

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

NASA ADVISORY COUNCIL

Human Exploration and Operations Committee

June 23, 2014

**NASA Headquarters
Washington, DC**

MEETING MINUTES

Mr. Ken Bowersox, Chair

Dr. Bette Siegel, Executive Secretary

**Human Exploration and Operations Committee
NASA Headquarters
Washington, DC
June 23, 2014**

**MEETING MINUTES
TABLE OF CONTENTS**

Call to Order and Announcements.....2
Opening Remarks.....2
Evolving Mars Missions and Trade Space.....2
Exploration Strategy and Overview.....4
Public Comments.....7
Committee Discussion and Recommendations.....7

- Appendix A Agenda
- Appendix B Committee Membership
- Appendix C Meeting Attendees
- Appendix D List of Presentation Material

**Meeting Minutes Prepared By
David J. Frankel, Consultant
P B Frankel, LLC**

**NASA ADVISORY COUNCIL
HUMAN EXPLORATION AND OPERATIONS COMMITTEE
NASA Headquarters
Washington, DC**

**PUBLIC MEETING
June 23, 2014**

Call to Order and Announcements

Dr. Bette Siegel, Executive Secretary for the NASA Advisory Council (NAC) Human Exploration and Operations (HEO) Committee, called the public session of the Committee meeting to order at 10:30 a.m. She announced that it was a Federal Advisory Committee Act (FACA) meeting and, therefore, open to the public. Minutes would be taken and posted on-line. There would be an opportunity for the public to make comments towards the end of the meeting.

Opening Remarks

Dr. Siegel introduced Mr. Ken Bowersox, HEO Committee Chair. He welcomed everyone to the Committee meeting. He explained that the first presentation would be given by Mr. Jason Crusan, who would describe NASA's future human exploration plans, including the Capability Driven Framework and how humans will advance from an Earth-reliant phase of human spaceflight to an Earth-independent phase to support long-duration Mars missions. It is important, he noted, to lay out that strategy.

Evolving Mars Missions and Trade Space

Mr. Bowersox introduced Mr. Crusan, Director, Advanced Exploration Systems (AES) Division, Human Exploration and Operations Mission Directorate (HEOMD), who addressed the Committee and presented telephonically.

Mr. Crusan reviewed the Capability Driven Framework, which establishes incremental steps to steadily build, test, refine, and qualify capabilities that lead to affordable and sustainable flight elements and a deep space capability. He presented a chart listing six key strategic principles for a sustainable Exploration program:

- Implementable ***in the near term with the buying power of current budgets*** and in the longer term with budgets commensurate with economic growth;
- Application of ***high Technology Readiness Level*** (TRL) technologies for near term, while focusing research on ***technologies and capabilities*** to address challenges of future missions;

- **Near-term mission opportunities**, with a defined cadence of compelling human and robotic missions, providing for an incremental buildup of capabilities for more complex missions over time;
- Opportunities for **U.S. commercial business** to further enhance the experience and business base learned from the International Space Station (ISS) logistics and crew market;
- **Multi-use, evolvable** space infrastructure; and
- Significant **international and commercial** participation, leveraging current ISS partnerships.

Mr. Crusan described the Evolvable Mars Campaign (EMC). He explained that this means thinking about a real, sustained program that is not tied to a specific monolithic mission, but rather a series of missions to accomplish the Agency goals. A slide was presented to show capabilities and missions evolving from an Earth-reliant zone, to a proving ground zone, and then to an Earth-independent zone. Charts showing a potential Mars “Split Mission” concept were discussed as an example. In the split mission scenario, Solar Electric Propulsion (SEP) would be used to pre-deploy destination systems and the crew return vehicle into Mars orbit and to pre-deploy destination systems to Phobos. A crew transit habitat for Mars would be assembled in a lunar Distant Retrograde Orbit (DRO). The crew would be launched to cis-lunar space, join with the habitat, and then travel to Mars orbit using chemical propulsion. This would allow surface operations for 30 to 500 days. The transit habitat would return to the staging point of cis-lunar space for refurbishment and the crew would return directly to Earth. A key benefit would be the ability to refurbish and reuse the transit habitat. In response to a question from Mr. Bowersox, Mr. Crusan clarified that a habitable surface element would land on Mars, while the transit habitat would remain in orbit.

