



NASA Advisory Council (NAC) Aeronautics Committee

March 26, 2015
NASA Headquarters, Washington, D.C.

Summary of Meeting Minutes

Participants:

First	Last	Organization	Role
Marion	Blakey	AIA	Chair
John	Borghese	Rockwell Collins	Vice Chair
Mike	Francis	United Tech Research Center	Member
Lester	Lyles	NRC/AESB	Ex-Officio Member
John-Paul	Clarke	Georgia Tech	Member
John	Langford	Aurora Flight Sciences	Member
Stephen	Morford	Pratt & Whitney	Member
Mark	Anderson	Boeing [retired]	Member
Jaiwon	Shin	NASA ARMD	NASA AA
Susan	Minor	NASA ARMD	Exec. Secretary
Jay	Dryer	NASA ARMD	Director, AAVP
Peter	Coen	NASA ARMD	Manager, High Speed Project
Doug	Rohn	NASA ARMD	Director, TACP
Richard	Barhydt	NASA ARMD	Deputy Director, TACP
Jessica	Nowinski	NASA ARMD	Observer
John	Cavolowsky	NASA ARMD	Director, AOSP
Edgar	Waggoner	NASA ARMD	Director, IASP
Robert	Pearce	NASA ARMD	Director, SAA
David	Miller	NASA OCT	Chief Technologist
Annette	Kempisty	NASA ARMD	Observer
Lee	Olson	FAA	Observer
Jon	Montgomery	NASA ARMD	Director, IMO
Brenda	Mulac	NASA ARMD	Observer
Teresa	Kline	NASA OCT	Observer
Steve	Hirshorn	NASA OCE	Observer
Peggy	Cornell	NASA ARMD	Observer
Akbar	Sultan	NASA ARMD	Dep Director, AOSP
Barb	Esker*	NASA ARMD	Dep Director, AAVP
Waseem	Naqvi*	Raytheon	Observer

Christian	Rice*	HSSTC Staff	Observer
Mal	Peterson*		Observer

* = participated remotely

Thursday, March 26, 2014

The meeting was called to order at 9:04 a.m.

Introductions

Aeronautics Research Mission Directorate (ARMD) Associate Administrator Dr. Jaiwon Shin welcomed all the Aeronautics Committee members, thanking them for their participation as usual, and said he would elaborate on the update to the fiscal year (FY) 2016 budget.

NASA 2015 Budget Overview by Jaiwon Shin

Dr. Shin said that ARMD is operating year by year, with budgets for years farther out as purely notional. Overall, ARMD funding levels have remained fairly stable. The FY2015 budget has \$100 million more than President Obama’s request: actually one-year money, but ARMD can make it two-year money as long as it’s committed in the first year. Dr. Shin he had no idea if ARMD will get the same level for FY2016.

In response to a question from Dr. John Langford about the origin of the \$100 million increase, Dr. Shin attributed it to Republican Congressman Frank Wolf, who retired on January 3, 2015, and who was the former chair of the U.S. House of Representatives Subcommittee on Commerce, Justice, Science and Related Agencies. Dr. Shin said that Republican Congressman John Culberson, the new chair of the subcommittee, has indicated that he considers aeronautics very important, and that he will continue to push that same level of support.

In his FY2016 budget highlights, Dr. Shin elaborated on what’s pending, mentioning the unmanned aerial systems (UAS) traffic management (UTM) convention slated for late July 2015 in California at NASA Ames Research Center. In ARMDs projected FY’16 activities, it won’t be centered only on research into environmentally friendly aeronautics technologies, but also be flight demonstrations. New activities will begin. Low-carbon propulsion research will not be conducted in one fell swoop. In addition, some additional hypersonics investment should incentivize continued collaboration between ARMD and the Department of Defense.

