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

August 12, 2016

Mr. Charles F. Bolden, Jr.
Administrator
National Aeronautics and Space Administration
Washington, DC 20546

Dear Mr. Bolden:

The Aerospace Safety Advisory Panel (ASAP) held its 2016 Third Quarterly Meeting at NASA Headquarters, Washington, DC, on July 19-21, 2016. We greatly appreciate the participation and support that was received from the subject matter experts and support staff.

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

Sincerely,

Patricia Sanders

Patricia Sanders
Chair

Enclosure

ASAP AEROSPACE SAFETY ADVISORY PANEL
Public Meeting
July 21, 2016
NASA Headquarters
Washington, DC

2016 Third Quarterly Meeting Report

Aerospace Safety Advisory Panel (ASAP) Attendees
Dr. Patricia Sanders
Lt Gen (Ret) Susan Helms
Dr. James Bagian
Dr. Donald McErlean
CAPT (Ret.) Brent Jett
Dr. George Nield
CAPT (Ret.) Robert Conway
VADM (Ret.) Joseph Dyer

ASAP Staff and Support Personnel Attendees
Ms. Carol Hamilton, NASA ASAP Executive Director
Ms. Marian Norris, NASA ASAP Administrative Officer
Ms. Paula Burnett Frankel, Writer/Editor

Other Attendees:
Joseph Kelly, NHTSA
Pamela Whitney, House Committee on Science, Space and Technology
Allen Li, House Committee on Science, Space and Technology

Telecon Attendees:

Carlos Sampaio	NASA/JSC
Curt Weiderhoeft	NASA/JSC
Linda Karanian	Karanian Consulting
Sam Black	OMB
Sean Pitt	SpaceX
Kristin Van Wychen	GAO

Opening Remarks
Ms. Carol Hamilton, Aerospace Safety Advisory Panel (ASAP) Executive Director, called the public meeting to order at 10:15 a.m. She noted that no written public comments were received prior to the meeting, but that there would be an opportunity for comments at the end.

VADM Joseph Dyer, ASAP Chair, welcomed everyone to the quarterly meeting. He noted that Mr. John Frost was absent from this meeting due to a scheduling conflict. Some recent personnel changes on the Panel were noted. CAPT Robert Conway will be leaving the ASAP as he takes up additional responsibilities at his job as the Manager of Quality Engineering, Worldwide Safety and Assurance at Walt Disney World Resort. VADM Dyer noted that CAPT Conway has been a real contributor across the board, but especially with regard to flight test safety and NASA aircraft operations at the flying Centers. He thanked him for his years of contribution to the Panel. He introduced a new member—Lt Gen Susan Helms, independent consultant, former astronaut, former Commander of the 14th Air Force at Air Force Space Command, previous positions at U.S. Strategic Command and others, and a total of 211 days in space—and remarked that she brings a warm and thoughtful presence to the Panel as well as an "I've been there and done that" perspective. VADM Dyer announced that he would be leaving the Panel after this meeting. He stated that it has been his honor and privilege to lead the ASAP since 2003. Looking back over those years, he noted that he started just before the Space Shuttle return to flight following the Columbia accident. He has seen the completion of the International Space Station (ISS) and the development of commercial space. At this meeting, he noticed the re-emergence of NASA aeronautics and the

initiation of X-planes. Aeronautics is critically important not only to NASA safety, the military, and the public, but it is also critically important to the Nation's economy and technical aerospace leadership.

VADM Dyer announced that Dr. Patricia Sanders had been unanimously elected by Panel members to be the next Chair. He briefly reviewed her background and emphasized why he believes she is the right person at the right time. Dr. Sanders is currently an independent consultant and has a background of 34 years with the Department of Defense (DoD). Her last position in DoD was as Executive Director of the Missile Defense Agency. She has a long and storied history in analysis, test and evaluation. Dr. Sanders is an American Institute of Aeronautics and Astronautics (AIAA) fellow and is one of the few people who has three Presidential-rank awards.

