

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

November 7, 2023

The Honorable Bill Nelson  
Administrator  
National Aeronautics and Space Administration  
Washington, DC 20546

Dear Senator Nelson:

The Aerospace Safety Advisory Panel (ASAP) held its 2023 Fourth Quarterly Meeting in-person at NASA's John H. Glenn Research Center, October 24-26, 2023. We greatly appreciate the participation and support that were received from NASA's leadership, the subject matter experts, and the support staff.

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

Sincerely,

A handwritten signature in cursive script that reads "Patricia Sanders".

Patricia Sanders

Chair

Enclosure

**AEROSPACE SAFETY ADVISORY PANEL**

Public Meeting  
October 26, 2023  
Hybrid

**2023 Fourth Quarterly Meeting Report**

**ASAP Panel Member Attendees**

Dr. Patricia Sanders, Chair  
Mr. William Bray  
Dr. Amy Donahue  
Lieutenant General Susan J. Helms, USAF (Ret.)  
Mr. Paul S. Hill (*virtual*)  
Mr. Kent Rominger  
Dr. Mark N. Sirangelo  
Mr. David B. West  
Dr. Richard S. Williams, MD, FACS (*virtual*)

**ASAP Staff and Support Personnel Attendees**

Ms. Carol Hamilton, NASA ASAP Executive Director  
Ms. Lisa Hackley, NASA ASAP Administrative Officer  
Ms. Ashley Mae, Tom & Jerry, Inc, Technical Writer

**[Appendix A – Teleconference Attendees](#)**

Ms. Carol Hamilton, Aerospace Safety Advisory Panel (ASAP) Executive Director, called the meeting to order at 2:18 p.m. eastern standard time (EST) and welcomed everyone to the ASAP's Fourth Quarterly Meeting of 2023, held at the National Aeronautics and Space Administration's (NASA) Glenn Research Center. Ms. Hamilton noted that the Federal Registry Notice gave the public the opportunity to send safety-related statements or to make comments prior to the scheduled meeting. It was noted that no such comments or statements had been submitted prior to the meeting, but time would be allocated at the end for public comments.

Dr. Sanders thanked Mr. Jim Kenyon and his personnel at NASA Glenn for hosting the ASAP this week and thanked all the NASA leaders and personnel who took the time to engage in discussion with the Panel during their meeting. She acknowledged how positively impressed the Panel was with the extent to which NASA Glenn has embraced the Agency's strategic vision, mission, and objectives and aligned the Center in support of them.

As NASA continues to undertake a magnitude of highly complex and challenging efforts to further space exploration, the discussions for the Fourth Quarterly were both wide ranging and in-depth. The Panel engaged on the strategic level and reviewed progress on the high-level recommendations the Panel has made on vision, strategy, governance, and program management. The Panel delved into several detailed technical aspects – assessing the status of mitigation and resolution efforts. It was an intense set of discussions on difficult and challenging issues.

The Moon to Mars (M2M) Program was a substantial focus of the discussions – to include both the nearer term efforts associated with Artemis II as well as the more encompassing aspects of architecture and systems engineering and integration.

General Susan Helms led the assessments in this area. The Panel had the opportunity to meet with M2M's new Deputy Program Manager (PM), Ms. Lakiesha Hawkins and the program team. The Panel continues to be pleased with the PM team's stand up of the organization, the progress towards the next Artemis Missions, continued programmatic and technical alignment of the various developments, and the application of good system engineering practices based on first order principles with a focus on risk.

Maturation of the PM Office continues at an impressive pace. One of the most impressive efforts recently implemented is an improved process for risk management in Acquisition Planning and Contract Management, led from the Earth Science Division (ESD) Mission Directorate level, which establishes the relationship of executing programs and projects to the driving goals and objectives. As an example, the Artemis Program Office has added an Element Initiation Review (EIR) Milestone that will provide an entry point for any new architecture element to be accepted into the program. This review will provide an upfront understanding of acquisition strategies, identification of element-need dates for broader system integration, and an identification and understanding of programmatic, technical and safety risks both at an element and broader system integration level upfront and before an acquisition is initiated.