Dr. Langford asked how things were going with the Defense Advanced Research Projects Agency (DARPA), and if there was any overlap of issues. Dr. Shin replied that ARMD subject matter experts are supporting DARPA programs. The relationship is better this year than even it was last year. The struggle is trying to make the situation work, given ARMD hypersonics funding. General Lester Lyles said that he assumed that ARMD’s relationship with the U.S. Air Force Research Laboratory would be productive. Acting Director of ARMD’s Advanced Air Vehicles Program (AAVP), Mr. Jay Dryer, said that ARMD is tied in with Air Force efforts; hypersonics research is important but expensive. General Lyles said that he hoped ARMD could join the Department of Defense in discussions with the Office of Management and Budget to argue the need for hypersonics research. Dr. Shin said that NASA Administrator Bolden is a strong

supporter, and knows that NASA technical expertise is needed as a national resource. The coordination and meeting of minds is not really the issue; it's the funding environment. Dr. Michael Francis observed that diversity of investment is important. It's an easy thing to say no to hypersonics research since it is very expensive.

Dr. Shin expressed his appreciation for the Committee's support for the ARMD Strategic Thrusts, saying that it was gratifying to know the NASA workforce is rallying behind the strategy. On the management side, ARMD needs to provide the steady support. Dr. Langford said that the substantial [Aeronautics] budget increase was bound to help morale, but it needs to be built in and not just a one-time thing.

Dr. Shin said Dr. Langford's comment was a good segue. How does ARMD demonstrate how \$100 million improves the work? ARMD has undertaken some facilities improvement, and has been able to move activities to 2015 from 2016. Additional studies are ongoing to define the specifics of a future direction. Talking to the headquarters team, the main question is how to build a stronger and wider advocacy. The effort has begun in a more direct way with some airlines and some airports. This year, ARMD is trying to expand partnerships and have a more direct impact on airports and airlines, looking to see how ARMD can bring different sectors together for more convergent research and to extract areas of common interest. That's how some of the augmentation is being used. Exciting public-private partnerships are possible, not just with manufacturers but including research organizations around the world. NASA Aeronautics must do whatever it can to help the aviation community as a whole, unlike the one-time Recovery Act augmentation. Dr. Shin said that in his testimony on the Hill, he has emphasized the reality of international competition. Congressional staff, especially on the Senate side, seemed to have a lot of interest in technology demonstrators.

In summary Dr. Shin has argued that ARMD has delivered, demonstrating the ability to perform high-impact research. The results coming out of the Environmentally Responsible Aviation (ERA) Project have been very compelling, although, in some areas, the NASA workforce doesn't have all the skills. Dr. Francis: "Do you have a companion strategy involving skill sets? How does ARMD get those skills?"

Dr. Shin replied that one part is that NASA's research centers didn't know ARMD's role. ARMD was living year by year, driven by budget levels. Last year, Dr. Shin and his management team started to put in place a 10-year investment plan: a blueprint with elements that require robust aeronautics research. There will be a new hiring plan. The second part, shorter term, requires working with research centers to have more flexible resource management, to move talent between programs and between directorates. Some of those technical moves necessitate working closely with the centers. Public-private partnerships could also help. Dr. Shin cited \$180 million in industry investment in the ERA Project. Government invested \$400 million. Industry partners didn't just put up money, but brought skills and a workforce. Dr. Shin added that the way the Boeing ecoDemonstrator Program is working out is very gratifying, with much flight research to come.

In response to a question from Aeronautics Committee Chair Ms. Marion Blakey regarding three specifics for ecoDemonstrator studies, Dr. Shin responded that the Boeing vertical tail research and the related laminar active-flow-control work could be of

real benefit if it pans out. Vertical spacing and approach being demonstrated in real situations was a tremendous accomplishment. Dr. Shin asserted that NASA's engine chevron work many years ago "really moved the ball down the road. This is not the time to scale back flight research and flight demonstrations." Mr. Mark Anderson agreed, citing the need for flight demonstrators and the need to do more.

Answering Dr. Langford regarding the status of ARMD safety programs, Dr. Shin said that changes would be detailed in presentations to come later in the day. Dr. Langford said that most of what ARMD is doing drives safety in the areas that really matter. Citing the Silicon Valley experience of Department of Defense (DoD) Secretary Ash Carter, Dr. Langford said that Mr. Carter is pushing DoD to take a moon-shot spirit and apply it. ARMD likewise has a chance to do that in practice. The discipline of unmanned aerial systems traffic management, or UTM, is moving at the speed of Google, versus NASA's chevron work that actually began in the 1970s. Having Jeff Bezos and Larry Page show up at the UTM conference in late July could really be transformational.

