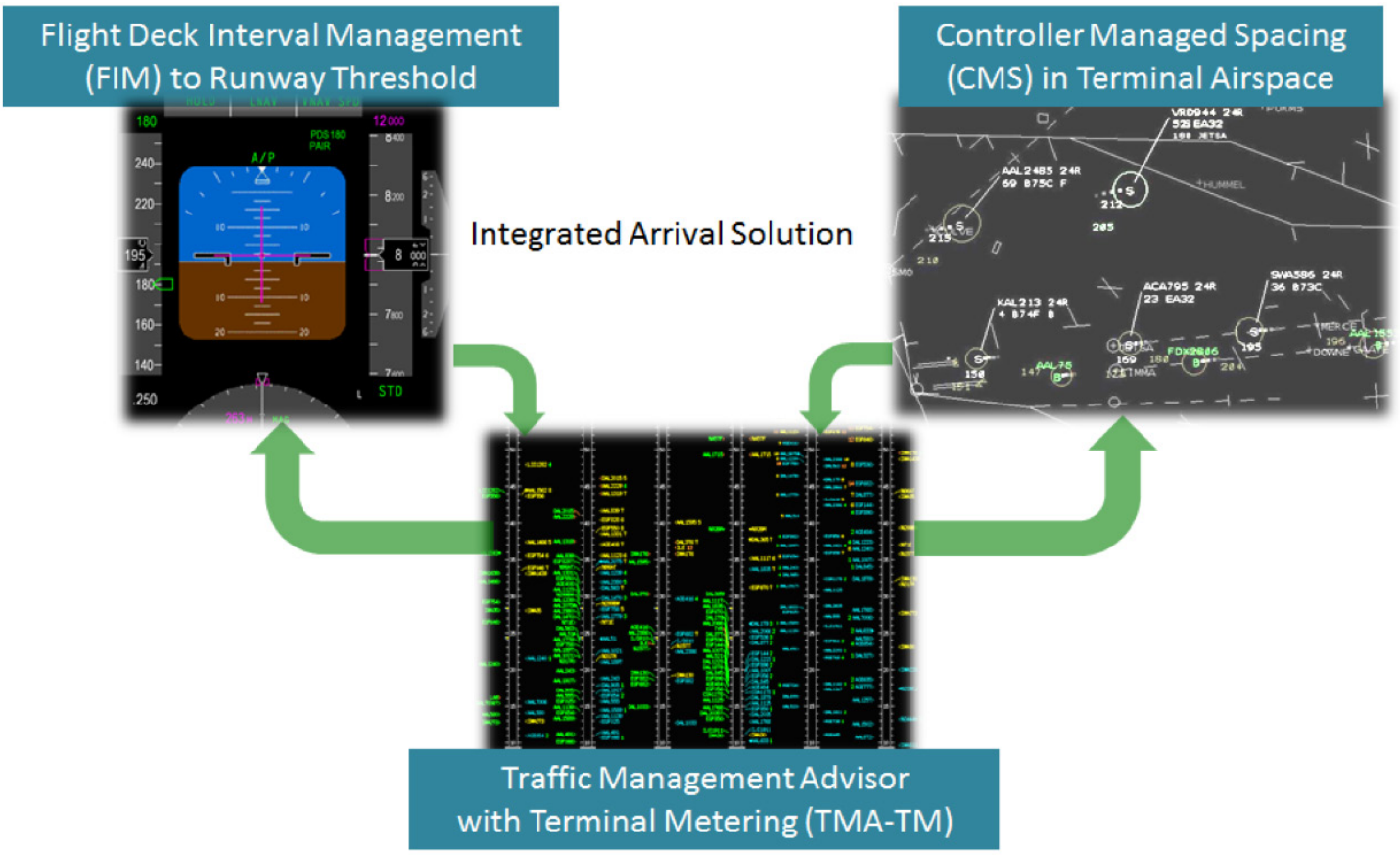
National Aeronautics and Space Administration

# Airspace Systems Program Newsletter

JAN–MAR 2013

## Continous Descent

# // Technical/Programmatic Highlights




*ATD-1 Technology Components.*

## ATD-1 Meeting with Airbus, January 2013

William C. Johnson, deputy lead for Air Traffic Management Technology Demonstration-1 (ATD-1), and Michael Koch, ATD-1 avionics lead, met with industry manufacturer Airbus in Washington, D.C. to discuss a possible role for Airbus in ATD-1. The meeting was also attended by Akbar Sultan, Airspace Systems Program (ASP) deputy director, and Leighton Quon, Systems Analysis, Integration and Evaluation (SAIE) Project project manager. ATD-1 is an activity within ASP/SAIE. Mr. Johnson presented an overview of ATD-1 and fielded questions from Airbus leaders in air traffic management, avionics and product development. ATD-1 was well-received with actions taken by both organizations to foster further dialogue. Airbus is particularly interested in the far-term implementation of Flight Deck Interval Management (FIM). NASA Langley Research Center-developed FIM technology is one of the key technologies in ATD-1 and will be

used to provide speed guidance during an aircraft's arrival according to an inter-arrival spacing behind another aircraft.

Opportunities for Airbus to partner with NASA Langley on future research and development activities across the center were also discussed. Another discussion with Airbus is being planned for the near term to address strategic direction of a NASA/Airbus partnership for ATD-1 and with NASA Langley. This meeting was a direct result of discussions held during ATD-1 Industry Day at Langley in August 2012.
*(POC: William C. Johnson)*

## ATD-1 Meetings with Thales, October 2012 – January 2013

William C. Johnson, deputy lead for Air Traffic Management Technology Demonstration-1 (ATD-1), and Michael Koch, ATD-1 avionics lead, conducted a series of three meetings with industry manufacturer Thales to discuss Thales participation in ATD-1. Thales is the parent company of Aviation Communication & Surveillance Systems (ACSS), an avionics manufacturer that is currently partnered with Boeing to prototype ATD-1 flight deck technologies within an ACSS commercial product on a Boeing 737NG aircraft. At the initial meeting at NASA's annual Systems Analysis, Integration and Evaluation (SAIE) Project conference, Mr. Johnson presented an overview of ATD-1 and fielded questions from Thales leaders in air traffic management, avionics, and product development. ATD-1 was well-received, with actions taken by both organizations to foster further dialogue.

