

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

NASA ADVISORY COUNCIL

Human Exploration and Operations Committee

November 1, 2011

**NASA Headquarters
Washington, DC**

MEETING MINUTES

**Richard Kohrs
Chair**

**Bette Siegel
Executive Secretary**

Human Exploration and Operations Committee
NASA Headquarters, Washington, DC
November 1, 2011

MEETING MINUTES
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*Meeting Minutes Prepared By
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**Human Exploration and Operations Committee
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Welcome and Introductions

Dr. Bette Siegel, Executive Secretary, Human Exploration and Operations Committee (HEOC), called the meeting to order. She noted that this was the HEOC's first meeting, and that it is a Federal Advisory Committee Act (FACA) meeting and open to the public. Mr. Richard Kohrs, HEOC Chair, welcomed the members and attendees to the meeting.

Reorganization Status

Ms. Lynn Cline, Deputy Associate Administrator for Policy and Plans, Human Exploration and Operations Mission Directorate (HEOMD), updated the Committee on the recent reorganization. She noted that the NASA Strategic Plan was issued with the budget in February 2011, and contains several strategic goals that relate to the Directorate. Ms. Cline explained how the Directorate aligns with those goals. The first goal—"extend and sustain human activities across the solar system"—relates to the International Space Station (ISS), development of commercial transportation capability, and development of new vehicles to go beyond low Earth orbit (LEO). All the Directorates support the third goal: "create the innovative new space technologies for our exploration, science, and economic future." The fifth goal—"enable program and institutional capabilities to conduct NASA's aeronautics and space activities"—aligns with the Directorate's Launch Services Program, Space Communications and Navigation Program, Rocket Propulsion Test Program, and other enabling capabilities. The Directorate also supports goal six—"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"—by providing content about programs that can be used for the educational activities.

Gen. Lester Lyles noted that goal four—"advance aeronautics research for societal benefit"—is important. He observed that the goal appears to be somewhat limited, and more could be said in this area. Ms. Cline indicated that when the Plan was developed, a number of themes or overarching strategies that are the means to the goals were included. Under each goal, there are annual performance goals by program area or major milestones. If one looks at the aeronautics content, one would see how broad that goal is. In response to a question by Dr. Stephen "Pat" Condon, Ms. Cline indicated that the annual performance goals are included in the budget. They represent milestones or deliverables. There are no specific milestones in the Strategic Plan text because it is more broad-based. In response to Mr. Joseph Cuzzupoli's observation that there is no specific destination cited in the Plan, Ms. Cline stated that NASA is developing capabilities that could be used for a variety of destinations. Mr. Cuzzupoli opined there should be some destination, rather than a broad comment about the solar system. Ms. Cline indicated that the Committee would hear later from Dr. John Olson on the Global Exploration Roadmap (GER) and the Design Reference Missions (DRMs). Dr. Condon added that the Committee has struggled with understanding NASA's intent with regard to human exploration. It is fine to have a goal to extend human activities across the solar system, but if there are no specific objectives and tasks under that goal, it remains too amorphous and doesn't give the Committee confidence that there is a direction that everyone can support. Ms. Cline responded that the long-term goal should be to explore a variety of destinations. At some point, we will explore multiple destinations, and there is time to select what the next one will be. The question is: When do we choose the next destination? How do we focus it? We will get there, but we are not there now. In response to a question from Mr. Kohrs, Ms. Cline indicated that she did not know when the next destination would be selected.

Mr. Bohdan Bejmuk noted that one goal that is missing in the Plan is providing global leadership in space exploration. Ms. Cline stated that the National Space Policy has that goal, and NASA adheres to it. She indicated that she would provide a copy of the Strategic Plan to the Committee members. "International partnerships" is another cross-cutting element; however, it is not a programmatic goal in the Plan; rather, it is a means to achieve a goal.

Gen. Lyles cited a recommendation made to NASA and the President in a National Academy study two years ago—stewardship and leadership should be a critical goal for America's space program. That national goal should be reinforced in NASA's Strategic Plan. Mr. Kohrs observed that the Plan has about five items under each goal, but international leadership is not among them. Ms. Cline replied that global leadership/cooperation as a Plan goal would require metrics, and it would be difficult to develop meaningful metrics for this type of goal. One reason for having it as a principle or overarching strategy is to avoid this difficulty. She indicated that NASA does want to lead and the international partners are looking to NASA to lead.

Before continuing her briefing on the reorganization, Ms. Cline briefly reviewed all the human spaceflight priorities. She emphasized that the reorganization would be secondary to accomplishing the mission. The reorganization has taken longer than expected. Currently, the detailed reorganization package is going into the final approval process. The employee placement

process has been completed and has worked very well. Employee skills were aligned with open positions. The spaceflight Centers are reorganizing to align with HEOMD. In response to a question about a NASA reduction in force (RIF), Ms. Cline noted that by law, NASA is not allowed to conduct a RIF. To the extent that NASA is driven to a lower full-time equivalent (FTE) number, reductions in the workforce are accomplished through attrition, temporary freezes, and other mechanisms. NASA is offering early-outs and buy-outs in some field Centers. As the FTE reduces, NASA reallocates and reassigns the workforce. Mr. Cuzzupoli inquired about a system for monitoring morale. Ms. Cline noted that the Office of Personnel Management (OPM) performs a personnel survey every year, and the survey includes a few Agency-specific questions. Data was received in the February/March timeframe, and NASA is reviewing the latest results from OPM. Gen. Lyles indicated that he would be interested to see if anything has drastically changed from the previous year. Ms. Cline noted that each organization has a process to look at the lowest scores and decide what specific action plan should be implemented.

Ms. Cline showed the HEOMD organization chart, which has not changed since the joint meeting in August. The Deputy Associate Administrator position, formerly held by Mr. Doug Cooke, is presently vacant. The programs are unchanged. At some point, the Shuttle Program will no longer be a separate Division. An organization at JSC under Ms. Dorothy Rascoe is responsible for Shuttle and Constellation transition, and that group is working closely with the Exploration Division. Ms. Cline highlighted the responsibilities for each Division. In response to a question, she noted that the Crew Office is now under the Human Spaceflight Capabilities Division. The Center Directors do not report directly to the HEOMD, but work closely with it. As a mission directorate, HEOMD has responsibility for the programs, objectives, and schedules; the Centers Directors are partners and provide the Center workforce and capabilities. The support functions—public affairs/communications, legislative affairs, international/interagency relations, general counsel—are offices that work with all the organizations. One or more individuals in each office support the Directorate, although not all are collocated. When there is a request from the Hill for a briefing or testimony, the program officials provide the content briefing; the Legislative Affairs people serve as liaison/coordinators.