Mr. Bowersox suggested that the delta-V (dV) for a one-sol Mars parking orbit is relatively low and may allow transfer with SEP. Mr. Crusan concurred. Mr. Bowersox asked Mr. Crusan to compare the dV for establishing a DRO around the Moon versus the dV for returning directly to Earth. Mr. Crusan responded that significant dV was being saved due to the SEP pre-deployment activities and that the trade on returning is not as significant as previously thought. Mr. Bowersox observed that if this were done with the crew, there would be no need to provide a heatshield or Earth entry vehicle for the entire trip to Mars. Mr. Crusan noted that avoiding the need to carry that mass to and from Mars is a trade that is being examined. Mr. Bowersox explained that it would lower risk and has the potential to increase safety if they use the Moon as an intermediary point for returning from Mars. Mr. Crusan concurred. He noted that different trade scenarios are being explored and that some trajectory maneuvers that have not been reviewed for many years are being re-examined.

Mr. Crusan presented a chart showing how the Asteroid Redirect Mission (ARM) will provide risk reduction for the EMC. The ARM will provide experience in the following areas:

- Sensor suites and proximity operations required for aggregating Mars mission vehicle stacks in deep space;

- An enhanced understanding of uncooperative, low-G targets;
- Long-duration human scale systems operating in the deep space thermal and radiation environment;
- SEP;
- Mission operations; and
- Advanced Extravehicular Activity (EVA) operations on a micro-g body (Phobos), sample handling, and In-Situ Resource Utilization (ISRU).

A slide describing proving ground planning was presented. The slide featured Exploration Transportation Systems for beyond Earth orbit (BEO), Capability and Strategic Knowledge Gap (SKG) Pathfinders, the ARM, the Exploration Augmentation Module (EAM), and the Mars Transit Habitat. Mr. Crusan explained that the EAM will be used to start breaking the chain for direct communications with Earth. The EAM will support multiple 30- to 60-day missions with quiescence between missions. It will have docking capabilities for commercial and international partners, and will enable interaction with International partners that have activities on the Moon. Mr. Bowersox observed that it appeared to be a small space station, and Mr. Crusan concurred. Mr. Bowersox noted that the solar arrays from the ARM could provide a power system for the EAM concept leading to a Mars Transit Habitat. He added that if the ARM asteroid were present, work could be performed on it similar to work that might be performed on a Martian moon. The EAM concept might also be used in Mars orbit as a place for aggregation, refurbishment, and refuge. Mr. Crusan explained that the Mars Transit Habitat will provide a 500- to 900-day deep space habitat. He discussed a slide on Human Exploration Pathways. The slide showed going to the Moon and beyond with international and industry partners, then on to Mars and becoming Earth independent.

Mr. Crusan discussed a slide on EMC forward work and the trade spaces involved in moving forward. Trades across all destinations include SEP sizing, ISRU benefits, developing a small pressure shell that can be used for multiple purposes, and pathfinder mission developments. Cis-lunar trades include the ARM, ISRU, and EAM concepts. Mars vicinity trades include concept development activities for key performance metrics, packaging needs, configuration layouts, and refined mass estimates; fission reactor requirements; Mars surface operations and site selection; and Entry, Descent, and Landing (EDL) capability. HEO is preparing a year-end EMC report to support development of capability roadmaps and external stakeholder engagement products.

In response to a question from Mr. Bowersox, Mr. Crusan explained that mass requirements for the Mars surface were being developed by a cross-cutting Mars surface campaign team sponsored by his office. Mr. Bowersox asked whether the key performance metrics included previously discussed performance metrics from a sensitivity study. Mr. Crusan responded affirmatively and explained that system maturation teams are set up for key capability areas. Mr. Bowersox asked whether the fission reactor is an absolute essential. Mr. Crusan explained that it is required due to power requirements required for ISRU and that the reactor is the size of a small refrigerator. He noted that similar reactors have already been built by the U.S. and International Partners, although not for use in space.

