

**National Aeronautics and Space Administration
Washington, DC**

NASA ADVISORY COUNCIL

Human Exploration and Operations Committee

November 14-15, 2012

**NASA Headquarters
Washington, DC**

MEETING MINUTES

Richard Kohrs, Chair

Bette Siegel, Executive Secretary

Human Exploration and Operations Committee

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NASA ADVISORY COUNCIL

HUMAN EXPLORATION AND OPERATIONS COMMITTEE

NASA Headquarters
Space Operations Center (SOC)
Room 7C61
Washington, DC 20546-0001
PUBLIC MEETING
NOVEMBER 14-15, 2012

WEDNESDAY, NOVEMBER 14, 2012

Call to Order and Opening Remarks

The NASA Advisory Council (NAC) Human Exploration and Operations Committee (HEOC) meeting was convened by Dr. Bette Siegel, Executive Secretary. Dr. Siegel noted that it is a Federal Advisory Committee Act (FACA) meeting and open to the public. Minutes will be published and will be taken on that day by Mr. David Frankel. The HEOC will hold a joint session with the Science Committee in the afternoon. At the end of the meeting, there will be an opportunity for public comments. Dr. Siegel introduced Mr. Richard Kohrs, the HEOC Chair, who welcomed everyone to the meeting.

Status of Orion, Space Launch System and Ground Systems Development & Operations and Integration

Mr. Kohrs introduced Mr. Daniel Dumbacher, NASA Deputy Associate Administrator for Exploration Systems, Human Exploration and Operations Mission Directorate (HEOMD). Mr. Dumbacher briefed the Committee on the status of the Orion Multi-Purpose Crew Vehicle (MPCV). The “top-level” schedule for Exploration Systems was reviewed. This schedule shows the overall progress being made in Space Launch Systems (SLS), Orion, and the Ground Systems Development and Operations (GSDO) program.

The Exploration Flight Test -1 (EFT-1) Integrated Schedule was presented. In response to a question from Mr. Kohrs, Mr. Dumbacher explained that EFT-1 will land in the ocean and be recovered. Agreements are in place with the Navy for the retrieval. A chart showing recent accomplishments in Exploration Systems Development (ESD) was presented; these accomplishments include the EFT-1 heat shield installation, a Neutral Buoyancy Lab main parachute water recover test, a J-2X rocket motor test, a Boiler Plate Test Article vertical drop test, and a contract award for the Multi-Payload Processing Facility (MPPF). In response to a question from Mr. Joseph Cuzzupoli, Mr. Dumbacher explained that the test for the launch abort escape system would use the Constellation design and would be launched by a Minuteman rocket. A slide showing the Orion MPCV ground test article in KSC was presented, and the MPCV Summary Master Schedule was discussed. Mr. Bohdan Bejmuk asked whether the entire faring would be included in the launch abort test and Mr. Dumbacher responded affirmatively. In response to a question from Mr. Kohrs, Mr. Dumbacher explained that no International Exploration Mission (EM) hardware is being built at this time, and that the European Space Agency (ESA) does not have a formal role in EM at this time. There are, however, ongoing discussions at the ministerial level for ESA to develop service modules. The EM-1 service module work is currently being performed under a contract with Lockheed Martin. Slides showing the proof pressure test for the Orion Crew Module (CM) were presented. That test was terminated when an audible noise was heard. Cracks were observed and failure investigation teams at Lockheed Martin and NASA are examining the options. The Orion heat shield construction was described. It is a primary driver on the critical path for EFT-1.

Mr. Dumbacher briefed the Committee on the SLS status. He presented several charts on the SLS milestone schedule. The SLS Rigid Buffet Wind Tunnel model has been completed and installed in the Transonic Dynamics Tunnel at the NASA Langley Research Center (LaRC), where testing has been initiated. A slide was presented showing the SLS Wind Tunnel Schlieren technique. In response to a question from Mr. Cuzzupoli, Mr. Dumbacher explained that a decision on the competition between solid and liquid fuel would be made in 2014 and would apply to the third flight test. The MPCV Stage Adaptor (MSA) manufacturing status was described. Mr. Kohrs observed that the booster would be the largest booster taking off from the Cape Canaveral launch site, and he recommended that the risk for an explosion on the pad be discussed with the NASA Range Safety Program (RSP). Mr. Dumbacher agreed that this is important and asserted that RSP and SLS are in good shape. He briefed the Committee on the GSDO program status. The initial assessment for Mobile Launcher (ML) – Vehicle Assembly Building (VAB) compatibility has been completed. Several designs for Launch Pad 39B have been initiated. The twenty-year life extension project for the Crawler Transporter is complete. Internal cracks were found that need to be repaired. The VAB High Bay 3 (HB3) Platform removal is complete. Basic command and control hardware and software capability for the Spaceport Command and Control System (SCCS) has been delivered. A contract has been awarded to provide complete Design, Development, Test, and Evaluation (DDT&E) for the NASA 50 MHz Doppler Radar and Wind Profiler (DRWP). The GSDO program is proceeding well with infrastructure refurbishment and multi-user preparations. Mr. Dumbacher believes that the three programs are coming together. In response to a question from Mr. Kohrs, Mr. Dumbacher explained that a five-year lead time is needed for EM 1 and EM 2. Mr. Kohrs asked whether there will be customers other than NASA for the booster. Mr. Dumbacher responded that the booster is being developed

as a national capability, and that there have been discussions with the Department of Defense (DoD). Mr. Richard Malow asked whether a cargo flight in 2020 might be possible for the new NRO "class." Mr. Dumbacher responded in the negative and advised that without additional funding, it would be important to stay focused and avoid adding new requirements.

Mr. Kohrs thanked Mr. Dumbacher for his presentation.

International Space Station Status

Mr. Kohrs introduced Mr. Michael Suffredini, Manager, International Space Station (ISS) Program. Mr. Suffredini provided an overview on the ISS Program. The ISS assembly was completed in 2011, at which time the program was reorganized to better focus on the ISS's scientific capabilities. The Vehicle Office (OB) now maintains all hardware onboard the ISS. The Utilization Office (OZ) remains responsible for integrating the needs of utilization customers. The Avionics and Software Office (OD) now maintains all avionics and software related services. The Mission Integration Office (OC) now plans and executes all on-orbit activities. A chart was presented showing the ISS Flight Plan schedule through September 2014. The crew on Expedition 33 was described. A chart showing Increment 33 and Increment 34 was presented, and the objectives for Expeditions 33 and 34 were discussed. The crew is expected to perform a minimum average of 35 hours per week on payload investigations. A chart was presented showing how crew time has been utilized on Increments 33 and 34. Mr. Suffredini discussed several charts on the status of consumables onboard the ISS. Several recent challenges were described. A Space Shuttle Extravehicular Mobility Unit (EMU) exhibited a cooling anomaly during Extravehicular Activity (EV) 18 and was returned to Earth for investigation. The three remaining EMUs are healthy and provide sufficient size variation for the crews in the immediate future. An ammonia leak in a photovoltaic thermal control system has been temporarily bypassed by substituting a photovoltaic radiator. The H-Transfer Vehicle (HTV) 3 post-release abort was discussed. Anomalies that arose during the recent SpaceX-1 mission were described. One engine on Falcon 9 had to be shut down due to a loss of pressure. A SpaceX engine investigation team has been formed and SpaceX has welcomed NASA's participation in the investigation. One of the three computers onboard the SpaceX Dragon spacecraft failed in route to the ISS. NASA had recommended that an effort be made to repair the broken computer while the Dragon was berthed to the ISS because two computers are needed for the Dragon's return to Earth. SpaceX elected to forgo repairs and make the return flight with just two computers. The return flight was successful. A computer chip failed due to a suspected radiation hit. In an effort to reduce costs, SpaceX had not used more expensive computer chips hardened for radiation. All three coolant pumps on the Dragon were lost after splashdown due to suspected water intrusion.

