National Aeronautics and Space Administration

AOSP Newsletter
Airspace Operations and Safety Program (AOSP)

JUL-SEP 2018 | Quarter 4

AOSP IN THE NEWS

Are flying cars ready for take-off? No, but Rep. Lamar Smith is

Fedscoop (7/24) reports that "despite some exciting developments — like Uber's partnership with NASA for flying taxis or the company Terrafugia's promise that its flying cars will be on the market next year — there's still a lot to be worked out." In their testimonies, witnesses from Uber, Terrafugia, NASA, Bell and the Georgia Institute of Technology mentioned the many challenges that must be addressed before said "take-off" — safety, noise, air traffic control and management for dense urban areas.

NASA engineer, Sammies finalist seeing how drones navigate US airspace

1050 AM (8/17) reports "some 700,000 drones, maybe a million will be humming along in the skies in a few years." How to make sure they operate in a safe manner is the concern of Parimal Kopardekar, Senior Technologist for Air Transportation Systems at NASA's Ames Research Center. He's been leading the effort at the agency to engineer a whole new air traffic management approach, and he is a finalist in this year's Service to America Medals Program.

Soldiers May Soon Be Hailing a Taxi to the Frontlines (Again)

Nextgov (8/21) reports "while the Army and Uber are developing the hardware, a separate partnership between Uber and NASA is looking at the technology that will be required to keep all those new flying vehicles from crashing into each other, or interfering with more traditional aircraft that are already packing the skies. That is the goal of NASA's Urban Air Mobility Project, which may eventually interface with the Army program as both advance, especially since Uber is a partner in both efforts."

Automakers' soaring ambitions for flying cars start to take shape

Automotive News Europe (9/02) cites in early May, the company announced at its second annual Uber Elevate summit that it was partnering with none other than the U.S. National Aeronautics and Space Administration (NASA) to advance its goals. "Urban air mobility could revolutionize the way people and cargo move in our cities and fundamentally change our lifestyle much like smartphones have," Jaiwon Shin, an associate administrator at NASA, said after creating the agency's first ever agreement specifically focused on researching the technology.

Are flying taxis about to become a reality?

CNN (9/10) reports developing airspace management models is where Uber's expertise is still green. NASA is more than qualified in this arena and the agency has co-signed two Space Act Agreements with Uber to develop air transportation systems in urban areas.

Domesticating Drones

Bloomberg Quint (9/18) reports NASA is working on the framework for a low-altitude air-traffic system; some elements, such as the FAA's capability to grant rapid approvals for flights near airports, are already in place. After complaints from companies that regulations were hindering innovation, the U.S. granted waivers in May at 10 locations to allow tests for uses ranging from inspecting hard-to-reach infrastructure to delivering defibrillators to heart-attack victims.

How simulations ease drone integration

GCN.com (9/19) reports that NASA is one of the many agencies at the federal, state and local levels contributing to the effort. The space agency has been using computer simulations to understand what this UAS Traffic Management system will look like and the rules and policies that will govern it, according to Joseph Rios, NASA's chief engineer for its UTM effort.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Data Collection Runs Completed in First UAM Human-in-the-Loop Airspace Simulation

POC: SAVVY VERMA

This past quarter marked the first successful human-in-the-loop Urban Air Mobility (UAM) simulation at the Air Traffic Control (ATC) Simulation Laboratory at Ames Research Center in California. The objective of the simulation was to study candidate procedures and routes for flying UAM traffic in Class B and D airspace in the Dallas-Fort Worth (DFW) terminal area, as well as to evaluate the corresponding impact of the UAM traffic levels on controller workload. Prior to data collection runs, shakedown simulation runs were conducted July 30–August 2, in preparation

for the data collection runs that were planned for mid September. The Air Traffic Management–eXploration (ATM-X) Testbed was used to generate the simulation scenarios. Scenarios were executed with seven controller and 13 pseudo-pilot stations. Three levels of UAM traffic density (high, medium, and low) were represented by vehicles temporally separated en route by 45 seconds, 60 seconds, and 90 seconds, respectively, on average. Three different procedures (conditions) were also tested, using helicopter routes in the DFW area: 1) current helicopter routes, 2) current routes with Letters of Agreement (LOA) that vertically separated the routes and codified the routes with reduced verbal communications, and 3) modified routes with LOA. Participating controllers and

confederates managed UAM traffic as well as conventional instrument flight rules and visual flight rules traffic around DFW, Dallas Love Field, and Addison Airport airspaces. Both objective and subjective data were collected during the shakedown that included actual separation between flights, throughput, workload, and usability. Data analysis and results from the shakedown runs were used to improve the simulation and prepare for the final data collection runs the following month. Data collection runs were conducted on September 14. Data analysis is currently underway, and the feedback received will be used to inform future UAM research. The UAM research is a major focus of the ATM-X project.

ATD-2 Implements Prototype TFDM Terminal Publication Feed

POC: AL CAPPS

On July 7, NASA and the FAA collaborated to provide a prototype Terminal Flight Data Management (TFDM) Terminal Publication (TTP) feed via the System-Wide Information Management Research and Development network as part of the Airspace Technology Demonstration 2 (ATD-2) Field Demonstration sub-project. The primary functionality of the TTP service is to distribute airport flight and flow data from the surface system to National Airspace System (NAS) consumers. This includes

UAM-X1 Data Collections Runs in the ATC Simulation Laboratory.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

information pertinent to enabling surface metering, overhead stream scheduling, and knowledge about airport configuration and resource utilization. TTP transmits data to consumers through the NAS Enterprise Messaging Service using the publish-subscribe Message Exchange Pattern. The ATD-2 implementation of TTP is based on TFDM specifications, incorporating requirements from builds 1 and 2. Several consumers have expressed interest in TTP thus far, and have begun the onboarding process. ATD-2 is currently publishing data for Charlotte Douglas International Airport and will soon add the Dallas-Fort Worth area. NASA is hopeful that early availability of TTP will help foster an environment of innovation to utilize this new information.

