



# AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

JUL-SEP 2022 | Quarter 4



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## AOSP IN THE NEWS

### [Building the Infrastructure for Advanced Air Mobility](#)

Space Daily (7/27) reports “small drones delivering packages, air taxis carrying passengers, or air ambulance providing lifesaving transportation – these are just some of the concepts NASA’s Advanced Air Mobility (AAM) mission is helping get into our skies. For these aircraft to safely operate, cities, suburbs, and rural areas will need new or enhanced infrastructure.”

### [Could Airlines Use an FMS In the Cloud?](#)

Aviation Week (7/29) reports “Why should the flight management system on an aircraft’s flight deck know more about what is going on than people on the ground who are supporting the flight? NASA study seeks to improve air-to-ground connectivity for airlines The project could further the FAA’s NextGen vision Advanced air mobility...”

### [NASA Steps up Urban Air Mobility Automation Trials in Vertiport Lab](#)

FutureFlight (8/05) reports “NASA is stepping up preparations for an advanced air mobility (AAM) future. The U.S. agency’s researchers recently completed simulations involving a vertiport hosting large volumes of eVTOL aircraft operations as part of its high-density vertiplex (HDV) subproject.

### [NASA Steps up Urban Air Mobility Automation Trials in Vertiport Lab](#)

AWIN (9/08) reports NASA has awarded TruWeather Solutions a \$750,000 Phase II Small Business Innovation Research contract to test a network of ground-based weather sensors in Hampton, Virginia. The sensor network is intended to provide weather measurement and prediction data for safe and efficient flights of beyond-visual-line-of-sight uncrewed

aerial systems (UAS) and electric vertical-takeoff and-landing (eVTOL) aircraft flying at low altitudes within cities and suburban areas, TruWeather said Sept. 8.

### [CANSO, NASA and the FAA Discuss “Collaboration on Our Future Skies”](#)

Aerospace America (9/23) reports “representatives from NASA, the FAA and the Civil Air Navigation Services Organisation (CANSO) as well as leaders from organisations that are at the forefront of technology, services and innovation in unmanned aviation, are meeting in California this week to collaborate on a blueprint for future skies. The meeting was born out of a desire to increase collaboration between the manned and unmanned aviation and space industries and to share the work that NASA, the Federal Aviation Administration (FAA) and CANSO are doing to create a seamless, safe and sustainable future airspace.”

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## ATM-X Supports Executive Session on Conflict Management with Industry and FAA

POC: [SHIVANJLI SHARMA](#)

On July 11, Shivanjli Sharma, deputy project manager of Air Traffic Management – eXploration (ATM-X), supported and presented at an executive session focused on the development and testing of the Airborne Collision Avoidance System (ACAS) for rotorcraft and Advanced Air Mobility (AAM) vehicles, also known as ACAS-Xr. The executive session was held at SkyGrid’s HyperWerx facility in Austin and included FAA representatives from the Traffic Collision and Avoidance System office, as well as executives from Boeing, Wisk, SparkCognition, SkyGrid, and Raytheon. The event allowed for discussions regarding development of capabilities needed to support cooperative conflict management, the need for implementation and testing to support future remotely piloted AAM operations, and the role of research organizations to support the development of Minimum Operational Performance Standards needed to further the AAM industry’s goal of airspace integration.

## xTM Fast-Time Simulation Capability Presented to the FSF

POC: [MIN XUE](#)

On July 12, the Air Traffic Management – eXploration (ATM-

X) project’s Extensible Traffic Management (xTM) subproject team was invited to present its fast-time simulation capability (called Fe3), a cloud-graphics units-based Monte Carlo simulation capability to the Flight Safety Foundation (FSF) at the Advanced Air Mobility Working Group meeting. The FSF representatives, from industry and academia, are looking for opportunities to leverage NASA simulation and modeling capabilities. The presentation and follow-up and discussion focused on how to use this simulation capability to support low-altitude operations.