Dr. Sanders chaired the remainder of the meeting. She remarked that none of the current Panel members have ever known the Panel without VADM Dyer, who has served for 13 years. The Panel has a reputation of professionalism that has been largely shaped by his leadership. Because of that leadership, as well as the quality and professionalism of the entire team, VADM Dyer leaves an important legacy of contribution to NASA. Dr. Sanders thanked NASA Headquarters for its hospitality as well as the depth and quality of two days of insight meetings. The Panel is continuing its focus on risks, management of risks, and the safety implications of those. There are a couple of emerging focus areas within that context: movement to operations and maintenance at a time and space different from that of the Space Shuttle era, and addressing cyber security issues within NASA. The Panel is looking for a cohesive, enterprise-wide approach to addressing the cyber security risk area, something beyond corporate Information Technology (IT) that is integral to mission operations.

Exploration Systems Development (ESD)

Dr. George Nield reported on a number of presentations that the Panel heard relating to ESD. The first was from Mr. Bill Hill, Deputy Associate Administrator for ESD, who provided a list of top concerns, including integrated avionics and software verification and validation (V&V); V&V in general; the budget (specifically, out-year funding uncertainty); the mobile launcher and outfitting; completion of the European Service Module (SM) for Orion; some of the Space Launch System (SLS) welding operations in the Vertical Assembly Center (VAC); long term sustainability in terms of production and operations sustainability at a planned flight rate of one flight per year; and Exploration Mission (EM)-2 mission planning, where the specific tests planned for that mission deliberately have not been identified. The Panel heard from Mr. George Gafka, ESD Chief of Safety and Mission Assurance (SMA) and Mr. Jeff Williams, who talked about the Cross Program Integrated Hazard Analysis (CPIHA). Two hundred seventy potential hazardous conditions have been identified, and those have been organized further for analysis and for potential mitigation action. That identification and organization has resulted in 75 integrated hazardous conditions being worked. Some of highest risk causes include the possibility of bird strike during ascent and external hydrogen at the pad due to failure to burn off sufficient hydrogen following an on-pad shutdown. The Panel also heard from Ms. Jennifer Franzo, the ESD SMA person, who identified some of the elevated program-only hazard causes. To NASA, "elevated" means, in the 5x5 hazard matrix that looks at the likelihood and severity of something happening, a zone 4 or a zone 3. A zone 4 is something that has a very high likelihood and a catastrophic severity. Zone 3 is something that has a combination of likelihood and severity ranging from very high likelihood with a severe outcome to a moderate likelihood with a catastrophic outcome. Currently, there is one hazard that has been identified as a 4x5 in the matrix, 33 hazards in the mid-area, and 4 that have not yet been categorized in terms of likelihood but are considered to be potentially catastrophic. That sounds arresting, but the Panel appreciates that the Program is doing some excellent work in identifying hazards, the likelihood that they are to happen, and the steps that can be taken to address those hazards. Overall, NASA's progress on ESD is best represented by work that is not necessarily visible to the public. A considerable amount of hardware has been built and is being integrated and tested and many analyses are

being conducted. All of this is leading to a potential EM-1 launch availability window of September through November 2018.

Strategic Planning and Transition

CAPT Conway thanked the Panel for the opportunity to serve on the Panel and expressed his appreciation to all of the members. The Panel learned about how the transition process would work from Mr. Tom Cremins, Associate Administrator for Strategy and Plans. The process involves an effort, championed by Mr. Robert Lightfoot, that NASA is conducting to survey the external environment and merge it with Agency-level guidance to achieve better mission alignment and coordination of effort and constancy of purpose. The Panel has recognized the need for constancy of purpose in its prior annual reports, and it was one of the themes in the 2015 Annual Report. A few issues noted were: inefficient redundancy of efforts, intentional or unintentional messages being sent both internally and externally to the Agency, restarting of programs due to Presidential Administration changes, etc.

CAPT Conway cited an excerpt from the introduction to the ASAP's 2015 report: "NASA faces another challenge that has historically led to disruption and inefficiency and arguably has impact on safety and good systems engineering. This is the challenge of starting over with new programs and directions following Administration change. As in prior reports, the ASAP urges constancy of purpose. Failing to stay the course with current programs of record will make it an even longer, costlier, and potentially less safe trip to Mars." He noted that this has been weighing heavily on the Panel members' minds for some time. What the ASAP heard at this meeting was a positive effort to take steps in the right direction to make a more cohesive organization for constancy of purpose.

