



NASA Advisory Council (NAC) Aeronautics Committee

February 28–March 1, 2013
NASA Headquarters, Washington, DC
Aeronautics Research Mission Directorate (ARMD)

Meeting Minutes

Participants:

First	Last	Organization	Role
Marion	Blakey	AIA	Chair
John	Borghese	Rockwell Collins	Member
Mark	Anderson	Boeing Phantom Works	Member
Mike	Bragg	University of Illinois	Member
J.P.	Clarke	Georgia Tech	Member
Mike	Francis	UTRC	Member
Ilan	Kroo	Stanford University	Member
John	Langford	Aurora Flight Sciences	Member
Mark	Pearson <small>[PHONE]</small>	GE Aviation	Member
Tom	Wood	Bell Helicopter	Member
Michael	Maloney	Nat. Research Council	Observer
Jaiwon	Shin	NASA	NASA AA
Tom	Irvine	NASA	Deputy AA
Susan	Minor	NASA	Exec. Secretary
Diane	Brown	NASA	Dir. Resources
Robert	Pearce	NASA	Dir. Strategy
Ed	Waggoner	NASA	ISRP Director
Jay	Dryer	NASA	FAP Director
Doug	Rohn	NASA	AvSP Director
Jon	Montgomery	NASA	Integration Director
Cathy	Bahm	NASA	ISRP Dep. Director
Lee	Olsen	NASA	FAA Liaison
George	Finelli	NASA	Langley RCenter
Alan	Angleman	Nat. Research Council	Observer
Waseem	Naqvi	Raytheon	Observer
Fred	McKee		Observer

February 28, 2013

The meeting was called to order at 9:15 a.m. by chair Marion Blakey.

ARMD Budget Status by Jaiwon Shin

Dr. Shin welcomed members and said the Fiscal Year (FY) 2013 budget has been submitted to Congress, and includes a reduction to \$544 million from \$551 million: a \$7.3 million decrease from the request level. NASA does not intend to furlough civil servants. Diane Brown said NASA is operating under a full-cost environment, and will be making some adjustments between mission directorates. Dr. Shin pointed out that continuing resolutions have “almost become a way of life,” with the looming sequester threat leading to a lot of uncertainty. Marion Blakey requested of Dr. Shin to see how any potential cuts would be allocated among the Aeronautics Research Mission Directorate (ARMD) programs. Ms. Brown reported that any cuts would work out to 1% per program, almost across the board. Dr. Shin said that ARMD would have an exciting presentation to share with the committee; it is the culmination of a long-term strategy developed over three years.

Discussion About Advisory Groups by Tom Irvine

Tom Irvine described three entities with clear and distinct purposes that don't act totally independently from one another. The NAC Aero Committee operates under and complies fully with Federal Advisory Committee Act (FACA) provisions. It's the only group that looks at current programs and ARMD's current portfolio. The National Research Council's (NRC's) Aeronautics and Space Engineering Board (ASEB) has a much broader scope, interacting with NASA leadership. They do formulate and execute studies, especially in the human spaceflight program. But ASEB studies can be used as inputs to the NAC Aero Committee deliberations.

The Aeronautics Research and Technology Roundtable (ARTR) was formed because ARMD needed one place to go for industry inputs. But although it provides a forum for dialog, it does not have an advisory function.

Dr. Shin said the state ARMD would like to get to is for all three groups to have more purposeful interactions. Ms. Blakey asked about the size of the three groups. Michael Maloney replied that while they don't have exact numbers, about 20 people are on the ASEB, which covers both aeronautics and space. The Roundtable is about the same size.

Ms. Blakey requested that before the next Aero Committee meeting, she would like the names and affiliations of both advisory committees, and to learn the focus the next time the ARTR is activated. The Committee then discussed the Federal Aviation Administration (FAA) adding some personnel as well to the ARTR.

NASA Aeronautics Research Future Direction by Robert Pearce

There are enormous benefits to the U.S. economy from aeronautics, which is why ARMD wants to continue to conduct research that makes real impacts in real

communities. Tools are coming up quickly from the laboratory for use every year, making their way to operation.

Dr. Shin said that in response to Aero Committee input, ARMD has been aligning efforts to a higher level of Technology Readiness Level (TRL) research. Mr. Pearce pointed out that technologies “have their own pace.” Putting them into projects that have a beginning, middle and end is a tough thing to make work. Mr. Pearce cited the fact that the adoption of electricity took 46 years for 25% of the population, but just seven years for the World Wide Web to reach 25% of the population.