## SWS Hosts Technical Challenge-3 V&V Capabilities Transfer Meeting

POC: [GUILLAUME BRAT](#), [TERRY MORRIS](#), AND [JOSEPH COUGHLAN](#)

The System-Wide Safety (SWS) project team hosted the SWS Technical Challenge-3 (TC-3) Verification and Validation (V&V) capabilities transfer meeting that commemorated the fiscal year 2022 closing of TC-3: “Deliver validated methods and recommended practices to reduce certification costs for ground and on-board vehicle guidance and control systems through expanded acceptability of analysis as evidence for certification.” The virtual event, held July 12–13, was open to the public via YouTube streaming and recorded for on-demand viewing afterward. During the event, there were 421

combined live and on-demand viewers on July 12 and 252 on July 13. Live viewership peaked at 123 viewers. The TC-3 meeting presented findings from industry-selected use cases and provided attendees with access to a library of in-depth training seminars on how to use the powerful V&V tools, techniques, and processes developed under the technical challenge (resource page: <https://nari.arc.nasa.gov/sws-tc3-diagram/>). The training seminars are archived and remain available for viewing. Speakers from NASA, FAA, industry, and academia discussed how to best leverage TC-3 capabilities. SWS researchers developed novel V&V capabilities that will aid American industry and increase U.S. competitiveness. NASA has developed tools, techniques, and processes to improve V&V performance and efficiency. Once these capabilities were introduced, TC-3 goals grew to include:

- Evaluate the impact of those NASA-developed software assurance tools and techniques in an industrial context.
- Provide a quantitative evaluation of the cost savings and eventual speed-up.
- Identify remaining gaps.

By collaborating across NASA and engaging stakeholders in the FAA, industry, and academia, NASA’s SWS project has fulfilled its critical commitment to deliver validated methods and recommended practices. TC-3 work has successfully reduced

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

certification costs for ground and on-board vehicle guidance and control systems through expanded acceptability of analysis as evidence for certification. As aircraft and air traffic management software become smarter and more complex, so too must V&V tools. TC-3 findings have provided the SWS project with an elegant transition into TC-4: “Complex Autonomous Systems Assurance,” with a goal of creating an assurance framework for complex machine-learning-enabled systems.

### SWS Contributes to FSF Working Group Meetings

POC: [MISTY DAVIES](#)

On July 12–14, subject-matter experts (SMEs) from the System-Wide Safety (SWS) project participated in working group meetings hosted by the Flight Safety Foundation (FSF). The SMEs are contributing to work products developed at these meetings – of which one will be a review for the American National Standards Institute Standardization Roadmap for Unmanned Aircraft Systems. Each day of the meeting had a specific focus. On July 12, the Advanced Air Mobility Automation Working Group was held; on July 13, the Airspace and Methodology Working Group met; and on July 14, a plenary was convened.

### ATM-X and UAM Support Raytheon Meeting and Demonstration

POC: [SHIVANJLI SHARMA](#) AND [KEVIN WITZBERGER](#)

On July 13, Shivanjli Sharma, deputy project manager of Air Traffic Management – eXploration (ATM-X), and Kevin Witzberger, subproject manager of Urban Air Mobility Airspace Management, met with Raytheon at their facility in Washington, DC. The purpose of their visit was to discuss potential future collaboration opportunities. Additionally, they were provided a short tour of Raytheon’s facility.

The tour included an overview of the Multi-platform Application Rehosting Solution (MARS) – a system that allows for multiple data streams to be viewed in an open architecture and configurable fashion. The system was discussed in the context of the needs for Advanced Air Mobility operations. NASA and Raytheon teams discussed collaboration on topics including leveraging trusted sources for services such as a surveillance service for potential inclusion in future airspace research and development efforts.



*Raytheon's MARS system.*

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

### ETM Team Meets with Raven Aerostar

POC: [JEFFREY HOMOLA](#)

On July 14, the Air Traffic Management - eXploration project's Extensible Traffic Management (xTM) subproject's Upper Class E Traffic Management (ETM) team leads met with representatives from the Raven Aerostar Company. The purpose of the meeting was to have preliminary discussions to establish a non-reimbursable Space Act Agreement. Raven Aerostar is a high-altitude balloon company with years of operational experience and demonstrated capabilities in the areas of communications, science, wildfire monitoring, and defense. Establishing an agreement with Raven Aerostar will be a benefit to the xTM subproject by providing key data-driven insights into the challenges and considerations of operations in the stratosphere, particularly for a unique platform with unique flight characteristics. Follow-on discussions are planned to continue the agreement development.