Mr. Suffredini described new research on the ISS and recent results. An aquarium has been delivered with 32 fish. One concern is that fish may bump into and become entrapped in air bubbles that do not clear. The aquatic habitat is the first sophisticated habitat that has been in orbit on the ISS. The next habitat on ISS will be for mice. An investigation into a pathogen that causes yeast infections on Earth was described. This investigation may help develop improved treatments and prevention. A chart was presented on the number

of utilization investigations by the international partners in different disciplines. Another chart summarized the major ISS benefits from the past decade. Mr. Suffredini explained that the ISS is being used to prepare for the Exploration Mission. The international partners are seeking collaboration opportunities that maximize return on investment. There will be on-orbit demonstrations or validations of planned and candidate Exploration technologies. Critical Exploration systems will be demonstrated. Research will be conducted to understand the main risks to human health and performance. Strategies will be validated for keeping the crew healthy and productive. There will be a one-year expedition for a Roskosmos cosmonaut and a NASA astronaut, starting in Spring 2015. A matrix chart was presented on the ISS's top program risks. In response to a question from Mr. Bohdan, Mr. Suffredini described the process that would be followed if the ISS had to be deorbited. The current plan would be to use an Automated Transfer Vehicle (ATV) to do the initial burn. Progress engines would be used to bring the ISS to a lower orbit. Solar array panels will need to be maintained for as long as possible during the deorbit in order to provide power for maintaining control. The media outreach strategy was described. An ISS Program Communications Plan is now being incorporated into Agency and Center-level plans. The web link for ISS Research and Technology is http://www.nasa.gov/mission_pages/station/research/index.html. The ISS Benefits for Humanity web link is http://www.nasa.gov/mission_pages/station/research/benefits/index.html.

Mr. Kohrs thanked Mr. Suffredini for his presentation.

Final Report of Mars Program Planning Group – Joint Meeting with NAC Science Committee

The HEOC held a joint session with the NAC Science Committee for a briefing on the Final Report of the Mars Program Planning Group (MPPG). The briefing was presented by Dr. James Garvin, NASA Goddard Space Flight Center (GSFC) Sciences and Exploration Directorate Chief Scientist, who was introduced by Dr. Wes Huntress, Science Committee Chair. Dr. Garvin described the MPPG's core team. He explained that the MPPG effort was initiated by NASA in March 2012. The effort was motivated by the need to re-plan the U.S. Mars program in order to take into consideration the President's FY 2013 Budget Submittal, the NRC 2011 Planetary Science Decadal Survey Recommendations for Mars Exploration, and the President's challenge for humans in Mars orbit in the 2030s. There was a need to develop the foundations for a program-level architecture for robotic exploration of Mars. The MPPG was chartered to provide options that integrate science, human exploration, and technology at an Agency level with Mars Exploration as a common objective. The job was not to foresee the future, but to enable it. The MPPG's immediate focus was in collecting multiple mission concept options for the energetically favorable 2018/2020 Mars launch opportunities. In addition, the MPPG was asked to provide notional architecture and pathways, spanning to the 2030s. The MPPG reached out to science and engineering communities, both internally and externally, to develop mission options and program architecture alternatives for NASA's consideration. The Mars Concepts and Approaches Workshop, was described. It was hosted by the Lunar and Planetary Institute (LPI), and was an opportunity for the community to discuss ideas and approaches for Mars exploration. Over 380 abstracts were submitted for the workshop and participants came from 10 nations.

The MPPG explored many possibilities for creating a meaningful collaboration between science and human exploration of Mars, while leveraging and focusing technology investments towards a common goal. The MPPG has recommended several options that will implement an integrated strategy for Mars exploration, providing flexibility and resiliency, while recognizing the programmatic and fiscal challenges. Each option provides a compelling science program, with Mars sample return (MSR) as a centerpiece in the overarching theme of "Search for Signs of Past Life." The options all leverage robotic missions to fill Strategic Knowledge Gaps (SKGs) for human exploration and to strengthen scientific collaboration. The MPPG options are estimated to reflect approximately a fifty percent cost reduction compared to NRC Decadal concepts and are responsive to Decadal objectives. The implementation options include: 1) spreading risk and cost across several missions, 2) MSR in a single mission, and 3) improving the probability of returning samples to preserve evidence of past life. Two basic pathways are recommended. Pathway A would search for signs of past life with samples returned to Earth for analysis collected from a site determined to have astrobiological significance using existing data. Pathway B would search for signs of past life through in-situ observations and selection of samples at multiple sites. Using in-situ information, the science community would select the optimal sample suite to be returned to Earth. The MPPG also suggested and priced a variety of "building block" rovers and orbiters. The building blocks provide options to specifically target early mission opportunities.

The MPPG found that MSR architectures provide a promising intersection of objectives for long-term collaboration between the Science Mission Directorate (SMD), the HEOMD, and the Space Technology

Program (STP). Technologies and capabilities were identified that would benefit each and would enable humans to reach Mars orbit in the 2030's, with opportunities for increased collaboration in the future. Crosscutting technologies being developed today by STP and SMD that support future robotic and human exploration, in addition to Entry, Descent and Landing (EDL), and In Situ Resource Utilization (ISRU), include optical communications, a deep space atomic clock, solar electric propulsion, sensors and software for autonomous rendezvous and docking, a Mars Ascent Vehicle (MAV), and large deployable supersonic decelerators. As capability is developed for humans to explore Mars' surface, the return of samples to Beyond Earth Orbit (BEO) for recovery by astronauts offers an early intersection of robotic and human flight programs.

A chart showing cost estimates for potential missions for 2018-2024 was discussed. While the MPPG did not reach out directly to the international community, the existing international partners are expected to play critical roles in human exploration. Possible scenarios leaving from ISS and low Earth orbit (LEO) are being discussed to build a common vision and to leverage current investments and preparatory activities. Mars activities provide worldwide attention with potential to strongly motivate next-generation talent in science, technology, engineering, and mathematics.