Dr. Francis said that UTM is different kind of airspace management. Aeronautics Committee Vice Chair Mr. John Borghese said that he agreed; it's happening very quickly. Dr. Langford said that if UTM works, everybody will want in. That could be NASA's legacy in the next five to 10 years. Dr. Francis said that the results of NASA's UTM research will really contribute. In addition, having the infusion of additional resources [of \$100 million] can help ARMD keep pace with Silicon Valley. Mr. Borghese said that if ARMD could get Amazon on its side that would help insure the \$100 million remains in the budget in coming years.

Dr. Shin said that Amazon is already on ARMD's side, and ARMD wants to use NASA's name appropriately to stimulate commitments from Amazon, Verizon and others. The Aeronautics workforce is beginning to pick up on this too; Dr. Shin cited acoustic research conducted at NASA's Armstrong Research Center, an effort that didn't involve a lot of money. In UTM, the people leading that activity are among the most entrepreneurial ARMD has. Dr. Shin said he was very hopeful ARMD can strike that balance. So far, everything being done has gathered overwhelmingly positive responses.

Dr. Langford suggested channeling perhaps 40% of the \$100 million budget increase to UTM: "You have all the stars lining up, and you have the money. You have the chance to change the world." Dr. Shin responded that ARMD has given the maximum amount of money possible to the UTM effort. Dr. Langford responded that ARMD personnel "have been beaten down for so long [regarding the budget] they don't think big anymore. There are times you have to think bigger. When you're talking to guys who use the word 'moon shot' every other sentence, you're actually the people who did a moon shot. This is your moment, and I want to encourage you to run hard."

Mr. Anderson said he heard that ARMD has been pleased with its partnership efforts. What about forming partnerships with Google or Amazon? It could be a really collaborative program. Dr. Langford said he agreed, but don't "just make it a rich guy's game." There's a role for the smaller companies as well.

Citing the difficulty of quickly executing a contract or cooperative agreement resulting from a NASA Research Agreement (NRA), Mr. Borghese wondered how one might get a contract signed in a week. Dr. Langford said that it would be "a moon-shot goal for

NASA – getting a contract out in a week.” Dr. Shin replied that identifying red tape is easy; the real challenge is how to remove that red tape. ARMD will be putting a task force together in the next few months to figure out how to do that. Dr. Francis said that if one is a pioneer, it’s all about taking risks. At the end of the day, one gets rid of the known unknowns in order to address the unknown unknowns. General Lyles said that he hoped ARMD would take advantage of the partnerships with the Defense Department. Working with Ash Carter is a definite opportunity. Dr. Shin thanked everyone for the comments.

Aeronautics Committee Work Plan

Led by Ms. Blakey, a discussion occurred about upcoming meetings and agendas, and specifics about when and how the Aeronautics Committee will provide guidance on topics. Mr. Anderson expressed concerned about activities not core to ARMD’s mission. Complexity is just as central to NASA’s aeronautics mission now as engine cowlings were to the National Advisory Committee for Aeronautics (the NACA). Mr. Borghese said that certification is also an outstanding issue, and that NASA should play a major role in that respect. Dr. Langford said that such issues are core to certain missions, but not to all missions. UTM addresses many of these; they are great topics, but not in the abstract: only for specific areas. Ms. Blakey said the Committee would have to consider how to fit them into the overall work program.

Innovation in Commercial Supersonic Aircraft by Jay Dryer and Peter Coen

Mr. Borgehese said that when he hears general aviation associated with Part 25 [federal regulations concerning airworthiness standards for transport aircraft], he suggests changing it; it would be an easier sell. Mr. Dryer said it was a fair point. NASA is not just about building a business jet and moving on, but wants to open the market. A discussion then ensued about how to categorize small supersonic business jets. In terms of market growth and economic benefit, Mr. Borghese said that ARMD was trying to promote it in terms of small market. Mr. Dryer said that it’s a larger economic value in producing these business jets, but the point was well-taken. There is no publicly available intelligence on China’s efforts in supersonic airplane research and/or production. Mr. Anderson said that NASA is always on very thin ice when it talks about the business case. Future presentations should reflect the technology and its inevitability, not the business case. Mr. Dryer agreed, but said that there is an economic driver nonetheless.