### SWS Participates in an FAA/MITRE/Industry Collaboration

POC: [NIKUNJ OZA](#)

On behalf of the System-Wide Safety (SWS) project, Nikunj Oza

attended the FAA/MITRE/Industry Collaboration for Advancing Towards Automatic Detection of Safety Hazards/Risks workshop held July 18–19 at MITRE in McLean, Virginia. The purpose of the workshop was to discuss how the various players within the National Airspace System (NAS) can improve in finding safety issues that cover more components of the NAS and look for them continuously. Oza attended in person to confer with other attendees and discuss what is currently being done in this space and prospects for future work. Invited attendees included representatives from the FAA, MITRE, airlines, and NASA.

### UAM/eVTOL IFP Simulator Familiarization and Test Plan Development

POC: [DAVID ZAHN](#) AND [ANDREW GUIJON](#)

A small team from the Advanced Air Mobility project's National Campaign (NC) subproject



conducted working meetings with Joby personnel in Marina, California on July 19–21. The purpose of the meetings was to collaborate on the planning for an upcoming simulator test effort as a part of the ongoing NC-1 series. This work was performed as part of the NC subproject's objective to develop instrument flight procedure (IFP) criteria for Urban Air Mobility (UAM) electric Vertical Takeoff and Landing (eVTOL) operations. The collaborative effort between NASA and Joby included detailed discussions to answer questions and refine a draft test plan for upcoming simulator testing. In addition, the team benefitted from several hours in Joby's engineering simulator, gaining familiarization with the aircraft's current levels of automation and operating practices while also executing first attempts of departure and arrival procedures across different criteria and conditions. The valuable insights gained in working meetings during



*NASA and Joby team working together.*

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

the week will directly strengthen the quality and detail of the draft IFP simulator test plan. Interactions with Joby subject-matter experts provided several findings that will shape test points, areas of test interest, test methodology, and data measures.

### **AOSP Projects Support the Experimental Aircraft Association (EAA) AirVenture**

POC: [ADAM YINGLING](#) AND [MICHAEL VINCENT](#)

The Advanced Air Mobility (AAM) project's National Campaign (NC) subproject, along with the Air Traffic Management – eXploration and System-Wide Safety (SWS) projects, supported the Experimental Aircraft Association (EAA) AirVenture in Oshkosh, Wisconsin the week of July 25. The venue attracted more

than 650,000 aviation enthusiasts from around the planet and amassed more than 17,000 planes flying in to participate in the festivities. The AAM project team participated in several media engagements including giving three radio interviews, talking at forums, and newspaper articles. The team handed out more than 4,000 pamphlets while engaging the public inside the NASA tent. Overall, the event was a great opportunity to educate the American people on how AAM is shaping the future of aeronautics.

The SWS project hosted a booth and two forum talks during the AirVenture event. Visitors to the SWS booth were able to have a virtual-reality experience that demonstrated safety technologies

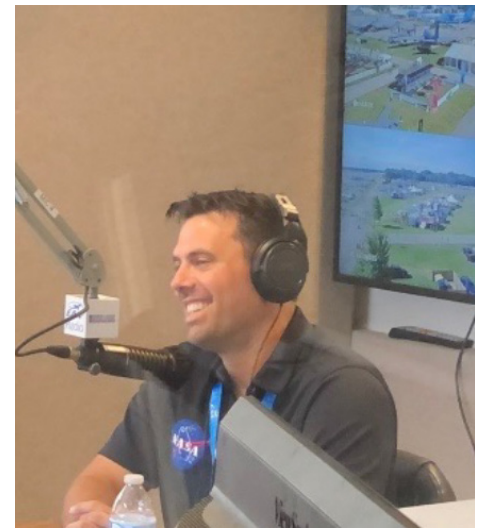
needed for the future of air transportation. Additionally, visitors were able to interact with SWS fatigue scientists working on understanding the impact of different types of flight operations on airline crew performance and data scientists working to model and predict safety hazards in commercial operations. Dr. Wendy Okolo and Michael Vincent hosted a forum talk entitled “NASA In-Time Safety Management” which discussed the SWS Technical Challenge (TC) 1, In-Time Terminal Area Risk Assessment and TC2, In-Time Risk Assessment for Emerging Operations subprojects. SWS project members that attended were able to make contacts with industry, academia, and government. These included



*17,000+ Aircraft*



*World's Busiest Tower*



*One of Three Radio Interviews*

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

members of the United Kingdom's Civil Aviation Authority working on remotely piloted aircraft integration, the chief executive

officer of Puerto Rico 5G Zone + Blockchain Ignition lab, and potential Ph.D. students who could support the future work of SWS.