Mr. Crusan concluded his presentation by noting that the 2011 *Voyages* document will be renamed *Pioneering Space* and updated to incorporate the EMC and Human Space Flight (HSF) plans for the pioneering of Mars. A schedule for the document's publication was reviewed.

Dr. David Longnecker asked whether systems maturation teams were performing parallel work on the human aspects of exploration. Mr. Crusan responded that AES does not have a human systems maturation team and, instead, relies on NASA's Human Research Program (HRP). In response to a question from Mr. Bob Sieck, Mr. Crusan explained that there could be five or six missions before an EAM mission. Dr. Pat Condon asked the about the resources and the technology contributions that need to come from the international partners. Mr. Crusan reported that there are ongoing discussions on how to leverage the robust logistics capabilities possessed by some partners. A decision has not been made on how the EAM would be developed--it could be domestic, international, or commercial. AES is looking at different trade possibilities with the international partners. Some partners have an interest in landing on the Moon and may be interested in trading for NASA's expertise in that area. There is also an ongoing dialogue with the partners over the ISS. The two discussions are intertwined. In response to a question from Ms. Shannon Bartell, Mr. Crusan explained that the EAM and the Orion spacecraft would be separate hardware elements. In response to a question from Mr. Bowersox, Mr. Crusan explained that liquid oxygen and hydrogen would be the most likely propellant used to move the Mars Transit Habitat from lunar orbit to Mars. SEP may also be used for maneuvering the Mars Transit Habitat over long time periods.

Mr. Bowersox thanked Mr. Crusan for his presentation.

Exploration Strategy and Overview

Mr. Bowersox introduced Mr. William Gerstenmaier, Associate Administrator, HEOMD. Mr. Gerstenmaier discussed the reasons for human space exploration. Scientific and human exploration and pioneering mark advancing civilizations and expand human experience. Exploration and pioneering ignites imaginations, leads to discovery and to advances in science and technology, and creates a vision about a better future for the next generation. Space exploration will involve human and robotic explorers in partnership. Robots can explore distant and hazardous environments, while human explorers provide greater speed, intuitive ease, and efficiency. Greater risk acceptance is required on the human side. Finally, human space exploration garners national prestige and unites nations around a common goal. He noted that the word "pioneering" is being used rather than exploration. It means staying and keeping a sustained presence off the Earth. A slide was presented showing how NASA's mission directorates are aligned for pioneering space. The directorates are talking together as a combined mission directorate with Mars being used as the focus and horizon destination.

Mr. Gerstenmaier reviewed the six key strategic principles for a sustainable Exploration program. (See page 2)

1. Implementable **in the near term with the buying power of current budgets** and in the longer term with budgets commensurate with economic growth;
2. Application of **high Technology Readiness Level** (TRL) technologies for near term, while focusing research on **technologies and capabilities** to address challenges of future missions;
3. **Near-term mission opportunities**, with a defined cadence of compelling human and robotic missions, providing for an incremental buildup of capabilities for more complex missions over time;
4. Opportunities for **U.S. commercial business** to further enhance the experience and business base learned from the International Space Station (ISS) logistics and crew market;
5. **Multi-use, evolvable** space infrastructure; and
6. Significant **international and commercial** participation, leveraging current ISS partnerships.

He explained that there is a need for longer-term budgets commensurate with economic growth and that no increase only means a delay to the horizon. International and commercial participation will be used wherever possible. Industry has been asked to indicate how they can use the ISS for their benefit.

A chart showing NASA's building blocks to Mars was presented. Missions fall into three classes. Earth reliant missions last from 6 to 12 months and require only hours to return to Earth. Proving ground missions last from 1 to 12 months and require days to return to Earth. Earth independent missions last from 2 to 3 years and require months to return to Earth.

