NASA AEROSPACE SAFETY ADVISORY PANEL
National Aeronautics and Space Administration
Washington, DC 20546
Dr. Patricia Sanders, Chair

September 6, 2019

Mr. James Bridenstine
Administrator
National Aeronautics and Space Administration
Washington, DC 20546

Dear Mr. Bridenstine:

The Aerospace Safety Advisory Panel (ASAP) held its 2019 Fourth Quarterly Meeting at NASA Johnson Space Center, Houston, Texas, on September 4-6, 2019. We greatly appreciate the participation and support that was received from the Center leadership, the subject matter experts, and support staff.

The Panel submits the enclosed Minutes and Recommendation resulting from the public meeting for your consideration.

Sincerely,

Patricia Sanders

Patricia Sanders
Chair

Enclosure

AEROSPACE SAFETY ADVISORY PANEL
Public Meeting
September 6, 2019
Johnson Space Center, Houston, TX

2019 Fourth Quarterly Meeting Report

Aerospace Safety Advisory Panel (ASAP) Attendees:
Dr. Patricia Sanders, Chair
Lt. Gen. (Ret.) Susan Helms
Mr. Paul Sean Hill
Dr. Sandra Magnus
Dr. Donald McErlean
Dr. George Nield
CAPT (Ret.) Christopher Saindon *(via telecon)*
Mr. David West
Dr. Richard Williams

Telecon Attendees:
See Attachment 1

ASAP Staff and Support Personnel Attendees:
Ms. Carol Hamilton, NASA ASAP Executive Director
Ms. Lisa Hackley, NASA ASAP Administrative Officer
Ms. Kerry Leeman, Technical Writer/Editor

NASA Attendees:
Mark Geyer
Kirk Shireman
Steve Stich
George Gafka
Marshall Smith
Tom Whitmeyer
Wayne Jermstad
Michael Sarafin
Dan Mulligan
Randy Bresnik
Eric Boe
Pat Forrester
Terry Wilcutt
Ralph Roe

Opening Remarks
Ms. Carol Hamilton, ASAP Executive Director, called the meeting to order at 11:30 a.m. and welcomed everyone to the ASAP's fourth quarterly meeting of 2019. Prior to the meeting, the public had been invited to provide verbal or written statements; no public comments were made.

Dr. Patricia Sanders opened the meeting by thanking Mr. Mark Geyer, Johnson Space Center (JSC) Director, Ms. Vanessa Wyche, JSC Deputy Director, and JSC personnel for hosting the ASAP's fourth quarterly meeting and insight visit. Dr. Sanders stated that the Panel members had intense and productive insight engagements with NASA leadership and program staff during this quarter's meeting. The Panel's observations and recommendations were shared, beginning with an acknowledgement of the visionary work at JSC. The Panel agrees with the Center's thrust to *Dare* to expand frontiers, *Unite* with partners to complete bold missions, and *Explore* space for the benefit of humankind.

Dr. Sanders noted that, while saddened by the devastation and loss of life caused by Hurricane Dorian, the Panel is relieved that Kennedy Space Center was spared any significant damage. Program efforts based in that area experienced about a week of schedule loss, but that was minor in relation to a potential more serious impact on operations, test and development efforts.

Dr. Sanders recognized Mr. Paul Hill as the newest member of the ASAP and welcomed the rich experience he brings to the Panel.

Before launching into the Panel discussions, Dr. Sanders took a few moments to comment on the recent NASA leadership changes in the Human Exploration and Operations area. First, she recognized the significant contributions made by Bill Gerstenmaier over more than 42 years with the Agency. He truly served as America's rocket scientist, and his role in advancing the exploration of space cannot be overstated. Now, as the Agency moves on, Dr. Sanders encouraged NASA leadership to be cognizant of, and deal aggressively with the impact of change. It is important to recognize the sense of uncertainty that accompanies a vacuum in a key leadership position and address the need for stable and credible direction for the future. NASA personnel are continuing to move forward on the programs of record but having positive confirmation of the specific direction from a permanent leader is imperative, and a sense of uncertainty should not be allowed to linger during this critical time.