Ms. Blakey asked if most ARMD research still focused on prototype aircraft. Mr. Dryer said that what he was presenting was commercial. ARMD expertise is currently providing some guidance to the military. Mr. Borghese observed that it was important to be able to justify to the public about why NASA is making this investment. It used to be jet aircraft were for the very rich, and NASA helped make jet aircraft more efficient. Mr. Dryer said that, without the possibility of low sonic boom [incorporated into the design of commercial supersonic aircraft], supersonic flight cannot be opened up to the general public.

Mr. Borghese wondered how an aircraft control system could be paid for. People who use [supersonic] aircraft could pay more because they can afford it. Mr. Dryer, speculating on whether an aircraft such as the one he was describing could be a candidate for alternative fuels and spark the market for others to follow, said that some

of that is being looked at. ARMD won't drive as a NASA policy, but rather as a means to provide the data for a rule change to take place. There has to be an international rule change, substantiated within rule-making.

A discussion ensued about ARMD's supersonic research focus. Mr. Anderson would like to see "macro strategies" for flying a technology demonstrator. Mr. Borghese said it was almost a chicken-and-egg conundrum: no one is investing yet because standards have not yet changed. Mr. Peter Coen, acting manager of ARMD's High Speed Project, said that ARMD is evaluating how to approach doing a demonstrator. In response to a question posed by Ms. Blakey about Gulfstream Aerospace Corporation and its interest in a supersonic demonstrator, Mr. Coen said that the company decided their technology approach was not the right one, but that Gulfstream remains generally interested. The issue was what propulsion system to choose: a question about engines, not about sonic booms per se. Although the effort was discontinued early in 2014, Gulfstream is still working on a refreshed design. The Committee agreed that a private-industry demonstrator would be a good thing. A brief discussion then followed regarding Mach attenuation over land and flying supersonically without actually creating a boom, which requires a specific set of atmospheric conditions.

In response to a question from Mr. Borghese about the difference in sonic boom levels, Mr. Coen said that for unrestricted supersonic overland flight to occur would probably require a noise footprint of 70 decibels or less. Mr. Borghese then asked about the validity of simulations. Mr. Coen said that the idea of shaping a sonic boom has been around a long time. Now that better computational fluid dynamics approaches have been developed, researchers have learned that the goal should be to create a shock wave on the ground. That was the breakthrough because of greater design freedom. Mr. Borghese said that psychologists should be enlisted to make sonic boom noise acceptable to the general public. Certain communities will object. Mr. Coen agreed; more psychologists are needed. He and his team studying how to do a community survey.

Dr. John Paul Clarke said that there was a [boom noise] assumption that relies on atmospheric conditions. If the atmosphere doesn't cooperate, how boom be kept from forming? Mr. Coen said that, in a conventional end-way boom, 50% of the time it's louder; 50% of the time it's softer. They don't know yet what the shape will be of the preferred sonic-boom curve. A discussion then followed about N-waves, signal stability, working with the military, turbulence effects, and the subjectivity of human response to sonic booms. Regarding inverse codes, although additional design code capabilities are currently available, some of the most sophisticated will not be until 2030.

A discussion also occurred about a supersonic demonstrator timetable and sonic boom noise-reduction efforts. Noise levels should be able to fall to 65 decibels from 75 decibels; that compares to the 105 decibels by overland flight of an F-18. A five-year, \$300 million program is feasible, although an unmanned version isn't realistic, given the research imperatives. As soon as supersonic [demonstrator] flights begin, ARMD can begin to collect sonic boom data. Eventually, a community will be chosen over which to fly. ARMD is in touch with Federal Aviation Administration (FAA) about community noise standards.

Committee members and ARMD staff discussed that even a slight change in supersonic overflights can cause strong emotional response. Mr. Coen agreed that ARMD needed

to work those aspects and get community buy-in. Mr. Dryer said that there was an array of international interest, and that noise concerns are more acute in the U.S. and Europe. Dr. Francis said there was a need to find a proactive way to alleviate community anxieties. Perhaps a change in nomenclature would help: replacing sonic “boom” to sonic “music” as Mr. Borghese suggested. Dr. Langford said that flying an X-plane over populated areas could be of great benefit. Mr. Borghese congratulated ARMD on making great progress in sonic boom research. Agreeing with Mr. Borghese’s previous comment, Ms. Blakey said that ARMD might be able to use another, better descriptor for sonic boom: “You can say ‘sonic boom was then; this is now.’ Make this an exemplar of American technology.”