While in France for an Radio Technical Commission for Aeronautics (RTCA) Special Committee (SC)-186 Working Group (WG)-4 meeting, Mr. Koch visited Thales' facilities in Toulouse, where he had discussions with their manager for airborne separation assistance systems (ASAS) and received a tour of their facilities, including their ASAS capabilities. A subsequent planning meeting was held at Thales' Headquarters in Virginia to exchange more information pertaining to Single European Sky ATM Research activities related to ATD-1 and to determine how both organizations might work together. The initial meeting was a direct result of discussions held during ATD-1 Industry Day in August 2012 at NASA Langley Research Center.
*(POC: William C. Johnson)*

## Wake Research Discussions with NWRA and DLR, January 2013

Dr. Nash'at Ahmad and Dr. Fred Proctor met with Don Delisi, Matthew Pruis and David Lai of Northwest Research Associates (NWRA), and with Don Jacob of the Coherent Research Group during the January American Institute of Aeronautics and Astronautics (AIAA) 51st Aerospace Sciences Meeting and Exhibit, in Grapevine, Texas, held January 7-10. This meeting was held to discuss efforts of NWRA under a current NASA Research Announcement (NRA) activity, sponsored by the Airspace Systems Program's Concept and Technology Development Project. In the meeting, status and near-term goals were discussed and a list of action items and delivery dates were developed.

Topics included:

- Deployment of meteorological and lidar sensors at Memphis International Airport in order to acquire high-quality wake-vortex measurements;
- Reprocessing of existing Denver 2005 and 2006 measurements with newer and more accurate lidar processing algorithms;
- Processing of turbulence and crosswind profiles from an existing Denver lidar file; and
- Documentation and standardization of file format and database structure for measured data and software.

Drs. Ahmad and Proctor also met with Frank Holzapfel of the German Aerospace Center (DLR) to discuss joint research and planned milestones for wake research under the NASA-DLR agreement "On Cooperation in Aeronautics and the Exploration and Use of Outer Space for Peaceful Purposes." DLR is considering the deployment of their lidar to Memphis and would like to coordinate with the NASA measurement campaign. The outcome of the NRA contract and the DLR collaboration will provide much needed field data, and contribute to the development and validation of wake-vortex prediction tools that will allow the development of safe and efficient aircraft separation criteria within the national airspace system.
*(POC: Fred Proctor)*

## Delta Airlines, Passur Aerospace Discuss NASA Collaborations, January 2013

The general manager of air traffic management from Delta Airlines and the vice president of air traffic innovations for Passur Aerospace visited NASA Ames Research Center on January 10-11. During their visit, they were given briefings and demonstrations of NASA technologies, including the Dynamic Weather Routes System, airport surface scheduling, mitigation of weather constraints, airline behavior modeling, airport scheduling in and around Atlanta, and a tour of simulation facilities. The meetings ended with discussions to investigate specific collaborations between NASA and these two organizations.
*(POC: Tom Davis)*

## ATD-1 Announces First Airline Partner, January 2013

US Airways has agreed to be the first airline partner with NASA on Air Traffic Management Technology Demonstration-1 (ATD-1). A letter announcing the airline's intent to partner with NASA was sent on January 14 from the US Airways senior vice president for flight operations to the NASA Airspace Systems Program director and the aeronautics directors at NASA Langley and NASA Ames research centers.

The objective of ATD-1 is to demonstrate an integrated set of NASA Next Generation Air Transportation System, or NextGen, technologies that provide an efficient arrival solution addressing the complexities

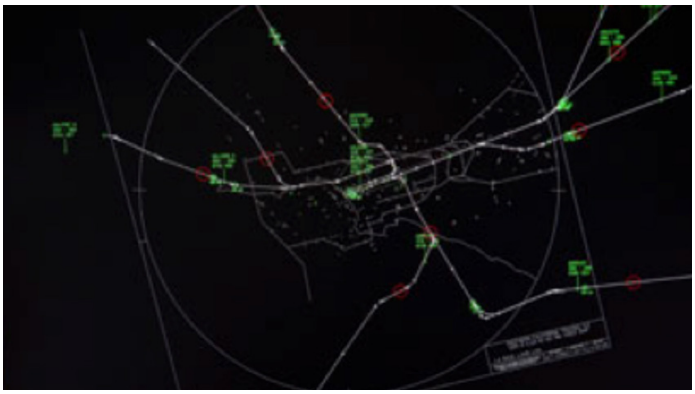
of high-density operations. This integrated set of technologies includes the Flight Deck Interval Management System (FIM), an Automatic Dependent Surveillance – Broadcast (ADS-B) In-based application, and the Traffic Management Advisor with Terminal Metering (TMA-TM) and Controller Managed Spacing Tools (CMS).

The US Airways partnership is a major step forward toward the successful execution of the ATD-1 activities and the planned flight demonstration, as well as toward the acceleration of the FIM ADS-B In application into operational use in the national airspace system. A number of discussions with, and briefings to, US Airways by the ATD-1 team, including William Johnson, the deputy lead for ATD-1 and Mike Koch, the ATD-1 avionics lead, were instrumental in the airline's decision to partner with NASA.

The ATD-1 team continues to have discussions with other airlines, including Fed Ex and Southwest airlines, to gain additional partners for this game-changing activity.
*(POC: William C. Johnson)*

## ATD-1 Integration Testing at Raytheon, January 2013

An ATD-1 team traveled to Raytheon Corporation facilities in Mt. Laurel, N.J. January 22-24 to conduct integration testing of NASA's Aeronautical Data Link And Radar Simulator (ADRS) and Multi Aircraft Control System (MACS) with the Federal Aviation Administration's (FAA's) Standard Terminal Automation Replacement System (STARS). STARS is the intended platform for hosting ATD-1 technologies, and several STARS displays will be used in upcoming simulation experiments at NASA.