Initial Technical Interchange Meeting with Southwest Airlines
POC: BRYAN BARMORE

On July 10–11, NASA researchers and managers from Ames Research Center in California, Langley Research Center in Virginia, and Glenn Research Center in Cleveland traveled to Dallas, Texas to tour Southwest Airlines (SWA) facilities and discuss research plans and potential opportunities for collaboration in support of the Air Traffic Management–eXploration and System Wide Safety projects. NASA attendees

exchanged detailed information with SWA staff members involved in flight operations, in-flight (cabin crew) operations, and network operations. Additionally, NASA attendees toured SWA's Leadership Education Aircrew Development Center, technology (maintenance) operations facility, ground operations facilities at Dallas Love Field, and the Southwest Airlines University training complex. To further the mission of SWA's Principal Scientist of Human Performance—that is, to "increase the potential of success through the effective utilization of human factors and ergonomics to optimize human performance at every level and in every aspect of the operation"—Langley will host SWA representatives sometime in the September–October timeframe to provide facility tours and continue ongoing technical discussions.

Meeting with Aerospace Industries Association
POC: PARIMAL KOPARDEKAR

Dr. Parimal Kopardekar, Senior Technologist for Air Transportation at Ames Research Center in California, was invited by the Aerospace Industries Association (AIA) to a meeting July 11–12, focused on high-altitude (60,000 feet and above) operations and the use of the Unmanned Aircraft System Traffic Management (UTM) construct. Industry plans for high-altitude airspace operations and the UTM construct's applicability

to those operations were discussed, including operator use cases and the adoption of UTM for cooperative airspace operations. Along with FAA Chief Scientist Steve Bradford, Dr. Kopardekar discussed off-nominal and contingency situations that operators will have to consider, and how UTM's cooperative, intent sharing, data exchange protocol would support these operations. This extension of the UTM construct to high-altitude operations is a strong indicator of applicability and movement towards UTM-inspired air traffic management. The meeting was also attended by representatives from Google Loon and Wing, Facebook, Lockheed Martin, Northrup Grumman, Airbus, Boom, and International Civil Aviation Organization members. The FAA and NASA will continue to collaborate on the high-altitude UTM topic.

Smart Buildings Briefing
POC: YURI GAWDIAK

Representatives from the National Telecommunications and Information Administration and the National Institute of Standards and Technology briefed the NASA Digital Transformation team, as well as AOSP staff, on a Smart Cities Super Cluster focused on smart buildings, at NASA headquarters in Washington, DC, on July 11. The briefing described smart building standards, guidelines, and architecture and infrastructure

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

services applicable in three areas: smart centers, smart airports, and smart skyports. As a follow-on activity, the team met on July 30 to coordinate planning of the Smart Cities/Buildings community support to the NASA ARMD Urban Air Mobility (UAM) Grand Challenge. The focus of the Smart Cities/Buildings community will be on the land-side of the vertiport/skyport technologies in order to enhance UAM operations and integration into other municipal systems and initiatives.

Discussions with Darrell Pennington, ALPA
POC: BRYAN BARMORE AND MIKE MADSON

Leadership from the Air Traffic Management–eXploration (ATM-X) and System Wide Safety (SWS) projects met with Darrell Pennington, Senior Engineer in the Engineering and Air Safety Department at the Air Line Pilots Association (ALPA), at Langley Research Center in Virginia, on July 13. NASA provided overview briefings of the ATM-X and SWS projects. Mr. Pennington offered to assist with future interactions between the projects and ALPA.

ARMD Monthly Technical Seminar on Integrated Demand Management
POC: NANCY SMITH

Nancy Smith at Ames Research Center in California, Principal

Husni Idris, Hyo-San Yoo, Connie Brasil, Nancy Smith, Paul Lee, and William Chan (seated left to right) get ready to present IDM to other ARMD centers for the monthly ARMD Technical Seminar.

Investigator for the Integrated Demand Management (IDM) sub-project within the Air Traffic Management–eXploration project, provided a briefing at the ARMD Monthly Technical Seminar, on July 18, which is broadcasted to all ARMD Centers. In her briefing, she described the IDM concept–which addresses demand and capacity imbalances through coordinated use of the Traffic Flow Management System and Time-Based Flow Management system, and shared results from a recent workshop where airline representatives engaged in a simulation demonstration of IDM operations to explore the benefits of utilizing a collaborative trajectory options program.

Risk Management Workshop
POC: YURI GAWDIAK

On July 23, Yuri Gawdiak, Associate Program Director for AOSP, attended the Risk Management Workshop at Georgia Tech Research Institute in Atlanta, Georgia, on behalf of the program and as a

representative of the ARMD Urban Air Mobility (UAM) Coordination and Assessment Team. Hosted by the Decision and Control Laboratory at Georgia Tech, the goal was to understand and shape the ecosystem encompassing UAM operations, regulations, insurance, and legal aspects by considering a range of key operational and policy questions.