Dr. Stephen "Pat" Condon asked whether the MPPG went beyond the President's vision to have humans in Mars orbit in the 2030s. Dr. Garvin responded that the President had used the words "Mars system," which implies getting into Mars orbit and ultimately to the surface. He explained that the first window in the planning horizon for humans to the Mars system, meaning orbit, is in the 2030s. Dr. David E. Longnecker acknowledged the MPPG for the tremendous work that was done in preparing the report and asked that the most valuable pathway for human exploration be identified. Dr. Garvin responded that the MPPG prepared the report to be used as a tool kit for making choices driven by budget and senior leadership. The first step is to develop the flight systems: Orion, SLS, and a longer-term habitation vehicle with an energetic upper-stage; continue the measurements phase robotically, and then use Orion and SLS as the agents for MSR. That would require efforts through the mid-20s. Other optimizations take place at the experiment and technology level with the STP. Getting back to the Mars surface and handling the drive for MSR is a first step that should ultimately open the Mars frontier to humans and sustained science. Mr. Kohrs advised that placing humans into the equation would increase costs by a factor of 10 or more. Dr. Garvin concurred. Mr. Cuzzupoli, after reviewing the MPPG's almost \$2 billion cost estimate for a Rover mission, opined that to include humans on the surface in that mission would increase the mission's cost by a factor of 100 or more. In response to a question from Dr. Huntress, Dr. Garvin explained that the MPPG had chosen not to study Phobos or Deimos because, while sampling those objects is achievable, human interaction with those objects raised additional safety issues.

Dr. Huntress observed that if we are serious about sending humans to Mars and bringing them back safely, we should show we know what to do by bringing back a rock first. He thanked Dr. Garvin for his presentation.

Outreach

The HEOC returned to its regular session and Mr. Kohrs introduced Ms. Alotta Taylor, Director, Mission Support and Communications, HEOMD. She provided the Committee with a presentation on engaging the public in the future of human spaceflight. At her request, four members from her education and public information team, Mr. Rocky Lind, Ms. Beth Beck, Mr. Nick Skytland and Elsie Weigel introduced themselves. HEOMD's three communications and education goals were described. The first goal is to increase public awareness of the marvels associated with ISS, including world-class research/technology advancements and tangible benefits to humanity. The second goal is to articulate meaningful, exciting, and viable missions and uses for SLS and Orion MPCV as part of a capability-driven approach to multi-destination, human spaceflight exploration. The third goal is to engage the public and Congress in understanding the reasons for exploration in a way that is exciting to young people. These goals are aligned with Agency goal number five, to "enable program and institutional capabilities to conduct NASA's aeronautics and space activities," and Agency goal number six, to "share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy."

Ms. Taylor explained that it is more important than ever to engage the public. This is accomplished through traditional media as well as social media. The website for all social media connectivity is <http://www.nasa.gov/connect>. A USA Today 88-page, special publication on the Mission to Mars was described and distributed. HEOMD's web communications and Exploration video products were described. NASA's "Spot the Station" service has been downloaded by over 220,000 people. It sends subscribers an e-mail or text message a few hours before the ISS passes overhead. The Orion hardware tour was described. In response to a question from Ms. Shannon Bartell about engaging SpaceX and its competitors, Mr. Lind informed the Committee that public affairs specialists are embedded with the commercial crew partners. Dr. Condon advised that it is important to get the American public excited about the research that is being performed on the ISS. Ms. Beck reported that her office has been working on speaking in people's "passion language" about what affects their lives. The problem is getting people to look at the "gorilla in the room." The ISS is a "gorilla" that is flying overhead in space. It is an engineering marvel that people cannot see. Her office has worked hard to come up with the ISS' benefits to humanity; however, it requires more than a press release.

Dr. Condon observed that there is very little appreciation from a public standpoint for the benefits derived from the ISS. He counseled that this is critically important. Ms. Bartell recommended using a marketing campaign to help target an appropriate audience. Mr. Bob Sieck noted that a great job is being done communicating to "space fans," but that the other "99 percent" are being missed. Dr. Condon advised that the publicity about ending the Space Shuttle program has led people to think that NASA is not in the manned spaceflight business anymore. Mr. Cuzzupoli recommended that education and public outreach should be handled through NASA's contractors. He explained that this would improve outreach because NASA's Centers are located in only nine states, while NASA's contractors are located throughout the country. He suggested including a public outreach program in the evaluation criteria for awarding contracts.

In response to a question from Mr. Cuzzupoli, Ms. Taylor explained that there were no longer a sufficient number of astronauts to circulate as frequently as desired for public outreach purposes. In response to a question from Mr. Sieck, Ms. Taylor explained that every NASA Center has an Education Office and an Office for Public Affairs. Mr. Cuzzupoli opined that it would be beneficial for all schoolchildren to have a four-hour course on space history. He asked whether a national lottery could be held to give away a flight to the ISS. Ms. Taylor responded that the NASA General Counsel has advised that space flights cannot be given away. Mr. Cuzzupoli suggested working with contractors to accomplish this, and Ms. Taylor agreed to explore doing so with the General Counsel. Dr. Condon asked Ms. Taylor to identify the biggest challenges. Ms. Taylor responded that they are getting the right resources and getting people on the Hill to support their activities. Ms. Beck noted that when her budget was reduced it made her better because she had to be smarter about getting the job done. Dr. Longnecker recommended meeting with the public in focus groups to learn about their interests. Mr. Lind explained that budget cuts prevent them from conducting that research. Dr. Longnecker suggested approaching the Kahn Academy, which produces educational videos. It has over 35,000 videos and only two currently address space. Ms. Taylor agreed to follow-up on the suggestion.

Mr. Kohrs thanked Ms. Taylor and her staff for the presentation.

Committee Discussion

Dr. Longnecker noted that a proposal for a new committee, tentatively named the Research Committee, is pending approval in the Administrator's Office. Dr. Condon expressed discouragement because the public outreach described during Ms. Taylor's presentation "did not seem to fit into an integrated strategy." Mr. Kohrs explained that the overall strategy should come from the Administrator.

Public Comments

Mr. Kohrs asked the members of the public attending the meeting whether any of them would like to briefly address the HEOC. There were no comments.

Adjournment

Mr. Kohrs adjourned the meeting for the day at 5:15 p.m.

THURSDAY, NOVEMBER 15, 2012

Opening Remarks

Dr. Siegel called the public meeting to order at 9:00 a.m. She reminded everyone that it is a FACA meeting and open to the public. Minutes will be published and will be taken on that day by Ms. Paula Frankel. At the end of the meeting, there will be an opportunity for public comments. Dr. Siegel introduced Mr. Kohrs, who welcomed everyone to the second day of the meeting.

Human Exploration and Operation Status

Dr. Kohrs introduced Mr. William Gerstenmaier, Associate Administrator for the HEOMD, who provided an update on the programs in the Directorate. NASA is taking the incremental steps to build, test, refine, and qualify capabilities that lead to affordable flight elements and a deep space capability. Starting with the ISS and initial exploration missions, NASA will extend human spaceflight beyond LEO into the solar system. Mars is the ultimate human destination in the next decades. As we move out, we will need more capabilities, including the 130 metric ton (mt) configuration. The elements in the initial exploration phases will feed forward to later exploration phases.