*Screenshot of ATD-1 Controller Managed Spacing tools.*

The integration and validation testing was intended to compare ADRS/MACS with Raytheon's ATCoach software to determine whether MACS can be used for simulations on the STARS displays. MACS-driven aircraft targets successfully appeared on the STARS displays for Los Angeles-based airspace, and development is underway to enable testing using Phoenix, Ariz. airspace. Additional integration testing at Raytheon is planned for late February to evaluate the Phoenix adaptation, and a future simulation is planned to evaluate the incorporation of the CMS tools. These integration milestones are key steps to enable a successful ATD-1 human-in-the-loop simulation with the STARS system, known as Fully Integrated ATD-1 Technologies, or FIAT.
*(POC: Kevin Witzberger)*

## ATD-1 Invited to Present at Conference, January 2013

ATD-1 leadership from NASA Langley and NASA Ames research centers provided an invited presentation on ATD-1 to an airline technical pilot conference January 23-24 hosted by US Airways (an ATD-1 airline partner). The purpose of the conference was to gather airspace users and FAA decision makers to explore ways to enable changes in the national airspace system (NAS). The conference was attended by commercial air carriers US Airways, United Airlines, Southwest Airlines, Delta Airlines, American Airlines, Alaska Airlines, FedEx, Frontier Airlines, Horizon Airlines, Mesa Airlines, Pinnacle Airlines, Pacific Southwest Airlines, United Parcel Service, and WestJet; as well as manufacturers Airbus, Boeing, Honeywell, General Electric, Jeppesen, Rockwell Collins, Thales and various FAA organizations and personnel from the Air Traffic Controllers Association.

At the conference, US Airways cited the NASA ATD-1 team for helping them to address key terminal area capabilities that are needed for improvements to the NAS. ATD-1 is viewed by the community as a crucial effort in enabling higher density terminal arrival operations and increased use of performance-based navigation in the national airspace system.

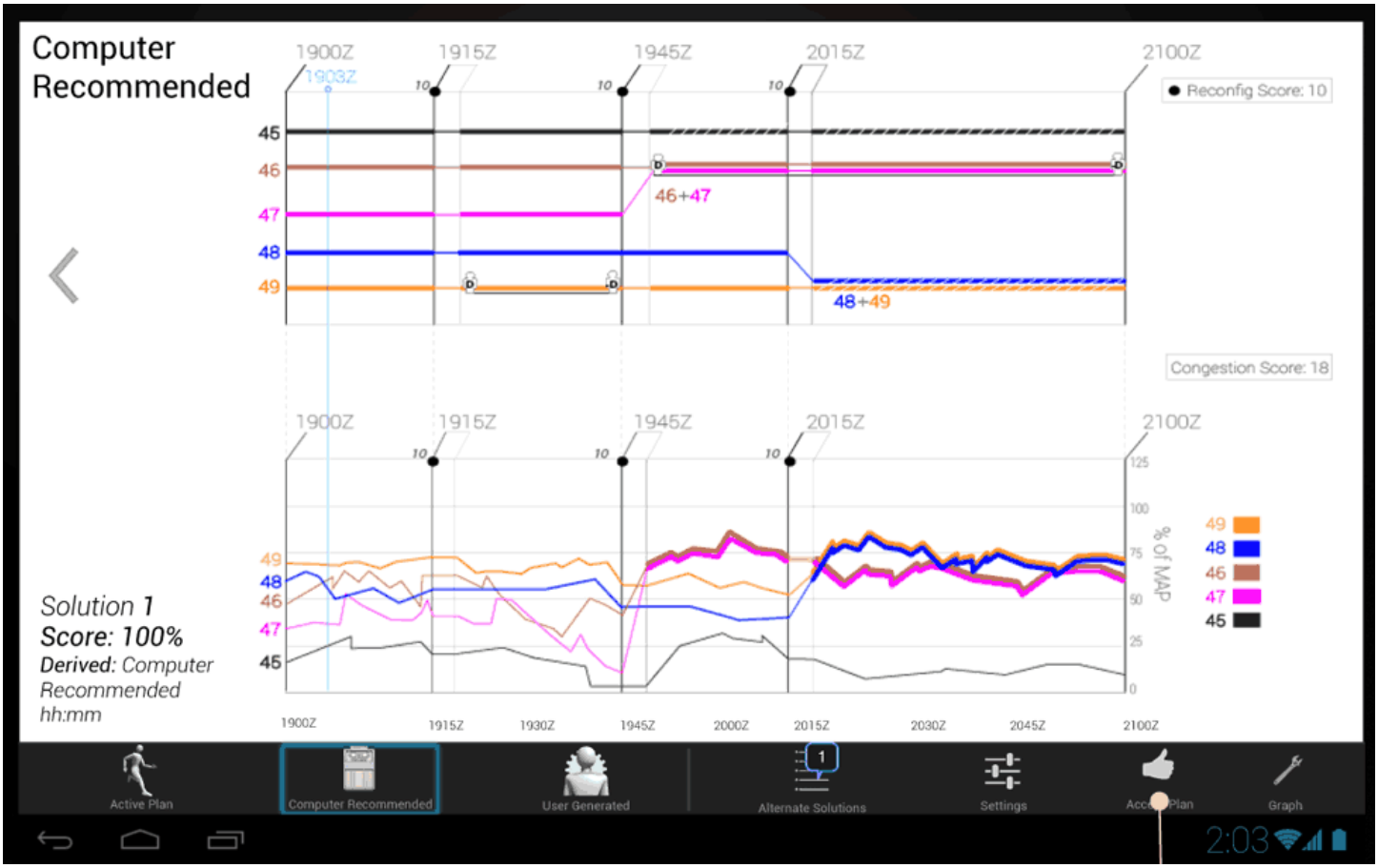
ATD-1 was presented by John Robinson, chief engineer for ATD-1, with support from ATD-1 deputy lead William C. Johnson. NASA's presentation of ATD-1 was well-received by everyone at the conference. Interest from several airlines, including American, Delta, Southwest, and US Airways, resulted in further discussions during the conference. Further ATD-1 engagement with this group will continue through various avenues such as activities and working groups sponsored by Airlines for America; interested airlines will be invited to observe key ATD-1 milestones going forward.

Interest in ATD-1 from these stakeholder airlines is seen as a validation of the nation's airspace improvement needs and importance of the solutions being developed by NASA.