The team also provided a detailed program brief, highlighting key accomplishments since the last ASAP meeting for Artemis II and III mission preparations. As expected, a great deal of work is underway for Artemis II, across the entire stack and ground systems. Artemis I has a few remaining unresolved issues that are being carried forward as risk items for Artemis II, including the heat shield performance. The Artemis Program Office is coming closer to finishing up important testing in support of its root cause analysis effort which will inform the path forward. The Panel will continue to watch these remaining risks to closure. The critical path for the Artemis II schedule to launch is the new crew module and its mating to the service module.

With respect to Artemis III, the forward plan is aligned and focused on understanding risk items and driving them down as the team progresses towards a launch. This technical focus early in the Artemis III mission planning is critically important because of all the technical firsts that will occur on this mission. Focusing on this now will pay dividends in the future so that risks are truly understood, mitigated, and clearly communicated along the way.

It was good to see the M2M team's continued technical focus on these missions founded on engineering rigor, risk identification and management, and disciplined execution. And as a reminder, it is always important to continue to involve and engage the operators, even in the development stages, to best understand and identify operational risks and challenges for these missions. This includes the core operational precepts of appropriate vehicle command and control, comprehensive navigation, and robust communication.

The Panel also noted that the Human Landing System (HLS) is in the critical path of a high risk and complex mission with a lot of "firsts" for Artemis III. While each program element has its

individual risks, the aggregate of risks for Artemis III looks especially daunting. The Panel has asked for an update on the Artemis III mission Concept of Operations (CONOPS), to include the HLS CONOPS, and would like to relook at how the integrated risks are distributed across the objectives of the overall Artemis campaign, to include Artemis IV and beyond.

It was clear throughout the discussions on M2M that the PM and their team have safety and technical risk as an overarching priority. Previously, the Panel heard about how the M2M PM has embedded Independent Review Team (IRT) members, with past relevant experience and knowledge, across various program teams to provide an objective view, encourage knowledge learning from past lessons learned, and provide overall program feedback in near real time rather than waiting for a problem to manifest. The Panel continues to be impressed by the newly established integrated processes to consistently manage risk across the architecture, the programs and projects, the acquisition approaches and the business office functions of budget, funding, information technology (IT), and human resources (HR). The newly established M2M Program office and the ESD Mission Directorate have gone a long way to align to foundational risk management principles to mitigate integrated risks.

The Panel revisited **Recommendation 2021-05-03**:

“NASA should manage Artemis as an integrated program with top-down alignment, and designate a Program Manager endowed with authority, responsibility, and accountability, along with a robust bottom up, collaborative feedback process for both Systems Engineering and Integration (SE&I) and risk management.”

Given that the M2M Program Office has now been formally established, and that broad improvements have been implemented to manage integrated risks across the Artemis campaign with the requisite processes and authorities, the Panel would now like to close this recommendation. There are still some questions related to program risk management that the Panel has, such as those related to the absence of a Prime Integrating Contractor (PIC), but NASA has fulfilled the overall intent of this recommendation, and the Panel is confident that the essential organizational dysfunctions have been corrected.

Dr. Sanders stated that the Panel cannot understate how complex and challenging the M2M effort is with components that include legacy elements originating under a variety of assumptions and decision conditions and components with disparate acquisition strategies as well as international partners. The strides that have been made and are being made to unify and align these components into a cohesive program are truly amazing.

Mr. William Bray summarized the Panel’s views to the ongoing NASA 2040 strategic endeavor. The Panel spent some time with Ms. Casey Swails and her team to discuss their efforts to operationalize the Agency’s published vision and strategy and understand the status of the goals and action plans necessary to achieve it. This initiative has been named NASA 2040. It is important to note that this is not intended to take fifteen years to achieve, rather the NASA 2040 denotation is the Agency’s “North Star” and will drive the identification of the major goals and the necessary muscle movements the Agency needs to take today to achieve that vision of tomorrow.

