National Aeronautics and Space Administration
Washington, DC

NASA ADVISORY COUNCIL

Human Exploration and Operations Committee

November 14, 2016

Johnson Space Center
Houston, Texas

MEETING MINUTES

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N. Wayne Hale, Interim Chair

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Bette Siegel, Executive Secretary

NASA Advisory Council
Human Exploration and Operations Committee Meeting
Johnson Space Center
Houston, Texas
November 14, 2016

MEETING MINUTES
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Minutes Prepared By:
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P B Frankel, LLC

NASA Advisory Council
Human Exploration and Operations Committee Meeting
Johnson Space Center
Houston, Texas
November 14, 2016

Monday, November 14, 2016

Call to Order, Welcome, and Opening Remarks

Dr. Bette Siegel, Executive Secretary for the NASA Advisory Council (NAC or Council) Human Exploration and Operations (HEO) Committee, called the session of the HEO Committee to order at 9:30 a.m. She announced that the meeting was a Federal Advisory Committee Act (FACA) meeting and, therefore, would be open to the public. Minutes would be taken and posted online, along with the presentations. Dr. Siegel explained that there would be an opportunity for the public to make comments towards the end of the meeting, and she requested that all questions and comments be held until that time.

Dr. Siegel introduced the Committee chair, Mr. N. Wayne Hale. Mr. Hale welcomed everyone to the meeting. He thanked Dr. Ellen Ochoa, Director, NASA Johnson Space Center (JSC) for the Center's hospitality. He introduced Dr. Patricia Sanders, Chair of the NASA Aerospace Safety Advisory Panel (ASAP). Mr. Hale reported that he had presented three Committee recommendations to the NAC for consideration at its recent meeting and that none were approved, primarily due to wording. The recommendations will be represented to the NAC at its next meeting at the NASA Armstrong Flight Research Center (AFRC).

Status of Human Exploration and Operations Mission Directorate

Mr. Hale introduced Mr. Greg Williams, Deputy Associate Administrator (AA), Human Exploration and Operations Directorate (HEOMD), who briefed the Committee on the status of the Directorate. Mr. Williams noted that Mr. Bill Gerstenmaier, HEOMD AA, could not attend the meeting because he was in Russia for a Soyuz launch. Mr. Williams presented a graphic known as the "Squid Chart" for the Journey to Mars and explained that the most important elements on the graphic are: the segments referred to as Earth Reliant, Proving Ground, and Earth Independent; and the segments on integration of science, exploration, and technology. He stated that everything needed for a human Mars mission is in development. The international partners are looking to NASA for leadership, and the European Space Agency (ESA) will soon be considering extending the International Space Station (ISS or Station) to 2024. He reviewed a chart showing the human space exploration phases from the ISS to the surface of Mars. Phase 0 is for Exploration systems testing on the ISS to demonstrate key exploration capabilities and operations and for fostering an emerging commercial space industry in low Earth orbit (LEO). That phase will end when testing, research, and demonstrations are complete. Phase 1 is for cislunar flight testing of Exploration systems. The Asteroid Redirect Mission (ARM) and the Asteroid Redirect Crewed Mission (ARCM) mark the move from Phase 1 to Phase 2. Phase 2 will cover cislunar validation of Exploration

capability. Phase 3 will cover crewed missions beyond the Earth-Moon System. It will end with a one-year, crewed Mars-class shakedown cruise. Phase 4b will be Mars human-landing missions.