A discussion ensued about how certain countries may be able to leapfrog current technologies, and how commercial aviation in China is poised to make a worldwide impact. Mr. Mark Anderson cited the experience of Airbus, the source of much derision in 1980. It took but two decades for Airbus to create an industry-leading airplane. If aircraft become commodities, the United States can't compete on the basis of cost and will have to compete on the basis of quality.

A discussion ensued about using the third dimension as an opportunity space for the short haul, on the system side, everything from moving goods to moving people. Mr. Pearce said the trend toward higher fuel costs will continue indefinitely. Flight research is a critical element of technology maturation and any public-private partnership. A discussion ensued about Verification and Validation (V&V) and the proper role of simulation. Also discussed were safety systems on aircraft, and how mandates from Congress have led to the inclusion of at least one such system on airplanes. However, an overly strong focus by safety committees may lead to no or far slower certification of otherwise useful advances.

Dr. Mike Francis mentioned that, regarding Unmanned Aircraft Systems (UAS), the current [military] requirement is for one operator per airplane in constant contact: that is its Achilles heel. A civil system would operate at an intermittent fashion at a higher level. Dr. J.P. Clarke mentioned the need to distinguish between intermittent and constant contact.

Mr. Pearce pointed out the need to get a sustainable pathway for high-speed mobility. Ms. Blakey asks whether ARMD is taking into account the real-world practical barriers to entry. In particular, there are increasing privacy issues near-term regarding UAS. Mr. Pearce replied that ARMD is structuring strategy to be sensitive to this. Regarding supersonics, the largest hurdle is not to fly overland. Industry responsiveness will ultimately drive aeronautics strategy and research. NASA is actively working to lower technology barriers and then see what happens, according to Dr. Shin.

In response to a question from Ms. Blakey on organizing universities around groundbreaking research, Mr. Pearce cited the NRA process for bringing in the universities, and the potential of consortia. Dr. Mike Bragg mentioned the National Science Foundation (NSF), and how the NSF funds creative activities at universities. He didn't see that in current structure of the NASA Research Announcements (NRAs).

Dr. Shin said that going forward ARMD would like to have three operating models in regards to the universities. One would be discipline-based (what is presently being done). Second, on the front end, maybe the NSF model, including a very challenging problem statement, yet still quite exploratory and far-out work without an immediate payout. Third would be harnessing universities' strengths in systems engineering: it may not be exactly a center of excellence model, but similar. A discussion ensued about the most effective way to encourage innovative ideas and garner first-cut proposals.

National Research Agenda for Autonomy in Civil Aviation by Robert Pearce

Mr. Pearce pointed out that integration is really where the hard things lie. A question was posed by Mr. John Borghese concerning UAS in the NAS, and addressing autonomy as it relates to improving safety. Mr. Pearce pointed out that autonomy is highly transformative across the board. It's not just a matter of what NASA can do, also what the community can do. NASA ARMD is looking broadly to make sure it fully understands the state of the art. ARMD also needs to understand the policy issues it will be facing and apply research to that.

A discussion ensued about convincing the FAA the system ARMD is developing is as safe as current flight. Mr. Pearce said that ARMD's goal is to collaborate closely with the FAA. NASA is still looking for tools to understand the system-level effects of complexity and apply them in a relevant environment to see the same effects. ARMD is working to create a collaborative, virtual space in the NAS to test out UAS.

A discussion ensued about what to do when things go wrong. Committee members pointed out that there needs to be contingency planning at the vehicle level: a layered approach, in the air and on the ground, with multiple approaches that are additive. Certification may be achieved in that fashion. Further conversation followed about the the NRC proposal and its status.

Dr. Ilan Kroo wondered about what kind of UAS vehicles to include, including their classes and weights. Struck by the breadth, Dr. Kroo encouraged NASA to prioritize. Mr. Pearce replied that it was an excellent point, and that ARMD is standing up an internal planning team. A discussion followed about connectivity and work in the classified realm.

NASA's Integrated Systems Research Program (ISRP) Future Direction by Ed Waggoner

Dr. Waggoner said that ISRP is conducting very focused projects with finite resources and a finite life, with new opportunities to invest in new areas to follow. Mr. Borghese asks about FAA funding. Dr. Waggoner said that ISRP is closely coupled to other ARMD programs research, and plans to support the FAA in helping with UAS in the NAS. Budgetary support currently stands at \$30 million a year for UAS and \$70 million annually for Environmentally Responsible Aviation (ERA). There will be key flight demonstrations as UAS in the NAS concludes.