ATM-X Visit to UNC at Chapel Hill and U.S. Environmental Protection Agency
POC: WILLIAM CHAN AND KEE PALOPO

On July 25, NASA Air Traffic Management–eXploration (ATM-X) representatives traveled to the University of North Carolina (UNC) at Chapel Hill in order to discuss the Testbed community support model. The Testbed is driving towards moving into a more community supported system such as the Community Modeling and Analysis System (CMAS) Center at UNC. The CMAS Center is partially funded by the Environmental Protection Agency (EPA) to maintain and support its software for a global community. ATM-X project team members William Chan, Kee Palopo, and James Murphy visited the CMAS Center and EPA to gain insight into how the Center manages the operations of the EPA software, which is analogous to transitioning the ATM-X Testbed to the external community. In investigating achievement of this goal, the team found that the EPA developed

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

environmental software that is now supported by the CMAS Center who distributes the software, as well as holds regular conferences showcasing how the software was used and improved by the community. The team learned how the EPA achieved this collaboration, the involvement the government still has with their environmental software, and lessons learned to make government-developed software more community owned and maintained. The CMAS Center provides software downloads through their website, training, software tests, and conferences, and helps users to understand and use the software. Using this information, the ATM-X team can develop approaches on how to move the Testbed towards a better suited community-supported system. The ATM-X Testbed will be adopting many of these same practices.

Trajectory Based Operations Technical Exchange Meeting

POC: WILLIAM CHAN AND KEVIN WITZBERGER

Representatives from the Air Traffic Management–eXploration and Airspace Technology Demonstration (ATD) projects met at the FAA's William J. Hughes Technical Center (FAATC) for the 3rd Trajectory Based Operations (TBO) Technical Exchange Meeting (TEM), from July 25–27. Boeing and MITRE were also in attendance. The first day was a series of presentations by NASA, Boeing, FAA, and MITRE.
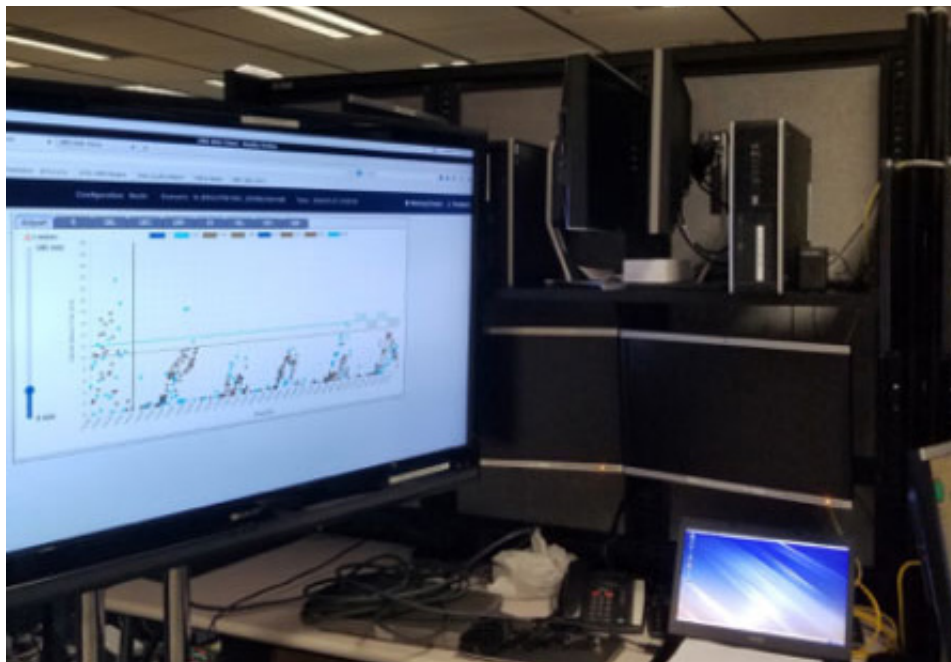
ATD-2 Surface Management Display at FAA WJHTC.

The second day was a series of lab tours. FAA presented their TBO storyboard. They also described how their labs in the Tech Center are integrated, presented a Traffic Flow Management System (TFMS) estimated time of arrival analysis, and described the Florida Testbed, which is part of the FAATC. Boeing presented their perspectives on TBO, Model Based Systems Engineering, and the ecoDemonstrator program. NASA discussed its role in the ecoDemonstrator, and scenarios that have been developed in conjunction with Boeing and the FAATC. MITRE presented their role in evaluating Terminal Sequence and Spacing (TSAS). The lab tours included the FAA's TSAS and ATD evaluation labs, weather

integration lab, TFMS, and Flight Management System (FMS) lab. It was a good meeting in which the team was able to interact with ecoDemonstrator colleagues and see the FMS systems the FAA are using in the ecoDemonstrator activity. The next TEM is planned to be at Ames Research Center in California, with dates to be identified.

ATD-2 Conducts Training for DFW Ramp Controllers

POC: LINDSAY STEVENS

From July 30–August 1, the Airspace Technology Demonstration 2 (ATD-2) team provided training to the Dallas-Fort Worth (DFW) ramp controllers on ATD-2's Ramp Traffic Console (RTC) and Surface

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Trajectory Based Operations (STBO) Client. Thirteen controllers from the D and E DFW ramp towers participated in one of five offered training sessions. During each session, controllers were guided through interactions with the RTC and STBO Client interfaces and engaged with features and data exchange between the two tools. Ramp controllers had the opportunity to provide feedback and discuss feature requests. Outcomes of the ramp training, beyond proficiency on the ATD-2 systems, included increased excitement about using the tools. The RTC is expected to be in daily use in the DFW ramp tower operational areas beginning August 6.