Additionally, Dr. Sanders noted that the Panel has some, admittedly anecdotal, indications that the leadership change signals that schedule is paramount, and that extraordinary measures should be taken to maintain schedule — even at the potential expense of safety and mission performance. While NASA leadership has firmly stated that this is not the case, and in fact, made decisions — such as continuing with the Space Launch System (SLS) Green Run — that reinforce higher priorities than schedule, this message must be reiterated strongly and often. Dr. Sanders emphasized that since actions speak louder than words, decisions should continue to be made with this imperative in mind.

Dr. Sanders announced the commencement of Panel deliberations on the Human Lunar Exploration or the Moon to Mars effort, led by Dr. George Nield and Dr. Sandra Magnus.

Moon to Mars

Dr. Nield began the discussion by emphasizing the extraordinary lunar initiative NASA is undertaking. With the direction to land U.S. astronauts on the moon by 2024, NASA has been given a tremendous challenge and a tremendous opportunity. Because the Apollo program successfully accomplished the task 50 years ago, the needed technologies are clearly there to do the job, so the hard parts of recreating that capability really involve things like developing the right set of requirements, settling on an acquisition strategy, getting companies on contract, and integrating all of the many different pieces of the overall system architecture that will be needed. Doing all of these things well is certainly no easy task. After talking with Marshall Smith, the Director, Human Lunar Exploration Program, Dr. Nield was particularly impressed with the kinds of things that NASA is doing to position the Artemis Program for success. The number of synopses, requests for information, and draft and final requests for proposals that NASA has put out in the last 6 months is really impressive. Maxar is now on contract for the power and propulsion element for the lunar Gateway. Northrop Grumman has been selected to provide a mini hab based on their Cygnus spacecraft, and a number of companies have been chosen to

send experiments to the lunar surface using small landers. A final solicitation to provide Gateway logistics services was issued last month. For the Human Landing System, the first draft solicitation was put out in July, and a second one was issued in August, with the final solicitation expected out by late summer. That is quite a procurement pace, and it is certainly not an indication of a "business as usual" schedule.

Dr. Nield added that the current plan to select three to four Human Landing System providers to do an initial nine-month study phase, followed by a down-select to two providers to actually build and demonstrate the hardware, will allow NASA to take advantage of the many benefits of competition -- something that has been proven to be extremely important during the commercial cargo and commercial crew programs. NASA's intent is to set up integrated government-industry engineering teams right from the start, which is another lesson that has been carried over from NASA's experience on commercial crew and cargo. In summation, Dr. Nield stated that the bottom line is it appears that Artemis is off to a great start. If Congress agrees to provide the needed funding, NASA may have a real shot at achieving the 2024 goal. At the same time, it will be important to remember what can go wrong along the way, and what things need to be done to ensure crew safety. Dr. Nield introduced Dr. Magnus, who examined the Panel's main concerns about crew safety.

Dr. Magnus stated that the acquisition approach that NASA is taking for the many elements of the Gateway and the human lander leverages the lessons learned during the execution of a similar paradigm for the Commercial Crew Program (CCP). She stated that these lessons learned included the criticality of competition, the importance of communication between the program and the contractor, the benefit of having government personnel located at the contractor site in order to maintain adequate insight, not only to feel comfortable with the progress of the work, but also to address issues as they arise to help decision velocity, and a clear set of design requirements with an equally clear set of certification criteria from the government. Effectively executing these elements will be critical in achieving an outcome for the lunar program architecture that is on schedule with a well understood risk posture.

However, Dr. Magnus emphasized, the additional complexity of integrating multiple complex elements, each procured as a "service" being provided by different vendors, should not be underestimated – not the least of which is the human lander system. Managing and tracking risk and risk mitigation across such a complex ecosystem will require vigilance and constant communication and some forethought about how to navigate the contractual environment. The nine-month study period, where NASA and potential contractors will work through details of systems' requirements and certification processes should also spend time addressing integration approaches and procedural mechanisms. Dr. Magnus stated that the Panel believes the nine-month study period will be an important exercise in influencing the risk posture of the program, and NASA should continue to articulate sound safety principals during these discussions. The Panel, she added, would also like to suggest that NASA and the contractors consider the merits of including an uncrewed test of the human lander system prior to the first crewed mission as a major risk-reduction exercise.