*(POC: William C. Johnson)*

## Algorithm Tested in Human-in-the-Loop Experiment, January 2013

Dr. Bryan Barmore and Mr. Michael Koch attended a November 5-8 meeting of the Radio Technical Commission for Aeronautics (RTCA) Special Committee 186 (SC-186) and the European Organization for Civil Aviation Equipment (EuroCAE) Working Group 51 (WG-51) subgroup at the Airbus Company in Toulouse, France. SC-186 and WG-51 are developing Flight Deck Interval Management (FIM) and Traffic Situation Awareness with Alerts (TSAA) Minimum Operational Performance Standards (MOPS), which are new capabilities being introduced as part of the FAA's NextGen Airspace Program. The NextGen-System Analysis, Integration, and Evaluation (SAIE) Air Traffic Management (ATM) Technology Demonstration-1 (ATD-1) activity intends to demonstrate MOPS-based FIM procedures, software, and equipment for use in flight trials planned for 2015-2017.




*Screenshot of OASIS.*

This meeting was the third in a series of quarterly meetings and only included committee members supporting the FIM MOPS. Its primary focus was to discuss the results and status of several ongoing efforts in support of Operational Performance Analysis (OPA) and Operational Safety Analysis (OSA) activities. Dr. Barmore led the Delta operational services and environment description (OSED) discussion presenting a summary of final operational scenarios and the results of a workshop conducted to address several small OSED-related questions that rose out of previous meetings.

Mr. Koch held several breakout meetings with committee leadership and equipment manufacturer representatives to discuss the impacts of new display requirements the FIM equipment must support. New display requirements have impacted the architecture assumed for ATD-1, affecting planned experiments and the avionics development already underway.

The results of the OPA and OSA activities will drive many of the MOPS requirements, which will directly affect the FIM avionics development for ATD-1. Some analyses were mature enough to begin driving

requirements. Others are still a work in progress and have not yet led to any tangible requirement recommendations. The objective of presenting such work was to gain committee buy-in with regard to the analysis approach, or to share preliminary results, which must be studied further. Once complete, the MOPS will pave the way for FIM to be integrated into commercial aircraft and into the national airspace system, contributing to efficiency gains in arrival operations and improvement in airport throughput and capacity.

The next meeting is scheduled for early March at the RTCA Headquarters in Washington D.C. The MOPS development is scheduled for completion in May, 2014. *(POC: Michael Koch)*

## Presentation to the CSPO Working Group, January 2013

Dr. Bryan Barmore and Mr. Brad Perry attended the Closely Space Parallel Operations (CSPO) Working Group meeting at The MITRE Corp. in McLean, Virginia on January 30. Mr. Perry presented a summary of the FY 2012 Phase I FAA reimbursable work that developed, tested, and transferred to the FAA the Adjacent Landing Alerting System (ALAS) algorithm software. The ALAS algorithm is an aircraft-based alerting capability that monitors and alerts pilots of airspace intrusions by aircraft on adjacent, closely spaced parallel runway approaches, and can enable enhanced approach capability to these runways. He also outlined the FY 2013 Phase II FAA reimbursable work that will include refining the ALAS algorithm for use with the current and future ADS-B capabilities, working with MITRE and the FAA to develop a concept of operations, and assisting the FAA with preparations for a planned human-in-the-loop simulation study to be conducted by the FAA in FY 2014.

Mr. Rick Butler, Mr. Wilfredo Torres-Pomales, and Mr. Michael Madden joined Mr. Perry for follow-up discussions on January 31. Mr. Butler provided a demonstration of the ALAS algorithm performance to the CSPO Working Group and discussed the algorithm's current capabilities. The CSPO Working Group is focused on developing instrument approach solutions for closely spaced parallel runways that will enable aircraft arrival rates during instrument meteorological conditions that are as close as possible to visual approach arrival rates.
*(POC: Brad Perry)*

## HITL Simulation Explores Trajectory Prediction Requirements, January 2013

Airspace Systems Program researchers completed what is believed to be the first human-in-the-loop (HITL) simulation to address the age-old question regarding trajectory prediction (TP) performance: "How good is good enough?" That is, how much trajectory-prediction error can be accommodated by air traffic controllers before a NextGen trajectory-based operations (TBO) concept becomes untenable?

Two controller teams used an advanced set of tools during 22 typical Atlanta arrival-metering trials in which uncertainties in the form of wind forecast errors

and errors in aircraft performance (e.g., descent rate) assumptions were varied from nominal levels to four to five times those of real-world uncertainties. Real-time controller performance metrics on the number of clearance instructions, workload, and quality of service in terms of arrival metering accuracy and traffic separation were recorded. Preliminary observations suggest that there was no clear controller "breakpoint" (whereupon the operational concept became untenable).

Even with the largest errors, controllers were able to compensate and adapt the advisories suggested by the automated tools to maintain safe separation and deliver arrival aircraft on time. Reported workload ratings did increase with increasing errors, but on average remained within acceptable levels. Increased TP errors did not appear to be correlated with an increase in the number of corrective clearances, nor did a reduction in the efficiency benefits of the NextGen tools.

These findings suggest future research should further investigate the exact nature and impact of how the controllers adapted to the TP errors, and, if the same TP errors that were so effectively managed by the controllers are found to overwhelm a fully automated system that relies solely on corrective advisories, there may be a need to incorporate corrective learning in TBO automation as the controllers did naturally in the simulation. There may also be a need for additional development of the HITL concept for transition to more automated paradigms.
*(POC: Steve Green)*