ATD-2 Hosts Chicago Airport Executives
POC: AL CAPPS

On July 31, the Airspace Technology Demonstration 2 (ATD-2) team hosted a meeting with the Chief Operating Officer of Chicago Department of Aviation and executives from American Airlines Chicago Operations. The ATD-2 team briefed the Integrated Arrival/Departure/Surface (IADS) concept, its currently deployed capability, and future expected capability. Live-data shadow displays from the ATD-2 IADS system deployed at Charlotte Douglas International Airport were used to demonstrate several


Executives from American Airlines and Chicago Department of Aviation briefed on ATD-2 concepts at NTX.

capabilities, such as data exchange and integration, overhead stream scheduling, and surface metering. The Chicago visitors shared information with the ATD-2 team on airport and airspace challenges they commonly face, and the ATD-2 team shared information on how future capabilities may assist some of these challenges.

Alaska Airlines Dispatcher visits NASCENT Team at Ames
POC: KARL BILIMORIA

Mr. Alek Mead, a Lead Dispatcher at Alaska Airlines, along with three summer interns, visited the Ames Research Center in California on July 31 to meet with the National Airspace System Constraint Evaluation and Notification Tool (NASCENT) team. Alaska Airlines is NASA's industry partner for the Multi-Agent Air/Ground Integrated Coordination (MAAGIC) effort. The Alaska Airlines team was briefed on NASCENT, and then observed a MAAGIC flight test which featured NASCENT software for
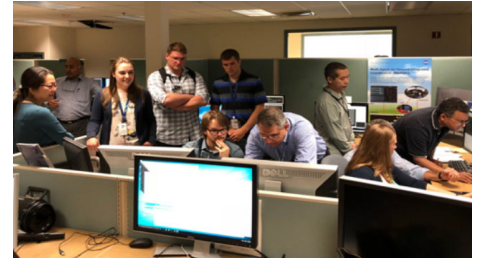
Alaska Airlines team interacting with ATD-3 tools.

dispatchers running on a computer at Ames communicating with the Traffic Aware Planner (TAP) software for pilots running on NASA's HU-25 aircraft operating from Langley airfield. The flight test exercised many capabilities of TAP and NASCENT, as well as the communication and information-sharing capabilities that MAAGIC provides for air/ground integration. Later, Alek spent some time exercising NASCENT with a live traffic and weather data feed, and evaluated several time-saving advisories for Alaska Airlines flights. He provided some very positive feedback about NASCENT and MAAGIC capabilities.

ATM Background and NASA Investment Justification Video
POC: JOSEPH DAVIS

On August 1, Crown Consulting Inc. delivered an educational video to AOSP. The video conveys the historic role that NASA has played in Air Traffic Management (ATM) research and development, the impacts ATM has had on the current systems, and the current and

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

future research and development endeavors to revolutionize the National Airspace System. The video is targeted for ARMD stakeholders, as read-ahead or leave-behind material, as well as online web material for public consumption.

Academy Students Present Progress on Mixed Reality UAM Simulator Prototype

POC: KELLIE KENNEDY

The 2018 NASA Academy, led by Liz Ward, was a 13-member multidisciplinary team of students from multiple universities. Their project challenge (provided by Kellie Kennedy, Neil O'Connor, and Nelson Guerreiro, each from the Langley Research Center in Virginia) was to develop an Urban Air Mobility (UAM) concept vehicle for use in a mixed reality simulator. A mixed reality system combines virtual reality with physical objects co-located in the real world. This task required developing the desired virtual environment, a unique vehicle concept, and physical components to facilitate human interaction. The students presented their final concept development efforts towards assembling a functional UAM simulator prototype on August 2 in the Pearl Young Theater, and received praise for their work. This system will continue in development to enable near-future rapid-prototype testing of UAM concepts agency-wide.

Crown Hosts ATM-X Technology Convergence Opportunities

POC: WILLIAM CHAN

On August 3, Crown Consulting Inc. hosted a meeting to identify opportunities for Air Traffic management–eXploration (ATM-X) Technology Convergence. In particular, the meeting explored the potential for infusion of technologies to enable the air traffic management system beyond 2025 being defined by NASA's ATM-X project. The meeting also provided recommendations for further exploration of selected candidate technologies, with a focus on definition of the system architecture for the ATM-X concept. Subject matter experts from Quid, CPLANE. ai, Momenta Partners, QxBranch, and Senior Talent International discussed their technologies and how they could inform architecture concepts for ATM-X.

FAA/NASA Quarterly Meeting

POC: MIKE MADSON

From August 7–8, FAA and NASA representatives held a quarterly meeting at the Ames Research Center in California to discuss progress on the various AOSP projects including Airspace Technology Demonstration (ATD), Air Traffic Management–eXploration (ATM-X), and Unmanned Aircraft Systems

Traffic Management (UTM) research. The first day covered statuses on the ATD-2 and ATD-3 technical challenges, followed by the ATM-X project. The following day focused on the UTM project, including technology transfers and the joint FAA/NASA UTM pilot program, which included presentations from both NASA and the FAA. The next meeting is tentatively scheduled for the first week of December.

Integrated UTM/D-NET Capabilities Demonstrated at JAXA Research Facility

POC: MARCUS JOHNSON AND JEFF HOMOLA

On August 8, researchers from NASA and the Japan Aerospace Exploration Agency (JAXA) have been collaborating to enable the incorporation of unmanned air assets into disaster response situations. This collaboration has involved a concentrated effort in integrating NASA's Unmanned Aircraft Systems (UAS) Traffic Management (UTM) technologies and approach with JAXA's fielded Disaster Relief Aircraft Information Sharing Network (D-NET) used for the management and optimization of manned aircraft response and asset allocation in a disaster. The current state of this integration effort was presented to Dr. Jaiwon Shin, Associate Administrator for ARMD, and Mr. Akbar Sultan, AOSP Program Director, as part of their visit to JAXA to meet with researchers and

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

management in Tokyo, Japan. For the demonstration, operation plans for UAS flights were developed and exchanged between the UTM and D-NET systems with visualizations provided of the operational areas and real-time position updates of a simulated UAS flight. The integration and exchange of data with associated visualization will continue development as part of preparations for participation in a large-scale, national level disaster drill planned for October 2018.