Dr. David Longnecker asked what NASA is doing in particular to ensure alignment with the Plan's goals. Ms. Cline responded that this was one purpose for the "all hands" Directorate retreat. Several activities have been held to facilitate communications, information flow-down, and cross-cutting discussions. The Program Management Council also facilitates program understanding. There are weekly telecons with the Johnson Space Center (JSC), Marshall Space Flight Center (MSFC) and Kennedy Space Center (KSC) Directors. She provided some examples where programs are working together. Each group has its version of a monthly or quarterly meeting at the Center level. The Administrator is beginning a new effort to examine how to improve strategic planning and development. In addition, there are social networking elements, e.g., NASA facebook, blogs, and wiki-sites. The Directorate is also looking at what the requirements are for engineering collaboration tools. Mr. Cuzzupoli noted that bringing Center Directors into weekly or monthly meetings is an important activity. The main emphasis should be communication among Centers and NASA Headquarters.

Dr. Longnecker observed that a more robust research program on the ISS appears to be coming together. In response to his question regarding changes in personnel, Ms. Cline indicated that there are a few more people in the Space Life and Physical Sciences Research and Application Division, and this function is augmented in the new organization. At this time, HEOMD is only four FTE above its allocation, so it cannot hire new people. In the near term, the organization will be augmenting its workforce by detailee assignments from the field Centers. When the organization has the ability to begin hiring, it will look at filling the gaps. The Academy study on life and physical sciences helps guide the Division's direction. Ms. Cline agreed that the research program is more robust and more focused. There had been some discussion on whether Space Life Science should be under the ISS Division, but management decided to keep it separate. There is a liaison between the Division and the ISS National Laboratory. In response to a question, Ms. Cline agreed to report back on the number of detailees. This is the primary way that the organization can bring people in. In response to another question, she noted that system engineering and integration is within the Exploration Systems Development Division. Mr. Bejmuk reported that he had received a presentation at JSC on systems engineering and integration, and it appeared to be weak.

Ms. Cline presented a graphic showing the HEOMD's program areas at the Centers. In response to question from Mr. Bob Sieck, she explained that analysis of future DRMs/destinations is in Dr. John Olson's group. Mr. Cuzzupoli observed that one of the biggest problems NASA has is getting enough budget to support the programs. The way the Strategic Plan is written makes it difficult for the public to understand what NASA is trying to do. He stated that he was not convinced that what is in the Strategic Plan, i.e., no specific destination, will "sell" programs. Mr. Bejmuk inquired about how the internationals relate to "capability without specific destination." Ms. Cline indicated that they recognize that certain capabilities are needed, but they are struggling with this as well—specifically, over what their role should be and where they fit in. Over a period of years, NASA generated an international coalition interested in the Moon as the next destination. The international partners prefer that NASA identify the destination because that would make it easier for them to align themselves. Both NASA and the international

partners are in a transition period, examining what the answer should be. China has been clear that it is interested in a long-term, incremental build up in its space capabilities; its next step is its own space station. China has also talked about lunar activities. Although China is a participant in the international space coordination group, by law, NASA cannot do anything bilaterally with China.

Space Launch System (SLS)/Multi-Purpose Crew Vehicle (MPCV) Status

Mr. Daniel Dumbacher provided an update on the SLS and MPCV since August. He highlighted the topics from the August NASA Advisory Council (NAC) briefing. HEOMD is approaching the exploration strategy from a capabilities standpoint, and programmatic planning activities are in progress. The Independent Cost Assessment (ICA) is now complete. In the future, there must be an independent cost estimate around the design review phase. Mr. Bejmuk noted that there has been much discussion regarding capabilities vs. destination. Most transportation systems on the planet are capabilities-based, not destination-based; one exception is the railroad. However, it is difficult for the public and the internationals to relate to a capabilities-based plan. Mr. Dumbacher noted that in the past, NASA has been destination-focused; this time, the Agency is approaching things differently.

Mr. Dumbacher showed the various modules in Orion, noting that these elements were in Constellation. The same requirements for these elements apply, and all work on them continues. Orion completed a Preliminary Design Review (PDR) that did not include a cost assessment—the team is still working on that. The drawings are in process for the test article. When questioned about the percent drawings that are complete, Mr. Dumbacher agreed to obtain that information for the Committee. The service module is the same as Orion. The human interactive display panels and crew life support system will be different from Constellation. The Program has moved to an incremental approach. In response to a question, he noted that acoustics are driven more by the launch abort system. Mr. Dumbacher reviewed the Orion Program objectives. Orion is being designed for beyond LEO; however, the requirements envelope includes what is required to deliver crew to the ISS. Orion will be able to execute that mission if required. An early flight test (EFT-1) is planned for 2013/2014. The budget is planned around an altitude abort test in early 2014. With respect to the work, the split among the Centers has stayed much the same. The launch abort system is still at Langley Research Center (LaRC), with support from Marshall Space Flight Center (MSFC). However, the approach is “go get the work from the right place to get the right skills,” rather than “10 healthy Centers.”

In response to a question from Mr. Bejmuk, Mr. Dumbacher indicated that the ascent abort test will be based on the SLS environment. Mr. Cuzzupoli asked whether it would be better to do the abort test first. Mr. Dumbacher noted that this is included in the trade study that is being conducted. He showed photos from the Orion testing at LaRC, Lockheed Martin/Denver, and the Michoud Assembly Facility (MAF).

Mr. Dumbacher briefly reviewed some technology advancements in each major subsystem. Orion is being designed for ten reuses. What needs to be done with the heat shield between uses is still “to be determined (tbd).” The launch abort has three new solid motors, and the system includes some new technology. The intent is to use the prior Orion investment and work that applies to the current program. Mr. Dumbacher showed a graphic of EFT-1, which is still under trade study but should be completed soon. The intent is to deal with risk early enough in the timeline to influence design. The upper stage is a Delta IV. The capsule is being designed for a four-person crew, with strategic capability for a six-person crew for a Mars mission. In response to a question from Gen. Lyles, Mr. Dumbacher stated that about 10 to 12 of the 16 risks on Orion are addressed by EFT-1. He will provide a chart on this to the Committee. In terms of cost, they are still working the numbers for EFT-1, but it is less than \$500M.

Mr. Dumbacher provided an overview of SLS. The first two flights will use the solid rocket motors from the Ares program. The Launch Vehicle core stage will use the Space Shuttle Main Engines. There are trade studies on what the right number of engines should be, but it appears that a minimum of three, maximum of five will be needed. Currently, the studies show that the vehicle can be flown on three engines. One key trade study concerns the engines and stage firing. The budget will influence this aspect heavily. Mr. Cuzzupoli noted that in the trade studies, it appears that cost is the number one priority and technical performance is the number two priority. Mr. Dumbacher explained that in the past, the focus has been on safety and technical performance, and cost falls out accordingly. Now, cost is in the trade study as an independent variable, along with safety and technical. However, the safety and technical thresholds must be met. The process is changing—cost is more important as an independent variable rather than a dependent variable.