ISS has a multitude of roles: a scientific National Laboratory; a technology testbed; an orbiting outpost; a galactic observatory; and lastly, the promise of serving as an economic innovation engine. Through the National Laboratory, there will be commercial activities and experiments on the ISS, e.g., investigations on the salmonella bacteria, which express genes differently in space. Pharmaceutical companies can exploit the ISS opportunity to look at what genes make the bacteria stronger and weaker, and eventually develop a vaccine for salmonella. Currently, they are struggling to get this development through the Food and Drug Administration (FDA) process. Broader segments of industry can be exposed to the opportunities in microgravity research, and this could be a “game-changer” for the ISS. Dr. Longnecker endorsed this role. He noted that there are some other interesting opportunities, e.g., three dimensional cell culture, which could present the possibility of regenerating organs. The potential applications to human health on Earth are intriguing and offer huge possibilities.

Mr. Gerstenmaier stated that assembly is complete and the ISS is being utilized for exploration. ISS activities to support future human exploration missions will build upon current activities and leverage the incremental development of exploration capabilities. Exploration preparation activities on the ISS fall into four main categories: exploration technology demonstrations; demonstrating maturity and readiness of critical exploration systems; human health management for long duration space travel; and operations simulations and techniques for missions beyond LEO. A tremendous amount of work is going on, and the ISS is starting to become a very productive research facility. NASA needs to get this message out more strongly and publish results. Mr. Kohrs added that another important message for outreach is that currently, the ISS is offering free launch and crew time. Mr. Gerstenmaier informed the Committee that NASA and its international partners have agreed to do a one-year increment on ISS to examine how crew will perform. The question is: With the detailed investigations and more intricate research, will we learn anything that will change what we will do for future human exploration?

Mr. Gerstenmaier reviewed some of the technology demonstrations and critical Exploration systems developments that are onboard or manifested on ISS. This includes demonstrating the use of robots for

mission-enhancing intra-vehicular activity (IVA), extravehicular activity (EVA), and scientific operations. NASA and its international partners are conducting over 160 studies and activities onboard the ISS to address the top human health and performance risks. Mr. Gerstenmaier noted the current ISS-related policy, guidance, and performance documents for the Committee's information and record. The Agency has annual performance goals on crew capability, commercial cargo flights, resources utilization, utilization activities, and crew time. He discussed how the program knows it is at full utilization: real estate; crew time; and upmass/downmass. Currently, the racks are 71 percent occupied. Crew time is constrained and scheduled time is oversubscribed. Currently, upmass is not a limiting factor. Three to four commercial flights per year will allow for better frequency for research coming to ISS. However, the program needs to watch the down-mass capability. This could become a bottleneck if large amounts of equipment need to be returned.

The Station should not be seen as a separate activity from exploration. NASA will utilize the ISS to enable human spaceflight exploration beyond LEO and will leverage the ISS partnership to form the basis for collaboration with international partners on exploration activities. In addition, the ISS will provide the market and resources to expand the commercial spaceflight industry. The Agency is effectively aligned to fully benefit from the ISS and needs to start thinking about commercial opportunities and partners. At the strategic level, NASA needs to start talking about ISS extension beyond 2020; however, rather than a hard cutoff date, NASA needs to look at what criteria could help it identify the most appropriate time to phase out the Agency's active, full-time participation.

In response to a question from Mr. Cuzzupoli regarding micrometeorite and orbital debris (MMOD) risk, Mr. Gerstenmaier indicated that NASA is continuing to improve MMOD protection. Soyuz and Progress vehicles now have better protection. In addition, the panels on the Service Module provide better protection. The crew is being trained to be better prepared, and events in particular modules can be simulated. NASA has developed a debris avoidance maneuver that provides some protections. Mr. Gerstenmaier emphasized, however, that MMOD is still the number one risk on ISS.

Mr. Bejmuk noted that when he was on the Augustine Committee, Mr. Suffredini gave the panel the impression that there was no good way to de-orbit. He posed the question: Now that there is a single string capability (the Soyuz), is the Program comfortable with de-orbit? Mr. Gerstenmaier replied that NASA now has a very good plan. This plan was requested by the Aerospace Safety Advisory Panel (ASAP). There is an approach using Progress vehicles to hit a well-defined footprint. The Station can be de-orbited, even under uncontrolled situations. The ASAP is reviewing these plans. Mr. Gerstenmaier emphasized that the situation now is very different from when Mr. Suffredini talked to the Augustine Committee.

Mr. Gerstenmaier provided an update on Commercial Cargo and Commercial Crew. He noted the engine problem on the SpaceX vehicle that was revealed on the latest launch. NASA is following what Space X is doing and feels that they are doing a good job of analyzing the issue. NASA will review the findings with them. With modifications to Dragon, SpaceX will be able to provide extra cargo capability. Commercial cargo is moving forward. HEOMD is also working the Commercial Crew activity. Commercial Crew Development (CCDev)¹ has been successfully completed and the majority of the CCDev² milestones have

been completed. Commercial Crew integration capability (CCiCap) is underway and milestones are being achieved. NASA's safety and performance requirements have been baselined, and industry is making significant progress on multiple crew transportation system designs. The Certification Products Contract (CPC) Request for Proposal (RFP) is out and NASA intends to make selections in February 2013.

In the Space Life and Physical Sciences research area, research has been completed demonstrating that exercise using the Advanced Resistive Exercise Device, together with appropriate nutrition, can be an effective countermeasure against bone and muscle loss in space. Station now has the ability to use 120V AC and can run commercial devices without a power supply. A commercial Wi-Fi router now provides uninterrupted Wi-Fi throughout the Station. A lot more needs to be done about the radiation environment. A Radiation Assessment Detector (RAD) instrument onboard Curiosity has enabled us to know about the radiation environment between the Earth and Mars. In addition, we now have radiation data on the Martian surface. Thanks to Curiosity instruments, we now have detailed information on what it is like to fly through the Martian atmosphere. This will affect the design forward. Mr. Gerstenmaier noted that Science gave up precious mass to put these instruments onboard, and the data from them has been very valuable. Precursor work for a Mars mission is starting to be put in place.

Combustion research on ISS is advancing the understanding of "cool flames" and allows much better combustion models than before. Results from magnetorheological fluid experiments may have some applications for dampening devices. Work has begun to reestablish an animal research capability on the ISS. There may be an interesting application for evaluating the effectiveness of new bone loss medication. The Center for the Advancement of Science In Space (CASIS) has announced selections from its initial research solicitation in protein crystal growth. This area has strong economic potential, and projects are being evaluated for flights in FY 2013 and 2014.