Dr. Clarke asked about industry partnerships. Dr. Waggoner said that ISRP has

highly coupled partnerships with industry. Cost sharing from industry is \$40 million. Dr. Shin said that since 2008 ARMD has strengthened programs for technology transfer, supporting the [aeronautics] community. On the FAA side, there's 3-D PAM, which entails the FAA working side by side with ARMD researchers.

Dr. Waggoner mentioned the cultural shock to researchers who now must meet deliverables schedules. It's a change in thinking. Although the ERA team gets it, Dr. Waggoner doesn't know if the UAS in the NAS team yet gets it. Overall, of ISRP's 20 technology packages, eight went forward, one went partially forward and the fate of the other 12 is still not clear. Of the eight going forward, ISRP packaged the technologies and did a structured assessment on them, discussing the risks and costs. Phase 2 will be a three-year effort for all, and a return to Dr. Shin for his final decision.

Dr. Shin: "Some of you may remember that during the 1990s we had some focused programs. They were finite as well. The reason why we emphasized 'research' in the program name is because the focus is research. Projects have a finite lifetime and we have to focus on the end goal. When a researcher came in and said I have a better idea, I had to say, 'No can do.' Personally, I learned my lesson. One big drawback was the plan was chiseled in stone. We spent a lot of time replanning and re-baselining but we couldn't adjust. We'll fail on some of these. At some point there may be a dead end. We are learning even from the process perspective. As a result we have a much stronger Phase 2. Now we have to deliver. The pruning process is done."

Dr. Clarke cited the Joint Propulsion Laboratory experience of getting a technology flight-ready. How do you integrate ideas that have come to the fore in the interim? Dr. Shin cited ARMD's Fundamental Aeronautics Program. Potential ISRP future projects may involve multiple testbeds.

Dr. John Langford cited the current status of remotely piloted aircraft. Commands go up from a remote ground station and the plane flies around. How do you tie that into the NAS? "That is the wrong model in two ways: it's the 1990s version of a model airplane with limited intelligence and the 1950s, 1960s instantiation of the Air Traffic Control (ATC) system that needs to take account of NextGen [Next Generation Air Transportation System]." Putting 20th century airplanes in a 21st century airspace system is much harder [than the reverse]. He cited 2015 as one crucial milestone.

A discussion among Committee members developed about military vs. civilian UAS. According to Dr. Langford, it's a question of balance. Dr. Francis says the answer in the near term is hybrid. Cites military use of airspace as desired. Regulatory issues remain: that's where NASA could be especially helpful. A discussion ensued about the proper equilibrium.

Mr. Anderson asked: What is ISRP trying to accomplish in three years? Regarding potential ISRP future projects, he understands demonstrators and testbeds, but not composites and autonomy research. Dr. Shin replied that is not three or five years of more intense research, but the former. The questions Mr. Anderson asks are ones ARMD is asking internally. ARMD will address other needs through future projects.

A discussion followed about the Joint Planning and Development Office (JPDO) and its effectiveness. Industry is pushing back about NextGen costs, and there is a time-consuming regulatory and certification environment. China may have an ATC system 10 times more efficient than that of the U.S. Spending time on 20th century technology is not a good idea. The barriers are regulatory ones, and there is political resistance from companies that don't want new things to happen. Disruption will happen regardless. NASA has a unique role to play throughout.

Dr. Bragg observed that almost all the UAS safety data is coming out of the military. Barriers to introduction will be formidable. Theoretical research is not useful. Some of the legislation being introduced on the Hill could be show-stoppers.

Dr. Shin completely agrees with everything that's been said. "If UAS in the NAS project at the end of 2016 is all we're going to do and then walk away, we're not doing what we should. It's going beyond UAS in the NAS, and going beyond UAS itself [as it is currently]." ARMD will support the future direction of autonomy; studies will need to focus and there will need to be some sort of master plan. ARMD is looking at that project as having a lot of flight-heavy contact.

A discussion ensued about research centered around low-boom signature and how that aurally affects people. Data that ARMD has collected in a controlled environment has been a first step. How is success defined by the FAA? There is a need to incorporate low-boom signatures on a test vehicle. There is a difference between research success and how research results will be accepted by the community.