Mr. Gerstenmaier described the third annual ISS Research and Development Conference that was recently held in Chicago. The conference was well attended. A third of the attendees were non-NASA funded. He noted that there is a lot of interest now in using the ISS as a technology testbed. It is anticipated that half the attendees at the next conference will be non-NASA funded and will be reporting on their activities on the ISS. A slide prepared by Noble Laureate Professor Samuel Ting was presented. The slide showed how discoveries in physics often come about unexpectedly from experiments that were not designed or intended to produce the discovery. Mr. Gerstenmaier used this to demonstrate that it is important not to set sights on the past and not to ignore potential discoveries.

Mr. Gerstenmaier discussed the ARM. It has three main segments: Identify, Redirect, and Explore. In the Identify segment, ground and space-based assets will be used to detect and characterize potential target asteroids. In the Redirect segment, SEP-based robotic capture systems will redirect an asteroid to cis-lunar space. There are two options for this: capture and move a small asteroid, or retrieve a boulder from a larger asteroid. In the Explore segment, a crew launched aboard a Space Launch Systems (SLS) rocket will travel to the redirected asteroid in the Orion spacecraft, explore and study the asteroid, and return to Earth with samples. Mr. Gerstenmaier explained the ARM's objectives:

- Conduct a human exploration mission to an asteroid in the mid-2020's, providing systems and operational experience required for human exploration of Mars;
- Demonstrate an advanced SEP system, enabling future deep-space human and robotic exploration with applicability to the nation's public and private sector space needs;
- Enhance detection, tracking and characterization of Near Earth Asteroids, enabling an overall strategy to defend Earth;
- Demonstrate basic planetary defense techniques that will inform impact threat mitigation strategies to defend Earth; and
- Pursue a target of opportunity that benefits scientific and partnership interests, expanding knowledge of small celestial bodies and enabling the mining of asteroid resources for commercial and exploration needs.

Mr. Gerstenmaier described the role that the ARM has in NASA's Human Exploration Strategy. It leverages on-going activities across the Agency to implement a compelling and affordable human exploration mission in the proving ground, providing systems and operational experience for human missions to Mars. ARM technologies, systems, and capabilities are included in NASA's sustainable exploration strategy. There are three key aspects to the ARM vision: moving large objects through interplanetary space using SEP, conducting integrated crewed and robotic vehicle stack operations in an interplanetary space-like trajectory, and the opportunity for the workforce to share knowledge and learn together over the next decade. Mr. Gerstenmaier noted that HEOMD is beginning to look at Mars-class missions where pre-positioning resources and hardware around Mars is becoming important. The results of a Broad Agency Announcement (BAA) were discussed. Eighteen proposals totaling \$4.9M have been selected for six-month studies to define and mature system concepts and to assess the feasibility of potential commercial partnerships. The areas to be studied are asteroid capture systems, rendezvous sensors, adapting commercial spacecraft for ARM, partnerships for secondary payloads, and partnerships for enhancing the crewed mission. The study results will inform the ARM Mission Concept Review. A slide was presented showing the ARM milestones for a February 2015 Mission Concept Review.

Mr. Gerstenmaier discussed the Human Exploration Strategy for public engagement and outreach. The 2011 *Voyages* document will be updated and renamed *Pioneering Space*. The update will incorporate the Evolvable Mars Campaign study results. A schedule for the publication's development was provided. HEOMD is beginning to look at "big picture" trades, including how much cargo is needed on the surface of Mars and which moons appear intriguing. For human Mars surface missions, an Entry, descent and Landing capability of eighteen to forty metric tons will be necessary, according to current studies. A slide was presented showing different publicity campaigns being assembled by the communications teams. The June 11 Exploration Day on the Hill was described as a success. Efforts are being made to expand NASA's reach and to engage new audiences through the media, including social media. HEOMD works closely with the Office of Education to collaborate with schools and universities to develop the next generation of Science, Technology, Engineering, and Math (STEM) leaders. Destinations Station was described. It is a traveling exhibit that promotes

research opportunities and educates communities across the country about activities performed on the ISS. Charts were presented on products and activities that are used internally and externally to communicate information on major NASA milestones, including the upcoming Orion exploration flight test (EFT-1). HEOMD will continue to work closely with internal and external organizations to increase awareness and understanding and to grow support for NASA's future exploration plans. In addition, HEOMD will continue to educate the NASA workforce to create a cadre of ambassadors that effectively share NASA's exploration plans with the public.