(Left) EAA Forum "Envisioning Future Airspace with NASA's Advance Air Mobility." (Right image, left to right) Adam Yingling, Shivanjli Sharma, and Starr Ginn.



EAA Forum – Women at NASA



Newspaper coverage.



NASA tent with Advanced Air Mobility booth engaging the public.

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## ATM-X PAAV Holds Kickoff Meeting with ODOT

POC: [ARWA AWEISSI](#) AND  
[RICHARD COPPENBARGER](#)

On July 28, a kickoff meeting was conducted between the Air Traffic Management – eXploration (ATM-X) project’s Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject team and the Ohio Department of Transportation (ODOT). The meeting was the official start of programmatic and technical collaboration with ODOT as part of the Annex 3 Agreement signed on June 15. The PAAV team presented an overview of the subproject including the research strategy, schedule, and technical focus areas. ODOT presented an overview of several ongoing activities supporting unmanned aircraft operations, including their Air Traffic Operations Center, collaboration with the FAA on remote digital towers, and their SkyVision collaboration with the Air Force Research Laboratory for low-altitude flight tracking and ground-based detect-and-avoid systems. ODOT also discussed the National Advanced Air Mobility Industry Forum they are hosting, and which is being sponsored by JobsOhio, on Aug. 22–23. A planning meeting with ODOT, ATM-X, and PAAV is currently being scheduled. The

PAAV technical co-lead will attend the event in person.

## Annual Progress Presentation for SWS NASA Research Announcement-Funded Project Toward Self-Healing sUAS

POC: [LILLY SPIRKOVSKA](#)

The Safe Deployment of Small Unmanned Aerial Systems (sUAS) through On-Board Monitoring and Assessment project, performed by Notre Dame and Iowa State Universities and administered by the System-Wide Safety (SWS) Emerging Operations Technical Challenge subproject, presented their first year’s progress to the SWS community on July 28. The goals of the three-year project are threefold: 1) develop and evaluate automated techniques for predicting, detecting, diagnosing, and mitigating diverse configuration problems and runtime failures in sUAS; 2) deploy these techniques onboard for real time analysis of critical sUAS failures, and off-board via services to aggregate data over time and across multiple sUAS; and 3) assemble and release annotated data sets that support ongoing research by NASA and other researchers. The research team has made significant progress on each of the three tasks. The project duly complements in-house research and several points of synergy are being pursued.

## AFCM HPA Team Briefs the FAA’s TCAS Program Office

POC: [CONRAD RORIE](#) AND [CASEY SMITH](#)

The Advanced Air Mobility project’s Automated Flight and Contingency Management (AFCM) subproject team presented results of a recent part-task simulation to the FAA’s Traffic Alert and Collision Avoidance System (TCAS) program office on Aug. 1. The presentation was conducted by members of the Hazard Perception and Avoidance (HPA) team within the AFCM subproject. The simulation study was conducted in the Human Automation Teaming Lab in March 2022 and assessed performance of an FAA-sponsored prototype version of Airborne Collision Avoidance System (ACAS) currently in design for rotorcraft, ACAS-Xr, in application for electric Vertical Takeoff and Landing vehicles and with assistive automation concept software. The briefing covered the experimental design of the study and its key results and discussed some implications of the work and its findings. Also included was a description of the upcoming simulation test to be conducted in the Vertical Motion Simulator at NASA’s Ames Research Center in California to solicit TCAS office feedback prior to shakedown. The audience also included contractors from the Massachusetts Institute of Technology Lincoln Labs and



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the Johns Hopkins University Applied Physics Laboratory, which developed the ACAS logic.

### HDV Initiates Grant with Virginia Tech MAAP

POC: [STEVEN ALPERIN](#)

The Advanced Air Mobility project's High-Density Vertiplex (HDV) subproject has initiated a grant to the Virginia Tech Mid-Atlantic Aviation Partnership (MAAP) to perform an initial characterization of several ground-based radar systems and to quantify performance of these radars in performing Ground Based Detect and Avoid (GBDAA). The radars of interest include a pair of GA-9120's, a Raytheon Skyler, and an L-STAR. MAAP will leverage simulation tools developed in-house to calculate relevant performance indicators to include risk ratios and operational volumes as described in ASTM's "Standard Specification for Detect and Avoid System Performance Requirements" (F3442/F3442M – 20). This work was initiated the week of Aug. 1 and will help support efforts in the development of the safety case for waiver submission to the FAA to enable beyond visual line of sight unmanned aircraft system operations in a corridor in and around NASA's Langley Research Center in Virginia.