Mr. Williams reviewed a chart on HEOMD progress and current activity. He explained that HEOMD is becoming an "ambidextrous organization" that can simultaneously exploit and explore. HEOMD has baselined an Exploration objectives document for Phases 0, 1, and 2. It is operating under the Fiscal Year (FY) 2017 Continuing Resolution (CR). Dr. Craig Kundrot is the new Director for the Space Life and Physical Sciences Research and Applications (SLPSRA) Division. HEOMD is preparing for transition to a new Administration and building consensus on the phases of progression of human exploration from ISS to the surface of Mars. The next step is to allocate Phase objectives to flight objectives for Exploration Missions (EM) 2 through 8, which would be conducted in 2017 through 2020. EM-2 will be the first flight of the Space Launch System (SLS) and Orion with crew. HEOMD is working toward a one-flight-per-year cadence after EM-2, depending on FY17 appropriations. An initial cislunar habitation capability is planned for the early 2020s, depending on the outcome of NextSTEP activity and international planning. The ARCM is planned for 2026. Budget uncertainties and the evolving partnership landscape make it too early to baseline a full manifest of missions through 2030. In parallel to HEOMD, the Science Mission Directorate (SMD) and the Space Technology Mission Directorate (STMD) are collaborating on technology developments, precursors, and trade studies for Mars missions.

Mr. Williams described Exploration Systems Development (ESD) progress and current activity. ESD is working with ESA to complete the ESA Service Module (ESM) critical design review (CDR). The RL-10 engine procurement is in process. The existing RS-25 engines have been tested. Umbilical testing is underway. Eight of ten platforms for the Vertical Assembly Building (VAB) have been installed. Progress is being made on Ground Systems Development and Operations (GSDO) software integration. Mr. Williams discussed progress and current activity on the ISS. HEOMD is working with SpaceX to identify the next cargo flight readiness. The Japanese H-II Transfer Vehicle (HTV)-6 is on track for a December 9, 2016, launch. Crew time availability on the ISS has exceeded goals in recent increments. The Russian complement on board the ISS will temporarily be reduced to two crew beginning in March 2017. The Center for the Advancement of Science in Space (CASIS) has signed multi-year agreements with the National Institutes of Health (NIH) and the National Science Foundation (NSF) to conduct research onboard the ISS.

Mr. Williams reviewed progress and activity in the Commercial Crew Program (CCP). HEOMD has awarded two operational missions to the ISS for each partner, and milestone schedules remain optimistic. He presented a graphic on commercial collaborations in space involving transportation, research, and exploration. He provided an overview on NextSTEP habitation systems and discussed specific habitation systems objectives for life support, environmental monitoring, crew health, extra-vehicular activity (EVA), radiation protection, fire safety, logistics, and cross-cutting areas. The goal is to develop a deep space habitat with fully functional systems for ground-based testing by 2018, while at the same time stimulating commercial habitats in LEO. Mr. Williams discussed the development of NextSTEP habitation common interfaces and standards to enable NASA, industry, and international partners to contribute safe, reliable, and cost-effective interoperable systems and elements. Mr. Hale noted that the Federal Aviation Administration (FAA) was working on standards, and he suggested that NASA work with that agency in developing those standards.

Mr. Williams described the key contributions that the ARM is making to the Journey to Mars. He noted that the House has draft language that NASA not make additional investments in the ARM. Mr. Williams presented a chart on recent ARM progress and upcoming milestones. He discussed the two-step, spacecraft-procurement process for the robotic spacecraft. He explained that NASA's approach to human spaceflight is to move human presence into the solar system by pursuing a sustained program that builds capabilities that feed forward to next steps, utilizing private sector and international partners where appropriate. Mr. Williams concluded his presentation by stating that NASA wants to be the "orchestrator" of the Journey to Mars. Dr. Pat Condon noted that NASA does not need to develop and fund everything and that a human mission to Mars is more than any country can do alone. He asked whether a cost estimate has been performed for the mission and whether there has been an estimate on what the international partners, who are struggling budgetarily as much as NASA, can provide. Mr. Williams responded that the calculation has not been done all the way to Mars. He added that NASA has studied the cost for getting to a cislunar phase and is still shaping the calculation on what the international partners can contribute to that.

Mr. Hale thanked Mr. William for his presentation.