Dr. Condon suggested having NASA's Office of Education offer Mars-oriented programs aimed at middle and high school students. He cited, as an example, the Air Force Association's cyber security competition. Mr. Gerstenmaier described NASA's zero-G robotic competition, where high school students compete against university teams. Mr. Bowersox observed that communicating the outreach strategy is a topic that is frequently mentioned. Dr. Condon commented that the communications strategy is not clear. Mr. Gerstenmaier reported that HEOMD is only the content provider. The Office of Education has responsibility for the overarching strategy. Mr. Bowersox explained that the Committee is searching for the person who is in charge of the outreach strategy and the source for its funding. He commented that the Science Mission Directorate (SMD) does a good job in generating interest in its missions. In response to a question from Dr. Condon, Mr. Gerstenmaier explained that there is a communications coordination group that sets the message for the entire Agency. When HEOMD wants to release a message, it brings it to that group, which then determines how best to make it happen. Ms. Bartell reported that people think that NASA is closed because the Space Shuttle Program has been shut down. She commented that in areas removed from the Centers there is not a visible strategy for generating public support. Mr. Gerstenmaier noted that the National Research Council (NRC) released a report that should be read by the Committee members.

Mr. Bowersox thanked Mr. Gerstenmaier for his presentation.

Public Comments

Mr. Bowersox invited comments from the public. There were none. ¹

Committee Discussion and Recommendations

¹ One email message was received later in the afternoon from Mr. Chris Gilbert. The message states as follows:
Subject: Re: Space News 23 June 2014
You might like to draw the NAC committee's attention to one of the findings of the recent GER workshop:
"The community shared the ISECG consensus that a deep space habitat in the lunar vicinity is the next foundational exploration capability."
This does at least reflect some level on international consensus.

Mr. Bowersox invited discussion from the Committee members.

Mr. Sieck commented that the charts in the presentations are greatly improved from a year ago. He questioned whether educating the public and the stakeholders about the Exploration plan is HEOMD's responsibility or the responsibility of the Office of Communication. He explained that there is a need to make sure that the necessary resources will be available when they are needed. Youth needs to study science and engineering to make it happen, and suppliers have to be ready to build the parts that are needed. He suggested that the next briefings should include charts showing the networking that the NRC wants to see. Mr. Sieck endorsed the concept for the Capability Driven Framework. He indicated that there is a need, however, for back-up plans if going straight to Mars is not possible. Mr. Bowersox asked whether the plan seems feasible from a technological perspective. Mr. Sieck responded that it could be accomplished as long as the resources and commitment are there. He believes that the biggest challenge is whether a human can withstand the rigor and radiation in a trip to Mars. Mr. Bowersox asked whether launching multiple SLSs would be feasible. Mr. Sieck responded that the ability exists for that to happen.

Dr. Longnecker commented that Mr. Crusan's presentation clearly described the approaches and the trades that need to be considered as part of an Exploration plan. It is clear that a single frozen approach is likely to not be feasible. He advised that adult education requires engagement. He explained that "they have to be shown something, they need to see something lifting off the ground, they need to see fire and smoke." Mr. Bowersox asked whether the plan was technically reasonable. Dr. Longnecker responded that, while he was not an engineer, when the Committee probed, it received answers that indicated it was feasible. Right now, he explained, the long pole in the tent is galactic cosmic radiation. He did not hear that as a consideration for the mass for the Mars lander.