The last time the Panel was briefed by Ms. Swail's team, during the first Quarterly of 2023, the effort was in the formative stages. Since that time, the NASA 2040 team has made very good progress. They have identified seven distinct, but interdependent workstream areas to focus their efforts which include Mission, Structure, Budget, People, Infrastructure, Technology, and Process. Each workstream has a dedicated team assigned that is composed of NASA Headquarters and Center leadership and subject matter experts (SME), and each is progressing forward along a timeline to deliver recommendations and implementation plans in the next three to nine months, with the Mission and Structure workstreams as the first to report out at the end of this calendar year.

The work to date has established a necessary collaborative environment for strategic agreement, critical thinking, and decision-making for Agency leadership. Moving forward, NASA 2040 can serve as an effective framework to ensure alignment and accountability for execution on the actions to address the challenging and dynamic strategic issues facing the Agency in this rapidly changing space environment, always with safety and risk management implications at the forefront.

Notably, the NASA 2040 effort is directly responsive to the Panel **Recommendation 2021-05-02**, which states in part that NASA should create a forum of Center Directors and other key officials – along the lines of a Board of Directors – that then acts to “identify the strategic risks and obstacles that NASA may encounter in executing its mission, evaluate Agency-level mitigation approaches, and align the efforts of all Centers to ensure desired outcomes.”

The final step the Panel recommended is instilling accountability. As written in the 2022 annual report, “Expect centers to then execute accordingly, bringing exceptions, new information, reclaims, et.al. back to the senior leadership team as a group. Inherent in this are both the formal expectations to execute accordingly and being held formally accountable to do so, from budget submissions to infrastructure and workforce decisions. All of which is intended to pivot the Agency at all levels to the top-down strategy and missions.

In this context, it was clear to the Panel that Ms. Swails and the Agency leadership team are tracking to the NASA 2040 North Star and are having the right discussions within each of these workstream teams. Having seen that, the Panel is now interested in seeing the more specific outcome-based actions as they are delivered by these teams and the associated expected change and initial results that are anticipated in the execution of these actions, and how accountability for follow through and completion of these actions will be assigned and assessed.

NASA 2040 has an ambitious agenda, and it involves direct engagement from several key leaders. Given this, a couple of things for the team to consider going forward to ensure this work is strategically impactful include not letting the process become the product and to focus on results and outcomes; avoiding the bureaucracy and focus on value-added activities; shared agreement on the goals and priorities with accountability to execute them; communication and constancy of purpose by continuing to ensure the entire organization is involved; and documenting and celebrating successes.

The Panel's recommendation to Ms. Swails and her team is to keep pressing. This is good leadership work and will bear fruit with continued Agency leadership attention, focus, and commitment. The Panel looks forward to seeing specific implementation plans and achieved outcomes over the next six months, particularly regarding strategic workforce shaping, infrastructure investment and divestment, and their positive impact to risk management and safety and the overall budget and agency investment priorities.

Dr. Sanders commented that as the Panel assesses the requirement for a continuous presence in lower Earth orbit (LEO), particularly as a fundamental for deep space exploration risk reduction, a close look at the ongoing International Space Station (ISS) as well as plans for transitioning to some projected future commercial platform engendered intense discussions with NASA program personnel and leadership.

Mr. David West addressed the Panel's assessment of the ISS and commercial LEO destinations. The Panel continues to be impressed by how the ISS Program successfully manages and operates the aging ISS in the face of an intense operational tempo, as well as various uncertainties, ongoing concerns, and emerging technical challenges. To address and overcome these issues, among other things, NASA must maintain a constructive and collaborative relationship with Russia.

While on-orbit debris rose to high levels after the November 2021 Russian Anti-Satellite Test (ASAT), leading to a substantial increase in conjunction notifications and a few additional avoidance maneuvers, the ASAT debris spike is mitigating as the measurable pieces left over from the test decay below the ISS operational altitude.