Dr. Shin wonders if NASA's role should be to have [a supersonic technology demonstrator] as NASA's objective: "We'll open this door and see who comes out of the barn. We're trying to help with supersonic development We are ready to do this demonstrator. It's truly technically mature enough."

Dr. Langford said that NASA should be doing exactly that. "This is a perfect candidate for partnership with Defense Advanced Research Projects Agency (DARPA). It should a demonstrator with civil and military applications. Move the overpressure to something that's numerically based. That would be a huge success."

Mr. Borghese wondered if there was a choice between a blended wing body (BWB) and a supersonic technology demonstrator, what the choice would be. Dr. Shin replied that for absolute value, BWB or SugarVolt is the higher priority. NASA should be creating new capability and opening new markets.

Public Comments: None

Committee Deliberations

Dr. Clarke observed that if there was a capstone program, it may be very useful to help propel those programs along, especially UAS in the NAS. Dr. Kroo said that conflating UAS in the NAS with autonomy muddles the waters. It's important to identify what each of them means.

Dr. Shin asserted that when the NRC study committee convenes, he would like to see this committee ensure that ARMD is not proscribing this from its perspective. Ms. Blakey said she would make the recommendation that the committee include subject matter experts from other fields, but the preponderance from aeronautics.

Mr. Tom Wood worried that general aviation would get squeezed out by too much of a focus on autonomy. Dr. Francis replied that uncontrolled airspace is where the problem is. It's the small aircraft that will take down a Cessna that has everyone concerned.

A discussion proceeded about the number of pilots decreasing. Autonomy may be the salvation of general aviation, which may be going in the direction of mass transit.

A discussion continued about inclusion of Automatic dependent surveillance-broadcast (ADS-B). By 2020, commercial aviation will have to have it.

Dr. Clarke said ARMD has one advantage: Dr. Shin's longevity in his post as AA. Dr. Francis observed as NASA looks to the future, the agency is very dependent on the internal workforce and skill sets. ARMD needs to have a technical plan on that front, and an alignment with their personnel.

MEETING ADJOURNED at 4:26 p.m

March 1, 2013

The meeting was called to order at 8:37 a.m. by chair Marion Blakey. A NASA video was introduced, with a perspective from a young researcher. Ms. Blakey mentioned the schedule for rest of the year: one meeting at the end of July and one in December. The meeting in July is intended to immediately precede the NAC meeting Charlie Bolden is holding. During the meeting in December the Committee will lay out plans for 2014.

Report from UAS Subcommittee by John Langford

The subcommittee has a two-year charter expiring August 2013. One reason that the NextGen schedule slips to the right is that strong constituencies don't pull to the left. There is concern that the UAS in the NAS Project is too focused on only pilot in the loop with high data connectivity to the ground. NASA has to wrestle with who the customer is. There are many overlapping participants in the process.

Lower or higher latency of aircraft responding to the controller is one major issue. In the case of an off-nominal situation and a human comes in, sometimes humans can make things worse, said Dr. Langford, citing the 2009 Air France crash.

Discussion ensued about flying under instrument flight rules (IFRs), which is subsumed in the FAA UAS ConOps assumptions. In terms of Implementation Plan milestones, a key question is what is success and its definition. There are a lot of unfunded or not supported categories.

There remains a stovepiped approach. Transportation Security Administration (TSA) procedures have now substantially reduced block speeds. Looking at airplanes as a transportation system, security is very important. Questions remain about redundancy and data security.

In response to questions about white papers and what it takes to operate UAS in the NAS, Dr. Waggoner said ISRP realized what an incredibly systems problem NextGen would be. The Program put together an integrated work plan: "When we got into looking at the cost it scared a lot of people ... Folks from industry are very aggressive in terms of the dates they want things done by. It's going from pie in the sky to the art of the possible: what are the minimum things that have to be done to have routine UAS in the NAS. It's embryonic, but it's much farther along than we were three years ago."

Dr. Francis observed that the U.S. infrastructure is based on information technology and cybersecurity. Dr. Langford agreed that cybersecurity is one of the big frontiers today in the private and public space. Dr. Francis said cybersecurity is even more significant when it pertains to a machine and affects human safety.

Dr. Langford said that UAS amplifies the aforementioned: "Solutions are possible and sometimes not even all that hard. It's an area NASA shouldn't shy away from."

Dr. Clarke mentioned on board and embedded software. Dr. Langford said that "stuff in the glass cockpit is moving so fast you almost want to buy a steam engine." Mentioning iPad use by pilots, he said that's where the fastest growth is today: "The uncertified stuff, because the technology is moving so fast."