Mr. Gerstenmaier noted other programs and projects in HEOMD. He noted that the HEOC received a presentation on Orion the previous day. In July, the SLS completed a major system design review that clears the way for manufacturing and testing of key hardware elements. There has been significant acoustic and vibration testing on Orion, as well as parachute tests in various configurations. These activities have direct application to NASA's commercial partners and will help with their certification. In response to a question from Mr. Bejmuk, Mr. Gerstenmaier stated that the tests are being done to the SLS environment. In addition, the ESD program is continuing extensive progress on the ground systems, including the launch infrastructure. Mr. Gerstenmaier discussed the flight tests for SLS. The uncrewed EFT-1 in 2014 and EM-1 in 2017 will validate the approaches to space systems development to ensure the systems are safe for human travel. The crewed EM-2 will validate human risk mitigation techniques developed for the integrated SLS/MPCV system. The current flight test plans take the integrated system to lunar fly-by and high lunar orbit. Current assessments are evaluating alternate destinations to address long-term exploration and science-based objectives.

Mr. Gerstenmaier reviewed the activity associated with the cracked occurrence on the radius of the rib run-out on the far side of the backbone of panel 4 during Orion proof testing. He emphasized that NASA knew this was a high stress region, and that is the reason for proof testing. The plan is to cut out these areas, do

more forensic inspection, effect repairs, and get back into the flow. The section was put together by Lockheed Martin at Michoud. Mr. Gerstenmaier stated that they will look at whether this was a one-time event. In response to comments, he noted that weight is a precious capability. The program was struggling from the beginning to reduce the weight and knew this was a high-stress region; therefore, it was heavily instrumented to collect data.

In response to a question, Mr. Gerstenmaier responded that the booster for EFT-1 is a commercial buy. Lockheed was told that NASA wanted the entry data, and it was up to Lockheed to make the booster selection, which was a Delta IV. It is similar to a service contract—NASA receives the entry data and Lockheed retains vehicle ownership.

Mr. Gerstenmaier discussed some Advanced Exploration System accomplishments during FY12: a prototype Portable Life Support System for an advanced space suit; air revitalization systems to improve reliability; a Morpheus Vertical Test Bed; a RAD; imaging by Goldstone Radar on 12 near-Earth asteroids; and a field test of a lunar ice prospecting experiment. In the Space Communications area, all the data and command come through the space network. Support from the Deep Space Network (DSN) has been tremendous. Tracking and Data Relay Satellite (TDRS) K is almost ready to launch (January 2013).

The Launch Services Program (LSP) provides launch on different vehicles for the Science Mission Directorate (SMD). Two major contract activities in FY12 were NASA Launch Services (NLS) II contract “on-ramp” activities and the NLS II Launch Service Task Order (LSTO) awards. There will be a common set of standards for high-value payloads. The LSP is working on certification of Falcon 9 for the Jason 3 science mission. Future launches include TDRS-K on an Atlas V in January, the Landsat Data Continuity Mission (LDCM) spacecraft on an Atlas V in February, and the Interface Region Imaging Spectrograph (IRIS) on a Pegasus XL in February. In response to a question from Mr. Cuzzupoli, Mr. Gerstenmaier indicated that Falcon 9.1 comes online with Cargo Resupply Service (CRS) mission 3. There will be two launches on this vehicle prior to CRS mission 3. This mission will allow use of the external capability on Dragon.

Mr. Gerstenmaier discussed the Taurus XL (Glory) failure investigation. Orbital Science’s Accident Investigation Board was unable to identify root cause for the failure. The NASA Mishap Investigation Board (MIB) was also unable to identify a root cause for the failure. However, the NASA and Orbital teams did not stop digging. A special Flight Planning Board (FPB) is being planned to discuss the awareness of what was found. It appears that there may have been some possible extrusion problems during heat treatment. It may be a generic manufacturing problem. Mr. Gerstenmaier emphasized that the results of the investigation are still fairly preliminary, but the teams have uncovered what may be the real culprit. This is a good lesson for the Agency. NASA had two failures in a row: the Orbiting Carbon Observatory (OCO) and Glory, which means that there was not a good failure investigation job on OCO; however, the teams did not give up on Glory. In response to a question, Mr. Gerstenmaier stated that the ISS cargo missions will fly on Antares. The cargo will be category D (loss can be tolerated). In response to a question from Mr. Kohrs, he noted that in order to get performance for 130 mt, the boosters and upper stage will need to be changed. With regard to the competition between a solid booster and a liquid booster, NASA is in the process of

awarding several contracts that will be considering kerosene and solid fuels. Some are based on the F-1 engine. NASA is making the Air Force aware of this activity so that NASA can obtain inputs from them.

Mr. Kohrs thanked Mr. Gerstenmaier for his presentation.

Commercial Certification Process and Accomplishments

Mr. Kohrs introduced Mr. Phil McAlister, Director of Commercial Spaceflight Development, who briefed the Committee via telecom. He opened with a video of the SpaceX launch and ISS capture of the Dragon spacecraft. He noted several “firsts” on this mission: clearing the tower, deployment of solar arrays, guidance on orbit, and unberthing and re-entry. SpaceX completed all the test objectives. The Space Act Agreement (SAA) is concluded, and SpaceX has moved into the CRS missions.

After 72 months, 40 milestones, and a \$396M investment from NASA, SpaceX has brought into operations a new U.S. intermediate class commercial launch vehicle (Falcon 9), a spacecraft (Dragon), and a launch pad (LC-40) capable of safely transporting cargo to the ISS and returning cargo to the Earth. Orbital Sciences is a little further behind. Mr. McAlister explained that the Orbital SAA was signed about 18 months after the SpaceX agreement. Orbital has completed 25 out of 29 milestones and has received \$276M out of \$288M. The maiden test flight of Antares is tentatively scheduled for December 2012, but may slip to 2013. If the test flight goes well, the ISS demonstration mission will be three months after the test flight. Sierra Nevada has had a drop test of its engineering test vehicle.

NASA has been working on Commercial Crew “pieces” for several years. CCDev 1 started in 2010. CCDev 2 started in April 2011 when four companies were selected to mature the design and development of elements of U.S. crew transportation systems: Blue Origin; Boeing; Sierra Nevada; and SpaceX. During the next phase, CCiCap, the designs will culminate in a level of maturity approximately equivalent to a CDR. Awards were made to three companies in August 2012: Sierra Nevada, SpaceX, and Boeing. SpaceX and Boeing received full funding; Sierra Nevada received partial funding. The total NASA expenditures for the program have been a little over \$1B.

Mr. McAlister showed the Commercial Crew Program (CCP) roadmap and explained the certification strategy. NASA wants to get Phase 1 of the certification process underway early next year with award of the Certification Products Contract (CPC). Under the SAAs, NASA has not been able to tell the partners whether their designs meet NASA’s requirements. In response to a question, Mr. McAlister noted that CPC will be a fixed price, Federal Acquisition Regulation (FAR)-based procurement. The certification for the CCP will be in 2 phases: CPC, the first phase, is where NASA will get an early certification process; this will lead to a Phase 2—a full-up, NASA certification. NASA has not decided what to do after the Phase 1; it might exercise some of the optional milestones under CCiCap. This is all “to be determined.” Progress and results under the CPC will inform how to go forward with Phase 2. Mr. McAlister reminded the Committee that NASA has always had two goals for the CCP: to enable commercial capability to LEO, and to obtain crew transportation to and from the ISS. CCiCap enables the first goal. Certification will enable the NASA mission. Some transport missions could be included in Phase 2. NASA would like to begin crew transportation services in 2017.