The station follows a highly complex flight plan that tracks the rotation of two international crews, regular spacewalks by members of both crews, utilization of eight different ports, and launches and docking of numerous visiting vehicles. As structured and complex as the flight plan is, it still must maintain some flexibility. For instance, Boeing's Crewed Flight Test (CFT) of the Starliner spacecraft is getting closer, but there is still considerable uncertainty as to exactly when it will occur, and all the interrelated elements of the flight plan must allow for this.

This week, the Panel discussed some of the key technical, schedule, and programmatic challenges with ISS Program personnel. A leakage of air from the Russian PrK service module, first reported over three years ago, is still being monitored and investigated. Leaks appear to have resulted from various cracks in the module's structural shell. Some cracks have been identified and even repaired or patched, but others remain elusive. The leak rate has been reduced to less than one pound (mass) of air per day.

A leak and loss of coolant from a thermal control system on the 68 Soyuz occurred last December, and another coolant leak from a Russian Progress cargo spacecraft occurred in February of this year. These events have resulted in the development of improved response options, crew return contingency procedures, and imagery inspections. Just this month, another coolant leak was discovered, this one from a supplemental radiator on the Russian Multipurpose Laboratory Module (MLM). The Panel will be interested in learning more details as this leak is investigated.

As the ISS continues to age, the proper planning for its end of life is becoming an increasingly critical activity. The Panel first issued a recommendation over ten years ago, involving the need for a planned deorbit capability. More recently, the Panel recommendation evolved to include the need for a fully resourced plan to deliver a United States (US) deorbit vehicle (USDV) that would bring about the controlled re-entry of the ISS. US participation in the ISS is currently confirmed through 20230 and the deorbit plan calls for the USDV to be on orbit and certified by 2029. A request for proposal (RFP) to develop the USDV was released last month, with a contract award expected next Spring. This leaves only five years for successful development and launch of the USDV. While this timeline is challenging enough, a more serious challenge at this point concerns uncertainty over how the USDV will be funded. The Panel feels strongly, and will continue to emphasize, that funding the deorbit vehicle is not optional, and it cannot be delayed; it must be adequately funded in a timely fashion, to provide the means for safely disposing of the ISS. This capability will certainly need to be available according to the planned schedule for ISS deorbit, but it could be needed sooner, if any serious or catastrophic failures occur on station.

The Panel has previously expressed concern over the risk posed by the aging fleet of extravehicular activity (EVA) mobility units, or spacesuits. This week, the Panel learned some details on progress the program has been making to address the issue and reduce the associated risk. The Panel will continue to monitor the issue and provide feedback as developments continue.

Another important aspect of planning for the end of the ISS Program is the transition of the workforce. The ISS Program, which has been around for over twenty-five years, has amassed a large team of personnel with valuable expertise, and NASA will need to carefully plan for transitioning them to other programs when the ISS Program ends.

Perhaps the most far-reaching concern about planning for the end of the ISS Program is the need for timely and assured transition of the capability for living and working in LEO to the commercial LEO destinations. If these new commercial platforms are not complete and operational before the ISS is deorbited, the US will face the loss of its ability to perform vital scientific research in weightless conditions, research essential for minimizing safety risks posed by future space exploration activities and specifically the Artemis Program.

NASA is taking advantage of, and acting as a facilitator for, increasing engagement by private enterprise in space activities. The Agency is actively working on a plan to transition from an owner/operator of an orbiting LEO space laboratory, the ISS, to being a customer for industry led LEO-based space stations.

In the 2022 Annual Report, the Panel noted a series of challenges with the Artemis campaign, including the need for comprehensive and aligned integrated guidance that directs resources and projects in a cohesive manner to manage the overall risk. These challenges include the need for clarity on how important risk management functions are being accomplished, clear governance of an unprecedented mix of acquisition approaches with asynchronous delivery time horizons, and consistent expectations of transparency and data-driven risk discussions. NASA has made substantial, meaningful progress addressing these management challenges for Artemis. The Panel sees a similar set of challenges for the Commercial LEO Program and the transition of the ISS to

Commercial LEO Destinations (CLD). The Panel believes NASA should adopt as concerted an approach here as it has with Artemis, with a clear connection to the Artemis Architecture and LEO's important contribution to the Artemis Mission Campaign.