Status of International Space Station

Mr. Hale introduced Mr. Sam Scimemi, Director for ISS, who briefed the Committee on the status of the ISS. Mr. Scimemi described the crew and major stage objectives for Increments 49 and 50. There will be two EVAs to replace batteries. The number of EVA activities have been significantly reduced by a tremendous amount of robotic activity. He reviewed a graph on crew utilization time over Increments 49 and 50 and presented a chart on ISS research statistics. There have been 304 investigations conducted during those increments and approximately 2,276 investigations overall. Mr. Scimemi discussed an investigation on functional immune research. It is a comprehensive examination of inflammation, physiological stresses, latent viral reactivation, and the immune system cellular responses.

Mr. Scimemi reviewed a chart on total ISS consumables. He explained that there is sufficient water on board to supply the ISS through March 2017. He discussed the status of the Oxygen Generation Assembly (OGA). The installed OGA had been shut down on October 28, 2016, and the onboard spare was installed by the crew on November 9, 2016. Additional spare parts will be delivered to the ISS by the Progress vehicle, scheduled to launch on December 1, 2016, and a full spare will be delivered on the next Orbital-ATK (OA) mission. He presented a chart on additional vehicle issues.

Mr. Scimemi described the OA-5 Antares return-to-flight mission that was successfully launched on October 17, 2016. He discussed the SpaceX Falcon anomaly, which occurred during pre-launch static fire operations. Indications are that the anomaly initiated around the upper stage liquid oxygen tank. The propagation time was approximately 35 to 55 milliseconds. SpaceX has assembled an Accident Investigation Team (AIT), with oversight from the FAA and participation from NASA, the United States Air Force (USAF), and the National Transportation Safety Board (NTSB). The leading suspicion for the cause is an issue in the cryogenic helium system in the second stage liquid oxygen tank. Damage to the launch site at Cape Canaveral Air Force Station (CCAFS) Pad 40 from the explosion was extensive. SpaceX is focusing on accelerating the readiness

of NASA Kennedy Space Center (KSC)Pad 39A to resume Falcon launches. In response to a question from Mr. James Voss, Mr. Scimemi explained that many anomalies only get to the most probable cause, not to the root cause, and that SpaceX will need to prove to NASA that it is safe to fly again.

Mr. Scimemi described the status of the planned HTV-6 mission. He discussed the status of Commercial Resupply Services (CRS). CRS-2 contracts have been awarded to OA, Sierra Nevada Corporation (SNC), and SpaceX. A minimum of six missions will be ordered from each provider.

Mr. Scimemi described the status of the ISS National Laboratory (ISS-NL). The NSF has selected five projects for the ISS-NL in an annual sponsored program valued at over $1 million (M) per year. The NIH National Center for Advancing Translational Sciences (NCATS) is providing grant funding focused on studying human physiology and disease on board the ISS. Corporate sponsorships complementing those partnerships bring the FY16 total for external funding of ISS-NL research competitions to more than $6M. To date, CASIS-sponsored projects have led to 29 academic journal publications. CASIS has facilitated over 70 introductions between startup companies and the investor network. In response to a question from Mr. Tommy Holloway, Mr. Scimemi explained that a commercial space station would not be practical until demand for LEO research becomes part of the private enterprise business plan. He added that NASA, from an Exploration perspective, would want to maintain a LEO capability.

Mr. Hale thanked Mr. Scimemi for his presentation.

Status Report from Research Subcommittee

Mr. Hale introduced Dr. David Longnecker, who briefed the Committee on the status of the Research Subcommittee. Dr. Longnecker reviewed the Subcommittee's agenda from its last meeting and reported that the incoming SLPSRA Division Director, Dr. Craig Kundrot, had attended the Subcommittee's meeting.

Dr. Longnecker reviewed the Human Research Program's (HRP's) plans for research on the EM-series missions in the 2020s. He described NASA's plans for collaboration with the German Space Agency (DLR) for atomic physics research on a DLR-built successor to the Cold Atom Laboratory ISS facility.