In response to a question from Mr. Bejmuk, Mr. McAlister explained that the top level, Human Rating Requirements document was used to create the 1100 series of requirements documents, which are the level 2 program requirements. They have not yet been applied in a contractual manner; however, NASA has made these requirements available and the partners know what they are. A lot of detail on the verification statement was added to the documents this past summer, and the partners know what they need to do to obtain NASA certification.

The CPC requires four products. Alternate standards (a cost-saving measure), is one of the first products. The other three are: hazard analyses (the key to the transportation system); the certification plan; and the verification and validation plan. NASA will ask for an interim draft in the early part of the CPC, with a final at the end. CPC will allow technical interchanges between NASA and the partners on the certification requirements and enable the partners to meet the certification requirement objectives before they complete their integrated system designs. The CPC matures key certification products to enable industry readiness and level of maturity required for NASA to enter into the Phase 2 certification contracts. NASA anticipates multiple awards, between two and four, for CPC. The maximum value per award is \$10M, with not more than \$40M total. Proposals have been submitted and are being evaluated. Contract start is anticipated in February with completion by May 30. The key for NASA is how to receive the products and provide feedback in a quick turnaround so that the partners can move forward. The program office at Kennedy Space Center has established a tiger team with input from the Technical Authority and everyone involved in evaluating the process to develop a streamlined procedure to turn around the products.

In response to a question from Mr. Kohrs regarding the competition, Mr. McAlister agreed that it would be challenging for any company not in the CCP to compete for CPC. They would have to produce the detailed design information that would enable them to produce products. Mr. McAlister indicated that because NASA is in the midst of the proposal evaluation process, he could not comment on any of the proposals that have been received. Mr. Kohrs observed that NASA may be setting itself up for a protest. Mr. McAlister explained that the acquisition strategy has gone through the procurement review process and has been approved. He indicated that he feels confident about the approach. If an outside company feels that they have a mature system that could produce the products, they could propose; however, they must convince NASA that they have such a system. In response to another question, Mr. McAlister stated that NASA will not provide the design; the contractor must have a crew transportation system of a maturity that could produce the products required by the CPC. Mr. McAlister emphasized the importance of a streamlined process during this phase. The CCP has formed a Tiger Team to address the decision-making process during execution of CPC. This process will be completed before the CPC is awarded.

The Phase 2 competition will be based on the results of Phase 1. To be a successful, a bidder must have completed a Phase 1 activity. Although Phase 2 is open, it is a "down-select." Phase 2 will be the full-up certification. The CCP Insight Teams will support the verification activities and make recommendations through the system offices within the program to accept verifications and certification efforts for the program. The CCP will approve those and recommend NASA Certification. The Phase 2 RFP release is anticipated in September 2013. In response to a question regarding the competition, Mr. McAlister stated that there are FAR requirements for full and open competition; however, it would be difficult to be selected

for Phase 2 without a credible system. Mr. McAlister described the timing of Phase 1 and Phase 2. Before making Phase 2 awards, NASA will have the final products from CPC. In response to a question from Mr. James Odom regarding the number of awards for Phase 2, Mr. McAlister indicated that this is to be determined; it is dependent on the budget and progress in the prior phases. NASA would like to maintain competition as long as possible. In response to a question regarding certification requirements, Mr. McAlister stated that the 1100 series requirements were developed by NASA. The purpose of CPC is to evaluate company designs against the NASA requirements; NASA will be evaluating those and providing feedback. Phase 1 award is expected in February 2013.

The HEOC members discussed the budget, the requirements for Phase 2 certification, and NASA insight into the efforts. Several HEOC members raised budget and funding questions. Although Mr. McAlister's budget status chart reflected a budget request of \$830M for 2013, no one thought it likely that NASA would receive this level of funding for this period. Mr. McAlister did not have a definitive answer for the question: What if NASA only gets \$406M again in 2013 as it did in 2012? He stated that budgets will always be a challenge and next year will not be any different. The program has had to re-plan every year; and may have to do that again. In terms of the 2017 target date for Crew Transportation Services (CTS), the partners have more aggressive dates: SpaceX says they can do it in 2015; Boeing says they can do it in 2016. In 2012, the budget informed the size of the awards for CcCap—Space X and Boeing were fully funded; Sierra Nevada was partially funded. If NASA cannot fund everything in 2013, the effort can bleed into 2014. Sequestration will present a huge problem; however, given reasonable budgets, the program believes that it can at least get through the base period. Mr. Malow observed that a Continuing Resolution (CR) allows most programs to spend at the 2012 rate or the budget request, whichever is lower. He asked: Is NASA spending at the 2012 rate? Mr. McAlister replied in the affirmative—NASA is meeting the requirements of the CR. Mr. Bejmuk opined that NASA could use this timeline as leverage for funding to finish this program during the President's term. He asserted it would be a nice legacy for the current President.

Mr. Holloway asked Mr. McAlister to expand on requirements for Phase 2. He responded that the certification requirements are the 1100 series; the contract requirements have not yet been established. Mr. Holloway opined that documents and large reviews attended by senior people do not get the job done. What are needed are a few people smart enough about the system to be able to ask the right questions. Mr. McAlister agreed. He noted that the Program Integration Teams (PITs) spend a significant amount of time at the partners' facilities. This was a deliberate design on NASA's part to have better insight into the system design and performance. NASA wants a constant level of robust insight into these systems. The Core PIT is a dozen people representing many disciplines. In response to a question, Mr. McAlister explained that those 1100 series documents, the technical interchanges, and the reviews of partners' plans will go into the certification process. It will be a collaborative activity. The partners will bring forth their data, and NASA, through the CCP Program Boards, will determine the acceptability. The Boards have already acted with respect to the milestones in the SAAs. The certification contracts will use same Board structure. Phase 2 will be a FAR-based contract; NASA has not yet decided on contract type.

Mr. McAlister discussed the features of the Sierra Nevada, SpaceX, and Boeing designs. Sierra Nevada has a "Dream Chaser" spacecraft, which is a reusable, piloted, lifting body vehicle derived from the NASA

HL-20 concept. This design uses non-toxic propellants. Dream Chaser will launch on an Atlas V vehicle from LC-41. It has significant abort capability and can land on any runway long enough. During the base period, Sierra Nevada will be making good progress, but it is not certain whether they will make it all the way to CDR. SpaceX is utilizing Falcon 9 and a crewed version of the Dragon capsule. It will be launched from LC-40. SpaceX claims that it can have an initial launch in 2015. In response to a question from Dr. Condon regarding the SpaceX investment, Mr. McAlister replied that each of the partners bid their own financial contributions, which are highly proprietary and cannot be released in this meeting.

Boeing has not yet named its spacecraft, but it is a reusable capsule design utilizing many proven flight components. It will launch on an Atlas V vehicle using the dual engine Centaur upper stage configuration, which is the same as Sierra Nevada. Boeing will have a lot of testing during its base period. Boeing thinks it can have a crewed test flight in 2016.