Dr. Magnus stated that an integral system required to put "boots on the moon" is literally the boots—the extravehicular surface suits that the crew will need. While NASA has managed to provide some funding for internal research and development on next generation extravehicular mobility units (EMUs) (space suits), up to this point there has been no priority placed on

producing a next generation space suit. Space suits, which are, quite frankly, one-person spaceships, are complex and have stringent safety requirements. In order to produce a safe and reliable lunar suit to meet the Artemis Program's 2024 deadline, NASA needs to immediately create a structured space suit program with a budget, schedule with critical milestones, and both the authority and responsibility to produce this critical capability. Anything less than full, robust program-level attention to this system reduces the potential to not only field the capability but do so in a safe manner.

Exploration Systems Development (ESD)

Dr. Sanders stated that clearly the Exploration Systems Development program remains a key component of human space exploration. She introduced Lt. Gen. Susan Helms and Mr. David West to lead these deliberations.

Lt. Gen. Helms opened the discussion on human exploration developments. With the advent of the Artemis program just before the Panel's last quarterly, this quarterly offered members an opportunity to see how the multiple Artemis missions build on each other toward Lunar 2024, and also to see that NASA is making notable progress in preparing and integrating the various components of the ESD program in preparation for the first flight.

Lt. Gen. Helms expressed her belief that the continuation of the Green Run is one of the more significant developments since the last ASAP quarterly meeting. The NASA Administrator announced that the Green Run will proceed; an event that this Panel considers a critical milestone toward first flight of the SLS. As currently planned, the final integration of the engine section with the core segment will occur in prep for shipping to the Stennis test site by the end of the year. As the Panel has stated before, this run will be an outstanding milestone to aid in validating critical integrated performance, reducing uncertainty, and understanding the inherent risks surrounding the development of a brand new rocket. The Panel was a strong advocate for the Green Run, and the team is gratified that NASA has also formally embraced the Green Run milestone as a critical step.

Lt. Gen. Helms noted that every time Panel members meet with ESD program personnel, the Panel sees the continuing progress of significant activity for the program as they march toward the first flight. At the fourth ASAP quarterly meeting, some of the notable milestones since the last meeting include the successful in-flight demonstration of the ascent launch abort system in early July, the successful propulsion qual test of the Orion propulsion system in early August, the mating of the crew module with the service module at the Kennedy Space Center, and completion of the Artemis 1 crew and service module flight software testing. In addition to the SLS processing for Artemis 1, components of the SLS for Artemis 2 are also in process and proceeding at a comfortable rate. There is also planning for long-lead items related to Artemis 3. In recent news, Lt. Gen. Helms made a special shout-out for the successful risk management of ESD hardware at the Cape (Canaveral), including the Mobile Launcher, in the face of the threat from Hurricane Dorian.

The Artemis 1 mission, which will demonstrate critical maneuvers to take the unmanned Orion out and around the Moon and back, has well-defined objectives and priorities that are aligned with all important risk reductions for the crewed flight of Artemis 2. Lt. Gen. Helms enumerated the initial mission objectives:

1. For Orion, demonstrate that the Orion heat shield performs as designed in an actual flight environment, especially the high-speed translunar re-entry, and for the SLS, validate the as-designed launch and ascent performance. Successful accomplishment of both these objectives are mandatory prior to crewed flight.
2. Operate systems in the flight environment to include Orion deep space environment performance, communications, propulsion and navigation systems, ground systems, flight operations of the mission control teams and management, recovery operations, and management of the deep space networks and facility support systems. In other words, carry out a robust end-to-end flight test of the integrated system prior to crewed flight.
3. Retrieve the spacecraft to include all special instrumentation, video and avionics, and demonstrate the ability to safely perform recovery operations in preparation for future crewed flight.