Dr. Clarke said that there is a placebo effect for experiments like this, and it must be relevant to everyday life. Mr. Anderson said that, with \$300 million over five years, three partners to the table, and an industry team composed of multiple partners each willing to annually invest \$20 million a year, that a demonstrator would be doable. That being said, \$300 million is a lot of money. There have been rumors that billionaire Warren Buffet is interested in investing in a supersonic airplane. In response to a question from Dr. Langford about the Office of Management and Budget’s (OMB) position on a supersonic demonstrator, Dr. Shin said that 10 years ago OMB thought it was viable, but now sees it as low priority and a costly effort. Dr. Shin praised Mr. Coen and his team’s ability to wisely spend their annual \$30 million budget for the past seven years, which includes workforce money. In response to a question from Dr. Francis about a partnership with potential investors, Dr. Shin said it is not simply a matter of ARMD looking for different kinds of partners, but also involves a complex approval process. Technology is not the issue anymore.

Dr. Langford said that just because ARMD could do it, it doesn’t mean ARMD should: “You really do have to look at the economics of this. I’m not sure we have a strong case yet. Computational acoustics is difficult. It would be a mistake to sell something on the Hill that would get shot out of the sky. The history of expensive supersonic flight cannot be ignored. Decades of public resistance say that supersonic flight is bad. I agree that you do have to do a demonstrator, but you should do a joint demonstrator with the military. You need broad public support for such an expensive program. You have to have the whole story on both sides, acoustics and expense.”

Mr. Coen agreed that partnership with the military is a good idea, but that he didn’t see any way to combine stealth and low boom. Mr. Anderson suggested that ARMD “plug into the right forums” where certain exciting things are happening. Dr. Shin said that he and Mr. Coen have learned the lesson of being a technology pusher. Economics is a really big thing. Even focusing on low boom is too big a ticket to swallow. Dr. Francis observed that today’s economics are not tomorrow’s. If a new technology is pushed long and hard enough, barriers will fall. Dr. Clarke then wondered how long one has to push and how much will it cost. Trickle down does work with technology. There’s light at the end of the tunnel, and it’s not a train.

A discussion then ensued about the economics of supersonic flight. Although economically viable supersonic transport may not be possible even today, small business jets are a great way to create entry. How fast it will happen is a tricky proposition. N+3 (far-term aircraft) goals are achievable. There will be tradeoffs between speed and fuel efficiency, plus aircraft operations constraints. Mach 2.4 (about 1,600 miles per hour at altitude) looks like the sweet spot for supersonic flight. A manufacturer

won't step up until the technology is put out there. When that does happen, it could lead to a potential revolutionary change.

Safety Program: Reorganization Implementation by Douglas Rohn

In response to mention of assurance of flight-critical systems by Acting Director of ARMD's Transformative Aircraft Concepts Program (TACP) Mr. Douglas Rohn, Mr. Borghese asked if there was any plan to transition that work to a company that can actually sell a tool. Mr. Rohn said the TACP approach generally has been open source. ARMD is working on transferring the results of its research to industry. A brief discussion then followed regarding traditional testing and formal methods, the latter of which has been used by the FAA. Formal methods involve sophisticated mathematics, and Ph.D. mathematicians normally work in this field.

In response to Mr. Rohn's comments on research regarding aircraft control under hazardous conditions, Mr. Borghese said that given the number of instances that aircraft have stalled, he was surprised it's not being picked up by the airlines. Mr. Rohn replied that the airlines are interested, as is the FAA. It may be possible to use a simpler mathematical model. The FAA is in the process of revising its regulations as regards this research. A brief discussion then followed about G-loading on the six axis, and the scenarios being considered for training to recover from a stall in the real world.

Regarding jet engine icing, Mr. Borghese said there are two categories of icing: high-altitude microscopic icing but also high-water-content icing. Mr. Rohn said he was talking about both. Mr. Borghese said that, in the 1990s, NASA proved that one could put synthetic vision on aircraft. It's now standard on business jets and is going on newer transports. ARMD ought to take credit. Mr. Rohn said that ARMD has emphasized, and wants to continue to emphasize, activities now going on. In terms of icing, ARMD is interested in engine icing and icing on future airframes. All of ARMD's programs are worrying about safety-related issues that will need to be addressed in the future.