As Mr. Cremins described, the external environment merging with Agency-level guidance to achieve better mission alignment (e.g., the Mars mission) will feed into the architecture of the project or program and help shape the acquisition environment, which in turn will show the need to partner with commercial and international partners as well as traditional Centers and their roles. This will help determine capabilities and leads at the Centers and help prevent unnecessary redundancy of capabilities. Ultimately, the objective is to acquire an informed workforce planning structure. Significant benefits come from identifying and coordinating efforts. The coming Administration transition is helping to provide momentum for this process as it moves forward. As this process gets its footing and matures, a by-product will provide a very proactive message to the incoming Administration. The intent of the transition process is to provide briefings that present and frame NASA to the new Administration, to form relationships with people in the new Administration, and to discuss interests and objectives. Referring to the Panel's emphasis on constancy of purpose, Mr. Cremins indicated that the strategic planning initiative is a large part of this. The objective is to present current vision and course and how it ties to the current Administration goals as well as how it can tie into the next Administration's goals. NASA is taking a comprehensive look at what is going on and how it can better organize to ensure "one voice."

Top level focus is on: the value proposition of exploration and science, global and national security, global vitality, and social challenges such as climate issues. The NASA team is also looking at notional layouts and sensitivities to change in those layouts. The process is in its beginning stages, but the intent is to provide a robust message based on the foundation of knowledge and one voice from NASA, rather than multiple voices. As the team presents these messages, they will be focusing on previous experience and integrated strategy, not just hardware, but how it ties to strategy and how to communicate this—not to convey the transitions team's perception of change as an existential crisis, but rather to communicate effectively the benefits and costs of any deviation from the current path. Mr. Cremins noted that the bottom line is to be prepared for the questions as much as possible, rather than being reactive or unprepared.

CAPT Conway stated that the Panel commends this initiative; it is what the ASAP has been looking for for some time. It is a step in the right direction to make a stronger, more effective, more cohesive organization, which makes for a better and safer organization for exploration.

Dr. James Bagian noted that while this is a transition effort, it is not just for that purpose. It is a continuation of what the Panel had heard from Mr. Lightfoot and Ms. Lesa Roe previously. During the discussion, the Panel asked specifically whether it would be a tool for both internal and external communications. The transition is a motivation to get something done in near future, but also to continue to use on an ongoing basis.

International Space Station (ISS)

CAPT Brent Jett and Lt Gen Susan Helms discussed the report on the ISS. Dr. Sanders noted that for some time, CAPT Jett has been recused from participating in the Panel's discussions on the Commercial Crew Program (CCP). His potential conflict has been eliminated, and he is now fully participating in all aspects of the discussions.

CAPT Jett reported that Mr. Joel Montalbano, one of the Deputy Program Managers for the ISS, led a discussion on current status, future plans, and some of the challenges. The current six-person crew is Expedition 48, which has three Russian cosmonauts, two U.S. astronauts, and one Japanese Space Agency (JAXA) astronaut. Mr. Montalbano reviewed the flight plan for the increment, focusing on the visiting vehicles that will be arriving and departing and the two upcoming U.S. extravehicular activities (EVAs). The first EVA will install a docking adapter (recently delivered by the SpaceX cargo Dragon) for commercial crew vehicles. The second will stow a thermal radiator that is no longer needed. Time permitting, both EVAs will also incorporate a series of other tasks from a "get-ahead" list that the Program maintains.

The Panel heard a detailed discussion on the two EVA terminations due to water in the helmets (EVA 23 in 2013 and EVA 35 in 2016) and the bigger picture implications of the aging EVA suit. The question in the mind of the Panel was: How is the ISS Program going to ensure that it has a safe and reliable EVA suit through the end of the ISS life – whether that is in 2024 or 2028? In its review, the Panel found that NASA had learned valuable lessons from these incidents and, as one might expect, NASA has a certification extension effort in place for the EVA suit and continues to replace and upgrade various components. It is a challenging problem, because the suit was not designed for the type of "on-orbit maintenance" that is required in the current ISS era of long duration spaceflight. CAPT Jett noted that it was his personal observation that the ISS Program appears to be working through these challenges in a deliberate and thoughtful manner. He opened the floor to other panel members to add their thoughts.