### SWS Participates in DARPA ARCOS Evaluation

POC: [MALLORY GRAYDON](#)

Researchers from the System-Wide Safety (SWS) project participated as subject-matter experts in support of the government review of achievements in the Defense Advanced Research Projects Agency (DARPA) Automated Rapid Certification of Software (ARCOS) project, (<https://www.darpa.mil/program/automated-rapid-certification-of-software>) July 25–Aug. 2. ARCOS participants demonstrated assurance-case-related tooling that they are constructing. Mallory Graydon, Paul Miner, and Natasha Neogi provided expert feedback that will help the DARPA team determine whether ARCOS is on track to deliver rapid, low-cost means to assess and assure the safety and security of high-consequence software systems following changes. While ARCOS aims to reduce the cost of certifying software-intensive military systems, the tools and techniques it results in may have applications to software used in aviation and spaceflight applications.

### SWS Participates at JIMDAT

POC: [LANCE PRINZEL](#)

Representing the System-Wide Safety (SWS) project, Lance Prinzel attended the Joint Implementation

Measurement Data Analysis Team (JIMDAT) meeting held Aug. 2–3 at the National Air Carrier Association headquarters in Arlington, Virginia. JIMDAT monitors the implementation and effectiveness of Commercial Aviation Safety Team (CAST) safety enhancements and recommends modifications and changes to the CAST Safety Portfolio (CAST website: <https://www.cast-safety.org>). JIMDAT, in conjunction with the FAA's Aviation Safety Information Analysis and Sharing system, also identifies emerging risks and additional areas of study. A number of safety enhancements (SEs) were reviewed at the August meeting including several that NASA has lead roles for. Prinzel received several actions in support of JIMDAT to report out at the next meeting. In addition, he was asked to be a co-lead to assess potential new SEs, due in March 2023, to extend previous NASA Technologies for Airplane State Awareness (TASA) SE-207 – which was the final TASA SE to be closed out. Final status was reported by JIMDAT to the CAST executive committee on Aug. 4.

### SWS NRA Conducts Year Three Midterm Review

POC: [NATASHA NEOGI](#)

On Aug. 2–4, all three NASA Research Announcement (NRA) performing teams supporting the

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

award topic “Assuring Increasing Autonomous Systems with Non-Traditional Human-Machine Roles” presented summaries of their progress on the Urban Air Mobility (UAM) case study. This was the year three midterm review for the Pennsylvania State and Collins Aerospace teams, and the year three kickoff for the Massachusetts Institute of Technology (MIT) team. On Aug. 2, the team from Pennsylvania State University presented a summary of their progress regarding the UAM Concept of Operations and task modelling in the Working Models that Compute framework, with a specific focus on a short-range cargo delivery service in a rural area (e.g. a cookie delivery service) where vehicle battery health monitoring and workload was examined. On Aug. 3, the team from MIT presented their work on the Systems Theoretic Process Analysis methodology, and they focused on how it could be applied to capture inimical human-machine interactions. On Aug. 4, the team from Collins Aerospace presented work that detailed and demonstrated their approach to model and train autonomous agents via reinforcement learning in the Soar cognitive architecture framework, with verification being performed in the NuXMV model checker. Natasha Neogi, NASA technical point of contact for these awards, arranged

for each team to engage interactively during the question-and-answer sessions enabling a vibrant exchange of ideas across both award efforts. This fosters a complementary set of research executed across the NRAs to address a wide range of human-machine teaming challenges in emerging technologies and operations. These sessions were attended by external subject-matter experts from the FAA, who provided valuable feedback to the performers.

### **HDV Holds Mission Concept Review for its SAO Work Package**

POC: [JEFF HOMOLA](#)

On Aug. 3, the Advanced Air Mobility project’s High Density Vertiplex (HDV) subproject held its mission concept review for its Scalable Autonomous Operations (SAO) work package. An independent review panel was assembled and in attendance with other team members and stakeholders. The HDV team presented its plans and objectives for SAO with dedicated discussions on the technologies in development, such as the Vertiport Automation System, the updated reference architecture, and updates made to facilities and technical components of the HDV system since the conclusion of the previous Advanced Onboard Automation

work package, completed in April 2022. Simulation and flight test plans were also presented along with the supporting scenarios and approach to data collection, management, and metrics. The review concluded with a discussion of budget, resources, and risks. Reviewer feedback is expected by Aug. 12, after which the HDV team will work to address comments and adjust accordingly.