Through NASA's Commercial LEO Development Program, various partners are designing and will be producing orbiting platforms for the important work of maintaining a human presence in LEO and continuing scientific research in weightless conditions. The current industry partners in this program are Blue Origin, Nanoracks, and Axiom Space. Until recently, there was a fourth main partner; however, that company, Northrop Grumman, has requested to terminate its funded Space Act Agreement and will participate on the Nanoracks team going forward. While Blue Origin and Nanoracks are developing commercial destination free flyers (CDFFs), Axiom's design is for a station that will initially be attached to the ISS, until the point at which the ISS reaches its end of life and needs to be de-orbited.

NASA's current plan for transitioning from ISS to one or more commercial destinations features a high-level framework and a timeline that is very tight. According to this timeline, Axiom Space's design for its Commercial Destination for ISS (CDISS) will be maturing by the end of 2025 so that it can be in orbit and certified with some minimum research capability by 2029. That same year, there will need to be a USDV on orbit and certified, to safely achieve the controlled deorbit of the ISS by 2031. The Panel, being watchful of this extremely tight schedule, remains concerned that there is not a clear, robust business case for commercial LEO, nor clear evidence of the financial viability of the CDISS and free-flyer destinations, creating programmatic and safety risk with the entire plan for NASA LEO.

Managing and understanding integrated risk across the complex transition from ISS to CLD is challenging and requires a clear rationale, a strong business case, and a viable, executable plan. In the 2022 Annual Report, the Panel noted that the transition to a commercially owned and operated destination raises many fundamental strategic, technical, and operational questions. Specifically, NASA should ask and answer the following questions: What are the US Government's desired goals and objectives in LEO? Are NASA's goals and objectives dependent on the development of a non-government-driven LEO market? If so, how big is this market, how much is the US willing to invest to get it, and who is responsible for developing that market? Who is responsible for defining and certifying that commercially owned and operated orbiting facilities are safe? What is the acquisition or investment approach that will allow the Agency to understand the risk they are accepting? How will the Agency address shared risks between the government and industry? And what will be the role of NASA's workforce in LEO operations in the future and what skill sets are needed?

If this program fails, NASA would be facing two very undesirable options: either extending ISS further or abandoning LEO. Abandoning LEO has significant implications for NASA's ability to manage risk in the M2M Program, which is perhaps the most compelling reason a viable CLD is vital. Specifically, the LEO environment allows the M2M Program to train crew, test equipment, investigate the operational and environmental implications of decisions, and engage in other testing and training to mitigate risk.



As stated in 2022, “the Panel believes that NASA’s activities in LEO can benefit from a similar approach in strategically outlining architecture, requirements, SE&I, and integrated schedule and program management as that being applied to the Artemis campaign.” The general timelines presented to the Panel this week are a start, but the Panel sees a critical need to make the following formal recommendation:

“NASA should develop a comprehensive understanding of the resources and timelines of the ISS-to-Commercial lower Earth orbit transition plan to a much higher level of fidelity, to provide confidence that the Nation will be able to sustain a continuous human presence in lower Earth orbit. The plan should be grounded in explicit, defensible assumptions and should include quantifiable metrics and progress deadlines for ensuring that the market for commercial lower Earth orbit activities exists and is sufficient to support the development, production, and operation of one or more commercial platforms to replace the ISS.”

The Panel’s basis for this recommendation includes the following key factors. First, the ISS will not be able to remain on orbit indefinitely. Second, if a CLD is not on orbit and certified before the ISS is de-orbited, the US will experience a loss of the ability to continue LEO-based scientific research vital to the management of risk inherent in the M2M Program. And finally, without assured revenue from a reliable customer base, a CLD will be economically unviable and will not succeed in the timeframe necessary.