NASA ATD-2 and Charlotte Field Demo Partners Host FAA Program Managers
POC: AL CAPPS

On August 10, Airspace Technology Demonstration 2 (ATD-2) Field Demo Partners from the FAA's Charlotte Air Traffic Control Facility and American Airlines' Control Center (i.e., ramp control facility)

Visitors from the FAA's program management organization at Charlotte air traffic facility.

joined with NASA personnel to host visitors from the FAA's Program Management Organization (PMO). The PMO group contains the managers of the major systems within the National Airspace System including air traffic management decision support systems. The visit began at Charlotte with a briefing from the National Air Traffic Controllers Association representative for ATD-2. The group then observed operations and use of ATD-2 equipment in the air traffic control tower and the Terminal Radar Approach Control Center. The group then transitioned to the American Airlines' Control Center to observe surface departure metering and obtain a briefing on the ramp traffic console from the ramp manager. The group finished their visit with a briefing on the concept, benefits, and next steps for the ATD-2 project. This visit provided an opportunity for the

PMO group to see the collaborative nature of operations in Charlotte and current day operational ATD-2 usage. This site visit afforded a vigorous exchange of ideas and information by all parties involved.

NASA SWS Researchers Participate in JPL Assurance of Autonomy Working Meeting
POC: GUILLAUME BRAT

On August 14, Martin Feather (from NASA's Jet Propulsion Laboratory) organized a Working Meeting on Assurance of Autonomy for Robotic Space Missions. This meeting was attended by Mallory Graydon (from Langley Research Center in Virginia) and Guillaume Brat (from Ames Research Center in California) of the System Wide Safety (SWS) project. Other attendees included NASA delegates from Ames, the Armstrong Flight Research Center in California, the Katherine Johnson IV&V Facility, as well as delegates from Japan Aerospace Exploration Agency, industry, and academia. Participants recounted the nature, purpose, and value of autonomous behavior in space applications, including rovers for planetary exploration and satellites built to repair and maintain other satellites. These applications are analogous to currently-proposed autonomous aerial vehicle missions on Earth. Group discussions identified challenges for the assurance of such systems and techniques that have

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

been used to address these challenges, such as the use of model checking to verify that dynamic scheduling rule sets satisfy basic safety properties. Follow-up efforts will create a repository to share knowledge within the group between experts in artificial intelligence, verification and validation techniques, application engineers, and independent assessors.

NASA SWS Hosts AFRL and Partners for the Summer of Collaboration
POC: MISTY DAVIES

On August 14–15, Air Force Research Laboratory (AFRL) researchers and their partners met at the Ames Research Center in California with affiliated NASA researchers to discuss the results and future goals of the NASA-AFRL Summer of Collaboration. The Summer of Collaboration is a follow-on to AFRL's 2017 Summer of Innovation. The goal of both summer programs was to explore techniques for the validation, verification, and certification of autonomous flight vehicles and ground systems. During this summer, NASA and AFRL researchers explored and refined requirements development, automated analysis, and statistical techniques for the assurance of autonomy. As part of the meeting, NASA and AFRL researchers and project managers discussed the most promising directions for continued collaboration.

NASA Representatives Attend the Aircraft Cyber Threat Working Group
POC: PAUL NELSON

From August 14–16, Paul Nelson, AOSP Integration Manager for Cybersecurity and Communications, along with Jamal Quinnert, Aircraft Projects Information System Security Officer at the Armstrong Flight Research Center in California, participated in the Aircraft Cyber Threat Working Group (ACTWG). The engagement was held at the National Air and Space Intelligence Center at Wright-Patterson Air Force Base. The ACTWG is a semi-annual meeting comprised of Department of Defense, Department of Homeland Security, FAA, NASA, and prime contractors.

ATM-X Team Attends ecoDemonstrator Meeting with Boeing and FAA
POC: WILLIAM CHAN

On August 15, Air Traffic Management–eXploration (ATM-X) team members met in Seattle, Washington with FAA's William J. Hughes Technical Center and Boeing staff to further develop the ecoDemonstrator 2019 activity. This effort will be a joint NASA, Boeing, and FAA activity. The meeting included demonstrations of the Boeing B787 test bench and their Electronic Flight Bag test and deployment facility. The team also discussed the three test scenarios

for the 2019 activity which will facilitate future discussions.

AOSP Center Visits to Aeronautics Research Centers
POC: JOSEPH DAVIS

This past quarter, the AOSP office conducted center visits to three of the four aeronautics research centers. On August 17, the AOSP office visited the Langley Research Center in Virginia. Akbar Sultan, AOSP Program Director, met with center and organization management, toured labs and test sites for matured research efforts, and hosted a town hall meeting with NASA researchers supporting AOSP. The visit allowed insight into ongoing and planned activities as well as discussion among AOSP researchers and program/project leadership staff. The next visit was on September 4, in which the

AOSP Program Director, Akbar Sultan, along with Langley project leadership and staff on a Launchpad for autonomous drone testing within the System Wide Safety project.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Akbar Sultan hosts a town hall meeting for resident staff at Ames.

office visited Glenn Research Center in Cleveland. Sultan hosted another town hall meeting with NASA researchers and personnel supporting AOSP. Also included in the visit were focused meetings with center and organization management, as well as tours and discussions around AOSP Convergent Aeronautics Solutions Project 2018 Round II and 2019 Round III opportunities. On September 11, the office visited Ames Research Center in California and again hosted a center town hall for the resident staff in the Space Science Auditorium. Sultan presented a brief talk about AOSP and had a question-and-answer session from the audience after the town hall. A fourth visit to Armstrong Flight Research Center in California, planned for September 13, had to be postponed due to inclement weather on the east coast following a hurricane affecting the mid-Atlantic region, and will be rescheduled at another time.