Mr. Tommy Holloway agreed that the presentations have come a long way. He noted that the environment that NASA is operating in is extremely difficult and that "without a boatload of money, the plan cannot be executed in 100 years." He noted that there is no timetable showing how the plan would evolve. He asserted that there is not enough money to get there and asked "What other conclusion could the NRC come to?" He commented that "an informed individual would say that it is ridiculous." Mr. Bowersox asked whether the plan was technologically feasible. Mr. Holloway responded that there is not enough money in the current environment and that it does not have a chance to succeed. He reported that his neighbors think that there is no longer a human space program. He suggested that the program would be simplified and that many problems would be eliminated if it were implemented robotically. In addition, the cost to do business at NASA needs to be reduced. He explained that the International Partners will not sign up for 20 years and that "there is no way to get there from now." Mr. Bowersox summarized that Mr. Holloway believed the plan was technologically doable if there was a change in resources.

Mr. Dick Malow stated that he resonated with Mr. Holloway. He commented that the presentations were good, and the "flexible game plan" is the right path to follow given the

available funding. He agreed with the NRC report that there is not a sufficient goal for the next 20 years. He believes that the NRC report will be well received on the Hill, because “it is what they want to hear.” He explained that the problem is multifaceted: a push for SLS is coming from Texas and Alabama, the ARM is “running amuck on the Hill,” and Commercial is making its own push. It is a confusing situation, and NASA can end up with a Constellation-type situation as 2016 approaches; it is like being in “limbo.” He commented that one problem is that the missions are too far apart, and he noted that the 2017 mission has now slipped 9 months. He agreed that NASA is on the right path technologically. He commented that putting cargo on Mars’ surface is the biggest problem.

Mr. Michael Lopez-Alegria commented that the plan can be accomplished technologically if the necessary money is provided. He suggested that NASA will need to take a different position on risk for the Mars mission. He expressed concern over the various concepts for grabbing an asteroid. Dr. Siegel explained that a decision on the method for grabbing the asteroid would be made in December. Mr. Lopez-Alegria asserted that the Moon is a more attractive destination than an asteroid and that there is a lot of support for making the Moon a destination. He believes that if the Senate becomes majority Republican, it will be difficult to move forward on the ARM.

Dr. Condon reported that his cost estimation mentor had advised that he take an initial estimate and “multiply it by pi.” With respect to the Exploration plan, Dr. Condon believes that it may need to be pi-squared. It is clear that the necessary money is not available. He is not worried about the mechanics. His concerns are in the radiation hazard area and in the fact that the psychiatric and emotional impacts from a long-duration mission have not been properly analyzed. He does not see the commitment level from the President or Congress that existed for the Apollo Program. He believes that Mr. Gerstenmaier is doing a marvelous job in an impossible situation. He agreed that Mr. Gerstenmaier’s approach is on the right track.

Mr. Leroy Chiao recalled that everyone was unanimous five years ago that NASA should go to Mars. It was understood that people did not have a 30-year attention span. A decision was made, therefore, to accomplish the plan in 15 to 20 years. Unfortunately, the necessary funding has not been available. Mr. Chiao explained that he is sympathetic to Mr. Gerstenmaier’s position. Nevertheless, he believes that the plan will not be achieved due to a lack of political commitment and money. He expressed concern over the need to develop a kerosene-liquid oxygen (LOX) engine, the funding for which will probably be taken from the SLS program. He concurred with Mr. Lopez-Alegria’s comments about the Moon, and believes it is the best place for testing and development. He has no doubt that the Chinese are going to land on the Moon. He advised that the U.S. should lead a coalition to return to the Moon and that there should be an international coalition, like the ISS, for going to Mars.

Ms. Bartell advised that the Gerstenmaier presentation represents the best chance for the program to survive the lack of commitment and funding. She explained that the plan is the same type followed in industry, where a plan is altered “as you go.” She expressed concern that NASA is not targeting the new baby-boomers and noted that she has never seen NASA address

the audience of the life-long learning center. She commented that the technical ability for the plan is possible and that it will just take time and money.