Mr. Kent Rominger summarized the Panel’s assessments of the Commercial Crew Program (CCP). Fourth quarter accomplishments for SpaceX include the launch and docking of Crew-7 and the successful handover from the off-going crew. Crew-6 spent 186 days docked to the ISS and returned to Earth on Dragon Endeavour on its fourth flight to date. The high tempo of SpaceX flight operations and the reuse of vehicles and components is something that NASA continues to monitor. The Panel encourages this continued level of involvement from NASA to ensure the safe implementation of these unforgiving human spaceflight operations.

NASA is continuing to work with SpaceX to prevent and mitigate valve corrosion on reused Dragons. The cause of the corrosion is well understood after fleet inspections, testing and analysis. Prior to the Crew-7 launch, SpaceX replaced and/or remediated various valves and valve components within the Dragon propellant system. NASA is working with SpaceX ahead of the Crew-8 mission to perform propellant system inspections and evaluate potential valve corrosion mitigations. The CCP is working closely with ISS and SpaceX to establish a cargo and backup crew launch capability at the Space Launch Complex 40 (SLC-40) for Dragon. This redundancy will be critical to mitigate potential schedule risks to NASA crewed and cargo launches off Launch Complex 39A (LC-39A). SpaceX is on course and has installed the crew access tower for future crewed flights from SLC-40.

Boeing is making headway with the Starliner issues that were highlighted in the last ASAP public meeting. Assuming that overall risk can be appropriately characterized and managed, the Panel believes that it is important for NASA to have two crew providers and is pleased by the progress made within the last three months. The NASA CCP and crew office were complimentary of Boeing’s cooperativeness and responsiveness working through these issues. The program is making good progress on the P-213LW tape flammability issue as the P213 tape removal in the

upper dome of the Starliner crew compartment is complete. Work is underway to complete the removal and/or remediation of the tape in the lower dome and is expected to be completed in the next several weeks. After the P213 tape remediation efforts conclude, NASA engineers will conduct final assessments to ensure that the risk of flying with any remaining tape is acceptable.

The new Boeing Crew Space Transportation (CST)-100's parachutes will incorporate planned strengthening of the main canopy suspension lines and a redesign of the drogue and main parachute soft-link joints, which will increase the safety factor for the system. Preparations are underway for an upcoming drop test of Starliner's upgraded drogue and main parachutes. The astronaut office was appreciative of the backup entry improvements that Boeing added to Starliner for the CFT mission, and the Panel acknowledges that this a good safety improvement. NASA and Boeing are working through the long-term Starliner battery redesign plan. Recent cell testing has been positive and gives the team more confidence in the path forward. Additional testing is planned to test the whole integrated battery system. The CFT batteries have been approved for flight and mitigations are being worked on for the Starliner-1 mission that will go through the board process when ready.

The Panel was, overall, pleased to see that the independent program reviews that both NASA and Boeing conducted last quarter continued in greater depth this quarter. The Panel applauds NASA and Boeing for continuing to implement systems modifications and improvements ahead of the Starliner-1 crew rotation flight. Examples of this work include suit and seat modifications, Starliner battery redesign, strengthening the landing airbag backing panel to increase operational flexibility on returns and allow for landing in increased winds.

Dr. Mark Sirangelo then discussed the productive and positive briefing from Ms. Karen Feldstein who is the Associate Administrator, Office of International and Interagency Relations (OIIR) regarding the Artemis Accords.

The Artemis Accords are a multilateral, nonbinding, whole-of-government political commitment to advance high-level principles for the peaceful exploration and use of outer space, increase the safety of operations, reduce uncertainty, and promote the sustainable and beneficial use of space for all humankind. The Accords advance principles grounded in the 1967 Outer Space Treaty (OST). The Accords were inspired by the Artemis Program. They were launched in 2020 by eight countries including the US. The Accords are accessible and describe a shared vision for the peaceful exploration and use of outer space. As of this meeting, there are now twenty nine countries that have signed onto the Accords.