Gen. Lyles observed that if cost is an independent variable and safety can never be violated, at some point, one must reconsider the technical requirements. Mr. Dumbacher indicated that NASA is willing to accept that discussion; however, the vehicle still needs to meet the Agency’s threshold requirements for safety. Anything above that threshold is tradable.

Mr. Dumbacher described the ultimate launch vehicle—the 130 metric ton (mT) vehicle; it will include solid or liquid rocket boosters, a core stage, and an upper stage with the J-2X engine. The larger version will be human rated and could be crewed, although the 130mT vehicle is primarily a cargo vehicle. Mr. Bejmuk expressed doubts on whether anyone could competitively propose a liquid booster. Mr. Dumbacher replied that the advanced boosters are not needed until the third flight. Industry representatives have asserted that they can compete and have a solution, and NASA is willing to consider it. From a competition viability standpoint, NASA is approaching the acquisition in two phases: (1) hardware demonstration and risk mitigation; and (2) full and open competition for full scale development. The first phase is for companies to demonstrate how they could meet the performance requirements and mitigate risks; then NASA would make a selection for a 30-month demonstration phase. Companies do not have to be winners in Phase 1 to compete in Phase 2. Industry claims that they have solutions that can meet performance and lower the cost. Development and operation costs will be key criteria.

NASA views SLS and Orion as a national capability. Mr. Dumbacher highlighted the program status and upcoming events. In response to a question, he noted that NASA has the test stand and the funding for the J-2X engine, so the plan is to move ahead with that work.

Mr. Dumbacher discussed SLS affordability. NASA is looking to leverage existing capabilities whenever possible. It is going to an insight/oversight model that is more risk-based. An important programmatic aspect is timely decisions. On Constellation, it took a year to change a bolt-hole pattern. The SLS Program is looking very hard at delegating decisions to the appropriate level. In response to a question from Gen. Lyles, Mr. Dumbacher noted that he and his lead managers are the “ombudsmen” for industry. Everyone is looking for ways to work the interfaces as efficiently as possible. This is a culture change and will require much diligence and discipline. He is encouraging open communication with industry and the Centers, including feedback on what the Program Office needs to do to get the work done. In response to a question, Mr. Dumbacher indicated that NASA is looking at incentive-based contracts for the effort and is backing off on enforcing government formats. The Program will be using contractor formats and taking advantage of industry practices. Over the next year, leading to PDR, the Program will gain experience with this new approach and how well it works, and be able to factor efficiencies into the cost estimate. Another affordability tenet is lean, integrated teams. The Level 1 integration key role is to watch the schedule and make sure the right people are making the right connections and meeting the milestones. NASA has been talking to the contractors, and they are providing input regarding standards and practices.

Mr. Sieck observed that the processes used on Constellation encumbered the decision-making. Mr. Dumbacher stated that his organization is looking at both Constellation and Shuttle and asking: Are we doing the right thing? What is needed to manage the job? He indicated that he would provide the Committee members information regarding where the managers stand on the numbers of documents. Another tool that is being used is on-site NASA representatives. Inputs from the Request For Information (RFI) have been factored into the processes. The major inputs were: timely decision making; using existing-data/document formats, rather than government-mandated formats; and obtaining input from commercial people who have used profit-driven processes. In response to a question from Dr. Condon, Mr. Dumbacher agreed that having an industrial base that can provide NASA what is needed reliably and affordably is a concern. In the solid-rocket area, the industrial base is thin; for liquid rockets, it is very thin. Overall, the supplier base is weakening, and this is a major concern. On the other hand, J-2X shares a common supplier base with RX-68. NASA has examined various ways to mitigate these concerns. The launch vehicle is the biggest issue, particularly the liquid engine aspects; Orion has the industrial base, but has a timeline problem associated with having to slow down now and bring people back later.

The DM-3 static test was conducted on September 8, and good data was obtained on the nozzle. All indications are that the motor works well. There was a successful 50-second test on J-2X in August. Mr. Dumbacher discussed the procurement status. The SLS public announcement was made on September 14, 2011?? and the synopsis was posted on September 22, 2011??. He briefly highlighted what was released in the announcement.

Mr. Dumbacher discussed the infrastructure work at KSC. The idea is to make it multi-user as much as possible. He discussed the project investment areas for the 21st Century Ground Systems (CGS), and highlighted the modifications to pad 39B, the mobile launcher construction, the launch control center, and the launch equipment test facility. He explained how the previous programs and projects are transitioning to exploration system development. In response to a question from Mr. Bejmuk, Mr. Dumbacher noted that the purpose of 21st CGS is for multiple-user systems. Ms. Cline added that the idea is to work collectively (commercial, NASA, and Department of Defense) on space transportation. In response to a question, she noted that NASA is not sponsoring space tourism, but the commercial sector may offer that.

Mr. Dumbacher discussed the SLS notional mission design for the first flight in 2017 and provided some highlights from the ICA. The notional mission design envisions using Orion for beyond Earth orbit, but it will not be crew capable on the first flight. It will utilize the SLS 70mT version. The ICA provided substantial rationale behind the basis of the estimate. It was a very thorough assessment, and the team was very interactive with the Program Office. Each action has a target completion date. With respect to reserves, various numbers are planned in the budget. The Program has not yet performed a quantitative risk analysis, but will be starting this in the near term.

The Report to Congress that was required in Section 309 of the Authorization Act of 2010 is in the Agency concurrence cycle. The formulation Authorization Documents for SLS/MPCV and 21st CGS are ready for the Associate Administrator's signature. The cross-program System Requirements Review (SRR) will take place November 2-3, 2011??. Mr. Cuzzupoli and Gen. Lyles commended Mr. Dumbacher on his program management and his attention to culture changes. Mr. Dumbacher noted that the team is highly motivated. He presented the Division's 18-month "look-ahead" schedule that contains some key milestones, noting that the master schedule should be approved by the end of this week. Each program is responsible for its configuration management and drawings repository. Interface Control Document (ICD) control has been delegated to the programs. The NASA Headquarters managers ensure that schedules are being met. The objective is to have SLS, MPCV, and 21st CGS ready at the same time.

Overall Human Exploration and Operations Mission Directorate Status

Ms. Cline provided an overview on the status of each Division's programs and projects. She showed a graphic depicting crew rotation, launches, and port utilization. The first commercial resupply mission is under review. NASA is discussing combining the SpaceX Demonstration (Demo) 2 and Demo 3 objectives into one mission. The Agency is considering the January 2012?? timeframe for launch.