Acting Director of ARMD's Airspace Operations and Safety Program Office (AOSP) Dr. John Cavolowsky said that during ARMD's Systems-wide Safety and Assurance Technologies (SSAT) Project transition, work will continue, even as the needs of the Next Generation Air Transportation System are accommodated. A brief discussion then ensued regarding the Vehicle Systems Safety Technologies (VSST) Project's close-outs and redirections. Mr. Borghese asked if ARMD had considered taking data from satellites and fusing it with data on airplanes. Mr. Rohn said, no, not yet. Others at NASA have some of that data, but it hasn't yet been consolidated in the cockpit. Mr. Borghese said that Mr. Rohn's presentation exemplified exactly what every research organization should be doing. It's a really hard thing to do, and Mr. Rohn has done it in a textbook way.

ARMD Investment Strategy by Robert Pearce

Mr. Robert Pearce, acting director for ARMD Strategy, Architecture and Analysis (SAA), explained the ARMD investment strategy is the basis for going forward, stopping at the top and working down. Researchers should also inform that process. The effort will remain in progress for at least another year. ARMD welcomes all feedback so the strategy can be updated.

Dr. Clarke said that having a 10-year plan is good, but there should be some sort of aspirational plan above and beyond. Dr. Shin replied that his desire was one 10-year plan that goes above and beyond what already exists. ARMD is modeling its strategy after what NASA's Science Mission Directorate has done. It's not simply NASA Aeronautics, but a plan for the whole community. Ms. Blakey said to be careful of giving people a roadmap on how to cut the ARMD budget. Dr. Shin said he wanted to show how ARMD is part of a community plan. Even though not everything will make sense to the community, ARMD will put it out there. Then the internal federal government process will determine how to fit it into the NASA investment strategy as a whole.

Mr. Anderson said he had a different view. He liked how ARMD is representing the views of the community, but it should be a living, breathing, branched-out document about where ARMD wants to go. He cited the supersonic demonstrator as an example: If it doesn't work, where do you go?

Mr. Borghese said the ARMD mention of processes is very good, and noted government selling of the radio spectrum. In terms of unmanned aerial systems (UAS), consideration should be given to a 4G system rather than a 2G system; there should be an emphasis on using part of the spectrum far more effectively. Dr. Cavolowsky said the World Radio Conference was trying to address those very things. A lot of that is infrastructure users need to count on rather than create. There is potential in this thrust to require bandwidth that has been already sold. Acting Director of ARMD's Integrated Aviation Systems Program (IASP) Dr. Edgar Waggoner said that, from a UAS standpoint, spectrum is a long pole. There is not yet complete control of the spectrum: that's what the Radio Conference is trying to address. Dr. Francis said there was a mismatch in the ways things come together here. All the dots should connect. A discussion then followed about how to integrate the six strategic thrusts by building connections in.

A discussion followed regarding UAS and UAS traffic management (UTM). The latter is a testbed and a validation of approach. For full national airspace system (NAS) transformation, UTM has to be modeled therein. That's one of the reasons for the six thrusts. Also, changing the workforce over 10 years will require "a long runway," according to Mr. Pearce. Mr. Borghese asked about underperforming NASA facilities: "If a new facility stands up and doesn't work out, what is the process to decommission or demolish it?" Mr. Pearce replied: "It doesn't affect us the same way. Once we stand something up, we have a harder time deciding how to get rid of it. Recently, because of the budget, we've mothballed or demolished a number of structures. Many of them were 20 or 30 years beyond their useful lives." Dr. Langford mentioned the lack of balance sheet for the U.S. government, which leads to underpayments for facilities use.