The Artemis missions are only some of the lunar exploration missions planned in the coming decades and other countries are also launching their own. There is a need to deconflict those missions and agree on a common set of principles or "rules of the road." With numerous countries and private sector players conducting missions and operations in cislunar space, it is critical to establish a common set of principles to govern the civil exploration and use of outer space.

As this is the first time that the ASAP has addressed the Artemis Accords, the Panel would like to highlight primary components and note that several deal with the ASAP's focus on safety issues

as a prime motivator. As safety is not limited only to NASA, these Accords will enable a broader and more robust international safety culture as well.

International cooperation on Artemis is intended not only to bolster space exploration but to enhance peaceful relationships between nations. Therefore, at the core of the Artemis Accords is the affirmation that all activities should be conducted for peaceful purposes, consistent with the OST. Transparency is a key principle for responsible civil space exploration and the US has always taken care to publicly describe NASA's policies and plans. The Artemis Accords follow this path as signatories are committing to this principle by publicly describing their own policies and plans in a transparent manner.

Interoperability of systems is critical to ensure safe and robust space exploration. Therefore, under the Artemis Accords, signatories commit to use reasonable efforts to utilize open international standards, develop new standards when necessary, and strive to support interoperability to the greatest extent practical. Emergency assistance is a cornerstone of any responsible civil space program. Therefore, the Artemis Accords reaffirm signatories' commitments to the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space. Additionally, under the Accords, the US and signatories commit to taking all reasonable steps possible to render assistance to astronauts in distress.

Registration of space objects is at the very core of creating a safe and sustainable environment in space to conduct public and private activities. Without proper registration, coordination to avoid harmful interference cannot take place. The Accords reinforce the critical nature of registration, and the signatories commit to work out registration of relevant space objects in advance. Release of scientific data is another component. NASA has always been committed to the timely, full, and open sharing of scientific data. Signatories plan to release their scientific data publicly to ensure that the entire world can benefit from the Artemis journey of exploration and discovery. Protecting heritage, historic sites, and artifacts will be just as important in space as it is here on Earth. Signatories will commit to the protection of sites and artifacts with historic value. The ability to extract and utilize space resources on the Moon, Mars, and asteroids will be critical to support safe and sustainable space exploration and development. The Accords reinforce that space resource extraction and utilization can and will be conducted in a manner compliant with the OST.

Avoiding harmful interference is an important principle of the OST which is implemented by the Artemis Accords. Specifically, signatories will determine the area in which harmful interference from an activity can occur. Within that area, referred to as a safety zone, signatories intend to provide public information regarding the location and general nature of their operation and to coordinate with any entity that enters the area to avoid harmful interference. Per the Treaty, free access to all areas of celestial bodies will be maintained while the safety zones will prevent conflict and confusion through transparency and coordination. Orbital debris and spacecraft disposal is an important key principle. Preserving a safe and sustainable environment in space is critical for both public and private activities. Signatories commit to plan for the mitigation of orbital debris, including the safe, timely, and efficient passivation and disposal of spacecraft at the end of their missions.

As a final note, the signatories commit to periodically consult to review the implementation of the principles of the Accords. The Panel will continue to monitor the overall progress of the Accords and report out any significant changes of developments.

Before closing the meeting, Dr. Sanders addressed an additional critically important risk. NASA does not execute its mission in a vacuum. It operates in an environment that is composed of geopolitical and fiscal realities. Focusing right now on the current budget environment, has significant implications which include mission and safety risk. NASA has a very full mission plate. To the extent that their budget request is not fully funded, the leadership will need to make critical decisions. Either program content or schedules will need to be adjusted to meet fiscal realities. Not doing so and attempting to do all planned work on expected timelines, will introduce unacceptable risk. NASA will have to acknowledge and make these difficult choices.

There are a few areas, though, that are not discretionary. The deorbit vehicle for the ISS is not optional. The day will inevitably come when the station is at its end of life, and we may not be able to dictate that date. It is inconceivable to allow the station to deorbit in an uncontrolled manner. The station is simply too massive and would pose an extreme hazard to populations over a broad area of Earth's surface. This needs to be resourced, and resourced now, if NASA is to avert a catastrophe.