Ms. Cline highlighted some recent events on the ISS. NASA awarded a cooperative agreement to the Center for the Advancement of Science in Space (CASIS), a non-profit organization, for the management of national uses of ISS. A Space Act Agreement (SAA) was signed with Arizona State University's Biodesign Institute for Vaccine R&D. Using DEXTRE, robotic exchange (under ground control from Canada) of a Remote Power Control Module was demonstrated. ISS assembly has been completed, and numerous logistics and spares have been pre-positioned for the post-Shuttle era. NASA followed the Russian investigation and conducted an independent review to confirm Roscosmos' findings of the cause of the Soyuz rocket failure and to confirm the recovery plan.

Ms. Cline showed the Launch Services Program (LSP) manifest for the robotic missions under contract. Since the Glory failure, there have been a series of successes, and Mars Science Laboratory (MSL) is scheduled for launch in November. In response to a question, she noted that once under contract, launch vehicles are available to compete for a particular mission, and Falcon 9 is one that is available to compete. The NPOESS Preparatory Project (NPP) mission is the last Delta II planned on the manifest; however, during the recent open "on-ramp" period, United Launch Alliance (ULA) offered its last few Delta IIs for future missions. Other proposals are being evaluated. In response to a question from Mr. Bejmuk, Ms. Cline stated that NASA has a long-standing policy for vehicle certification. It tries to balance the right approach for a given vehicle. The Air Force and the National Reconnaissance Office (NRO) have decided that NASA's certification approach would also serve them, so there is an overall common base for certification. In response to a question from Dr. Condon, Ms. Cline indicated that the MPCV is now being referred to as "Orion".

Ms. Cline briefly discussed some status highlights on commercial spaceflight development. In the six months since the CCD round two partners were selected, and 21 of the 57 planned milestones have been completed. In addition, NASA has entered into a partnership with Alliant Techsystems (ATK). On commercial cargo, NASA is evaluating SpaceX's proposal to combine the Demo 2 and 3 objectives into one mission. NASA is working on the "go/no go" criteria for each step in the mission timeline. The schedule for the next mission is under review, but it is likely to happen within the next two to three months. NASA is also reviewing the proposal to launch Orbcomm as a secondary payload on the Demo flight. With regard to Orbital Sciences activities, the Wallops launch pad is nearing completion. The Orbital test flight will be late February/early March next year; that schedule is under review. MSFC propulsion experts are working closely with Orbital on the recent engine failure.

Ms. Cline cited two recent space life sciences activities—a light-weight, blood analysis prototype that performs multiple blood analyses in space for inclusion in medical kits on ISS and Orion, and the Shear History Extensional Rheology Experiment (SHERE II), which completed its operations in August 2011.

In the Advanced Exploration Systems Division, one of the extravehicular activity (EVA) projects is a portable life support system for advanced spacesuits. With respect to a new suit, Ms. Cline indicated that NASA would continue the current contract at a lower funding level while examining how to go forward for Orion. Another activity was the NASA Extreme Environment Mission Operations (NEEMO) underwater lab, which simulated mission operations on a low-gravity asteroid. Although the mission ended early, it accomplished its mission objectives. HEOMD is working with the Science Mission Directorate to consider instruments on MSL that would help in the planning for the environment that humans would be exposed to on a future Mars mission. HEOMD also is interested in the Goldstone radar imaging of asteroid 2005 YU55. In response to a question from Mr. Bejmuk, Ms. Cline indicated that there is some work underway to look at appropriate radiation protection systems.

Ms. Cline discussed the status of Space Communication and Navigation. NASA is focusing on enhancing and upgrading the ground facilities. The Tracking and Data Relay Satellites (TDRS) K and L are under development; NASA is considering exercising the option for TDRS M. The Deep Space Network (DSN) is at 99.1 percent efficiency. NASA is also doing a considerable amount of international work to ensure interoperability. NASA serves as the Executive Secretary for the interagency Position, Navigation and Timing (PNT) Advisory Group. In response to a question, Ms. Cline noted that the Agency is very concerned about LightSquare's proposed network and has been actively engaged with the testing activities.

The first version of the GER was released in September. It reflects a consensus among twelve agencies that human exploration will be an international endeavor. Ms. Cline indicated that Dr. John Olson would discuss the Global Exploration framework and the GER later in the day.

Status of Commercial Orbital Transportation Services (COTS) and Commercial Crew Development (CCDev)

Mr. Philip McAlister discussed the status of Commercial Cargo, CCDev2, and the Commercial Crew Program (CCP). SpaceX has completed 80 to 85 percent of its milestones. The next mission's Dragon capsule is at Cape Canaveral and SpaceX has begun spacecraft checkouts. SpaceX asked for a December 19 launch date, but NASA is still assessing SpaceX's proposal to combine the mission objectives of Demos 2 and 3 into one mission. In addition, SpaceX wants to fly a secondary payload on that flight, which requires an additional technical analysis to ensure that deployment will not affect ISS safety. Mr. McAlister indicated that he expects a decision this month on the proposal to combine mission objectives. If the objectives are combined, it will be a long (2 to 3 week) mission. Orbital delivered the first pressurized cargo to Wallops; the pacing item is the ground structure completion. The Taurus II maiden test flight has moved about two months from December to late February/early March 2012.

The CCDev2 industry partners are making considerable progress. There are four funded SAAs—Boeing, Sierra Nevada, SpaceX, and Blue Origin—and three unfunded SAAs with ULA, ATK, and Excalibur Almazz. In addition, there are five Memoranda of Understanding (MOUs) with Boeing, ATK, SpaceX, Sierra Nevada, and ULA that enable NASA to have technical discussions about requirements. In response to a question from Mr. Cuzzupoli regarding the relationship with the new commercial partners, Mr. McAlister commented on each. There have been some good technical discussions about the requirements and the hardware. Blue Origin is careful about NASA's involvement. SpaceX has considerable pride in its culture. Initially, it was concerned about NASA's involvement; however, within the first month, that changed and now they are more aggressive in talking to NASA. Sierra Nevada is tapping into NASA expertise and welcomes it. NASA and Boeing are very comfortable with each other. NASA has received many comments on the draft RFP, and is working through them. Mr. McAlister expressed optimism about the results and maintaining SpaceX in the competition. Mr. Cuzzupoli observed that if the program is a success, industry will receive a lot of credit; if there is a failure, NASA will get the publicity. The Committee has been looking at how mission success and safety work out before the first flight. It should be clear, in writing, who has the responsibility. Mr. McAlister emphasized that NASA is not responsible for mission success; it is responsible for ISS safety. Overall, the relationship with all the partners is going very well. In response to a question from Gen. Lyles, Mr. McAlister indicated that the communication among the partners, NASA, and the Federal Aviation Administration (FAA) is good. For example, the FAA communicated fairly promptly with NASA about the Blue Origin failure, even though it was not related to any NASA work and was a different system. NASA is well aware of Blue Origin's processes and has requested a root cause analysis and report on the failure; however, there is no legal "contract" that allows NASA to require information on programs not related to the Agency.