Beyond those three priorities, there are a host of other objectives that further reduce risk and validate overall performance of the entire Artemis design. These objectives, if demonstrated successfully, will enable the program for the launch of Artemis 2, a mission that will take a crew of two into a temporary earth-centric orbit for necessary functional checkouts, and then on a transfer trajectory to fly around the Moon with a free return. The mission design of Artemis 2 is evolving very well, and the Panel had the opportunity to review flight-abort mode design, crew pad egress capabilities, crew return and recovery operations, and detailed nominal mission profile analysis. Forward work for Artemis 2 includes crew recovery trainer development, crew abort training, further flight rule and procedure development and validation, integrated team training, and off-nominal mission design.

All this activity related to concurrent development, design, and mission planning for the concurrent Artemis 1, 2, and even 3 development flows raised the natural concern about the drain on ESD resources to perform all of the concurrent technical and risk management activity. Lt. Gen. Helms stated that because of the concentration of technical expertise and the need to disposition that expertise across development, processing, and operations, the Panel anticipates that management of the ESD/Artemis workforce will be a significant challenge to keep them from being spread too thin. In light of Lunar 2024, this will be a continuing area of heightened interest for the ASAP in future meetings.

In the past, the ASAP has voiced concerns with several aspects of the European Service Module (ESM) propulsion system. Mr. West brought up the Panel's growing concern about the unresolved technical issues with propulsion system's serial propellant system design that affect both safety and schedule.

Over the course of several quarterly meetings, the Panel has been monitoring a technical issue involving the propellent system configuration in the ESM. This issue was covered in the Panel's 2018 annual report. One of the design challenges of the ESM propulsion system is to mitigate the risk of propellant leaks. Traditionally, for similar systems, a parallel architecture has been used to provide fault tolerance in the case of a leak. However, to save weight and minimize complexity, the Orion program decided to implement a serial propellant system architecture on the ESM for the first few Artemis flights. The design features an increased focus on the reliability of the components, specifically the valves, to increase the fault tolerance of the system. The remaining single fault part of the system is a welded area connecting tank plumbing, where

NASA assessed that leaks are unlikely. The Panel was pleased to see the thoroughness of the process to examine the problem and address the various risk postures involved with both the series and parallel plumbing approaches. In addition, appropriate processes were utilized to address dissenting opinions up through the highest levels of the agency.

However, this week, in discussing the status of the Orion program, the Panel was surprised to learn that the issue is not perceived to be resolved, and in fact, there is still some ongoing "churn" surrounding this issue and its disposition. The Panel will continue to monitor any developments, and it encouraged the program to ensure that the adjudication of risk assessments is conducted in such a way as to leave no ambiguity on whether a risk issue is closed or not.

Mr. West continued by stating that along the same theme, the Panel also learned that there were general concerns about how assumptions related to risk adjudication might evolve over time, particularly given that the Orion program has been in development for about 10 years. It's extremely important to have discipline, clarity, and transparency in how important risks are dispositioned, and when to revisit the risk discussions when the initial conditions or assumptions have altered during the development journey. Tracking on risk-related assumptions over time, and whether they change as development evolves, is a critical aspect of due diligence in systems engineering and integration first principles. Given the complexity of the ESD/Artemis program, the ASAP will continue to watch this dynamic.

Lt. Gen. Helms summarized that the Panel generally sees significant and appropriate progress in the management of risks of the ESD program as the team proceeds to Artemis 1 and beyond. Within the three components of the ESD, the Orion program, the SLS program and the Exploration Ground Systems program have all worked through important milestones and managed technical challenges along the way. But also of interest to the Panel is how all of this comes together in a manner consistent with systems engineering and integration principles for highly complex hardware. As discussed in previous meetings, the ESD program has a cross-program Systems Integration Office that is intended to manage technical and program concerns broader than the individual ESD program elements. This office has both schedule assessment activities and cross-program technical issue resolution teams. It was gratifying to see that there was focus on synchronizing various schedules across the ESD test programs, working through integrated loads and guidance challenges, enterprise verification and validation activities and the like, but this will continue to be an area of high interest. As we get closer and closer to more mature launch dates, how the risks arising from enterprise integration are managed and dispositioned will continue to be of interest to the Panel.