Dr. Francis asked how many times ARMD will re-visit the 10-year plan. Mr. Pearce replied that since ARMD has an annual budget cycle, it will be re-visited every year. Dr. Shin said that ARMD has advanced enough in its thinking that management wants to address why, what and how in a logical manner. For 25 years, Dr. Shin has seen ARMD focusing on why: "The rest of it wasn't connected. Sometimes we focused on what. But it wasn't clear why we were doing it. For my predecessors, it wasn't for lack of smarts or expertise. They just lacked the time from upstairs. We've had the time and ways to check our approaches to see whether they're valid or not." Integration is the crux. Citing stovepipes, Dr. Francis said goals and objectives have to be integrated. It's something that NASA can do uniquely.

Impact of Increasing Regulation to Certify New Airplane Systems by John Borghese

Dr. Francis said that while more detailed paperwork on accidents is being done, most of those events result from a lack of certification of the pilot/aircraft system. Both need to be certified together, not individually. He said he was arguing for the right kind of certification. Don't use the hardware paradigm alone, since advanced automation is creating problems between the human and the machine. Mr. Borghese replied that what he would recommend is to come up with what makes sense: what works and what doesn't. There is so much time spent on detail the overall system is not being considered.

Mr. Stephen Morford said many challenges remain, like the air traffic management system. There is a real issue on how to transition. Business weighs the downside risk to the benefit it receives. One of the things that would be beneficial is to have an understanding of exactly what the insertion of technology involves.

Dr. Shin said there needs to be an understanding of what the barriers are to new-aircraft introduction. It's part of ARMD's maturity: not just technical people interested in working with technology. A discussion then ensued about FAA regulations. Mr. Borghese said his concern is that China wants to get into the airplane-manufacturing industry and they will come up with their own version of the FAA. Then they will do what the United States can't. Should that occur, Dr. Shin said the comparative picture is that no amount of advanced technologies would overcome that [Chinese] edge. Dr. Clarke said that it is wise to prove to a certain level that products or process are safe. There should be a compromise, a balance.

A discussion then ensued about the right amount of risk to take. Driving up the costs is certifying everything that could possibly go wrong. Self-certification isn't exactly the answer, but companies may not be using optimal data analysis (ODA). Perhaps the ground rules should be revisited to see what should be changed and what should be kept. Dr. Shin said that if NASA invests its energy there, it could end up "chasing its tail." Dr. Francis said the goal is what rules make sense. Ms. Blakey wondered what Silicon Valley is doing. There may be a big contingent at Microsoft that could help solve this. Mr. Borghese said there's no way they'd come close to meeting the same standards required.

In terms of aircraft incident rates decreasing for newer aircraft, Mr. Anderson asked how safe the products are getting. Maybe there could be a systems-modeling exercise. A discussion then followed about how to get to better numbers. That's something NASA could work on. But how would ARMD baseline the process? One has to know the departure point. There may be more receptivity at the FAA currently. NASA could work on the tools that the FAA could use to certify. Dr. Langford asked what the rules of thumb at Rockwell Collins are. Mr. Borghese said they were trying to get away from those. What's more important is to measure defects. Dr. Cavolowsky said the ARMD transition roadmap, designed with the FAA, is intended to work with the FAA early on to get to the certification earlier. Mr. Borghese said everyone was trying to do the best possible job they can, trying to make aircraft safer. Dr. Langford said that NASA is going to run straight into this with UTM.

Another discussion ensued, this one about crowdsourcing quality control. The system is far more complex than it used to be. Perhaps a NASA Challenge Prize would be of help. Ms. Blakey said that, for UTM, she envisioned it developing it as the Internet did. Dr. Francis: "Before the Internet, there was ARPANET (the Advanced Research Projects Agency Network). It went through 20 years of scrutiny." Dr. Langford: "It's the whole information assurance thing. You can take everyone else down if you mess things up." Mr. Borghese said that the cost impact would have to be specified. Dr. Shin said that the comments were well-taken. ARMD is considering making UTM a priority.

Dr. Francis said that in the early stages of UTM, the longer ARMD hangs onto and devotes resources to it, the greater the influence ARMD will have on the UTM future. Dr. Shin observed that as the Committee has put high importance on verification and validation (V&V), he remains very much interested in getting the Committee's advice and input on what kind of effort ARMD can devote. ARMD will give it serious thought.

Ms. Blakey mentioned flight-certification processes elsewhere in the world. Mr. Borghese said that, in the case of a Chinese jet getting certification from the FAA, it could very well "run into a brick wall." China is the one country that could say it has learned from the FAA and they will do it right. The Chinese leadership is run by engineers; one example of that is how China stood up its own version of the World Bank.

