that NASA should be sharing the cost and risk.

Mr. Alexander thanked Ms. Lueders for her presentation.

Space Operations Committee Discussion

Mr. Alexander introduced Col. Eileen M. Collins, Chair, Space Operations Committee (SOC), NASA Advisory Council. Col. Collins described the SOC's recent endeavors. In February, they looked at the CRS contract and the COTS program. The Committee's opinion is that the commercial firms' success is very important to the country's space program. The human side to the program is going to be very difficult to accomplish. The plan is good; however, there are tough challenges. As advisors, they must make sure that this message gets through. Training for several different vehicles will be a big challenge on the operational side.

Col. Collins recommended that the commercial developers look carefully at the Columbia Accident Investigation Board report. She noted that the report was very well put together and readers will benefit from the lessons learned. One important example would be the section on crew escape. Col. Collins discussed NASA's flight readiness review; she noted that it is an excellent tool and she expressed concern that it might be lost when the Shuttle stops flying. She noted that the Mission Management Team (MMT) has evolved to be really good and expressed hope that the commercial firms would be able to learn from it and the mistakes made in the past. She described the Air Force Range at Cape Canaveral. She explained that there are constraints and challenges that are needed to protect innocent bystanders.

The SOC reviewed the plan for Orion's landing on water. Col. Collins explained that NASA has studied this thoroughly and she believes it is the right thing to do. She asked

what the commercial providers would be doing for landing. Mr. Suffredini explained that NASA would define it as a requirement. Mr. Lounge asked whether that meant that Soyuz might not be compliant. Mr. Suffredini elaborated that the requirements would address how fast you can get to the crew and how fast the crew can save the vehicle. Col. Collins suggested looking at the Skylab Operational Summit. She stated that the SOC has not yet looked at the human ratings requirement. Mr. Alexander observed that the human ratings requirements falls within the SOC's jurisdiction and that he'd like the committee to look at them, especially from a safety perspective.

Col. Collins described the SOC's proposed recommendations for the NAC. The first recommendation is that the Space Station be used to test concepts for human beings beyond low Earth orbit (LEO); for example, time-delayed or non-continuous communications. The second recommendation is for NASA to develop an operational model for a crew on commercial space vehicles, including a small team of government employees involved in the commercial company development and operations. The third recommendation is that NASA should develop an operations plan for the commercial resupply firms from launch to end of mission. The SOC is working hard to catch up with the many recent changes in space policy. There is an observation that may turn into a recommendation: NASA should make the ISS's capabilities and achievements better known to the public at large and particularly to the business world—let them know that there is a great facility up there. Mr. Alexander observed that that would be within the purview of the Education and Public Outreach Committee. Col. Collins agreed and responded that it could be a joint recommendation. She expects that her committee's next meeting would be at Kennedy Space Center, where they will be briefed on the 21st Century Space Launch Complex. They also want to visit Launch Pad 39B, the Space X facility, and a new life sciences lab. Mr. Alexander suggested that the committee might also want to visit the Atlas complex at that time.

Mr. Alexander asked Col. Collins to help educate the CSC on the operational side of Commercial Crew and on the human ratings side, particularly the process for verifying human ratings, which is a major driver on the insight/oversight model. He noted that these issues remain to be decided and will have a large impact on programmatic cost as well as on safety. The CRC wants to help NASA achieve the best balance in the insight/oversight arena so that safety is not sacrificed and burdens are not unnecessarily imposed. Col. Collins noted that there are now new threats to safety in addition to the standard threats like schedule and cost pressure; now in the commercial world there are the proprietary issues, ITAR issues, and competitive issues; it's a new approach. It is not as open as when it was purely government. NASA is off to a good start. It is going to be hard, but it can be done.

Mr. Alexander thanked Col. Collins for her presentation.

Committee Deliberations

Mr. Alexander explained the need for the Committee to develop proposed findings and recommendations for the NAC. They are on a compressed timeline to provide helpful suggestions to the NAC. The next NAC meeting will be at the Jet Propulsion Laboratory on August 4-6, 2010, and he suggested that the Committee hold two meetings in the interim: one in mid to late June and one immediately prior to the NAC meeting. He suggested the first meeting be in the week of June 7, 14, or 21. He would like to delve into the Launch Services Program (LSP) at KSC to see how they perform oversight and look for lessons learned. Another topic would be the new Commercial Crew Office Plan. He would also like a briefing on the NEXT View Program, a commercial imagery program being developed by the National Geospatial Intelligence Agency (NGA) for the next generation of commercial high resolution remote sensing systems. These briefings would be closed, non-FACA fact-finding sessions and any deliberations would be public FACA sessions.

Mr. Alexander suggested a proposed finding regarding progress on the transportation program: the program is moving forward at a deliberate pace, nothing is broken, and the Committee will monitor it closely. The language should reflect that Space X has passed critical design review, is further along than Orbital, and that both are behind their original milestones. The Committee debated whether to include program shortcomings. Mr. Lounge asked what the message to the Administrator should be. Mr. Alexander responded that the Committee has made an effort to look into the program, has not found an obvious problem, and will keep an eye on it. Ms. Smith concurred and emphasized that a steady state is the message. Gen. Hard suggested that the potential for developing excess capacity is a concern that should be monitored. He explained that the way to improve launch reliability is through frequent launches and questioned whether the business base for this would exist for more than one provider. Mr. Lounge observed that the environment for COTS providers improved with the ISS's expansion. Mr. Levin stated that he was satisfied with Mr. Alexander's recommendation. He noted that sustainability is a separate issue and that the COTS program schedule is working well. He expressed concern over conflicting information that has been given to the Committee about the use of the vehicles and the Space Station. Mr. Alexander agreed, noting that the planned use has changed from six seats every six months to four seats two times every six months. Gen. Hard explained that this was not a high launch rate.