Dr. Longnecker noted that the Research Subcommittee is being transitioned into the HEO Research Committee to comply with the requirements for advisory committees under the FACA. The change is being made because NASA's Office of General Counsel has advised that the planned use of Science Definition Teams (SDTs) was not FACA-compliant. The SDTs are important to the Open Science concept used by the SLPSRA Division. As a remedy, the NASA Office of the Chief Scientist (OCS) proposed that the Research Subcommittee be reconstituted and registered with the General Services Administration (GSA) as a formal FACA committee. Members must be newly appointed. The Research Committee Chair will continue to serve as a member of the NAC's HEO Committee. As a FACA committee, the HEO Research Committee will be able to provide advice directly to NASA without being required to go through the NAC, should the need arise. One of the Research Committee's first tasks would be to create one or more SDTs.

Mr. Hale thanked Dr. Longnecker for his presentation.

Status of Human Research Program

Mr. Hale introduced Dr. William Paloski, HRP Director, who briefed the Committee on the status of the Program. Dr. Paloski explained that the HRP mission is to enable space exploration beyond LEO by reducing the risks to human health and performance through a focused program of basic, applied, and operational research leading to the development and delivery of (1) standards for human health, performance and habitability, (2) countermeasures and other risk mitigation solutions, and (3) advanced habitability and medical support technologies. He reviewed a chart outlining the HRP Risk Mitigation Maturation Plan through 2035. He noted that HRP has been unable to fully fund the planned work effort. He described the Human System Risk Board (HSRB).

Dr. Paloski explained that the crew stressors in deep space missions would be radiation, altered gravity fields, a hostile closed environment, isolation and confinement, and the distance from Earth. He reviewed a chart on the HRP integrated path to risk reduction for a journey to Mars and a chart on FY16 risk mitigation research and development investments. He presented a graphic showing the states in which HRP had awarded research grants. Mr. Hale made suggestions for improving the graphic.

Dr. Paloski discussed the Translational Research Institute (TRI). Its mission is to lead a national effort in translating cutting edge emerging terrestrial biomedical research and technology development into applied spaceflight human risk mitigation strategies for Exploration missions. To accomplish this, a single cooperative agreement (CA) consolidating current National Space Biomedical Research Institute (NSBRI) and Universities Space Research Association (USRA) CA contents has been awarded to the Baylor College of Medicine, MIT, and Caltech. The new CA has a six-year base period and a value estimated at $246M. Dr. Paloski reviewed a chart on FY16 publication metrics.

The ISS is the primary space platform for HRP studies. HRP studies receive the highest priority for NASA science payloads aboard the ISS, and each ISS U.S. Operating Segment (USOS) crew member participates in 10 to 15 separate HRP experiments. Dr. Paloski described an experiment on circadian regulation via lighting and a study on fluid shifts. He described joint U.S. and Russian field-test studies.

Dr. Paloski discussed the Twins Study and explained that its objective is to examine next generation genomics solutions for mitigating crew health and performance risks through personalized countermeasures. He described the "extrapolation" issue concerning the confidence with which data from current, 6-month experiences on the ISS can be extrapolated to a 30-month, deep space mission. He discussed the One Year Mission (1YM) and reviewed a chart on follow-on 1YM plans. Dr. Paloski described a draft genomics policy that is under review by NASA's Chief Medical Officer (CMO). He noted that crew members are celebrities and are occasionally stalked. When a crew member dies, the data is no longer private and is subject to Freedom of Information Act (FOIA) requests.

Dr. Paloski described Exploration spaceflight analogs. He presented a graphic on the NASA Space Radiation Lab (NSRL). He discussed the external radiation field and explained that it is modified as it passes through shielding and tissue. He presented a chart on the status of mitigating the cancer risk caused by radiation. Dr. Paloski described altered gravity analogs using parabolic flight, neutral buoyancy, and head-down-tilt bedrest. He discussed a joint NASA and ESA solicitation for research on the physiological and behavioral responses in humans to intermittent artificial gravity during bed rest. He presented a graphic on isolation and confinement analogs and described the Human Exploration Research Analog (HERA). He presented a chart on metrics for isolation and confinement analogs. A very high-priority HRP proposed study on isolation has been accepted by the NSF and will be conducted during the FY17 winter at the McMurdo and South Pole Stations in Antarctica.