Mr. McAlister noted that all of the selection statements are online. Boeing and SpaceX got full-funding awards; Sierra Nevada received a partial-funding. In response to a question from Mr. Holloway, Mr. McAlister indicated that the 1100 series has 650 requirements. One of the ways to get a more cost-effective system is to have fewer requirements at higher level. The partners will manage their efforts below that. It was a real challenge for NASA to minimize the “how to” requirements. The program wanted to focus on what is needed, not how to do it; it feels this was accomplished.

Mr. Kohrs thanked Mr. McAlister for his presentation.

Committee Discussion and Recommendations

Dr. Siegel noted that the Education and Public Outreach Committee (EPOC) had submitted a proposed recommendation to the NAC on outreach, which was taken forward as NAC recommendation 2012-02-05—“One Message.” A response has been received from the Administrator, and a copy was distributed to the HEOC members. The Committee was satisfied with the response, but would like to have an update at the next meeting.

The Committee discussed a proposed recommendation on the MPPG by Dr. Condon, and whether it should be a formal recommendation or a request. Dr. Condon explained that the intent is to introduce a forcing function to let the leadership know that the HEOC is interested in this topic. Mr. Kohrs suggested requesting a status report at the next meeting. The Committee agreed with this approach, and asked Dr. Siegel to put the request into the proper format after the meeting:

“Recommendation:

Provide the Human Exploration and Operations Committee and the Science Committee with a status update on the disposition of the MPPG report and its recommendations at the next meeting of the respective committees.

Reason:

The MPPG has done an outstanding job in defining and analyzing several potential options for future Mars missions. Their report will soon be presented to NASA leadership for consideration.

Consequence of no action:

The Committee is concerned that this strategy for a Mars mission will not be implemented at the present time.”

The Committee discussed Mr. Bejmuk’s proposed recommendation on outreach:

“Background:

NASA has a multifaceted outreach program. It could be significantly enhanced by leveraging this program with a network of many hundreds of contractors and subcontractors.

Recommendation:

NASA consider including in their solicitations a requirement for bidders to include an outreach plan in their proposals. That plan will be included in evaluation criteria.

NASA should consider leveraging its contractors and subcontractors in developing its overall outreach strategy.”

Dr. Siegel agreed to polish the language, put it in the right format, and send it out to the Committee for review and comment.

Dr. Bartell observed that NASA is not getting the message out that human spaceflight is still alive. For the CCP, how are we working with the commercial partners to get NASA’s message out? The Committee discussed various ideas for contractors’ promotion of human spaceflight. The HEOC asked Dr. Siegel to schedule the Communication Coordinating Council (CCC) representative for a discussion with the Committee at its next meeting.

The HEOC discussed the response to the Committee’s previous recommendation on ESD program integration. Mr. Holloway stated that the elements at the working level need to be dedicated people, not part-time. In addition, the right kind of technical analysis needs to be ongoing at Marshall Space Flight Center (MSFC) and Johnson Space Center (JSC). Mr. Sieck observed that NASA’s response resembles Ares/Constellation, but it may be too early in the ESD program to grade how well it is working. The Committee concluded that it would make no new recommendation at this time, but would like a follow-up on this topic at the next meeting. HEOC would like the NASA status briefing to contain a greater level of detail. Mr. Kohrs agreed to help define the desired level of detail and it will be reviewed by the Commercial Committee.

Overall, the HEOC was impressed with the ISS. Mr. Holloway noted that the program has been slow in implementing the MMOD protection, but that timeline has been driven to some extent by the Russians. He expressed some surprise that NASA feels that the ATV is not a major loss. In response to a request from

Mr. Malow, Mr. Kohrs indicated that he has seen a report on utilization, e.g., the number of peer reviewed papers based on Station research. He asked Dr. Siegel to obtain the report and send it out to the members.

With respect to commercial certification, Mr. Holloway commented that the landscape has changed since the HEOC's last recommendation. NASA now has a more definitive plan: Phase 1 is fixed price; Phase 2 is "tbd." He felt that the Committee needs to reinforce its position that the Phase 2 contract and the CTS contract should be cost-plus. He indicated that the Committee supports the position of the ASAP. The HEOC would like to see the RFP for Phase 2 when it becomes available. It was noted that the RFP release is anticipated in September 2013; proposals are due in November 2013, with award in May 2014. The HEOC was concerned about the contract mechanism for Phase 2 certification. Mr. Kohrs indicated that he would prepare a draft recommendation on the contract mechanism for Phase 2 certification and the CTS contract and would circulate it to the Committee for review and comment. Mr. Kohrs dediced to not submit a recommendation on commercial contracts at this time.

Mr. Kohrs announced that the HEOC should meet again in February, at least a week before the NAC meeting.

Public Comments

Mr. Kohrs asked the members of the public attending the meeting whether any of them would like to briefly address the HEOC. There were no comments.

Mr. Kohrs adjourned the meeting at 12:05 p.m.'

**NASA ADVISORY COUNCIL
HUMAN EXPLORATION AND OPERATIONS COMMITTEE**

NASA Headquarters
Space Operations Center (SOC)
Room 7C61
Washington, DC 20546-0001

**PUBLIC MEETING
WEDNESDAY, NOVEMBER 14, 2012**

AGENDA

- | | |
|-----------------------|--|
| 10:00 AM | Call to Order and Opening Remarks <ul style="list-style-type: none">- Mr. Richard Kohrs, Chair- Dr. Bette Siegel, Executive Secretary |
| 10:00-11:00 AM | Status of Orion, Space Launch System and Ground Systems Development & Operations and Integration <ul style="list-style-type: none">- Mr. Daniel Dumbacher- |
| 11:00-12:00 PM | International Space Station Status <ul style="list-style-type: none">- Mr. Michael Suffredini |
| 12:00-1:00 PM | LUNCH |
| 1:00- 3:00 PM | Final Report of Mars Program Planning Group – Joint Meeting with NAC Science Committee <ul style="list-style-type: none">- Dr. Jim Garvin |
| 3:00-3:15 PM | BREAK |
| 3:15-4:15 PM | Outreach <ul style="list-style-type: none">- Ms. Alotta Taylor |
| 4:15-5:00 PM | Committee Discussion |
| 5:00-5:15 PM | Public Comments |
| 5:15 PM | ADJOURN |

**NASA ADVISORY COUNCIL
HUMAN EXPLORATION AND OPERATIONS COMMITTEE**
NASA Headquarters
Space Operations Center (SOC)
Room 7C61
Washington, DC 20546-0001
PUBLIC MEETING
THURSDAY, NOVEMBER 15, 2012

AGENDA

- 9:00 AM** **Call to Order and Opening Remarks**
 - Mr. Richard Kohrs, Chair
 - Dr. Bette Siegel, Executive Secretary
- 9:00-10:00 AM** **Human Exploration and Operations Status**
 - Mr. William Gerstenmaier
- 10:00-11:00 AM** **Commercial Certification Process and Accomplishments**
 - Mr. Phil McAlister
- 11:00-12:20 PM** **Committee Discussion and Recommendations**
- 12:20- 12:30 PM** **Public Comments**
- 12:30 PM** **ADJOURN**

Dial-In and WebEx Information

Dial-In (audio): Dial the USA toll-free number (800) 857-6564, or toll number (517) 308-9323 then enter numeric passcode: 6125443 followed by the # sign. You must use a touch-tone telephone to participate in this meeting.