Akbar Sultan, AOSP Program Director, viewing the Conformal Lightweight Antenna Structures for Aeronautical Communication Technologies (CLAS-ACT) project while touring Convergent Aeronautics Solutions Projects during his visit to Glenn.

ATD-2 Briefs Southwest Data Science Community

POC: AL CAPPS

On August 21, six members of the Airspace Technology Demonstration 2 (ATD-2) team presented to the Southwest Airlines data science community at the Southwest Airlines headquarters in Dallas, Texas. The briefing focused on the data being utilized in the ATD-2 system, the analysis products frequently used by ATD-2 researchers, machine learning techniques used in taxi time estimation, surface metering foundational concepts

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS
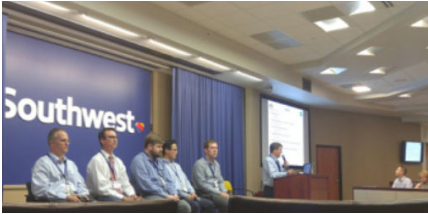
Members of the ATD-2 team give briefing at Southwest Airlines headquarters.

consistent with Terminal Flight Data Management, benchmarking performance of the operational system in Charlotte, and a benefits case for using Trajectory Options Sets in the North Texas environment. The briefing was well received and the community posed a number of questions to the ATD-2 panel. After the briefing, the ATD-2 team then met with leaders of several business units within Southwest Airlines to discuss potential applicability of System-Wide Information Management related data within the Southwest Airlines operational environment.

ATM-X Team Meets with German Aerospace Center to Further Collaboration Agreement

POC: WILLIAM CHAN

From August 21–23, Air Traffic Management–eXploration (ATM-X) team members met with the German Aerospace Center (DLR) at their facility in Braunschweig, Germany to further develop the technical plans of the DLR collaboration agreement. The meeting included
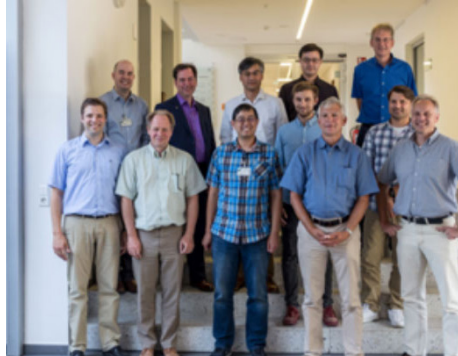
ATM-X and DLR collaboration team visit at German Aerospace Center.

tours of DLR's research facilities, such as the control tower and generic flight simulators. The joint DLR-NASA team was able to refine the research topics in both traditional and Urban Air Mobility research areas. One action item is to further develop the agreed upon topics. The team is aiming to finalize the technical work by the first quarter of FY19 for program review.

MITRE UAS Automation Workshop

POC: JOHN KOELLING

John Koelling, Project Manager for the System Wide Safety project, attended an Unmanned Aircraft System (UAS) Automation Certification Workshop, held at the MITRE Corporation in McLean, Virginia, from August 21–23. Presentations were made by representatives from MITRE, FAA, and multiple members of industry. Breakout groups included (1) Certification

of Automation; (2) Automation Technology Maturity/Readiness; (3) Operational Integration Challenges; and (4) Human Machine Teaming/Trust in Automation.

ATD-2 Demo to NASA Administrator and NAC Aero Committee

POC: LINDSAY STEVENS

On August 28 and 30, the Airspace Technology Demonstration (ATD) project team demonstrated the ATD-2 system capabilities to the NASA Advisory Council Aero Committee and to NASA Administrator Jim Bridenstine, on August 28 and 30, respectively, at the FutureFlight Central at Ames Research Center in California. Both demonstrations included an overview of the ATD-2 project, demonstrations of data exchange capabilities on the Surface Trajectory Based Operations Client and the Ramp Traffic Console (RTC), explanation of

NASA Administrator Jim Bridenstine tours Future-Flight Central for ATD-2 demo.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

the surface metering capabilities, description of benefits observed during the Phase 1 Field Demo at Charlotte Douglas International Airport, plans for Phases 2 and 3, and ATD-2 technology transfer strategy. Administrator Bridenstine interacted with the ATD-2 system directly, requesting to man the RTC himself during the data exchange portion of the demonstration. Each demonstration included positive engagement with the visitors as they asked questions and offered comments on ATD-2 research.

ATD-3 DRAW Technical Interchange Meeting at FAA Headquarters

POC: DOUG ISAACSON

On August 29, the Airspace Technology Demonstration 3 (ATD-3) Dynamic Routes for Arrivals in Weather (DRAW) team held a technical interchange meeting (TIM) at FAA headquarters. A description of DRAW functionality and results of recent DRAW simulation studies were presented to FAA stakeholders, along with a briefing on plans for upcoming studies. Representatives from FAA Terminal Flight Data Management (TBFM) operations were consulted on the implementation of the DRAW concept within TBFM, including Extended Metering (XM) operations. These detailed discussions with TBFM engineering personnel were particularly helpful toward understanding future DRAW-enabled TBFM XM operations and to the DRAW software development team that is currently prototyping core DRAW functionality into a TBFM code baseline. The FAA has indicated a strong interest in taking the delivery artifacts from the final DRAW technology transfer at the end of quarter 4, FY19, and incorporating it in TBFM Work Package 5.