A discussion followed about capstone efforts, such as ADS-B in Alaska: something where NASA had pulled together a live virtual system with a subsequent demonstration, showing how what ARMD developed integrates into the airspace. Dr. Bragg observed that Alaska was expensive and required multiple years of planning, with the infusion of a lot of federal money and working with the community involved. And the oil industry really stepped up. Dr. Langford: "Bingo! That's why it was so effective. Simulation and flight research: As long as it's a compelling demonstration."

Dr. Kroo asked about routine access to the NAS. Dr. Langford cited the example of the the FAA test beds, where one can experiment with various architectures and systems. Dr. Francis said live virtual simulations are one good way to proceed. He cited business case analyses that, in one study, show the only mission that's financially viable is law enforcement. The systems engineering needs to support the system construct.

Dr. Shin said ARMD is equipped to address the key message. "This is very analagous to what we went through with ERA. We have a lot of competing interests. There is a cost issue, certainly. And I have to deal with stakeholders in this town who want to make sure we're made an impact ... NASA can certainly be a catalyst."

A discussion ensued about different UAS weight classes. Also discussed was the UAS subcommittee recommendation. The Committee would like a definition of what the capstone effort would entail. Dr. Shin said that his understanding of the UAS Project was that the Subcommittee was all about doing research.

A discussion arose about the last two bullets of the recommendation. Mr. Anderson suggests a recommendation re-wording. Mr. Wood wondered if the [UAS] weight class was important for the simulation and whether there should be a weight limit.

Dr. Waggoner said that ISRP wasn't just addressing smaller unmanned aerial vehicles (UAVs). ISRP plans to show in a series of experiments how they're integrating key UAV capabilities. NASA, the JPDO and the FAA may work together on this effort, on a larger UAV. Smaller UAS will be under a different rule.

Dr. Clarke cited holes in what needs to be done on airspace systems side. A discussion continued on the rewording of the recommendation and the meaning of "capstone demonstrations." Ms. Blakey commented that the Committee was in agreement with the finding and the recommendation.

ARMD Strategic Implementation Plan (SIP) Document by Robert Pearce

Committee members posed questions about the baseline, what value is being added and, if proposed aircraft are built, what is seen on the ground in terms of noise and emissions.

Mr. Pearce said the metrics were derived from the N+2 and the N+3 studies. Mr. Borghese asked about the TRLs and what that means to the original equipment manufacturers (OEMs). Mr. Pearce said that when ARMD gets to integrated systems research, there is a lot of discussion with industry partners. At the fundamental level, ARMD doesn't go to that level of discussion with partners. It's different for TRL-5 and TRL-6.

Mr. Borghese: "What type of agreement do you have at what TRL with your transition partners?" Mr. Pearce: "It's more than serendipity, but it's less than getting an agreement to implement. There's a common understanding of the value of picking it up. We're not holding industry to build a specific product."

Mr. Anderson asserted that the real virtue of NASA rolling out the ERA Project is that the simultaneous pursuit of goals can be visualized. Dr. Shin said that ARMD generated an idea, a concept, not alone certainly, but working with partners. Industry has to decide whether it wants to take it further. It's more than numeric TRLs. But ARMD does have to generate an effort, because it's more than just a report: "While we are setting targets and goals, we have to come down to certain concepts."

Mr. Borghese asked if the chevrons concept was offered worldwide? Dr. Shin: "I think that was the case. Anyone can pick it up. Congress asked, how do you know you made a difference? My always answer was there is an intangible benefit from working together from the get-go. Some Chinese engineer reading a paper may take five years to do it, slower than someone like Boeing who already has tacit knowledge."

Mr. Anderson said that he didn't know who in Boeing has access to that intellectual property. He cited the chart of NASA DNA in aircraft. It's not a matter of relative financial

contribution. Industry will [take NASA work], pour money all over it and then discount NASA's contribution.

Dr. Shin: "What progress are we making in totality? That was the missing link. And how do we make the link between our program goals and objectives and the national priorities? ... We need to make sure that we are asking the right questions and not barking up the wrong tree. That's the contract between programs and projects. Are you accomplishing what you said over the period of years for the technical challenges?"

Mr. Borghese asserted that ARMD should have many failures doing research. If not, ARMD should be taking on more risk and "in your plan ... ask how you kill things." Mr. Pearce replied that ARMD has to plan for the fact of some turnover. Mr. Borghese: "You need to reward the people who fail." Mr. Pearce replied that it's always a tough problem.