Dr. Shin mentioned a South Korean television program entitled "Super China." He hoped the program will be dubbed in English and put into widespread distribution. As described in the program, the South Korean strategy was, first, to make inferior products, but then learn and improve. Over time, the products become good enough to compete in a global market. That's what Dr. Shin worries about on the aviation side. Mr. Anderson replied that any aircraft produced by countries other than the U.S. and Europe that aren't safe "won't see the light of day in this or the European market. The real risk is they get really good. They don't have to do an N+3 airplane; they just have to do a current airplane."

Committee Deliberations

In response to a query posed by Ms. Blakey about any recommendations and findings for the Committee to put forward, Dr. Clarke said that the proper process for certification could be a recommendation. Dr. Langford indicated that the discussion was good but didn't see an actionable path forward. Dr. Francis said he would like to see more on autonomy. Dr. Langford said he would like a Committee endorsement of the ARMD Strategic Implementation Plan (SIP): "I think it's an awesome document. It's on a very strong trajectory." Ms. Blakey said she agree, and would also say the Committee would encourage NASA to invest more in supersonics.

A discussion then followed about mentioning both the plan and supersonics. Dr. Langford cautioned about taking the ARMD supersonics plan to Congress; he wouldn't single out supersonics over the SIP. Regarding supersonics research, Mr. Borghese suggested expenses sharing with the Department of Defense (DoD). Dr. Langford said he liked that approach: it's in line with DoD priorities. Otherwise, it's too risky to support. ARMD ought to push battles it can win. How the \$100 million gets spent is incredibly important. The only way to get more, a bigger budget, is to prove ARMD can do really good things. Ms. Blakey said the research NASA is doing will pass muster with the

current administration. NASA has made a very good case beyond flying the corporate elite. It does have potential down the line for the much broader market of the general public. Dr. Francis said that corporate jets just gives the opportunity near-term.

Dr. Langford countered that he has never seen a case where supersonics are seen as economically competitive. The public wants the cheapest ticket: "I'm begging: don't walk into a buzzsaw on the Hill. There's no support for supersonics on the Hill. We've got some big winners here: UTM, very super-efficient transports. Run with those; carry those forward. Maybe it's easy for me, since this is my last meeting." Ms. Blakey suggested that the Committee should stick with the Strategic Implementation Plan since there wasn't a committee consensus regarding supersonics. There has been a concern from the NAC [NASA Advisory Council] about safety. I think we should say we had a good discussion about that and we can make a specific finding on that. Mr. Morford cited the one-year plus-up [of the \$100 million] and what would be done with the additional money. Mr. Borghese asked if ARMD could show the advantages of that \$100 million addition. Dr. Shin replied that the rule of thumb is staying away from budget specifics. Mr. Borghese cited the 10-year plan as very laudable; but it needs a rationale. Ms. Blakey said that the Committee would look at the wording, but she thought there are two very good, solid findings here. Dr. Clarke said that NASA has a very important role to play in V&V. Mr. Borghese suggested that maybe that would be an observation, given the challenge in certification. Dr. Francis said that it will resonate with both the producers and the regulators.

When asked by Ms. Blakey for any final thoughts, Dr. Shin thanked the Committee for the SIP feedback. ARMD put a lot of effort into its formulation, and takes the Committee's feedback very seriously. Ms. Blakey said that she very much appreciated that.

Dr. Langford said he thought the Strategic Implementation Plan is an outstanding document. There's been remarkable progress in structuring the ARMD that will pay great dividends. He strongly salutes what ARMD has done in the plan, and encourages ARMD to keep it going. He believes ARMD should strongly consider research based on the [NASA] Discovery Program in the 1990s (a series of lower-cost, specific American scientific space missions exploring the Solar System): a series of focused missions, and competitive awards. It brought vitality to that community on the small-mission side. His third point was to build and maintain diversity on the Aeronautics Committee; Dr. Langford is the Committee's only small-business representative. He has enjoyed being on the Committee and working with every member. Ms. Blakey conveyed the entire Committee's appreciation for Dr. Langford's contributions.

Public Comments:

None.

MEETING ADJOURNED at 4:59 p.m.