Mr. McAlister showed the CCDev2 milestones for 2011 and 2012 for each partner. In response to Mr. Cuzzupoli's question about NASA funds for thermal vacuum testing, Mr. McAlister stated that SpaceX had not planned to run thermal vacuum test on the ground. NASA accepted the SpaceX plan for flight-testing components, but that was for three missions. When SpaceX proposed combining the Demo 2 and Demo 3 objectives into one mission, NASA felt that additional thermal vacuum testing would reduce the risk. NASA did not pay for the cost of the test; it paid for successful completion of the test. In addition, there

has been much attention on software. Overall, Mr. McAlister indicated that he was satisfied with what SpaceX is doing. Mr. Bejmuk commended Mr. McAlister for not “front-loading” the funding for the partners.

The next contract will be under the CCP; it will be full and open competition. This is the Integrated Design Contract (IDC) phase which will lead to the Development, Test, Evaluation, and Certification (DTEC) phase. The biggest issue is funding. Mr. Bejmuk opined that the Administration should be stakeholders in the Program’s success. In response to Committee members’ comments, Mr. McAlister explained that the expected outcome for the first phase is a system end-to-end, integrated design with Critical Design Review (CDR)-level maturity. NASA wants more than one contractor, but doesn’t have enough funds to maintain all four contractors through CDR. The draft Request for Proposal (RFP) is out for review; the final RFP is scheduled to be released before the end of the year. In response to a question from Mr. Bejmuk, Mr. McAlister noted that NASA is confident about using the Firm Fixed Price (FFP)-type contract. The FFP-type contract is mitigated by two things: relatively mature requirements (no “tbd’s”); and a split into two phases—IDC and DTEC.

Mr. McAlister noted that NASA is requesting \$850M in FY12 to continue development of the U.S. commercial crew transportation system. Funding levels less than this request would result in delays in fielding an operational system. With respect to funding levels beyond 2012, NASA is using the \$850M number each year as a “placeholder.”

In response to a question from Gen. Lyles on what NASA is hearing from the Hill regarding why \$850M cannot be supported, Mr. McAlister replied that Congress has to be satisfied that the funding is prudent. Congress is concerned about insight/oversight, FFP, and the market. A large part of the recent hearing’s focus was on the market. All partners have other sources of revenue/business, and each company has its own business plan. There is a lot of variability, but even at the low end, NASA feels there is a sufficient market to justify the investment.

Global Exploration Roadmap and How It Interacts with the Human Exploration Framework Team (HEFT)/Human Spaceflight Architecture Team (HAT)

Dr. John Olson discussed the organization, policy, budget, architecture planning, HAT, international partnership development, and the GER. The HEOMD spans a broad range of activities. There is an international element associated with many of the HEOMD Divisions, and NASA’s Office of International and Interagency Relations (OIIR) has people aligned with the Directorate’s mission areas.

Since 1969, there have been 24 blue-ribbon panels that have assessed and reassessed human spaceflight strategy, exploration concepts, and national priorities. Planning and implementation teams were established in February 2010, and a cross-cutting, ongoing, sustained effort is helping shape the decision-making on an integrated architecture. Within HEOMD, international partnership coordination is under the Strategic Analysis and Integration Division. One key element of the NASA Authorization Act was to extend human presence beyond LEO. In 2011, the legislative language drove the architecture planning.

Dr. Olson noted that the budget lays the foundation for the progress on key human space activities. The decision velocity is increasing as we move forward, but affordability is still a huge challenge. He explained the capability-driven framework. This framework enables multiple destinations and provides increased flexibility, greater cost effectiveness, and sustainability. It enables an incremental approach and leverages technology as it becomes ready. In response to a question from Mr. Bejmuk, Dr. Olson noted that with respect to the Moon, NASA is looking at the 70mT and the 100mT systems. It is also looking at system drivers within the trade space, e.g., a lander and surface activities. With the budget availability, a cooperative effort would be required. Dr. Condon agreed, but emphasized that someone must take the lead. Would the lead role be NASA’s or would it be acceptable for NASA to take a “follower” role? Dr. Olson replied that the Administration expects NASA to take a leadership role; however, NASA is very supportive in demonstrating partnerships. Dr. Condon observed that NASA must have both technical leadership and political leadership. There are two ways to accomplish the latter: wait for a leader to show up, or generate enough interest to get leadership support. Dr. Olson indicated that NASA is doing both; the Agency understands the budgetary and political dynamics and is planning a realistic direction. Other countries have asked for NASA leadership. There has been a spirit and climate change—the Agency is out of the “doldrums” period and is moving forward. Mr. Kohrs observed that the international partners will probably drive NASA toward a destination. Dr. Olson agreed that the internationals would be a strong agent. Today, we are in LEO, and there are a variety of paths to exploration. The key is identifying the capabilities that would enable those destinations. Dr. Olson cited some common capabilities identified for exploration: human-robotic mission operations; in-space propulsion; deep space habitation; ground operations; cargo and crew access; and EVA. In response to a question from Mr. Bejmuk, Dr. Olson indicated that there are some studies underway to look at advanced propulsion systems—nuclear, solar, and electric.

NASA will develop the launch and spaceflight vehicles that will provide the initial capability for crewed exploration missions beyond LEO. SLS and MPCV are the Exploration enterprise cornerstones, but concurrent beyond-LEO capability development is vital. In response to a question, Dr. Olson noted that “critical path” partnerships are open for discussion. NASA has been looking at ways to augment and enhance the SLS and MPCV systems, e.g., what a 70mT capability could do. SLS is the baseline; beyond that, a higher propulsion stage is necessary. The enabling technology is a long-duration cryogenic source. The Office of the Chief Technologist (OCT) is an integral part of the dialogue. The NASA policy drivers are the Authorization Act, the budget, and the stakeholders.

The HAT is a multi-disciplinary, cross-agency study team that conducts strategic analysis cycles to assess integrated development approaches for architectures, systems, mission scenarios, and operations concepts for human and robotic space exploration. The team prepared DRMs that frame key driving requirements for SLS and the MPCV. Mr. Kohrs asked if the mass fraction analysis was being reviewed or checked carefully, because this affects the cost analysis. He cautioned against repeating the lessons-learned in the 1960s on Apollo. Dr. Olson indicated that he would obtain the mass fraction numbers and provide them to the Committee.