Dr. Sanders concurred with Mr. West, who noted that the issue of serial versus parallel propellant in the program has not yet been firmly resolved contrary to earlier indications. This is indicative of a broader concern impacting decision velocity within the Agency. The ASAP has consistently been a strong proponent of the dissenting opinion process within the Technical Authority, but we also believe that dissenting opinions should be adjudicated in a timely fashion, decisions should be reached and documented following due deliberation, and the process should move on. While decisions should not be made under schedule pressure, they also should not be allowed to linger and impede schedule progress.

Dr. Sanders commented on potential constraints on the workforce. Lt. Gen. Helms also mentioned the workforce in her comments. The ASAP noted throughout their engagement with NASA during the fourth quarterly meeting that, with so many critical and aggressive programs moving forward simultaneously, there is potential for an Agency-wide stress pulling on the talents of the workforce. This will need to be carefully managed across the multiple disciplines.

Commercial Crew Program

Dr. Sanders stated that the CCP remains a critical NASA endeavor and is on the cusp of achieving its objectives, albeit with some significant challenges remaining. Dr. Nield and Lt. Gen. Helms addressed the Panel's observations in that regard.

Dr. Nield commented that because Kathy Lueders, the Program Manager, was back in Florida preparing for Hurricane Dorian, the Panel met with her deputy, Steve Stich. Dr. Nield started out by complimenting Mr. Stich for the job he did filling in, talking through the status of the program, and all of the issues being worked. The Panel members were very impressed with his technical knowledge and insights, and his openness with the Panel in discussing their progress. In terms of schedules, both Boeing and SpaceX have been targeting their initial flights with crew for the end of this calendar year. The actual launch dates at this point are officially under review, and may end up slipping somewhat, but it is clear that both providers are heading down the home stretch and are clearly focusing on fixing the remaining problems (which are still significant) and resolving the remaining issues.

In addition to hardware and software testing and analysis, there are several launches on the to-do list. Before SpaceX launches a crew, they will need to complete an in-flight abort test. Before Boeing launches a crew, they will need to conduct their pad abort test and orbital flight test 1. On the technical side, both providers have work remaining on parachutes. Results from recent tests indicate that the math models traditionally used by the parachute community may not have accurately predicted the margins we had in the past, even back in Apollo, especially for asymmetric loading cases. Additional parachute tests are clearly needed, both to validate the updated models, and to demonstrate that the systems that are planned to be used for crew missions have the appropriate margins. Another issue affecting both providers relates to hardware supply chains. Lt. Gen. Helms discussed this issue.

For both providers, the Panel was able to explore details on technical issues with flight hardware that are currently in work toward resolution. In one particular instance, an issue with flight hardware subcomponents was discovered during some integrated vehicle testing. While this was yet again another validation of the value of integrated testing, it was determined that these particular subcomponents were not built to spec, but in spite of that, had apparently passed the subcomponent qual testing. Lt. Gen. Helms stated that the subcomponents themselves are very common pieces of hardware for spacecraft, and there is a long history both at NASA and in industry with qual testing this kind of hardware prior to acceptance and integration. In this case, the actual quality of the subcomponent hardware was compromised in manufacturing, but the commonly used qual testing of the subcomponent, developed by experience over time, did not catch the problems with the hardware. As mentioned, a more integrated test of the vehicle caught the problem, but it is a good reminder that supply chain challenges are manifesting across the aerospace industry, and that a robust, proactively aggressive qual testing and surveillance program is one of our best defenses in the face of these challenges.

Dr. Nield noted that the Panel would like to share several examples of good news stories with respect to resolving previous issues. SpaceX recently briefed senior NASA leadership on the Dragon static fire anomaly investigation. The fault tree is nearly complete, and corrective actions have been identified and are already being implemented. On the topic of composite overwrapped pressure vessels (COPVs), there has been a tremendous amount of work done, both by NASA and by SpaceX. The Panel has heard folks describe it as being worthy of several PhD dissertations, in terms of advancing the state of the art and increasing understanding of grain size, ignition risks, and non-destructive testing techniques. There has also been considerable progress made in evaluating crew insertion prior to propellant loading, sometimes referred to as "load-and-go." There is still work to be done, but the current plan will involve gathering data on an in-flight abort test (IFAT) dry run, an IFAT static fire, the IFAT launch, the Demo-2 dry run, and the Demo-2 static fire, prior to the SpaceX Demo-2 launch with crew aboard. In summary, the next several months will be very busy ones for the CCP, but things are definitely proceeding on the right track.