Dr. McErlean commented that one of the positive aspects that the Panel observed was that for the second EVA, part of the difficulty was traced to water quality in terms of cleaning various components at Johnson Space Center (JSC). There ensued a very intensive effort to drive that problem to ground. What was really encouraging was Mr. Gerstenmaier's charge to the team to look at what else could give the same difficulty. They have opened investigations related to supply of oxygen, supply of nitrogen, etc. While this may not have direct bearing on the water-in-the-suit issue, it goes to the question of the change in operations. One of the difficulties was the change from a suit that was maintained after only six days of service and came to ground (during Shuttle era) to a suit that may sit on orbit for six months. They are looking at other issues that might arise from having suits on orbit for an extended period of time. Dr. McErlean noted that this is exactly the kind of "look ahead" thinking that the Panel appreciates and applauds.

CAPT Jett agreed. When NASA develops the exploration suits, the Panel is confident that they will have in-space maintainability as one of the driving requirements.

As customary at the ASAP quarterlies, the Panel spent some time reviewing the ISS research statistics with Mr. Montalbano. Something new to the Panel at this meeting was the fact that Russian crew members are now contributing to U.S. science and utilization. This is a good first step, and the ASAP applauds the Program. To encourage commercial utilization of ISS, NASA is expediting the process to get payloads to station, primarily by eliminating many requirements related to the "mission success" of the actual experiment. "Safe to the station," "safe to the crew," and "move at the speed of business instead of the speed of government" were the mantras expressed by Mr. Montalbano. Also, the Program has instituted a tier rating for payload customers that even further streamlines the process for customers who have previous experience putting payloads on Station.

The Panel reviewed the current vehicle issues, two of which dealt with urine processing and water recovery. Water is a critical commodity on station and these issues are receiving the appropriate Program attention. The ASAP also learned more about how the ISS will test the future CO2 removal systems that will be required for exploration to Mars.

The Panel completed the ISS review with some questions concerning ISS planning for End of Life (EOL) and contingency deorbit, for which the highest probability scenario is depressurization due to micrometeoroid and orbital debris (MMOD) strike, which causes the crew to abandon the station. The Panel is pleased to note that the Program continues to make progress in this area, but there is still forward work to be done.

Dr. Bagian emphasized that the point of streamlining is to encourage more commercial users. The Panel would like to hear more about some of the details, such as how they give a user approval to use the streamlined procedures, and to understand more about quality assurance. However, this approach is definitely a step in right direction. Another subject that has been in the news is the Bigelow Expandable Activity Module (BEAM). It was installed since the last ASAP meeting, and it will be interesting to see how that structure operates over the next two years.

With regard to EOL, CAPT Jett added that NASA has been making progress. He noted that the Panel posed the question: If something happened tomorrow, the crew had to abandon the ISS, and NASA had to deorbit within 180 days, would they feel like the work that they have done to date would enable them to complete all the future work and still meet the deadline? The answer was yes. Dr. Bagian agreed that they presented a good account about how they have moved forward. The open actions are being closed out and they are making good progress since the last time this topic was discussed.

Lt Gen Helms added that it was gratifying to hear Mr. Gerstenmaier talk about the Station's life support technologies along with recognition that the way maintenance is done today on Station is not the way the life support technologies are being designed for exploration. There are no good resupply options for an exploration mission. Lt. Gen Helms applauded that forward looking strategy and the thought process in the team. Dr. McErlean emphasized what CAPT Jett said about the rules governing payloads to ISS. In order to encourage commercial use of the Station, NASA has revisited its rules for payloads. There has been a philosophical shift: NASA's role is to protect the Station and the crew. If there is a rule in the payload approach process that is directed at ensuring experiment success, NASA may not need that rule. As long as a commercial user's experiment is safe for the Station and crew, whether or not it succeeds is the user's business. This new approach is an interesting shift and should help expedite the process and improve the commercial utilization of ISS.