Dr. Paloski discussed the development of exercise machines for use during deep space missions. He described the Multi-Purpose Crew Vehicle (MPCV) Resistive Overload Combined with Kinetic Yo-Yo (ROCKY) exercise device and the Advanced Twin Lifting and Aerobic System (Atlas) deep space exercise device.

Dr. Paloski concluded his presentation with a discussion on HRP engagement and communications. He described the Mission X 2016 International Challenge, the Omics Exploring Space Through You video series, and the Analog Mission Webpage.

Mr. Hale asked Dr. Paloski to describe whether anything would be done to mitigate "getting places dirty" or contaminated with "bugs." Dr. Paloski responded that "we can't go anywhere without leaving bugs. People have lots of bugs."

Mr. Hale thanked Dr. Paloski for his presentation.

Status of Commercial Crew Certification

Mr. Hale introduced Ms. Kathy Lueders, CCP Manager. Ms. Lueders discussed the CCP progress over the last quarter year. She noted that there is significant work ahead in preparation for flight. She reviewed the status of key certification products from the two providers, Boeing and SpaceX. The CCP has robust and efficient processes for certification and addressing waivers to NASA standards. In response to a question from Mr. Holloway, Ms. Lueders explained that NASA allows the providers to propose alternatives to NASA standards, but they must still meet NASA's intent and present only risks that are acceptable. She added that deviations and exceptions in the CCP are referred to as variances and that variances are waivers. Mr. Holloway advised NASA to consider using the providers' standards if NASA wants to become cost-effective. In response to a question from Mr. Joseph Cuzzupoli, Ms. Lueders explained that the variances cover crew vehicles, launch vehicles, and ground systems. In response to a question from Mr. Voss, Ms. Lueders explained that the overwhelming number of variance requests for alternative standards are being accepted by the CCP. Four CCP missions are now in place, as NASA has awarded Post Certification Missions 1 and 2 to each provider. Ms. Lueders discussed the Certificate of Flight Readiness (CoFR) process.

Ms. Lueders described how the risk management process has evolved to delineate crew safety risks. She reviewed charts on the five CCP top programmatic risks and the one CCP top program safety risk. Programmatic risks include cost, schedule, and technical consequences. Ms. Lueders noted that the charts cover only NASA's risk system and do not include the providers' risk systems. She discussed the risk on the ability to close the loss of crew (LOC) gap and noted that micrometeoroids and orbital debris (MMOD) are primary contributor to the risk. The CCP wants the crew vehicle to be as robust as possible, and a decision may be needed on whether the LOC goal of 1 in 270 can be reached. The providers are "shooting at a 1 in 150 to 180." Mr. Leroy Chiao asked how the Soyuz would fare if analyzed under the latest test model. Ms. Lueders responded that using a model for a vehicle that has been "flying for a while" is difficult. Mr. Hale noted that there has been a "push" for an inspection of the Soyuz model. Ms. Lueders added that the CCP has the best probabilistic risk assessment (PRA) people and that the challenge comes from having to use very low populations for the data. Mr. Hale observed that the Space Shuttle could barely make the number with a two-week mission, let alone a six-month mission. Mr. Holloway explained that the PRA at this stage in the program would not be very good, because it is based on estimates and surrogates, rather than actual test data, and at some level would not inform the design.

Ms. Lueders described the architecture for Boeing's and SpaceX's spacecraft segments, launch segments, and ground and operations segments. She reviewed Boeing's and SpaceX's recent accomplishments. Both providers are granting increased insight opportunities for the NASA team. Mr. Cuzzupoli expressed concern over the CCP's ability to handle reviewing two new launch vehicles and two new crew vehicles at the same time. He explained that the testing program is key for both providers and must include the launch vehicle. He expressed concern that the CCP may not be watching the launch vehicles closely enough.