Ms. Bartell expressed concern that the safety community is eroding. She noted that SLS will not have anyone working on it who has been involved in a human spaceflight program. Mr. Bowersox noted that many people believe that NASA should not give up being the “gold standard for safety.” Mr. Chiao advised that NASA must be willing to accept more risk. He commented that the Orion is too heavy due to risk aversion. Mr. Lopez-Alegria asserted that there has been a “sea-change in being conservative just for that sake.” He observed that society is more risk averse than ever and cited wearing a helmet when riding a bicycle as an example. Going to Mars is a different order of magnitude than the Space Shuttle when it comes to risk taking. Mr. Malow commented that it should be expected that people will be lost. He added that little has been written about the psychological impact from being in space. Dr. Siegel noted that there are space diaries and that research has been conducted. Mr. Bowersox commented that there have not been psychological problems; there have been issues, but nothing that would keep people from going to Mars.

Mr. Bowersox summarized: the Committee consensus was that the program is technically feasible and a reasonable plan to start from, but that some things must change for it to happen. In addition, the probability for success increases if NASA can launch sooner or launch more frequently. Mr. Holloway recommended that the Agency better articulate the strategy. He suggested using a term other than “strategy.” He advised that NASA should work hard to reduce the cost for doing business, and it should look to lessons learned from its commercial activity to eliminate unnecessary bureaucratic infrastructure. Dr. Condon agreed that “strategy” is not the right word to use. He also cautioned against using the words “roadmap” or “plan.” He noted that the current environment does not lend itself well to specificity. Mr. Holloway commented that the current program is a “jobs” program that Mr. Gerstenmaier must work with. Mr. Lopez-Alegria concurred and noted that commercial enterprise preferred developing low-Earth orbit. Mr. Malow agreed and added that he saw no hope in doing anything about SLS.

Mr. Bowersox confirmed that the Committee wanted to endorse Mr. Gerstenmaier’s approach. Mr. Lopez-Alegria asked “What is the plan?” One Committee member responded that it was Pioneering in Space. Another Committee member suggested it was a white paper that had been previously distributed to the Committee. Mr. Bowersox explained that the plan is the Evolvable Mars Campaign or EMC. Formerly, it was the Human Exploration Strategy that had been previously presented by Mr. Gerstenmaier. Mr. Lopez-Alegria stated that he would not support the plan if it included the ARM. Ms. Bartell explained that what the Committee is endorsing is NASA’s flexibility while going forward towards Mars. Mr. Malow noted that this would not necessarily mean an endorsement for the ARM, because it is “flexible.”

At Mr. Bowersox’ suggestion, it was decided that the Committee’s recommended finding would be: “The NAC endorses NASA’s Human Exploration flexible path strategy as presented by the HEOMD Associate Administrator.”

Ms. Bartell requested that the safety issue be addressed. Mr. Bowersox observed that one group is worried that NASA will not be safe enough, another group is worried that NASA is going to be too safe to get anything done, and another group is concerned about the loss of people who have safety experience. Mr. Lopez-Alegria advised that there must be a new paradigm for a different risk posture that includes a safe infrastructure. He noted that there is a difference between risk and safety. Ms. Bartell agreed about the risk posture. She explained that risk is tied to safety because the safety community must have enough experience to adjust to the new risk posture and keep things safe within it. Mr. Bowersox commented that it helps to have made recent risk decisions in challenging situations when making new risk decisions. The skill fades when one is not in an environment where those decisions have to be made regularly. He added that by the time NASA is ready to fly under the plan, the people with the requisite safety experience will be found mostly in Russia, China, and commercial companies.

Adjournment

Mr. Bowersox adjourned the meeting at 5:00 p.m.