International Space Station (ISS)

Dr. Sanders commented that the ISS remains a vitally important facet of the NASA program of work. Dr. Rich Williams discussed the Panel's observations on the platform and its operations.

Mr. Kirk Shireman, ISS Program Manager, led the discussion with the Panel concerning the ISS. The Panel again notes the spectacular ongoing success of the ISS Program and mission. Increment 60 is currently on orbit, commanded by Aleksey Ovchinin, along with crewmembers Christina Koch, Nick Hague, Luca Parmitano, Aleksander Skvortsov, and Andrew Morgan. The ISS Program ranks amongst the greatest technical achievements in history and establishes the model of international cooperation on which future human space flight programs should be based. The leaders and involved members of each space agency have been able to sustain outstanding cooperation through the years of continuous operation, despite changes of key personnel at all levels. This tradition of mutual trust and excellence continues today.

Science utilization on the ISS remains high. Three hundred forty-nine scientific investigations are ongoing during Expeditions 59/60, with 2,876 investigations completed on ISS by over 3,809 investigators from 107 countries. Over 1,768 scientific publications have resulted from ISS research. Visiting vehicles continue to resupply the station with regularity, assuring adequate consumables and ongoing maintenance and utilization capability. Top ISS programmatic concerns include assured access to the ISS, transition to commercial use, science management/continued utility as a national laboratory, and potential budget constraints.

The Panel remains particularly concerned about assured ISS access. In anticipation of commercial crew vehicles, after the Soyuz return in October 2020, there are no more U.S. seats planned on Soyuz. While the CCP is making continued progress towards crewed flight, the ISS is at risk of any CCP delay to launch crewed operations, which would reduce the total crew size to only three and would not include any U.S. astronauts in the current manifest. The Panel encourages NASA to develop contingency plans for continuity of U.S. Orbital Segment (USOS) operations. Lack of personnel with the requisite skill sets and training to operate the USOS will place the entire station at risk.

The Panel further encourages NASA to consider adjusting ongoing Soyuz and commercial crew seat assignments to reduce the risk to the Russian Orbital Segment (ROS) or USOS for any launch delays for either launch vehicle.

Dr. Williams stated that extravehicular activity (EVA) remains the most hazardous activity conducted on the ISS. Multiple EVAs are scheduled over the coming several months, for P6 battery removal and replacement and Alpha Magnetic Spectrometer repair. Currently, four EMUs on orbit are GO for EVA. Efforts to extend EMU capability to 2024 and 2028 are underway. The Exploration EMU (xEMU) is also under development by the NASA Exploration EVA team. As the Panel heard earlier, this project is organized under the Gateway Program, and it is at the mid-point of flight design and certification. The xEMU, envisioned to be adaptable enough to support low Earth orbit, deep space, and lunar surface operations, will be developed in-house (including acquisition of ISS demo and lunar 2024 flight suits) with production eventually transitioned to industry.

The Panel is concerned about the ability of the ISS Program to maintain the legacy EMUs and considers the development of replacement suits as a critical human space flight priority. While the Panel lauds the in-house xEMU project, it was recognized that the suit project has not enjoyed the status appropriate to its importance to all human space flight programs. Again, the Panel urges NASA to apply rigorous program/project management discipline and adequate resources to this effort to enhance the chances of success. The Panel considers the development of the next generation EMU as a human space flight imperative, which should be pursued independent of any changes in NASA's overall space exploration strategy.

Dr. Williams noted that work on the ISS Deorbit Strategy and Contingency Action Plan is proceeding. NASA, the European Space Agency (ESA), the Japan Aerospace Exploration Agency (JAXA), the Canadian Space Agency (CSA) and the Italian Space Agency (ASI) have all concurred with the document and signed. Negotiations continue with Russian counterparts, focusing on technical aspects of the de-orbit operation. The Panel remains highly impressed with the ISS program, and compliments NASA and all international partners on its extraordinary ongoing success.