Ms. Lueders discussed the investigations into the recent SpaceX mishap. The biggest difficulty is establishing the root cause and most probable cause. SpaceX is conducting its own investigation and the NASA Launch Services Program (LSP) is conducting an independent assessment. The mishap caused substantial damage to Pad 40 at CCAFS; however, SpaceX had always planned on using Pad 39a at KSC for the CCP. In response to a question from Dr. Pat Condon, Ms. Lueders stated that the CCP is leveraging from the LSP insight. In response to a question from Ms. Shannon Bartell, Ms. Lueders explained that each investigation team is using the same data. Ms. Bartell commented that it might be better to have a single investigative team. Ms. Lueders responded that it was a commercial launch and that the LSP had been extremely supportive. Mr. Gerald Smith asked "who makes the call" if there is a disagreement on whether a company is ready to fly. Ms. Lueders explained that for NASA missions, the customer makes the call. Mr. Holloway cautioned that behavior traits, too many short-cuts, and insufficient process may be root causes. Ms. Bartell suggested that it would be advisable to educate the public on the reasons for approving a return to flight, because accidents are going to continue to happen.

Ms. Lueders reviewed charts on recent accomplishments by SNC and Blue Origin. The SNC drop test is scheduled to be conducted in 2017. Blue Origin is continuing to mature its design. Ms. Lueders commented that working with those companies helps NASA continue to learn how to resolve problems. She observed that each company has a team that "does things a little bit differently" and that her team is passionate about supporting commercial crew possibilities across the board. She noted that she could not share proprietary design details in a public meeting.

Mr. Hale thanked Ms. Lueders for her presentation.

Status of Exploration Systems Development

Mr. Hale introduced Mr. Bill Hill, ESD Deputy AA, who briefed the Committee on ESD's status. Mr. Hill presented ESD's EM-1 Integrated Mission Milestone Summary chart and discussed the status of milestones for June through October 2016. He described the EM-1 secondary payloads selected to date: Cubesat to Study Solar Particles (CuSP), LUNAr polar Hydrogen Mapper (LunaH-Map), Lunar Flashlight, Near Earth Asteroid Scout (NEA Scout), BioSentinel, Lunar IceCube, SkFire, ArgoMoon, Outstanding Moon Exploration Technologies demonstrated by Nano Semi-Hard Impactor (OMOTENASHI), and EQUilibriUm Lunar-Earth point 6U Spacecraft (EQUULEUS).

Mr. Hill reviewed a chart on ESD's top concerns:

- Integrated avionics and software verification and validation (V&V);
- Out-year funding uncertainty impacts to EM-2;
- Mobile Launcher (ML) outfitting;
- ESM CDR completion;
- ESM Flight Model-1 (FM-1) delivery to KSC;
- Vertical Assembly Center (VAC) welding operations;
- Productions and operations (P&O) sustainability at one flight per year after EM-3; and
- EM-2 first crewed test flight risk and related mission planning.

Mr. Hill described the status of Orion. He discussed the EM-1 Launch Abort System, the EM-1 Crew Module, the EM-1 Crew Module Adapter (CMA), and the EM-1 Service Module. He explained that NASA had decided to build the CMA to house avionics that could not be assigned to an international partner due to International Traffic in Arms Regulations (ITAR) requirements. He discussed the Crew Module Structural Test Article (STA) and the ESM STA. He presented a slide showing the NASA Plum Brook Station vibration test facility at NASA Glenn Research Center (GRC). He described work being performed at the Lockheed Martin Integrated Test Lab for software development.

Mr. Hill reviewed the status of the SLS. He discussed the EM-1 integrated spacecraft payload element effort at NASA Marshall Space Flight Center (MSFC). He presented a chart showing the work being performed on the EM-1 stages. He noted that the biggest challenge is obtaining new engine controllers from the vendor. Mr. Hill discussed the SLS STA testing and described the Launch Vehicle Spacecraft Adapter (LVSA) that is being loaded into Test Stand 4699 at MSFC. Mr. Hill discussed the development of the EM-1 Boosters at OA in Utah and described the work on the EM-1 Engines at NASA Stennis Space Center (SSC). He discussed software testing at the MSFC Software Test Lab.