NASA Administrator Jim Bridenstine Interviews Joey Rios on UTM

POC: RON JOHNSON

NASA Administrator Jim Bridenstine visited Ames Research Center in California on August 30. During his tour of Ames, Mr. Bridenstine visited the Unmanned Aircraft System Traffic Management (UTM) laboratory, and the Vertical Motion Simulator. Photos and video from the visit can be found on numerous social media posts:

https://twitter.com/NASAAmes/status/1036321673593536512

https://twitter.com/NASAAmes/status/1036320424831795200

https://twitter.com/JimBridenstine/status/1035212356039499776

https://twitter.com/JimBridenstine/status/1035943641821466624

https://twitter.com/JimBridenstine/status/1035260418531315712

Members of the ATD-3 DRAW team attended a TIM at FAA headquarters.

NASA Administrator Jim Bridenstine interviews Joey Rios at the UTM lab.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

UTM Simulation for DoD and DHS Partners

POC: SHON GRABBE, JEFF HOMOLA AND ABHAY BORADE

From September 10–11, a team of Unmanned Aircraft System Traffic Management (UTM) researchers at Ames Research Center in California conducted a live simulation and demonstration for members of the Department of Defense (DoD) and Department of Homeland Security (DHS) in the Airspace Operations Laboratory. The simulation served as a platform to explore the needs and requirements of the DoD and DHS in terms of airspace access and airspace awareness, and how the UTM architecture can be leveraged to support these focus areas. Multiple runs of the simulation were performed with members of both departments in attendance each time, followed by debriefs and discussions. Preparations for this simulation began with a tabletop exercise in April 2018, followed by development of the scenarios, procedures, and supporting software. The results of this simulation will help inform DoD and DHS approaches to UTM and will serve as guidance for future testing.

ATD-2 Conducts Training for Phase 2 Field Demonstration

POC: LINDSAY STEVENS

The Airspace Technology Demonstration 2 (ATD-2) team provided training for Phase 2 to American Airlines (AAL) ramp controllers and FAA Air Traffic Control Tower (ATCT) traffic management coordinators (TMCs) and front-line managers (FLMs), from September 10–11, at Charlotte Douglas International Airport. Training included an introduction of new features, refresher training on all features introduced since September 2017, and training of new ramp controllers and TMCs on ATD-2's Ramp Traffic Console (RTC) and Surface Trajectory Based Operations (STBO) Client. Four controllers from the AAL ramp tower and nine FAA ATCT TMCs and FLMs participated in the offered training sessions. During each session, controllers were guided through interactions with the RTC and STBO Client interfaces and engaged with features and data exchange between the two tools. Due to Hurricane Florence, training of all users could not be completed as planned; the remainder of the training will be rescheduled in early October. At the Atlanta Center, training and familiarization were conducted on the ATD-2 user interfaces and procedures for Phase 2, from September 17–21.

ATD-2 Phase 2 Field Demo Shadow Session Completed and Software Released for "Go-Live"

POC: ANDREW GING

On September 11, a shadow session was conducted in the NASA Airspace Technology Demonstration 2 (ATD-2) lab, located at Charlotte Douglas International Airport (CLT). The objective of the shadow session was to review Phase 2 requirements and accomplishments with Field Demo Partners from National Air Traffic Controllers Association (NATCA), American Airlines (AAL), and CLT FAA Air Traffic Control Tower (ATCT). The shadow session opened with a highlight of some of the new features introduced in the recent Integrated Arrival/Departure/Surface (IADS) software release. Following a brief overview of the training plan, the ATD-2 team presented a summary of Phase 1 metrics and benefits, and segued into a discussion of the Strategic Scheduling Micro-Phases to leverage Surface Metering from Phase 1 and transition the Metering Decision Making role from the AAL ramp to ATCT. Updates regarding Atlanta Center Pre-Scheduling, Terminal Flight Data Management Terminal Publication (TTP), and IADS Aircraft Management were also provided to the attendees, and the shadow session concluded with an approval from the Field Demo Partners to "go-live" with Phase 2. Following that decision, the ATD-2 software development team delivered v4.0.0 of the IADS system to CLT that evening. This software is now in daily operational use in the AAL ramp tower, CLT FAA ATCT, Washington Center, and Atlanta Center. ATD-2 has followed an agile requirements definition and software

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

development process wherein Field Demo Partners engage with the IADS system in live-data shadow evaluation sessions and provide the research team with feedback on system requirements. The IADS v4.0.0 release includes requirements identified during shadow sessions conducted from February–May of 2018. The software team completed 985 work items (e.g., Jira tickets) since the last major release in mid-February. Key areas of development included the ATD-2 integration with Advanced Electronic Flight Strips, Atlanta Center participation in Integrated Departure/Arrival/Surface capability-like scheduling into Time-Based Flow Management, strategic surface metering capabilities, and publishing ATD-2 data to the FAA System-Wide Information Management architecture via the TTP prototype. IADS software v4.1.0

will be released in mid-October and incorporate feedback from the field to further refine the IADS system.

AOSP Supports Digital Transformation Team Activities
POC: YURI GAWDIAK

This past quarter, Yuri Gawdiak, AOSP Associate Program Director, has been representing AOSP at the Agency Digital Transformation team meetings underway within NASA. From July 11–12, Gawdiak, along with Tiffany Smith, ARMD Knowledge Management Officer, participated in a two-day Digital Transformation team meeting in Washington, DC. The meeting focused on developing execution plans for external organizations who are leaders in digital transformation, and on internal interviews for NASA headquarters and center

organizations. At some follow-on meetings held September 24–28, Gawdiak supported site visit interviews at Boeing, NASA's Jet Propulsion Laboratory, and Armstrong Flight Research Center in California as part of the Digital Transformation team. The interviews were conducted with the organizations' Chief Information Officers and Chief Technology Officers. NASA's Digital Transformation team is conducting interviews to baseline the state-of-practice internally within NASA and externally in related industries and agencies.