Dr. Olson provided a quick snapshot of the destinations used to drive the transportation systems requirements and how the impacts from changes in mission assumptions are assessed. The 105mT vehicle for the SLS baseline is what is needed in the DRMs. Some DRMs require multiple launches. Moving forward, the HAT is analyzing options for missions that can be fulfilled using 70mT launch vehicles, then the 100mT launch vehicles. The HAT is also analyzing ways to effectively integrate early SLS upper-stage options into DRMs. The program’s tactical timeframes are driving the priorities for the SRR.

NASA has been a leader in the ISECG effort to develop a GER. The ISECG forum enables Agency discussions on key topics such as long-range mission scenarios that lead to sustainable missions to Mars and near-term exploration preparatory activities. The first GER version reflects a consensus by 12 agencies that human exploration will be an international endeavor. The ISECG members work collectively in a non-binding, consensus-driven manner towards advancing the Global Exploration Strategy. International Space Exploration Coordination Group (ISECG) has released two key technical products: the ISECG Reference Architecture for Human Lunar Exploration, and the GER. The second GER iteration is planned for release in September 2012. Dr. Condon expressed his frustration with NASA’s approach by using a sports analogy: everything is being done to get ready, but we don’t have a “game schedule.” People will fill the stadium to watch a game, but not to watch a practice. When will there be a real “game?” Dr. Olson responded that NASA is getting closer, but doesn’t yet have an answer. He agreed that the Nation and the Agency do great things when they are given a goal, but there are some complex factors affecting it. In response to Mr. Bejmuk’s question about a timetable, Dr. Olson noted that GER1 was set up this year; GER2 will be next year. NASA is working incrementally to get there.

Mr. Kohrs observed that the last exploration architecture study that resulted in Constellation had a timetable, and he asked Dr. Olson about the timetable for destinations in the GER. Dr. Olson indicated that the program has detailed schedules for both a nominal and a most aggressive schedule for the Moon, near-Earth asteroid, L1, and L2. Without a specific destination, all are carried in the portfolio. Mr. Kohrs stated that at some point, a destination needs to be selected. Continuing the sports analogy, Dr. Longnecker agreed that NASA has a great team and good players, but there are only three games scheduled in the next 20 years. It is hard to hone skills and keep people engaged under those circumstances. Mr. Cuzzupoli added that this trickles down to the contractors—where NASA is going affects everything. Dr. Olson explained that NASA is anchoring on the SLS decision; NASA knows where industry is making investments, and is seeing progress on cargo and crew. These refinements are helpful in tailoring and shaping the supply chain and NASA capabilities. There is not yet a single destination—the President wants the country to be able to go to all of these destinations. Two pathways are technically feasible and incrementally manageable: Near Earth Asteroid (NEA) and the Moon. Most international contributors are interested in the lunar aspect. A full capability NEA mission is more expensive and more challenging, but a “mini-NEA” is not. An expeditionary/small footprint lunar mission is challenged by descent to and ascent from the lunar surface. NASA needs to do some smart investments in research and capabilities development for beyond-LEO human missions. International partnerships and joint planning are essential elements. In response to Dr. Olson’s presentation, Mr. Kohrs observed that the Committee’s message in general was: get to a destination selection as soon as possible.

Space Life and Physical Sciences Research and Applications Research for Human Exploration

Dr. Brad Carpenter provided some background on why a research division is included in the HEOMD. Human exploration of space is driven by two big questions: What does the universe contain? What is the future of human civilization? Exploration and research work synergistically to answer those questions.

Dr. Carpenter discussed the outlook for the Human Research Program (HRP), Crew Health and Safety, Space Biology and Physical Sciences, CASIS, and the proposed Space Life and Physical Sciences Research and Applications (SLPSRA) Advisory Subcommittee. The HRP includes research that reduces risks to humans and focuses on the highest risks to crew health and performance during exploration missions. About 150 FTE are involved in the HRP. The budget is essentially flat at about \$135M per year. Although the HRP is built on well-documented evidence, it is still surprised by new things, e.g., in-flight vision changes in about 20 percent of the long-duration crew.

Crew Health & Safety is the medical care and occupational health and safety for past, current, and future astronauts. The biggest issue is the increase in health care costs, which is rising at about seven percent per year while the budget is essentially flat. Another issue is the relationship between medical operations and biomedical research.

The Space Biology and Physical Sciences Division is a new element. It covers basic research in biological, physical, and engineering sciences for ISS utilization and future exploration missions. CASIS is funded in the Division's budget at about \$15M per year. The issues that this Division is working on came from the National Research Council (NRC) Decadal Survey on Biological and Physical Sciences Research in Space. There are plans for a new budget line in FY13 for new flight research, which includes Principal Investigator (PI)-led flight opportunities. In response to a question from Mr. Bejmuk, Dr. Carpenter noted that science payloads will get to ISS via Soyuz, Progress, and the Dragon capsule. The NRC Decadal Survey had 65 recommendations; the Division is working on the responses and actions, starting with the payloads process. Dr. Carpenter showed the near-term ISS utilization strategy. Some of the hardware has been in development for a number of years; the schedule depicted when NASA expects each experiment to be on Station. Materials science research is based on availability of partner hardware.

CASIS was awarded a cooperative agreement valued at \$15M per year for 10 years. Its primary office will be in the Space Life Sciences Laboratory Building adjacent to KSC. CASIS is an important step in the space development evolution; it will explicitly seek external funding for space research. CASIS estimates the current project value and its likely future value. It will have its first solicitation release in late 2012, and will have its first brokered investment in ISS research in 2013. Dr. Carpenter described how CASIS performs an economic valuation of research projects. CASIS's service is in establishing the marketplace and facilitating venture capital investment in research. In response to a question from Dr. Longnecker, Dr. Carpenter indicated that National Institutes of Health (NIH) payloads will go through the CASIS prioritization process. CASIS will select the payloads and allocate resources based on economic value. He clarified that NASA-sponsored payloads and ISS partner payloads will not go through the CASIS process. Dr. Longnecker noted that NIH research is based on the national health priorities, not economic value. Dr. Carpenter agreed that CASIS has a real challenge in applying the model to basic research, but it is a worthy experiment and hopefully will enable new involvement in ISS. The Division will work closely with CASIS to make it a success, but is pressing forward with the long-term strategy for space biology and physical sciences. This includes PI-built ISS payloads, new initiatives that will bring new capabilities and cutting edge science to ISS, and a new era of ground-based research that would establish an advocacy community for human exploration.