NASA ADVISORY COUNCIL
HUMAN EXPLORATION AND OPERATIONS COMMITTEE

MEETING

NASA Headquarters
MIC 5A
300 E Street SW
Washington, DC 20546

June 23, 2014

AGENDA

COMMITTEE PUBLIC MEETING

10:30 – 10:33 am	Opening Remarks	Mr. Ken Bowersox & Dr. Bette Siegel Chair & Executive Secretary
10:33 – 12:00 pm	Evolving Mars Missions and Trade Space	Mr. Jason Crusan Director, Advanced Exploration Systems, Human Exploration & Operations Mission Directorate
12:00 pm – 2:00 pm	LUNCH	
2:00 pm – 3:00 pm	Exploration Strategy & Overview	Mr. William Gerstenmaier Associate Administrator Human Exploration and Operations Mission Directorate
3:00 pm – 3:05 pm	Public Comments	
3:05 pm – 5:00 pm	Committee Discussion and Recommendations	
5:00 pm	ADJOURN	

**Human Exploration and Operations Committee Membership
June 2014**

Mr. Ken Bowersox <i>Chair</i>	Former NASA astronaut and retired U.S. Navy Captain
Dr. Bette Siegel <i>Executive Secretary</i>	NASA Headquarters
Ms. Shannon Bartell	Former Director of Safety & Mission Assurance, KSC
Ms. Nancy Ann Budden	Director for Special Operations Technology, Office of the Secretary of Defense
Dr. Leroy Chiao	Former NASA Astronaut and ISS 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
Mr. Tommy Holloway	Former Space Shuttle and ISS Program Manager
Mr. Lon Levin	President, SkySevenVentures
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. Michael Lopez-Alegria	Former NASA astronaut and retired U.S. Navy Captain, President of the Commercial Spaceflight Federation
Mr. Richard Malow	Distinguished Advisor 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
Mr. James Voss	Former NASA astronaut and retired U.S. Army Colonel, Scholar in Residence, Department of Aerospace Engineering Sciences, University of Colorado, Boulder

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

June 23, 2014

MEETING ATTENDEES

Committee Members:

Bowersox, Ken, <i>Chair</i>	U.S. Navy (<i>Ret.</i>)
Siegel, Bette, <i>Executive Secretary</i>	NASA Headquarters
Bartell, Shannon	Aerospace Consultant
Chiao, Leroy	Aerospace Consultant
Condon, Stephen "Pat"	Aerospace Consultant
Holliday, Tommy	Aerospace Consultant
Levin, Lon	SkySevenVentures
Longnecker, David	Association of American Medical Colleges
Lopez-Alegria, Michael	Commercial Spaceflight Federation
Malow, Richard	AURA
Sieck, Bob	Aerospace Consultant

NASA Attendees:

Broadwell, Marguerite	NASA HQ
Gerstenmaier, Bill	NASA HQ
Johnson, James	NASA HQ
Kaman, Shari	NASA HQ
McKay, Meredith	NASA HQ
Monsi, Roman	NASA HQ
Scimemi, Sam	NASA HQ
Straughn, Anita	NASA HQ

Other Attendees:

Bordi, Francisco	Aerospace
Frankel, David	P B Frankel, LLC
Geminishi, Chris	Squire Patton Boggs
Irvina, Rick	Olia
Karanian, Linda	RPC
Latrera, Francisca	[not affiliated]
Leone, Dan	SpaceNews
Sanders, Patricia	NASA Aerospace Safety Advisory Panel
Wilhelm, Jim	P B Frankel, LLC

Attendees via telecom:

Allen, Gale

Barbier, Lewis
Clark, Stephen
Crusan, Jason
Dean, James
Foust, Jeff
Gilbert, Chris
Griffith, Jay
Holle, Marcel
Ip, Angela
Johnson, James
Kuhl, Katelyn
Lee, Greg
Lobel, Craig
Lochner, Jim
Lovel, Greg
Mann, Gregory
Perrotto, Trent
Race, Margaret
Smith, Marcia
Smith, Gwen
Tabach, Micheline
Troutman, Pat
Troxell, Jennifer
Warren, John

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

June 23, 2014

LIST OF PRESENTATION MATERIAL

- 1) Evolving Mars Missions and Trade Space [Crusan]
- 2) NASA's Exploration Strategy [Gerstenmaier]