Dr. Sanders noted that the ASAP has an open formal recommendation on contingency planning for manning the ISS so as to relieve schedule pressure on CCP. This remains relevant. The Panel also has an open recommendation addressing the need for dealing with the aging EVA suits.

In addition to the ASAP's deliberations this week, some members of the Panel also recently made an insight visit to the NASA Safety Center in Ohio. Dr. Magnus commented on that visit.

NASA Safety Center

Several Panel members had an opportunity to visit the NASA Safety Center in Cleveland, Ohio over the summer. The Safety Center supports the Office of Safety and Mission Assurance (S&MA) in four major areas: mishap investigation, audits and assessments, knowledge management, and technical excellence. In short, the center provides a wide breadth and depth of information, from policy to education, pertaining to maintaining and promoting a safety culture. One of the programs available from the center caught the attention of the Panel, the S&MA Technical Excellence Program or STEP. The STEP is available as online learning, providing continuing education credits designed to teach safety professionals and the overall workforce

about system safety. The program has multiple levels, with the Level 1 class specifically targeted to benefit the engineering workforce. Higher levels provide more advanced content for S&MA professionals.

Unfortunately, there is no requirement across the Agency for the workforce to take the training. The SM&A professionals are "encouraged" to enroll in the program. With the exception of the Kennedy Space Center, where the STEP Level 1 class is required for all new hires, the general workforce remains largely unaware of the offering. The Panel presented the following recommendation:

> Given the importance of creating a culture of safety across the NASA workforce, and the availability of a resource to promote that goal, the ASAP would like to recommend that NASA adopt an Agency-wide requirement for all employees to complete the STEP Level 1 training course.

In closing, Dr. Sanders reiterated some of the consistent guiding principles of the ASAP. First, while it is exciting and, indeed beneficial, to have clearly articulated goals and target schedules, the Panel feels NASA should never let schedule pressure dominate to the extent that decisions are made that unduly jeopardize safety and mission assurance. Second, NASA puts both schedule and safety at risk if constant commitment to the goal — including necessary resources — is not maintained. Third, it is recognized that human space exploration is inherently hazardous, so "safety" needs to be understood as a relative concept in a balanced risk-benefit judgment. And, finally, there is no one way to achieve success and safety, so NASA needs to remain open to, and embrace, new approaches in their efforts, while not sacrificing the underlying foundations of sound program management and execution.

Dr. Sanders adjourned the meeting at 12:15 p.m.

ASAP RECOMMENDATION, FOURTH QUARTER 2019

2019-04-01 Required Safety and Mission Assurance (S&MA) Technical Excellence Program (STEP) Training for all NASA Personnel [ASAP point of contact: Sandra Magnus]

Finding:
The NASA Safety Center supports the Office of Safety and Mission Assurance (S&MA) in four major areas: mishap investigation, audits and assessments, knowledge management, and technical excellence. In short, the center provides a wide breadth and depth of information, from policy to education, pertaining to maintaining and promoting a safety culture. One of the programs available from the center caught the attention of the Panel, the S&MA Technical Excellence Program or STEP. The STEP is available as online learning, providing continuing education credits designed to teach safety professionals and the overall workforce about system safety. The program has multiple levels, with the Level 1 class specifically targeted to benefit the engineering workforce. Higher levels provide more advanced content for S&MA professionals.

Recommendation:
Given the importance of creating a culture of safety across the NASA workforce, and the availability of a resource to promote that goal, the ASAP would like to recommend that NASA adopt an Agency-wide requirement for all employees to complete the STEP Level 1 training course.

Rationale:
There is no requirement across the Agency for the workforce to take the training. The SM&A professionals are only "encouraged" to enroll in the program. With the exception of the Kennedy Space Center, where the STEP Level 1 class is required for all new hires, the general workforce remains largely unaware of the offering.

ATTACHMENT 1

Telecon Attendees:

Due to a technical difficulty experienced during the conference call, the participant data was lost. It was determined that 34 lines were opened, but the names and affiliations of the participants were irretrievable.