## ATD-1 Discussions with FAA Albuquerque Control Center, January 2013

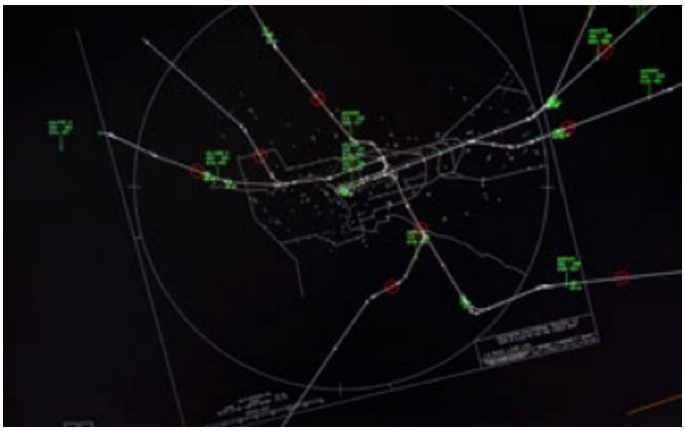
William C. Johnson, NASA Langley Research Center's lead for the Airspace System Program's Air Traffic Management Technology Demonstration-1 (ATD-1), met with FAA Albuquerque Air Route Traffic Control Center (ARTCC/ZAB) leadership staff in Albuquerque, N.M. to interview the staff and gather information in an effort to determine if the facility would be an appropriate testbed for ATD-1 research and development activities and field test. The visit went very well. Some challenges were identified that require further examination, but when combined with terminal operations at the Phoenix Terminal Radar Control (TRACON/P50) facility and Phoenix Sky Harbor Airport (PHX), the operational environment is a very good testbed for advanced terminal arrival research and development, such as ATD-1. As a result, ATD-1 has transitioned to conducting research and development in a simulated ZAB/P50/PHX environment.

In a related but independent activity, the FAA has announced that ZAB will be their initial operational capability site for ground-based interval management -spacing (GIM-S). GIM-S will provide a necessary traffic-flow conditioning function that the ATD-1 concept will leverage. Some of the data to support the FAA GIM-S key site evaluation was provided by the NASA ATD-1 team last year. This key site selection by the FAA further strengthens ZAB/P50/PHX as an ATD-1 appropriate environment for deployment.
*(POC: William C. Johnson)*

## FIAT-2 Completes Shakedown Simulations, February 2013

NASA has developed a suite of advanced arrival management technologies combining time-based scheduling with controller- and flight deck-based precision spacing capabilities that allow fuel-efficient arrival operations during periods of high throughput. An operational demonstration of these integrated technologies, the Air Traffic Management Technology Demonstration-1, or ATD-1, is slated for 2016. Human-in-the-loop simulations were conducted February 4-6 at NASA Ames Research Center to evaluate the performance of the ATD-1 system and validate operational feasibility.

Fully Integrated ATD-1 Technologies-2, or FIAT-2, focuses on developing the ground-based controller tools used in ATD-1. The Controller Managed Spacing (CMS) tools were ported and tested in the NASA Traffic Management Advisor (TMA) software baseline. The FIAT research team completed a set of system checkout simulation runs of the CMS algorithms. Participants included five controllers and eight pseudo pilots, who also assisted in refining the phraseology and procedures proposed forATD-1. MITRE researchers also observed the shakedown and discussed plans for the upcoming Terminal Spacing and Sequencing (TSS) simulations. *(POC: Jane Thipphavong)*



*Screenshot of ATD-1 Controller Managed Spacing tools.*

## Automation Maximus Workshop, February 2013

A two-day workshop entitled "Automation Maximus," to explore initial ideas for maximum desired level of automation for air traffic management (ATM), was conducted at NASA Ames Research Center on February 6-7. A total of 34 participants from NASA Ames and Langley research centers, Dryden Flight Research Center and NASA Headquarters attended the workshop. The goal was to initiate the exploration of automation ideas for the future air transportation system 25 years and beyond. All researchers who attended the workshop arrived prepared with specific automation-related considerations for future ATM.

The researchers discussed evolving trends in mobility, autonomy and automation, future vehicle types, including but not limited to personal vehicles, and future airspace usage, with the goal of deriving greater economic benefit from the airspace resource. There was a general agreement that future ATM automation should be considered from a clean-slate perspective and, as the starting point, the highest potential level of automation. Automation was seen as a key requirement of ATM operations to accommodate scalability, mixed

equipage, divergent user needs, and efficiency at the lowest possible cost.

Researchers will consider multiple concepts and architectures to enable future ATM systems. Multiple groups, in a breakout session, identified a number of initial considerations for ATM architecture-related research ideas, as well as enabling technologies and methods. Such explorations will continue along these directions. The workshop was facilitated by NASA personnel Parimal Kopardekar, manager of the Concept and Technology Development Project, and Natalia Alexandrov, project scientist for the Systems Analysis, Integration and Evaluation Project.
*(POC: Parimal Kopardekar)*

## PTM Briefing for FAA Senior Manager, February 2013

On February 8, Ken Jones, Ryan Chartrand, and Tom Graff briefed Mr. Vincent Capezzuto, FAA Director of Air Traffic Services in the Program Management Organization on a new Automatic Dependent Surveillance – Broadcast (ADS-B)- based air traffic management concept known as Pair-wise Trajectory Management (PTM).

Aircraft today are, at times, forced to fly on less than optimal trajectories to avoid conflicts with other air traffic. The goal of PTM is to reduce these traffic conflicts and save fuel and reduce delays by increasing time on an aircraft's optimal trajectory (track and altitude) using air traffic control-assigned airborne management of a specific conflict. Mr. Capezzuto was pleased to see NASA developing concepts such as PTM and agreed that PTM was a logical, strategic step toward enabling Next Generation Air Transportation System (NextGen) operations. Mr. Capezzuto was interested in collaborating with NASA on the development of the concept and supporting the development of PTM within standards organizations.

As a result of the meeting, PTM will be presented to a joint plenary meeting of Radio Technical Commission for Aeronautics Special Committee 186 and European Organisation for Civil Aviation Equipment Working Group 51 on March 8 for inclusion in their work program. This will result in an international government/industry working group that will work with NASA to mature the PTM concept. This work not only supports a NASA Airspace Systems Program's Concept and Technology Development Project milestone, but also begins developing critical stakeholder buy-in of PTM.
*(POC: Ken Jones)*

## Congratulations to Award Winners Aisha Bowe and Dr. Ousmane Diallo! February 2013

The 27th Black Engineer of the Year Award (BEYA) and Science, Technology, Engineering and Math (STEM) Global Competitiveness Conference was held in Washington, D.C. on February 8. The BEYA STEM Conference is the largest gathering of STEM professionals and leaders who are committed to increasing the percentage of people from historically underrepresented communities in the technology


*Poster congratulating the 2013 BEYA STEM Global Competitivenss Conference NASA Award Winners.*

workforce. The conference recognized several outstanding NASA employees, including Aisha Bowe and Dr. Ousmane Diallo.