Mr. Lounge asked about the subsidies that NASA would need to provide in order to have two providers. Would these include government-owned facilities? Would NASA compete with the providers? Gen. Hard stated that these should be presented as potentially significant obstacles. Mr. Alexander suggested expressing a concern that a level playing field is essential and that there are different ways that government funded assets could be used. Mr. Lounge observed that it is important to identify the objective and that a robust multiple supplier situation is different than developing a solution that is as fast and cheap as possible. Mr. Alexander noted that the Space Act calls for developing multiple suppliers. Gen. Hard stated that the definition for commercial

activity is important, including the concept of profit. Ms. Smith noted that the President's recent speech instructed NASA to benefit from the legacy contractors and develop as many new entrants in the market as possible. Mr. Lounge cautioned that some companies will attempt to claim an exclusive right to use government facilities. Mr. Lounge suggested that it would be valuable to identify the threats and pitfalls that might stifle competition. He and Ms. Smith agreed to prepare draft recommendations for the Committee's consideration at its next meeting.

Mr. Alexander suggested that the Committee obtain a briefing on the Space Act agreements from NASA's General Counsel's office. Ms. Smith requested that the briefing also cover the Soyuz contract. She is interested in seeing what it includes in the services to be provided. Mr. Lounge stated that the Committee should be briefed on the maximum potential seat requirements, not just the minimum. He noted that this would be important to providers who are trying to build a business. Gen. Hard explained that another important concern to look at is the requirement for crew training and the impact that would have on scheduling.

Mr. Lounge suggested that the Committee explore the ways in which commercial space might change the concept of operation (conops) in a way that is beneficial. Gen. Hard cautioned that looking at one element at a time makes it hard to see how they all fit together. Ms. Smith observed that there is a need to identify a system integrator and suggested looking at the aviation model. The Committee discussed whether standardization should be focused on as an issue. Mr. Alexander noted that while there are situations where standardization is desirable, the current policy encourages innovation.

Mr. Marc Timm, from the ESMD, requested the Committee's opinion on the impact that the CRV will have on the commercial crew transportation initiative. Mr. Alexander observed that there could be commercially sensitive issues involved in addressing this question, and that it is necessary to carefully manage the playing field to make sure it remains level for all potential commercial partners. He suggested that there are two issues: whether it competes with commercial crew and whether it is good for commercial crew. There are operational and technical benefits from not being part of the ISS program 365 days a year, 24 x 7, as a taxi or rental car is operational only when you are going up or coming back. On the other hand, there is the loss of market; there is more money to be made if you are going to be part of the program for six months. Mr. Lounge observed that decoupling the commercial crew transportation requirements from CRV functions gives another degree of freedom to the service provider to design to a "sweet spot." Adding a CRV offers the opportunity to reduce commercial crew flight operation and crew-training requirements normally associated with long term ISS-docked and rescue operations.

Gen. Hard offered to prepare a white paper for proposed observations and findings. Mr. Alexander proposed that the Committee be briefed by the FAA on its indemnification practices. Ms. Smith recommended that the Committee join the recommendations that

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Col. Collins described would be proposed by the SOC. Mr. Alexander stated that he would circulate a proposed presentation to the NAC.

Mr. Emond thanked committee members for volunteering their time and adjourned the meeting.

Appendix A
AGENDA
COMMERCIAL SPACE COMMITTEE, GILRUTH CONFERENCE CENTER

April 26 Morning Factfinding, Non-FACA

- 7:45-8:10 Committee members arrive
- 8:10-8:15 Brett Alexander reviews agenda/goals for the day
- 8:15-9:00 First company
- 9:00-10:00 FACA briefing, Diane Rausch
- 10:00-10:15 Break
- 10:15-11:00 Second company
- 11:00-11:45 Third company
- 11:45-12:30 Fourth company
- 12:30-1:30 Lunch

April 26 Afternoon, Open FACA meeting, Space Operations Committee invited to attend

- 1:30-1:45 Welcome from Michael Coats, JSC Director Confirmed
- 1:45-2:30 Briefing from Astronaut Office on views regarding human spaceflight
 - Peggy Whitson, Chief, Astronaut Office, Johnson Space Center
- 2:30-3:15 Briefing from SOMD program office at JSC, to include ISS operations and infrastructure, as well as research (including commercial research) on the ISS as a National Lab. Marybeth Edeen, ISS National Lab manager
- 3:15-3:30 Break
- 3:30-4:00 Briefing from ESMD program office at JSC on center view to commercial cargo and crew, COTS program office. Allen Lindenmoyer
- 4:00-4:30 Committee discussion with Space Operations Committee; Col. Eileen Collins.
- 4:30-4:40 Brief break
- 4:40-6:00 Committee deliberation
- 6:00 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; former Boeing executive

Patti Grace Smith
Former FAA Associate Administrator for Commercial Space Transportation

Wilbur Trafton
Former NASA Associate Administrator for Space Flight