Dr. Carpenter proposed establishing a HEOC subcommittee that near-term, would advise on the tactical implementation of recommendations from the NRC. In the longer term, it would advise HEOMD on the development of a stable research community and a research program that would support future exploration missions. In response to a question from Mr. Kohrs, Dr. Carpenter noted that the total FY12 budget request for his Division was under \$200M.

Discussion and Recommendations

Mr. Kohrs opened the discussion by recounting a couple of observations that Mr. Sieck had made before his early departure. While progress and morale has improved due to recent announcements, there is still no specific destination for long term human spaceflight missions. It is difficult to have commitment and national partners for SLS until specific goals and missions with schedules are established. Since human spaceflight was born, there has always been a destination. Mr. Cuzzupoli added that there are actually two issues: morale and destination. It was noted that the NAC Space Operations Committee recommended a destination about six months ago, and the Committee should look at NASA's response, if one was made. Mr. Longnecker observed that the Committee has no data regarding morale and cannot say whether it has gotten better or worse.

Mr. Kohrs stated that the new HEOC can again recommend that NASA select a destination; he suggested that the prior Space Operations Committee recommendation be reviewed as well as NASA's response to that recommendation if there was one. Dr. Siegel will prepare a statement and forward it to the Committee for review. Since the NAC is not meeting this week, Mr. Kohrs suggested that the HEOC send inputs on this issue to the Executive Secretary and request a discussion with the Administrator.

Ms. JoAnn Morgan observed that between the end of Apollo and the beginning of the Space Station, Skylab and the Apollo-Soyuz Test Project (ASTP) kept the workforce committed and energized and attracted new, junior people for the next generation. A long gap now would be a bad thing. Mr. Kohrs noted that if crew demonstration is in 2021, with hopefully the next flight to a destination a year later, hardware work must start at least 10 years in advance if the destination is an NEA or the Moon. That puts us at 2012; it makes sense, therefore, to have the next destination selection now. NASA argues that the Agency is laying out the plan based on funding, and the funding is not available for the ten-year, long-lead items. However, Mr. Kohrs countered, if NASA knows where it is going, it can at least start a low level effort toward that end.

In terms of process, Dr. Siegel suggested that the recommendations be prepared off-line and circulated within the Committee for a final draft. She took an action to forward the previous Space Operations recommendation to the Committee members for comments and editing to better reflect the HEOC's input.

Mr. Kohrs indicated that Mr. Sieck's second comment concerned commercial crew. In the environment we are in with the budget and the ISS resupply, the commercial capability and success near term is more important than the SLS and Orion. The message is that perhaps some funds should be diverted to ensure that the commercial entities succeed. Mr. Kohrs observed that both the House and the Senate want to cut the requested FY12 and FY13 budget for commercial crew. Mr. Bejmuk suggested recommending that commercial crew become operational in 2016 instead of 2017. This would serve two purposes: (1) it would recognize the importance of the Administration's support for human spaceflight; and (2) it would help close the "gap." Mr. Kohrs observed that the Agency argument is around funding—the comment has been made that it is cheaper to get another Soyuz. However, with only Soyuz, NASA is just one failure away from a real problem with ISS. Mr. Kohrs indicated that he would prepare a draft recommendation and Dr. Siegel would distribute it to the members for editing.

Mr. Kohrs observed that it does not appear that the HEFT/HAT activity is driving Mr. Dumbacher in the near-term. However, he did not feel that the Committee should do anything on a recommendation at this time.

The Committee discussed the FFP contracting approach. Mr. Cuzzupoli commented that under a FFP contract and a 2016 date for commercial crew, NASA is in trouble. He opined that a FFP contract would not work for the development vehicle. Mr. Kohrs added that it could work, but it would cost a lot more money. Although a cost-plus type contract might not be any cheaper, a Cost-Plus-Incentive-Fee (CPIF) could probably achieve a better schedule. Mr. Bejmuk counseled that with two and a half years development under FFP contracts and \$1.6 B split between contractors, NASA may be getting into a situation where the envisioned program cannot be executed. Mr. Kohrs noted that every contract in human spaceflight has overrun because NASA changes the requirements. Mr. Cuzzupoli opined that NASA should seriously consider a contract arrangement other than FFP. There is history at the Air Force that similar fixed price contracts have failed. NASA should use or obtain experienced people that understand the consequences of working with a fixed-price contract. Mr. Kohrs asked Mr. Cuzzupoli to write up an observation on this topic. Mr. Bejmuk suggested taking a second look at the contract type and see what could be done with schedule incentives.

Ms. Morgan commented that the Associate Administrator, Mr. William Gerstenmaier, needs help from the Committee with regard to the many external reviews, data requests, briefing requests, and Congressional testimony. The Committee could observe that the Exploration Program seems to be overburdened with these actions. Mr. Bejmuk suggested that the Committee get a briefing from the Legislative Office on what its role is and what it can do to help. Ms. Morgan agreed to prepare an observation and forward to Dr. Siegel to circulate for comments.

Dr. Longnecker stated that the Committee could make an observation about the life and physical sciences activity—it is a good step forward; however, there is concern about funding levels. He agreed to prepare an observation on this subject.

Mr. Bejmuk noted that on the FFP observation, the Committee could include a statement on schedule, i.e., moving it forward to 2016. He suggested making a recommendation for NASA to develop a timetable or schedule for the Global Exploration framework. Mr. Kohrs stated that this statement could be tied in with the destination comment, as well as a comment on international cooperation and more aggressive leadership.

Mr. Bejmuk asked whether the Committee should make an observation or recommendation that NASA should, whenever practical, align program milestones with Presidential terms. Ms. Morgan stated that she was not comfortable with a formal recommendation on this, although she agreed that NASA should be sensitive to this factor.

Dr. Longnecker observed that at the last NAC meeting, it was the consensus that too many individual recommendations dilute the intent. It was decided to say that the single most important thing to ensure leadership in spaceflight is continuity of mission, long term goals, and direction. Mr. Kohrs agreed that the Committee could prepare a statement similar to that, but the answer would probably be that NASA's budget-constrained. Mr. Kohrs asked Mr. Bejmuk to prepare a statement regarding aligning significant program milestones with "reality."

There was no further Committee discussion. Mr. Kohrs invited public comments or questions.

Public Comments

Mr. Chris Gilbert, a visiting scholar with the Space Policy Institute, stated that he was interested in international cooperation. He compared the situation now with the situation in the 1980s when the U.S. was starting its plan for the Space Station. Then, the process to gain international cooperation was "top-down;" now, it appears to be "bottom-up." To get support for ISS, President Reagan reached out and invited other countries; in the 1990's, President Clinton reached out to Russia to participate in the ISS. If space exploration is a national goal, then leadership of the space program should be a national goal. We need to achieve political outreach to countries to bring them to negotiate with NASA. Without that, everyone will still be talking in two years. The U.S. needs the international element contribution, and that must start now. NASA needs to respond to a national goal for international cooperation. Mr. Kohrs thanked Mr. Gilbert for his thoughtful input.