Another area that must be resourced as a critical safety need is the restoration of the communications ground station antennas for Tracking and Data Relay Satellite Systems (TDRSS) in Guam that were devastated by Typhoon Mawar last May. These support the ISS, the James Webb Space Telescope, Artemis, and many NASA missions. The destruction resulted in a gap in continuous global coverage creating a "blind spot" over the Indian Ocean and impacts the safe operation of launches and missions.

The Panel is aware that both items have been included appropriately in the disaster relief supplemental and strongly encourage that the requisite resources be provided. The funds in the annual NASA appropriation are not sufficient to meet these needs.

One additional safety risk that is engendered by the current political environment and resulting budget uncertainties is caused by the threat of a government shutdown. It is imperative, in the event of a shutdown, that work continues on the Artemis vehicles, especially Artemis II and III. If this work is interrupted, there will be impacts on vehicle configuration that could adversely affect safety and mission assurance.

Dr. Sanders opened the meeting for public comment. No comments were received.

Dr. Sanders concluded that it cannot be emphasized enough how much complex and challenging work is ongoing within NASA and how much vigilance is required to execute that work safely.

Dr. Sanders adjourned the ASAP Fourth Quarterly meeting of 2023 at 3:08 p.m. EST.

**Appendix A**  
Teleconference Attendees<sup>1</sup>

Adrienne Lewis	<i>GAO</i>	Micah Maidenberg	<i>Wall Street Journal</i>
Alicia McPhail	<i>NASA HQ</i>	Michael Sheetz	<i>CNBC</i>
Allison Wolf	<i>NASA ESDMD Chief of Staff</i>	Michelle Green	<i>NASA</i>
Alotta Taylor	<i>NASA HQ</i>	Miles Doran	<i>CBS News</i>
Amanda Miller	<i>Military.com</i>	Misty Snopkowski	<i>NASA</i>
Ashley Wilkins	<i>Health Science Committee</i>	Noelle Zeitsman	<i>Boeing Contractor</i>
Brian Dewherst	<i>NASA HQs USBNB</i>	Rachel Kraft	<i>NASA Communications</i>
Carrie Rogers	<i>GAO</i>	Rebecca Regan	<i>Boeing</i>
Catherine Williams	<i>Boeing</i>	Stephanie Schierholz	<i>NASA</i>
Chris Davenport	<i>The Washington Post</i>	Sylvie Espinasse	<i>European Agency</i>
Danny Lentz	<i>Nasaspaceflight.com</i>	Theodore Kronmiller	<i>Law Office</i>
David Gallus	<i>Unaffiliated</i>	Tim Gallus	
David Millman		Veronica Mills	<i>NASA</i>
Diedra Cutty	<i>Boeing</i>	Veronike Fuhrmann	<i>European Space Agency</i>
Donald Wood	<i>NASA</i>	Unnamed	<i>GAO</i>
Eric Berger	<i>Ars Technica</i>	Unnamed	<i>NASA Communications</i>
Erin Mahoney	<i>NASA</i>		
Gene Mikulka	<i>Talking Space</i>		
Heather Scott	<i>NASA</i>		
Ingrid Morales	<i>Boeing</i>		
Isidro Reyna	<i>NASA</i>		
Jeff Foust	<i>Space News</i>		
Jena Garrahy	<i>NASA HQ</i>		
Jessica Lund	<i>NASA</i>		
John Armstrong	<i>GAO</i>		
Karl Becker	<i>NASA</i>		
Kathryn Hambleton	<i>NASA</i>		
Lana Burlison	<i>GAO</i>		
Laura			
Lewis Groswald	<i>Lockheed Martin</i>		
Linda Karanian	<i>Karanian Aerospace Consulting</i>		
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Loren Grush	<i>Bloomberg</i>		
Marcia Smith	<i>Spacepolicyonline.com</i>		
Mark Nappi	<i>Boeing</i>		

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<sup>1</sup> The names and affiliations are as given by the attendees, and/or as recorded by the teleconference operator.