### **SWISS Head of Data Analytics Team Visits SWS Team**

POC: [NIKUNJ OZA](#)

On Aug. 3, Chrysanthi Tsimitri, team lead for data insights and analytics at Swiss International Air Lines AG (SWISS), visited NASA’s Ames Research Center in California. The purpose of her visit was to discuss the resumption of NASA and SWISS’s joint machine-learning/data-analytics activities. The System-Wide Safety (SWS) project has a Space Act Agreement with SWISS that includes machine-learning work that falls within the scope of Technical Challenge (TC) 1: Integrated Terminal Area Risk. SWISS allowed its data analytics team to resume work in April. SWS TC-1 machine learning team members highlighted recent work, such as what was done as part of the American Institute of Aeronautics and Astronautics SciTech 2022

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

paper “Semi-supervised Active Learning for Anomaly Detection in Aviation with Experts in the Loop.”

## ATM-X “Sky for All” Version 2.5 Released

POC: [SHAWN ENGELLAND](#)

On Aug. 3, version 2.5 of the Air Traffic Management – eXploration (ATM-X) project’s “Sky for All” vision was released. This version includes revised Research and Development (R&D) needs, as shown in the R&D Needs webpage, based on inputs received from stakeholder validation workshops. The team is drafting a white paper showcasing the capability cornerstones and technological and regulatory enablers necessary to achieve an interconnected,

cooperative ecosystem by the mid-21st century – one that accommodates and optimizes diverse operations and prioritizes safety and sustainability.

## AFCM Hosts Visitors at NASA Ames

POC: [MIKE FEARY](#)

On Aug. 5, the Advanced Air Mobility (AAM) project’s Automated Flight and Contingency Management (AFCM) subproject team hosted visits by Abby Smith, deputy executive director for the FAA’s Unmanned Aircraft Systems Integration office, along with an advisory group including visitors from Supernal. The visit included a tour of the Aerospace Cognitive Engineering Lab (ACEL) Rapid Automation Test Environment (RATE) simulator at NASA’s Ames Research Center in California. The AFCM team demonstrated the development environment for electric Vertical Takeoff and Landing (eVTOL) aircraft automated systems and test capabilities. The group was provided the opportunity to fly the simulator and advised of the research being conducted by the ACEL group in support of FAA-sponsored research into methods for certification of aircraft autonomous flight. On Aug. 8, the team hosted visits from the chief test pilot for Archer Aviation and the FAA-designated engineering

representative test pilot, who also toured the ACEL-RATE simulator for a demonstration of the flight test maneuvers developed by the ACEL group as a new means of compliance for certification of novel eVTOL aircraft autonomous flight capabilities. On Aug. 9, the team hosted AAM project leadership including Mike Guminsky, AAM project manager; Karen Cate, AAM deputy project manager; and Colin Theodore, AAM project chief engineer. The AAM leadership team visited the ACEL-RATE simulator for a demonstration of the development environment for eVTOL aircraft automated systems and test capabilities. They were also able to fly the simulator and receive updates about the state of the art of certification for industry automated passenger carrying aircraft.

## HDV Team Visits PteroDynamics

POC: [JEFF HOMOLA](#)

During the week of Aug. 8, representatives from the Advanced Air Mobility (AAM) project’s High Density Vertiplex (HDV) subproject visited the offices and test range of PteroDynamics. Representing the NASA team was Faisal Omar, HDV subproject technical lead, alongside colleagues from NASA and other federal agencies. PteroDynamics is a U.S. company developing a vertical



*Sky for All Portal Pages*

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

takeoff and landing unmanned aerial vehicle with a transverse folding-wing design that provides a more representative urban air mobility flight profile. The purpose of the visit was to assess the state of the vehicle's maturity and potential for incorporating into future HDV testing. During the visit, the team received presentations from the PteroDynamics team and observed flight demonstrations of the vehicle at the testing range. Further internal and external discussions will be held to decide on any additional actions.