Commercial Crew Program (CCP)

Dr. Sanders noted that the ASAP again had a very open and candid interaction with the Commercial Crew Program. Dr. McErlean and Dr. Bagian reviewed what the Panel learned from the CCP presentations and

discussions. Dr. McErlean reiterated Dr. Sanders' comments. The CCP continues on a trend that the Panel appreciates. Ms. Kathy Lueders, CCP Program Manager, demonstrates exceptional leadership and transparency and willingness to discuss all the issues in the Program. The Panel looked at the overall program schedule for both of the principal providers as well as the Program milestones. It is very clear that progress is being made. Both providers are working to the schedule, which is challenging. The next year or so will be a defining moment—the Program is about to enter the hardware testing phase. At this point, the providers are tracking to schedule and making significant progress. Besides the two well-known providers—Space X and Boeing—there are two relatively new, unfunded Space Act Agreements (SAAs). One is with Blue Origin. They are working with NASA to develop their own rocket and, with ULA, a rocket engine. A technical interchange meeting with NASA is scheduled for this summer. The second SAA is with Sierra Nevada Corp. (SNC). SNC continues to develop their orbital vehicle and to work on flying qualities and stability and control, and has done considerable wind tunnel work. They are looking forward to an orbital capable pressure test that will be done at Lockheed Martin.

Ms. Lueders reviewed the top programmatic risks. The first is what is currently labeled "requirements changes." Both of the commercial manufacturers have proposed to NASA certain changes in standards and policies. NASA must review these and determine whether these alternate standards meet NASA requirements or not. This is a continuing process. The other effort is involved with closing the Loss of Crew (LOC) gap between what the Program goal is and what the current analysis indicates that the systems will achieve. The primary threat to both vehicles is MMOD damage for the long-duration time in orbit. The MMOD damage analysis depends on the modeling of the environment, which is in many aspects speculative and quite robust. There are discussions regarding gathering additional historical information to determine if the environmental model is perhaps too robust. All answers are yet to be determined. The Program is moving ahead in other areas as well. Ground and mission operations teams are working the Search and Rescue (SAR) posture. The Program has been working with the Navy SAR people to put together high-fidelity simulators to train rescue personnel in egress under various conditions. They are also working to provide those simulators to the typical SAR organizations so that they can continue this training. The primary Program safety risk is continued effort analysis and design changes to meet the LOC goal. That activity is ongoing with both suppliers. Dr. Bagian added an amendment to Dr. McErlean's comments on SAR—NASA is working with the Air Force on rescue.

Dr. Bagian reported on some of the accomplishments thus far. He concurred with Dr. McErlean's comments regarding Ms. Lueder's openness and transparency throughout her entire tenure. Many of things that the Panel heard were "Sensitive But Unclassified" (SBU), and they were limited to what could be discussed in a public meeting. Dr. Bagian summarized the Boeing status. The crew module, Starliner, is in firm configuration and Boeing is currently working off some of the issues involving non-linear dynamic acoustics and loads on the stack. With regard to demonstration and test, they have been doing water landing, qualification, and test at Langley, and a number of simulations on the console for pre-launch, ascent, and recovery. They have done acceptance testing on trainers at JSC. They have also been doing land landing qualification tests at Langley. Parachute qualification testing will begin in August. The service module has been shipped to Huntington Beach and the crew module shipment is targeted for August. Other hardware deliveries are taking place at Kennedy Space Center (KSC) in the coming weeks. About 40 percent of the components will be in qualification testing within the next 60 days. With regard to facilities, they have cut the ribbon for the Space Training Analysis and Review (STAR) Facility in Houston. The crew cargo processing facility (high bay) at KSC is complete and the hazardous processing facility is underway. With respect to SpaceX, their certification plan has been approved. They have had 20 verification events delivered and two have been fully approved. Twelve alternate standards have been submitted and approved. SpaceX has completed the delta CDR for the spacesuit and trunk. Many other delta CDR packages have been delivered and reviewed, and others are on track for delivery. They are about 50 percent through design reviews for crew interfaces. NASA continues to work with SpaceX as they look at the actual Falcon 9 crew configuration. They have completed six full thrust tests with "load and go" operations with

densified propellant. All three demonstration flights needed for range approval have been completed. They have continued to go ahead with the Dragon pressure vessel weld and Environmental Control and Life Support Systems (ECLSS) testing. Everything else is moving ahead, but all the schedules are very success-oriented. This is new work for both Boeing and SpaceX, and the schedules may not hold. There are no specific schedule concerns at this time, but a lot of work is still ahead.

CAPT Jett concurred with the comments about Ms. Lueders. He noted that when he left the CCP in 2013, he recommended Ms. Lueders as his replacement, and she has been doing an outstanding job.