Mr. Joe Dillon, a retiree from space industry, expressed appreciation for the discussions and presentations, but observed that the Committee seems to have a very low profile. He asked whether there were any plans for the Committee to solicit inputs to its discussions. He was glad to see consideration of the importance in bringing the commercial sector into the plan for crew and cargo. The SLS would be complementary to the commercial activity in LEO and would augment the capability. Both are important to U.S. leadership in space.

Dr. Siegel announced that the presentations would be posted on the Committee's webpage, and there would be a link from the NAC webpage. She asked the Committee members to submit topics for consideration for future meetings.

Mr. Kohrs thanked Ms. Morgan, who will be leaving the Committee, for her service.

Dr. Longnecker asked that the Committee think about the subcommittee that Dr. Carpenter suggested. It would be a good way to work on topics and issues between Committee meetings. Mr. Kohrs agreed that the Committee would address the subcommittee proposal at its next meeting.

The meeting was adjourned at 4:35 pm.

**NASA ADVISORY COUNCIL
HUMAN EXPLORATION OPERATIONS COMMITTEE
NASA Headquarters, Washington, DC
November 1, 2011**

AGENDA

- 8:00 – 8:05** **Welcome**
- Mr. Richard Kohrs & Dr. Bette Siegel
- 8:05 – 9:00** **Re-Organization Status**
- Ms. Lynn Cline
- 9:00 – 10:00** **Space Launch System/Multi-Purpose Crew Vehicle Status**
- Mr. Dan Dumbacher
- 10:00 – 10:15** **BREAK**
- 10:15 – 11:15** **Overall Human Exploration and Operations (HEO) Mission Directorate Status**
- Ms. Lynn Cline
- 11:15 – 11:45** **Status of Commercial Orbital Transportation Services and Commercial Crew Development**
- Mr. Phil McAlister
- 11:45 – 1:00** **LUNCH**
- 1:00 – 2:00** **Global Exploration Roadmap & How It Interacts with HEFT/HAT**
- Dr. John Olson
- 2:00 – 2:15** **BREAK**
- 2:15 – 3:45** **Space Life and Physical Science Research and Applications- a new HEO Organization – Including Center for the Advancement of Science in Space and Plans**
- Dr. Brad Carpenter
- 3:45 – 4:55** **Discussion and Recommendations**
- 4:55 – 5:00** **Comments from the Public**
- 5:05** **ADJOURN**

HUMAN EXPLORATION AND OPERATIONS COMMITTEE MEMBERSHIP
November 2011

Mr. Richard Kohrs Chair	Former Deputy Director of the NASA Space Shuttle Program and Director of Space Station Freedom
Mr. Bohdan (Bo) I. Bejmuk Co-Chair	Aerospace Consultant, former Space Shuttle Orbiter Program Director, Boeing
Dr. Bette Siegel Executive Secretary	NASA Headquarters
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, the Arnold Engineering Development Center, and the Air Force Armament Laboratory
Mr. Joseph Cuzzupoli	Former Assistant Apollo Program Manager, Rockwell, and manager of the Space Shuttle Orbiter Project
Ms. Carolyn S. Griner	Vice President, NASA Programs, SAIC, former Deputy Center Director, MSFC
Dr. John Grunsfeld	Former NASA Astronaut and current Deputy Director of the Space Telescope Science Institute
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)
General Lester L. Lyles	The Lyles Group, 27 th Vice Chief of Staff of the Air Force
Mr. Tommy Holloway	Former Space Shuttle and International Space Station Program Manager
Mr. Richard Malow	Distinguished Advisor at the Association of Universities for Research in Astronomy (AURA)
Ms. JoAnn Morgan	Former Kennedy Space Center Associate Director, KSC Safety & Mission Assurance Director
Mr. Bob Sieck	Former Space Shuttle Launch Director

NASA ADVISORY COUNCIL
HUMAN EXPLORATION OPERATIONS COMMITTEE
NASA Headquarters, Washington, DC
November 1, 2011

MEETING ATTENDEES

Committee Members:

Kohrs, Richard (Chair)
Bejmuk, Bohdan (Co-Chair)
Siegel, Bette (Executive Secretary)
Condon, Stephen "Pat"
Cuzzupoli, Joseph
Lyles, Lester
Longnecker, David
Morgan, JoAnn
Sieck, Bob

NASA Attendees:

Robinson, Shawanda
Geldzahler, Barry
Cline, Lynn
Plumb, Thomas
Perritt, Eric
Barber, Scott
Neumann, Benjy
Beck, Beth
Dumbacher, Dan
Broadwell, Marguerite
Wan, Stephanie
McGowan, David
McKay, Meredith
McAlister, Philip
Irving, Rick
Carpenter, Brad
Parrish, Joe

Other Attendees:

Smith, Mike	Booz Allen
Bordi, Francesco	Aerospace
Bardos, Russ	Aerojet
Mackey, Bill	CSA
Lavaque, Rodolph	Booz Allen
Gilbert, Chris	SPI
Kernian, Linda	LMC
Correll, Randall	Ball
Reichhardt, Tony	Air & Space
Moloney, Michael	NRC

WebEx Attendees:

Zhu, Fuchun
Landis, Rob
Chabot, Valerie
Mackey, Bill
Kelly, D.S.
Dickey, Chuck
Rogers, Richard
Lamm, Tracy
Allen, Gale
Boyd, Robert
Epstein, Barry
Atkinson, Loretta
Link, Richard
Drosback, Meredith
Begnaud, Dean
Graham, Lee
Moore, Arlene
Leung, Ronald
Laurini, Kathy
JLK
Smith, Mike
Moloney, Michael
Wan, Stephanie

**NASA ADVISORY COUNCIL
HUMAN EXPLORATION OPERATIONS COMMITTEE
NASA Headquarters, Washington, DC
November 1, 2011**

PRESENTATION MATERIAL

- 1) Human Exploration & Operations Reorganization Status [Cline]
- 2) SLS/MPCV Status Briefing [Dumbacher]
- 3) Human Exploration and Operations Mission Directorate Status [Cline]
- 4) Commercial Spaceflight Status Briefing to NAC [McAlister]
- 5) The Big Picture on Exploration Planning and Integration [Olson]
- 6) Space Life and Physical Sciences and Applications Research for Human Exploration [Carpenter]