ATD-2 Briefing at Collaborative Site Implementation Team Meeting
POC: JEREMY COUPE

From September 26–27, members from Airspace Technology Demonstration 2 (ATD-2) team attended an FAA Collaborative Site Implementation Team (CSIT) meeting in Chicago, Illinois. The two-day event was hosted by United Airlines (UAL) and included participants from NASA, the FAA Terminal Flight Data Management (TFDM) office, and the FAA Traffic Flow Management System office. The first day consisted of a tour of Chicago O'Hare International Airport (ORD), including the UAL ramp tower and UAL Station Operation Center (SOC). During the tour, NASA and FAA participants were briefed

Field Demo Partners approve "go-live" of Phase 2 after review of requirements and accomplishments.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

United Airlines hosts Collaborative Site Implementation Team meeting at Chicago O'Hare International Airport.

on UAL's current day surface operations at ORD and the roles and responsibilities of the ramp tower and SOC. On the second day, UAL hosted a meeting at their Willis Tower headquarters in downtown Chicago where the FAA briefed UAL on TFDM and NASA briefed UAL on ATD-2. The goal of the meeting was to familiarize UAL with the TFDM concept and requirements while also illustrating the potential benefits of a surface management system. The ATD-2 briefing consisted of an overview of the ATD-2 system in Charlotte Douglas International Airport, the accrued benefits of ATD-2 during Phase 1 of operations, and the lessons learned throughout the ATD-2 project. After the briefing, UAL gave a tour to the NASA and FAA participants of their Network Operations Center, which acts as a centralized control center for UAL operations and synthesizes information from the various SOC's

located at each airport to improve decision making across the entire network of UAL operations.

NASA-FAA Technology Transfer Ceremony
POC: SHAWN ENGELLAND

On September 28, executives from NASA, FAA, and industry met at FAA headquarters to celebrate the technology transfer of NASA's Flight Interval Manager technology to the FAA, and the successful completion and close-out of Airspace Technology Demonstration 1 (ATD-1). The NASA-FAA Research Transition

Team (RTT) for Efficient Flow into Congested Airspace worked together to develop ATD-1 products. Speakers at the ceremony included the NASA Deputy Associate Administrator for Aeronautics; the FAA Chief Operating Officer; Associate Administrator for Aviation Safety and Assistant Administrator for NextGen; and the Honeywell Aerospace President for Electric Systems. Additional speakers included the RTT co-chairs from NASA and FAA, and sponsor and program personnel from NASA's ATD-1 sub-project, the FAA Air Traffic Organization, and the FAA Office of Aviation Safety.

(Left to right): Rocky Stone, Chief Technical Pilot, Surveillance, United Airlines; Carl Esposito, President of Electric Systems, Honeywell Aerospace; Jeanne Yu, Director, Product Development, Boeing Commercial Airplanes; Robert Pearce, Deputy Associate Administrator for Aeronautics, NASA; Ali Bahrami, Associate Administrator for Aviation Safety, FAA; Tim Arel, Deputy Chief Operating Officer, FAA; Greg Burke, Deputy Assistant Administrator for NextGen, FAA (acting).

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

ATD-2 Phase 2 Field Demonstration "Go-Live" Testing

POC: AL CAPPS

On September 30, Airspace Technology Demonstration 2 (ATD-2) researchers commenced Phase 2 "go-live" testing at Charlotte Douglas International Airport. The demonstration featured ATD-2 integration utilizing advanced electronic flight strips, the Atlanta Air Route Traffic Control Center's participation in Integrated Departure/Arrival/Surface capability-like scheduling into Time-Based Flow Management, strategic surface metering capabilities, publishing ATD-2 data to the FAA System-Wide Information Management architecture via the Terminal Flight Data Management Terminal Publication prototype, and integrating two-way data exchange for the existing pilot mobile application.

RECOGNITION

North Carolina Drone Summit and Flight Expo

POC: MARCUS JOHNSON

On August 7, Marcus Johnson, Unmanned Aircraft System (UAS) Traffic Management (UTM) Deputy Project Manager, briefed the UTM Project and future trends in small unmanned aircraft at the North Carolina Drone Summit and Flight Expo in Greensboro, North Carolina. The Summit included keynote talks, panel discussions, and contributed presentations that covered the spectrum of commercial and public safety UAS applications. A flight exhibition was conducted showcasing drone mission capabilities by flying demonstration missions onsite during the conference. Participants comprised of key industry representatives, technology pathfinders, influential government officials, and pioneering users.

UTM Panel and Keynote at Interdrone 2018

POC: JOSEPH RIOS

Joseph Rios participated on a panel, "Moving Unmanned Aircraft System Traffic Management Forward: The Current Landscape," at Interdrone 2018, on September 5 in Las Vegas, Nevada. Other panelists included Marke "Hoot" Gibson (NUAIR), Biruk Abraham (FAA), and Mark Aiken (Akin Gump Strauss Hauer & Feld LLP). The panel was chaired by Jim Williams (JHW Unmanned Solutions) and provided attendees with a good understanding of the impact and history of Unmanned Aircraft System Traffic Management (UTM). The next day, September 6, Rios provided a keynote address, describing the UTM project at NASA with a focus on recent testing. Overall, the attendance was good and there was an opportunity for follow-on conversations with several attendees.

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