## US Airways Visits Langley to Assess Cockpit Simulator, February 2013

Captain Mike Davis, a US Airways lead flight instructor, visited NASA Langley Research Center on February 14 to assess potential modifications to the Development and Test Simulator (DTS) flight cab, intended to make the cab more viable for Airbus qualified pilots to participate in future human-in-the-loop experiments. The visit was hosted by Langley's Crew Systems and Aviation Operations Branch and the Simulation Development and Analysis Branch.

While the DTS services a multitude of research activities, the impetus behind exploring an Airbus reconfiguration is twofold. First, since a significant percentage of aircraft in the national airspace system are Airbus models, the pool from which researchers can draw subject pilots will be increased substantially, and experimental conclusions may be improved as a result of manufacturer diversity. Second, since US Airways has officially partnered with NASA to support the Systems Analysis, Integration and Evaluation Project's Air Traffic Management Technology Demonstration-1 (ATD-1) activity, having a simulation resource more familiar to their pilots and staff will facilitate their involvement in near-term interval-management experiments supporting ATD-1 research.

The primary goal of the assessment was to identify avionics dissimilarities, as compared with an actual Airbus cockpit, and determine whether the additional training and workload necessary to overcome the differences would prove detrimental to the execution and results of an experiment. The focus was to identify irreconcilable show stoppers, insignificant differences that could be overlooked, and practical modifications to the cab that would make it more familiar to Airbus-certified subject pilots. Emphasis was placed on cockpit

controls and displays, the center console, graphics, symbology, and how the flight model flies.

Captain Davis was enthusiastic about his role, thorough in his assessment, and detailed with his input. In the end, he determined that no major hurdles exist and, for the purposes of experimental research, changing symbology and color schemes on the primary flight display (PRD) and navigation display (ND) are all that is needed to render the cab acceptable to US Airways pilots. Captain Davis also offered to host a group from NASA at the US Airways training facility in Charlotte to spend time in their A330 cab to get a firsthand look at an Airbus cockpit. If ATD-1 and Langley choose to move forward with changes to the PFD and ND, such a visit would facilitate the development process. *(POC: Michael Koch)*

## TAP Prototype Software Delivered, February 2013

A prototype technology called the Traffic Aware Planner (TAP) was delivered on February 15 by Engility Corporation under the terms of a NASA Research Announcement (NRA) contract led by NASA to further develop the concept of Traffic Aware Strategic Aircrew Requests (TASAR). TASAR was conceived as a near-term application of Automatic Dependent Surveillance – Broadcast (ADS-B) In technology, providing airspace users the opportunity to receive early and direct benefits from ADS-B In. Currently, few flight deck applications exist that incorporate ADS-B. TASAR is envisioned as one potential cost-effective avenue to accelerate the widespread use of ADS-B in the national airspace system. TASAR research and development is sponsored by the Airspace System Program's Concepts and Technology Development Project.

The TAP software application runs on a Class 2 electronic flight bag and will serve as an advisory tool for pilots in making flight-optimizing trajectory changes during flight. To make the trajectory changes more likely to be approved by air traffic control, TAP leverages ADS-B surveillance data to ensure the requests will avoid conflicts with nearby traffic aircraft. The latest version of TAP, referred to as Build 2, continuously scans for time- and/or fuel-saving possibilities in three ways: lateral-only route changes, altitude changes, and combination lateral/altitude changes. TAP also supports a manual mode, where the pilot enters a desired change and the fuel/time impact and conflict prediction results are displayed. This mode will be useful for coordinating trajectory-change requests sent by the aircraft's dispatcher. Future TAP versions will enhance the manual mode with the capability to automatically adjust the entered changed to avoid predicted conflicts. TAP will be tested by pilots this spring in a simulation experiment and this summer in a flight trial.

The challenge that TAP meets is to quickly create a near-term flight-deck capability, by leveraging NASA technology developed and matured for self-separation research, which provides immediate operator benefits with minimal equipage and certification costs. A TASAR benefits study showed that, on average, aircraft equipped with TASAR saved about one to four

minutes of time and about 50-550 pounds of fuel per flight, depending on the optimization objective, class of airspace user and aircraft type. These benefits make a compelling argument for adopting ADS-B In and associated airborne flight-optimizing capabilities. *(POC: David Wing)*

## Dr. Banavar Sridhar Elected to UConn's Academy of Distinguished Engineers, February 2013

On February 25, Dr. Banavar Sridhar, the NASA Ames Research Center's senior scientist for Air Transportation Systems, was elected to the University of Connecticut School of Engineering's Academy of Distinguished Engineers for 2013. The award acknowledges Dr. Sridhar's career achievements and impact. Dr. Sridhar received his M.S. and Ph.D. degrees in electrical engineering from the University of Connecticut, and joined NASA in 1986. He has served as the lead of modeling and optimization techniques in aerospace systems, and was one of the original developers of the award-winning Future Air Traffic Management Concepts Evaluation Tool (FACET). FACET received the NASA Software of the Year award in 2006, the American Institute of Aeronautics and Astronautics Engineering Software Award in 2009, the NASA Government Invention of the Year Award in 2010, and the FAA Excellence in Aviation Research Award in 2010.

Currently, Dr. Sridhar is applying learning automation techniques to improve air traffic operations, and developing methods to quantify and mitigate the harmful effects of aircraft emissions and contrails. Dr. Sridhar is also a Fellow of the Institute of Electrical and Electronics Engineers and the American Institute of Aeronautics and Astronautics.

*Dr. Banavar Sridhar.*

## PIRAT Demonstration, February 2013

A team of NASA Langley researchers and contractors led by Colin Smith and Jim Smail conducted the Phoenix Integration with Research Tools for Airspace Testing (PIRAT) demonstration in the Air Traffic Operations Laboratory (ATOL) and the Integration Flight Deck (IFD) on February 26. PIRAT was a development activity for the Airspace Systems Program's Air Traffic Management Technology Demonstration-1 (ATD-1), and was designed to complete, integrate, and test critical simulation and infrastructure developments for four upcoming ATD-1 experiments slated to occur in the remainder of the fiscal year. This early development activity was designed to reduce development required for the four individual experiments.