### AFCM FPM Completes Human-in-the-Loop Simulation

POC: [TERIQUE BARNEY](#)

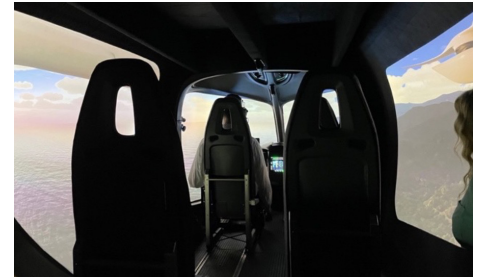
On Aug. 8–12, the Advanced Air Mobility project's Automated Flight and Contingency Management (AFCM) subproject hosted a simulation test in the Air Traffic Operations Lab at NASA's Langley Research Center in Virginia. The simulation was conducted by the AFCM's Flight Path Management (FPM) research team and featured an electric Vertical Takeoff and Landing vehicle flying in an urban environment with high traffic density to exercise NASA-developed automated strategic conflict detection and resolution algorithms. The simulation was intended to serve as a dry run for software components, scenarios, and

display content planned for flight testing in June 2023 as part of the National Campaign's Integration of Automation Systems first round of research flight tests. The three rotorcraft pilots scheduled to support the 2023 flight test traveled to NASA Langley to fly the simulation and provided very positive feedback for the operation of the automation and the level of awareness provided by the displays during the encounters and resolutions. Suggested improvements will be integrated into the components as part of the buildup for the flight test software delivery.

### ATM-X Meets with Agility Prime and Beta Technologies

POC: [SHIVANJLI SHARMA](#)

On Aug. 16, Shivanjli Sharma, Air Traffic Management – eXploration (ATM-X) deputy project manager,



*Photos of the Beta Technologies AAM simulator.*

met with representatives from Agility Prime in Washington, DC. The meeting was focused on Advanced Air Mobility (AAM) vehicle partnerships. Sharma also met with Beta Technologies at their Washington, DC office. During her visit, she was able to fly their vehicle simulator and discuss future plans. Beta Technologies will be coming to NASA's Ames Research Center in California for wind tunnel testing early next year and the ATM-X project has invited them to a technical interchange meeting.

### ATM-X PAAV Conducts Technical Interchange Meeting-2 with Northrop Grumman

POC: [RICHARD COPPENBARGER](#) AND [ARWA AWEISS](#)

On Aug. 18, the Air Traffic Management – eXploration

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

(ATM-X) project's Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject team held a technical interchange meeting (TIM) with Northrop Grumman at their facility in Rancho Bernardo, California. This was the second of a series of TIMs planned under the initial phase of a Space Act Agreement signed between NASA and Northrop Grumman earlier this year. The TIM focused on the planning of a joint flight demonstration and related simulation activities for PAAV, with flights potentially starting in 2023 at Moffett Field in California using Northrop Grumman's optionally piloted Firebird aircraft. To set the stage for flight demonstration planning, the TIM featured NASA-led topics on air cargo industry needs, mission scenarios, and concept elements for airspace integration. In following discussions, Northrop Grumman affirmed their desire to be an industry leader for remotely piloted operations in the National Airspace System. They further stressed the importance of concepts and flight demonstrations that move the needle toward implementation and realized benefits. Interest was expressed in concepts that support operations during adverse weather and leverage end-to-end digital flight path intent. Both sides agreed to further discuss flight demonstration objectives and potential issues during a meeting in

mid-September. That meeting will help prepare for a third official TIM in the October/November timeframe which will focus on detailed flight demonstration planning.

### Negotiation Model Developed for Cooperative Operations in Upper Class E

POC: [MIN XUE](#)

Min Xue, the Air Traffic Management – eXploration project's Extensible Traffic Management subproject technical lead, continued work on refining a negotiation model for strategic conflict management, built upon the sequential bargaining model, among high-altitude operations. Results to date show the proposed model can serve the cooperative operation concept, ensures an agreement can be reached within a predefined time window, and operators can accurately express their priorities without exposing their private business information. This work will be presented at the 2022 Digital Avionics Systems Conference in Portsmouth, Virginia on Sept. 18–22.