Dr. Shin elaborated: "[Refining workforce allocation] is always the most difficult problem. I'm of the opinion that DARPA has done great. But they don't have 30,000 people. We're doing everything we can, but my hands are tied. My administrator is helping us. He's asking every mission directorate: What are you going to take off the table? This is a mega-problem in NASA. It will not be solving by sheer willpower or by cracking the whip. Doing business differently, as challenging as it is, we have to do it."

A discussion developed about how best to deploy intellectual assets. ARMD employs about 1,300 civil servants and 600 contractors. During the time of a severe hiring freeze, ARMD hired onsite contractors, which was not as flexible as one may think. Ms. Blakey wondered whether voluntary incentives can be used to trim the workforce.

Dr. Shin: "Numerous studies have been done, but I'm not very hopeful. One of the main reasons people perceive us to be overly bureaucratic is because we have 10 centers spread out across the country with representation in Congress. It's highly charged politically. These are high-paying jobs at the field centers."

Dr. Francis said that ARMD should not do a wholesale change overnight. He cited experience at DARPA, where status can be modified over a period of time. "Spread it out and it's more palatable."

Mr. Anderson cited the DoD base realignment and closure (BRAC) as another example: "You need to be spooling up expertise that you may not yet have." Dr. Shin replied that center directors are really working hard to bring small but gradual changes. It will take a long time and steady effort. Ms. Blakey noted that the ban on NASA layoffs was still in place.

A discussion ensued about the mismatch between staffing and funding levels. A lot of hiring now is term employees. There is no guarantee for lifetime employment. New hiring at Langley Research Center is maybe 15 people a year. But immediate needs of existing projects call for older more experienced staff, which conflicts with centers' expressed desire to hire younger workers.

Dr. Langford noted that the reason for the existence of 10 centers is to make it hard to kill NASA and make the organization sustainable. It creates a political base for an

organization that otherwise would not have the support. Makes it resilient to short-term political impacts.

A discussion followed about how best to express NASA aeronautics goals: air travel to every congressional district and vertical and/or short take-off and landing (V/STOL) aircraft that weren't ready technologically in the 1960s. One approach is the DARPA model about pulling things off the shelf when the technology is ready.

Ms. Blakey mentioned the upcoming Committee meeting in July. A discussion ensued about overlapping study committees whose work would affect ARMD. A singular voice won't represent the Aero Committee adequately. The Committee is locked into with the July date because of the meeting with Administrator Bolden.

More discussion about the Recommendation language continued.

Dr. Langford mentioned DARPA's release of an opportunity for a \$100 million demonstrator that would take off and land vertically. He asked how this will be brought into the NASA program.

Dr. Shin: "We did have a discussion with DARPA about X-planes a few months back. We did talk about working together. Since then we haven't reconnected. We can certainly go back ... But working with DARPA has been difficult. They like to work with NASA expertise, but in a very narrow and cherry-picked fashion. For us, it's not the type of collaboration we want to have, and I don't think that's the kind of collaboration the Committee wants for us."

Dr. Francis suggested a new approach to DARPA that would involve a proactive plan to spend some NASA money, but to also achieve ARMD program/project goals. Volunteers are needed to run interference. There's a more compelling case to make now with current budget environment.

Dr. Shin said that he really enjoyed yesterday's and this morning's discussion: "Please let us know if we're moving in the right direction in terms of engaging the committee. We're trying to shape the right future."

Ms. Blakey mentioned the approach to the NAC report and was complimentary of ARMD's Strategic Plan.

Dr. Francis: "I endorse the approach to establish a strategic direction. The specifics are not there yet, but you are in the process of working through them. But I got the sense yesterday that we are all pleased with the underlying process." Dr. Kroo: "Kudos for actually doing the strategic plan. It's not done yet, but it's on its way."

Dr. Clarke asks how well ARMD is doing in terms of cross-coupling and synergizing the various directorates and the progress that's being made. Dr. Shin replies that there are some areas that Space Technology is working on that ARMD could coordinate together: "We are heading in that direction to solve common problems. Autonomy could be the poster child for how we work in our own directorate, to push progress together. I view autonomy as the driver."

Public Comments:

Mr. Waseem Naqvi from Raytheon said that he really enjoyed the top-down approach to strategic analysis and defining the future and how to get there.

MEETING ADJOURNED at 12:06 p.m.