Dr. McErlean added that there may be a public perception that not much is happening, which is unfortunate. All of the suppliers in the CCP and the SLS are on the cusp of a number of very visible actions. It has taken a period of time for hardware to be designed, built, component tested, and risk analysis to be done. Now, all of these programs are on the verge of huge testing and demonstration activities. Over the next 16 to 18 months, the public will see a lot of things happening. The unfortunate part of development programs is that it takes a significant period of time, particularly for things this complex, to get to point of large scale testing and demonstration. Dr. Sanders added that NASA and the contractors are entering the next difficult part of their programs.

Aeronautics and Aviation

Dr. Sanders noted that the aeronautics and aviation part of NASA's portfolio has not received as much attention for the last several years, but it is very important to the future. CAPT Jett reported on what the Panel learned from Mr. Jaiwon Shin, the NASA Associate Administrator for Aeronautics. Mr. Shin covered a variety of topics, including global trends in aviation, the NASA Aeronautics long term strategy, and the New Aviation Horizons Initiative. In terms of the global growth in aviation over the next 20 years, Mr. Shin provided the following projections: global air passengers will increase from 3.3 billion (B) to 7B, 58 million (M) current jobs will increase to 105M jobs, and over 36,000 new aircraft will be required. If one looks at where the air travel will occur by global region, there will be a continued shift towards the Asia-Pacific region, which by 2034 will have 40 percent of the passenger trips while North America and Europe combined will have 40 percent. These are compelling statistics that provide the foundation for why NASA is investing in aeronautics.

The NASA Aeronautics Directorate has six Strategic Thrusts with the ultimate goal of enabling the U.S. to be the world leader in aviation and aeronautics:

1. Safe Efficient Growth in Global Operations
2. Innovation in Commercial Supersonic Aircraft
3. Ultra-Efficient Commercial Vehicles
4. Transition to Low Carbon Propulsion
5. Real-Time System-Wide Safety Assurance
6. Assured Autonomy for Aviation Transformation

Mr. Shin discussed the details of the recently completed "Environmentally Responsible Aviation" (ERA) Project. This project, which was a tremendous success, was a partnership with industry that used a Boeing 757 to test technologies that would reduce fuel consumption. The Project was completed in 2015. The technologies tested and proven, if implemented, have the potential to save billions of gallons of jet fuel usage. By 2050, the projections could be as much as $5B to $10B saved.

In terms of planning for the future, NASA Aeronautics has a strategic and budget plan that has a 10-year horizon. One of the most exciting endeavors is the New Aviation Horizons Initiative, which is the proposed development and test of five new flight technology demonstration aircraft – often referred to as X planes. The first of those

demonstrators is the low boom flight demonstrator, which is an important capability to enable supersonic flight over the populated areas. NASA has already been working with industry on the preliminary design and they hope to begin final design and build in Fiscal Year (FY)17, with flight test in FY20. The other proposed technologies to be demonstrated focus on hybrid electric propulsion, hybrid wing body designs, propulsion airframe integration, and very-high-aspect ratio wings in addition to ultra-high bypass engines and new materials and structures concepts. All of these are very exciting concepts.

CAPT Jett concluded by commenting that this is the start of a new era for NASA Aeronautics. Investments in NASA's cutting edge aeronautical research today are investments in a cleaner, safer, quieter, and faster tomorrow for American aviation. The Panel is very pleased to see this emphasis on aeronautics. It is a tribute to the Administrator's leadership that this is now in NASA's budget plan.

Dr. McErlean remarked that as someone who has spent the last 45 years in engineering for airplanes, he was very pleased to see the emphasis on the enabling tools and technologies. The fundamental tools for the design and development of aircraft have come out of NASA. The entire industry uses things such as NASTRAN. NASA has had and continues to have the opportunity to impact every manufacturer in this industry. This has had extraordinary impact that may not be visible to the general public.

There were no further questions or comments.

Dr. Sanders noted that it is clear that NASA is on the verge of a lot of activity that is very critical to the success of the programs it has undertaken. It underscores the difficulty of what they are doing, but the immense potential for value to Nation. It also speaks to need for constancy of purpose. Dr. Sanders thanked everyone on the Panel, and especially VADM Dyer for his 13 years of service on the ASAP.

Dr. Sanders adjourned meeting at 11:15 am.