Mr. Hill updated the Committee on the status of GSDO. He described umbilical production and testing at the KSC Launch Equipment Test Facility (LETF) and discussed the outfitting and checkout of the Mobile Launcher. He described the platform installation work being performed at

the VAB and the upgrade design work at Pad 39B. He described software being developed at KSC by the Ground Flight Application Software Team (GFAST) and discussed Spaceport Command and Control Software (SCCS).

Mr. Hill introduced Mr. Wayne Jermstad, Deputy Chief Engineer (Acting) for Exploration Systems as well as Deputy Director (Acting) for Cross Program System Integration, who briefed the Committee on cross-program systems integration (CSI). Mr. Jermstad presented charts showing recent major CSI accomplishments and near-term forward work. He discussed the Cross-Program Integration Team's (CPIT's) top technical issues and described emerging issues and concerns.

Mr. Hale thanked Mr. Hill and Mr. Jermstad for their presentations.

Public Comments

Mr. Hale invited comments from the public. Mr. Robert Zimmerman suggested that the Committee consider at a future meeting the difference between the immediate verses long-term effects from radiation exposure. He explained that the current belief that effective remedies might be available in eight years is based on the treatment of clinical cancers that have different origins than the type of cancers that would be caused by exposure to galactic cosmic radiation or proton solar events, which are the kinds of radiation to which astronauts on deep space missions would be exposed. He also noted that there has been "considerable discussion" on whether astronauts returning from long-duration missions would have "recoverable health."

Dr. Paloski responded that NASA "is very cautious" about both near-term and long-term health effects from exposure to radiation.

There were no other public comments.

Discussion and Recommendations

Mr. Hale invited Committee members to offer suggestions for Committee findings, observations, or recommendations. There were none offered.

Dr. Sanders asked whether there had been any difficulty in making a shift in emphasis from looking at the effect of radiation to investigating how to mitigate those effects. Dr. Paloski responded that the program element affecting radiation had been established 20 years ago and had been missing a manager for a while. Mr. Hale commented that the ASAP had the primary responsibility among NASA's advisory committees for risks related to radiation exposure. Ms. Bartell requested that the Committee be briefed on how specific standards waiver requests are handled by the CCP. Mr. Hale noted that the number of requests for waivers from NASA standards are in the order of tens, not hundreds. Dr. Sanders noted that the ASAP has spent a great deal of time on the CCP certification process and found that it is good and very thorough.

Adjourn

Dr. Siegel adjourned the meeting at 5:30 p.m.

NASA ADVISORY COUNCIL
Human Exploration and Operations Committee
MEETING
Johnson Space Center
Gilruth Center, Lone Star Room
2101 East NASA Parkway
Houston, TX 77058

AGENDA

Monday November 14

9:30 – 9:35	Call to Order, Welcome & Opening Remarks	Mr. N. Wayne Hale & Dr. Bette Siegel
9:35 – 10:30	Status of Human Exploration & Operations Mission Directorate	Mr. Greg Williams
10:30 – 11:30	Status of International Space Station	Mr. Sam Scimemi
11:30 – 11:45	Status Report from Research Subcommittee	Dr. David Longnecker
12:45 – 12:45	***Lunch***	
12:45 – 1:45	Status of Human Research Program	Dr. Bill Paloski
1:45 – 2:45	Status of Commercial Crew Certification	Ms. Kathy Lueders
2:45 – 3:00	***Break***	
3:00 – 4:00	Status of Exploration Systems Development	Mr. Bill Hill
4:00 – 4:15	***Break***	
4:15 – 4:20	Public Comments	
4:20 – 5:30	Discussion and Recommendations	Mr. N. Wayne Hale
5:30	Adjourn	