WebEx (view presentations): The link is <https://nasa.webex.com> meeting number is 990 668 131, and password is Exploration!!!

**Human Exploration and Operations Committee Membership
November 2012**

- Mr. Richard Kohrs Former Deputy Director of the NASA Space Shuttle Program and Director
of
Chair Space Station Freedom
- Mr. Bohdan I. Bejmuk Aerospace Consultant, former Space Shuttle Orbiter Program Director, Boeing
Co-Chair
- Dr. Bette Siegel NASA Headquarters
Executive Secretary
- Ms. Shannon Bartell Former Kennedy Space Center Safety & Mission Assurance Director
- Ms. Nancy Ann Budden Director for Special Operations Technology, Office of the Secretary of Defense
- Dr. Leroy Chiao Former NASA Astronaut and International Space Station Commander
- Dr. Stephen "Pat" Condon Aerospace Consultant, Former Commander of the Ogden Air Logistics
Center,
Laboratory The Arnold Engineering Development Center, and the Air Force Armament
- Mr. Joseph Cuzzupoli Former Assistant Apollo Program Manager, Rockwell, and manager of the Space
Orbiter
Project
- Mr. Tommy Holloway Former Space Shuttle and International Space Station Program Manager
- Dr. David E. Longnecker Director, Health Care Affairs, Association of American Medical Colleges (AAMC),
member
Of the National Academy of Sciences Institute of Medicine (IOM)
- Mr. Richard Malow Distinguished Advisory at the Association of University for Research in
Astronomy (AURA)
- Mr. James Odom Former NASA Associate Administrator for Space Station Freedom
- Mr. Bob Sieck Former Space Shuttle Launch Director

**Human Exploration and Operations Committee
NASA Headquarters, Washington, DC**

November 14-15, 2012

MEETING ATTENDEES

Committee Members:

Kohrs, Richard, *Chair*
 Bejmuk, Bohdan, *Co-Chair*
 Siegel, Bette, *Executive Secretary*
 Bartell, Shannon
 Chiao, Leroy
 Condon, Stephen "Pat"
 Cuzzupoli, Joseph
 Holloway, Tommy
 Longnecker, David
 Malow, Richard
 Odom, James
 Sieck, Bob

*NASA Attendees:
Session:*

Science Committee Attendees at Joint

Allen, John	NASA Headquarters	Huntress, Wes	Carnegie Institute of
Wash			
Beck, Beth	NASA Headquarters	Conte, Dom	Orbital
Bryant, Devin	NASA Headquarters	Norris, Marian	NASA Headquarters
Carpenter, Brad	NASA Headquarters	Tapley, Byron	UT Austin
Deihl, Jessica	NASA Headquarters	McComas, Dave	SwRI
Dumbacher, Dan	NASA Headquarters	Dickinson, Tammy	OSTP
Geldzahler, Barry	NASA Headquarters	White, Nick	NASA GSFC
Hanna, Stephen	NASA MSFC	Malay, Jon	Lockheed Martin
Henning, Garth	NASA Headquarters	Meyers, Michael	NASA Headquarters
Hill, Bill	NASA Headquarters	Luhmann, Janet	UC Berkeley
Irving, Rick	NASA Headquarters	Peterson, Bradley	Ohio State U
Jemstad, Wayne	NASA JSC	Green, Jim	NASA
Headquarters			
Keaton, Jacob	NASA Headquarters	Hagan, Maria	NCAR
Kneiel, Jonathan	NASA Headquarters	Gay, Chuck	NASA
Headquarters			
Kraft, Rachel	NASA Headquarters	Billings, Linda	GWU

Lind, Rocky	NASA Headquarters	Wargo, Michael	NASA Headquarters
McConnaughey, Paul	NASA Headquarters	Rausch, Diane	NASA Headquarters
Perrotto, Trent	NASA Headquarters	Levy, Eugene	Rice U
Scimemi, Sam	NASA Headquarters	New, Michael	NASA Headquarters
Skytland, Nick	NASA Headquarters	McCuistion, Doug	NASA
Headquarters			
Smith, Charles	NASA Headquarters	Leamon, Robert	NASA Headquarters
Suffredini, Mike	NASA JSC	Lavery, Dave	NASA Headquarters
Weigel, Elsie	NASA Headquarters	Johns, Bethany	AAS
Zuniga, Allison	NASA Headquarters	Flanagan, Kathryn	STScI
		Lee, Tim	NASA ARC
		Feeley, T. Jens	NASA Headquarters
		Maizel, Roy	NASA Headquarters
		Keelor, Brad	British Embassy

Science Committee Attendees at Joint

*Other Attendees:
Session (cont'd):*

Bruegman, Uma	The Aerospace Corp.	Kaye, Jack	NASA Headquarters
Dyer, Joseph	NASA ASAP	Lochaer, James	NASA Headquarters
Parr, James	[not affiliated]	Luce, Margaret	NASA Headquarters
Mackey, Bill	CSA	Bernstein, Max	NASA Headquarters
Hawes, Mick	Lockheed Martin	Schmulte, Mitch	NASA
Headquarters			
Sanders, Pat	NASA ASAP	Sanders, Wilt	NASA Headquarters
		Rall, Jonathan	NASA Headquarters
		Robinson, Shawanda	NASA Headquarters
		Flaherty, Chris	NASA Headquarters
		Hollingsworth, Jeffrey	NASA ARC
		Engola, Mary	Ball
		Smith, Eric	NASA Headquarters
		Yoder, Geoffrey	NASA Headquarters
		Taylor, Ray	NASA Headquarters
		Harrington, J.D.	NASA Headquarters
		Hasan, Hashima	NASA

Headquarters

**Human Exploration and Operations Committee
NASA Headquarters, Washington, DC**

November 14-15, 2012

LIST OF PRESENTATION MATERIAL

- 1) Exploration Systems Development and Operations [Dumbacher]
- 2) International Space Station Program Overview [Suffredini]
- 3) Summary of the Final Report – Mars Program Planning Group [Garvin]
- 4) Engaging the Public in the Future of Human Spaceflight [Taylor]
- 5) NAC HEO Committee Meeting: Open Session [Gerstenmaier]
- 6) Commercial Certification Process and Accomplishments [McAlister]

Other material distributed at the meeting:

- 1) USA Special Edition: Our Future in Space
- 2) Exploration Design Reference Missions and Exploration Major Mission Elements
- 3) NAC Recommendations 2012-02-05, 2012-02-06, 2012-02-08, 2012-02-09 and NASA Responses