Phoenix Sky Harbor Airport (PHX) and supporting airspace facilities Phoenix Terminal Radar Approach

Control and Albuquerque Center were chosen for future ATD-1 research and development activities after a key site analysis of potential sites that was conducted last year. The key site analysis evaluated airspace configuration, traffic demand, route structure, automation schedules, facility logistics and facility staff. PHX was selected as an excellent test bed for evaluations of ATD-1 operations due to its refined arrival procedures, automation schedules, advanced performance-based navigation implementation, progressive staff, and tremendous interest from the lead carrier. With PIRAT, all ATD-1 research and development activities across ATD-1 technologies and NASA labs at both Langley and Ames research centers are now aligned with PHX operations.
*(POC: Colin Smith)*

## Boeing Demonstrates Four Concept Avionics Prototypes, February/March 2013

As part of the Air Traffic Management Technology Demonstration-1 (ATD-1) avionics development contract, Boeing conducted a series of simulations from February 28 through March 1 at NASA Langley Research Center to demonstrate the use of NASA's Automatic Dependent Surveillance – Broadcast (ADS-B) In-based Airborne Spacing for Terminal Arrival Routes (ASTAR) algorithm in four concept engineering prototype configurations designed for Flight Deck Interval Management System (FIM) operations.

The event, led by Mr. Michael Koch, was the third major deliverable of the Phase 1 task order with a primary objective of validating the viable use of ASTAR for FIM operations. The demonstration was well attended, with representatives from ATD-1's Management and Technical team, the Airspace Systems Program Office, the Systems Analysis, Integration and Evaluation Project, and Center management. Also participating were stakeholders from the FAA, US Airways, Boeing, and Aviation Communication & Surveillance Systems (ACSS).

Both retrofit and forward-fit configurations were addressed (one each in Boeing's 737NG and 777 models) targeting feasible solutions for the near-term and mid-term national airspace system (NAS). One configuration of particular interest was a full hardware retrofit solution using a commercial ADS-B application platform running ASTAR on the 737 platform. Such a real-world solution goes a long way in proving the viability of integrating the ASTAR application in existing aircraft. Several combinations of scenarios, designed by NASA to exercise critical integration aspects of the FIM system, were successfully demonstrated with ASTAR performing well in each.

Boeing did an excellent job briefing participants and conducting the simulations. The success of this activity was evident from participant feedback. In the end, this task served to validate prototype recommendations that will be used as a basis for FIM equipment requirements for the upcoming ATD-1 demonstration and help accelerate the transition of this ADS-B In-based application into NAS operations.
*(POC: Michael Koch)*

## DWR System Evaluated by FAA TMCs and Area Supervisors, February/March 2013

Six recently retired Fort Worth Center traffic management coordinators (TMCs) and area supervisors participated in an evaluation of the Dynamic Weather Routes (DWR) System February 26-March 7 at NASA Ames Research Center. Two main objectives of the study were achieved: first, Center participants provided their perspective and evaluation of DWR routes previously found to be acceptable to American Airlines (AA) users during the ongoing experimental trial at the AA System Operations Center; and, second, operating concepts for the use of DWR with automated airline/air traffic control coordination were examined.

The evaluation system included automated coordination between airline DWR users and FAA Center TMCs, enabling both users to visualize and modify airline-proposed routes using nearly identical graphic displays, as well as automated detection of active weather-avoidance routes issued by the Air Traffic Control System Command Center during severe weather events.

The evaluation resulted in several important findings. DWR route advisories with large savings (e.g., 15-20 minutes or more) clearly triggered participants to question whether or not existing weather-avoidance routes were still necessary. The NASA team also gained a better understanding of factors that determine whether a DWR route can go directly to the flight crew without coordination, versus those that should be pre-coordinated with the local or neighboring center,

*Dynamic Weather Routes System in operation at the American Airlines System Operations Center, Fort Worth, TX*

or with the command center. Simple automation that quickly displays a proposed reroute for those that need to approve appeared the best way to streamline coordination and implementation of a DWR route request, and make FAA traffic managers aware of route restrictions that may no longer be necessary.
*(POC: Chester Gong)*

## NASA Supports RTCA Meeting, March 2013

Dr. Bryan Barmore attended a meeting of the Radio Technical Commission for Aeronautics (RTCA) Special Committee (SC) 186 Working Group (WG) 4 and the European Organisation for Civil Aviation Equipment (EUROCAE) WG-51 subgroup 1 at RTCA Headquarters in Washington, DC. March 5-7. SC-186 and WG-51 are developing minimum operational performance standards (MOPS) for several Automatic Dependent Surveillance – Broadcast (ADS-B) In applications including: Flight Deck Interval Management (FIM), Cockpit Display of Traffic Information

(CDTI)-Assisted Visual Separation (CAVS), and Traffic Situation Awareness with Alerts (TSAA). Approximately 50 participants from airlines, avionics manufacturers, airframe manufacturers, research organizations and regulatory organizations attended.

Discussions focused on closing the final actions for the operational description for FIM, which Dr. Barmore is leading, as well as presenting results from the performance analysis. A sample algorithm, which will be included in the final FIM MOPS as industry guidance, was presented. Mr. Michael Koch assisted with the development of the sample algorithm based partially on the Airborne Spacing for Terminal Arrival Routes (ASTAR) algorithm developed at NASA, and used within NASA's Airspace Systems Program research and development activities, including ATD-1.

The committee accepted the analysis done to date as well as the first draft of functional requirements for the FIM equipment. The next working group meeting is scheduled for June 3-6 in Edinburgh, Scotland. The MOPS to support TSAA and CAVS is expected to go out for final review and comments in December 2013. The FIM MOPS is scheduled for completion in May 2014.

*(POC: Bryan Barmore)*

## Kickoff Meeting Held for SPO Certification Requirements, March 2013

The kickoff for the single pilot operations (SPO) certification requirements task activity was held on March 7 by contractor Research Integrations, Inc. and NASA representatives. The kickoff was attended by Paul Schutte, NASA technical monitor for the task, Ken Goodrich, Walt Johnson, Mike Feary and, from Research Integrations, Inc., Dr. Beth Lyall, Jennifer Wilson, and Greg Harron. SPO is a research thread within NASA's Concepts and Technology Development Project.