Human Exploration and Operations Committee Membership
November 2016

Mr. N. Wayne Hale *Interim Chair*	Consultant, Special Aerospace Services of Boulder, Colorado
Dr. Bette Siegel *Executive Secretary*	NASA Headquarters
Mr. Ken Bowersox	Former NASA astronaut and retired U.S. Navy Captain
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
Ms. Ruth Gardner	Technical Deputy Director, Engineering and Technology Directorate, Kennedy Space Center
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. Bob Sieck	Former Space Shuttle Launch Director
Mr. Gerald Smith	Former Deputy Director, Stennis Space Center
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 Johnson Space Center
Houston, TX

November 14, 2016

MEETING ATTENDEES

HEO Committee Members:

Hale, Wayne, *Interim Chair*	Aerospace Consultant
Siegel, Bette, *Executive Secretary*	NASA Headquarters
Bartell, Shannon	Aerospace Consultant
Chiao, Leroy	Aerospace Consultant
Condon, Stephen "Pat"	Aerospace Consultant
Cuzzupoli, Joseph	Aerospace Consultant
Gardner, Ruth	Kennedy Space Center
Holloway, Tommy	Aerospace Consultant
Levin, Lon (telecon)	SkySeven Ventures
Longnecker, David (telecon)	Association of American Medical Colleges
Lopez-Alegria, Michael	Commercial Spaceflight Federation
Sieck, Robert	Aerospace Consultant
Smith, Gerald (telecon)	Aerospace Consultant
Voss, James	University of Colorado, Boulder

NASA Attendees:

Hill, Bill	NASA HQ
Jermstad, Wayne	NASA HQ
Lueders, Kathy	NASA/KSC
Meier, Eric	NASA/JSC
Paloski, William	NASA HQ
Pullen, Renee	NASA HQ
Scimemi, Sam	NASA HQ
Williams, Greg	NASA HQ

Other Attendees:

Berger, Eric	Ars Technica
Bungo, Mike	U TX Health Science Center
Carrera, Mark	*Aviation Week & Space Technology*
Frankel, David	P B Frankel, LLC

Telecon Attendees:

Allen, Gale	NASA HQ

Barksdale, William	Boeing
Bevia, Adriana	Orbital ATK
Black, Sam	OMB
Branscome	Consultant
Broadwell, Marguerite	*[not affiliated]*
Clark, Stephen	Spaceflight Now
Colangelo, Anthony	Main Engine Cucolss.com
Cowing, Keith	NASA Watch
Dean, James	Florida Today
Faith, Ryan	US House of Representatives
Foust, Jeff	Space News
Gaten, Robyn	NASA HQ
Gates, Michelle	NASA
Hansen, Hans	NASA
Huntsman, Dave	NASA/GRC
Irving, Rick	NASA
Jones, Crystal	NASA CCP
Jones, Matt	Boeing
Karanian, Linda	Karanian Aerospace Consulting
Kobayashi, Tetsu	Asahi Newspaper
Li, Allen	House Committee on Science, Space, and Technology
McKay, Meredith	NASA
Mikulka, Gene	Talking Space
O'Rourke, Kelly	*[not affiliated]*
Perrotto, Trent	NASA
Rausch, Diane	NASA HQ
Regan, Rebecca	Boeing
Reilly, Deann	Boeing
Sloss, Philip	NASASpaceFlight.com
Smith, Marcia	SpacePolicyOnline.com
Smith, Marshall	NASA HQ
Tantardini, Marco	Italian Space Agency
Thomas, Daniel	NASA
Troy, Ben	LMB
Van Wychen, Kristin	US GAO
Warner, Cheryl	NASA
Wilmore, Sean	*[not affiliated]*
Zimmerman, Robert	Symbiotek

Human Exploration and Operations Committee
Johnson Space Center
Houston, Texas

November 14, 2016

LIST OF PRESENTATION MATERIAL

1) Human Exploration & Operations Update [Williams]
2) International Space Station Status [Scimemi]
3) NAC HEO Research Subcommittee Report [Longnecker]
4) Human Research Program Status [Paloski]
5) Commercial Crew Program Status [Lueders]