The objective of this task is to identify and document certification requirements necessary to certify SPO for Part 135, Part 121, and Part 125 operations. The contractor will also address certification challenges and include certification issues for aircraft certification (Part 23 and 25). The contractors will begin with a survey of FAA rules and practices for crew complement (including the history of moving from a three-crew to a two-crew flightdeck). This will involve interviews with regulators and manufacturers.

The next phase will involve reviewing the differences between Part 135 operations (which allows SPO in some cases) and Part 121 operations. Finally, certification estimates will be created for aircraft (Part 23 and 25) and for operations (Part 121 and 125). The task is due to conclude in July 2013. The results of this task will guide SPO research efforts to ensure that issues that affect certification will be addressed early in the SPO activities.

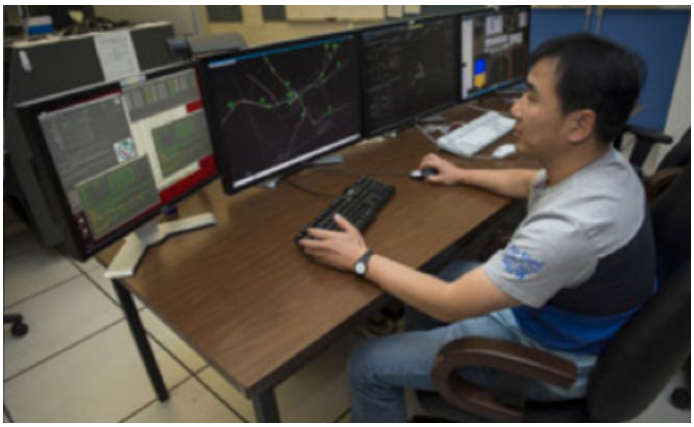
*(POC: Paul Schutte)*

## FAA/NASA Simulation Completes Shakedown Runs, March 2013

NASA has developed a suite of advanced arrival management technologies combining time-based scheduling with controller- and flight-deck-based precision-spacing capabilities that allow fuel-efficient arrival operations during periods of high throughput. An operational demonstration of these integrated technologies – the Air Traffic Management Technology Demonstration-1, or ATD-1 – is slated for 2016. The focus of the Fully Integrated ATD-1 Technologies-2 (FIAT-2) human-in-the-loop (HITL) simulation is the development of the ATD-1 ground-based system for field demonstration, which includes terminal scheduling capabilities and controller advisory tools. The FAA has partnered with NASA to conduct these Terminal Spacing and Sequencing (TSS) HITL simulations, which utilizes the ATD-1 ground system.

On March 4-8, shakedown runs for the FIAT-2 and TSS-2 HITL simulations were conducted at Ames Research Center to refine the algorithms used in the controller advisory tools, finalize the scenario used for data collection, validate the ATD-1 concept of operations procedures, and evaluate the effect of incorporating wind forecasts in the ATD-1 system. A small team from the FAA and MITRE were also present to finalize plans for the TSS simulations. Simulation participants included eight controllers and 15 pseudo pilots, who completed 20 simulation runs that varied wind forecast, scenarios and scheduling system settings. The FIAT-2 data collection week is scheduled for the week of March 25, followed by a set of TSS simulations the first two weeks in April.

*(POC: Jane Thipphavong)*



*NASA researchers prepare for FIAT shakedown simulations.*

## NASA Hosts Traffic Flow Management Team Meeting, March 2013

Several FAA and flight operator representatives involved in the Collaborative Airspace Constraint Resolution Phase II and Traffic Management Initiatives (TMI) Impact Modeling team met at NASA Ames Research Center on March 12-14. The team is investigating the available modeling and what-if analysis capabilities for the re-route impact assessment function. Current TMI modeling capabilities are available for the older Enhanced Traffic Management System framework, but lack an operational real-time option in the new Traffic Flow Management System (TFMS).

During the meeting NASA provided a demonstration of the Future Air Traffic Management (ATM) Concepts Evaluation Tool, or FACET, software and a multiple

metering capability, with and without passback, to an upstream FAA facility. This multiple metering capability is not currently available to the FAA, but they expressed strong interest in conducting more realistic evaluations of the capability. The flight delays and sector-load impact using the reroute TMI implementation were also demonstrated. Additionally, the team viewed presentations on dynamic weather routes, the environmental impact of aviation, and the ATD-1. Currently, the FAA is working with NASA to understand and integrate NASA research within TFMS. Additional details for the collaboration are being currently discussed.
*(POC: Dr. Kapil Sheth)*

## Ames Contractor Council Awards, March 2013

Several contractors were recognized on March 19 with 2013 Excellence Awards from the NASA Ames Research Center Contractor Council. Dr. Anastasios (Tasos) Nikoleris was awarded an Individual Excellence Award for his research on two fronts: his fuel-burn analysis that identifies specific ways to optimize delay-absorption advisories for metering operations with the Efficient Decent Advisor Tool, and his development of an extended metering concept for the Air Traffic Management Technology Demonstration-1, or ATD-1. In the category of team excellence, the Dynamic Weather Routes Team was recognized for its dedication and excellence in successfully delivering high-quality software to American Airlines' System Operations Center to successfully conduct the first of a multi-phase field trial in collaboration with NASA.
*(POC: Todd Farley)*

## NASA Researchers Visit JFK Airport, March 2013

On March 26-27, NASA airport surface researchers visited John F. Kennedy International Airport (JFK). The trip to JFK provided an excellent opportunity for technical exchange with operators and observation of airport surface operations at the JFK air traffic control tower, the Metering Coordination Center (MCC), and JetBlue Airways. JFK is the only U.S. airport that has a departure metering procedure to reduce the runway queue size by holding aircraft at the gates or in the designated holding areas, thus enabling taxi-time reduction and fuel savings.

The Departure Manager Tool (DMAN) is managed by the Port Authority of New York and New Jersey and allows for procedures and tools for collaborative decision making between the MCC and participating airlines. DMAN allocates departure slots to airlines using a ration-by-schedule technique similar to a first-scheduled, first-served technique. Each slot has an associated target movement area entry time, and airlines are allowed to swap aircraft within the slots allocated to them. As a result of the trip, the NASA visitors gained valuable insights to inform their ongoing surface research.
*(POC: Yoon Jung)*

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