### NASA Attends JobsOhio 2022 National AAM Industry Forum

POC: [DAVIS HACKENBERG](#), [MISTY DAVIES](#), [EVAN DILL](#) AND [WILLIAM CHAN](#)

JobsOhio and the Dayton Development Coalition hosted the



*Photos from the National Advanced Air Mobility Center of Excellence*

National Advanced Air Mobility Industry Forum from Aug. 22–23. The event brought together various members of the Advanced Air Mobility (AAM) ecosystem for panels, networking, flight demonstrations, and static displays. The event included a celebration of the groundbreaking of the National Advanced Air Mobility Center of Excellence, a center for innovation and collaboration in the AAM community, at the Springfield-Beckley Municipal Airport. Bob Pearce, Associate Administrator for the Aeronautics Research Mission

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Directorate within NASA, spoke alongside Abby Smith, FAA AUS, and Col. Nate Diller, AFWERX, in the federal agency panel. Davis Hackenberg, NASA AMM mission integration manager, spoke alongside Misty Davies, SWS Project Manager, and William Chan, Air Traffic Management - eXploration project manager in a panel highlighting the various NASA research and initiatives on AAM. The Forum included flight simulators and aircraft displays and coincided with the ground-breaking of the National AAM Center of Excellence at the Springfield-Beckley Municipal Airport, Springfield, Ohio. The event also included Congressional Representatives Mike Turner (R-OH), Troy Balderson (R-OH) and Mike Carey (R-OH), along with Ohio Governor Mike Dewine's Cabinet-level Aerospace Advisor, Col. (Ret.) Joe Zeis, as well as other state and local elected officials. The forum included over 600 attendees and is planned to be an annual event hosted in Springfield, Ohio. The agenda can be found at <https://www.aamohio.com/agenda>.

### UAM Conducts X4 Technical Findings TIM

POC: [KEVIN WITZBERGER](#)

On Aug. 24, the Air Traffic Management – eXploration project's Urban Air Mobility

(UAM) subproject held a technical interchange meeting (TIM) where they shared the technical findings from the "X4 Strategic Conflict Management Simulation," lessons learned, and gathered information directly from industry that could inform the subproject's approach to the UAM Discovery Synchronization Service in the future. There was good technical interchange of ideas with more discussions to follow on further addressing the pros and cons of each technical solution.

### HDV Initiates Flight Testing in Support of the Radar-2 Flight Test

POC: [LOUIS GLAAB](#)

On Aug. 27, the Advanced Air Mobility project's High Density Vertiplex (HDV) subproject team

began flight testing in support of the Radar-2 flight test using the UC-40 NASA 507 aircraft. This flight test was performed to gain valuable experience regarding the operation of the Lightweight Search and Track Acquisition Radar (LSTAR) and dual GA-9120 radar systems. In an effort to enable beyond-visual-line-of-sight small unmanned aerial systems (sUAS) flight operations, the HDV team has installed an array of radar systems at NASA's Langley Research Center in Virginia and is in the process of testing their performance. With a range of 40 km, the LSTAR is the primary radar system and was relocated to the top of the hanger in June. The LSTAR is on loan from NASA's Ames Research Center in California. The Dynetics GA-9120s are lower-cost individual panel-type radar systems that provide complementary radar coverage to



UC-40 NASA 507 aircraft.

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

the LSTAR and are mounted on the gantry. A Raytheon Skyler-2 radar, installed on Hampton University's Harbor Center building and part of a Space Act Agreement with Longbow, will also be incorporated. Output from the radar systems will be merged and fused with Automatic Dependent Surveillance-Broadcast and Flight Alarm inputs within the ANRA Technologies' Smart Skies control system and displayed in the Remote Operations for Autonomous Mission sUAS control center. Outputs from the radar systems will also be routed to the sUAS and integrated with the Independent Configurable Architecture for Reliable Operations of Unmanned Systems to provide onboard autonomous detect and avoid functionality for non-cooperative aircraft. Testing performed within the Radar-2 test will provide performance data for both radar systems and help assess manufacturer's performance predictions and build upon testing performed previously during the Radar-1 test. Multiple flights are planned for Radar-2 using 1,000 ft as well as 500 ft altitudes.

### **SWS Completes First Year of Collaboration with AAM/HDV Team**

POC: [STEVE YOUNG](#) AND [JEFF HOMOLA](#)

The System-Wide Safety (SWS) project team completed the first year

of collaboration with the Advanced Air Mobility High Density Vertiplex (HDV) team. The teams have worked together through monthly tag-up meetings and biweekly human-machine interface research discussions. These activities allowed them to maintain awareness of the status of ongoing work and future research plans – along with allowing opportunities to look for and leverage synergies. During the past year, SWS has shared its research findings plus four high technology readiness level services, functions, and capabilities with HDV. These include providing information on and access to a preflight risk assessment service, Ground Risk Assessment Service Provider; providing access to a networked weather station capability for use in the Remote Operation for Autonomous Mission (ROAM) Operations Center; and providing access to a radio frequency spectrum monitoring station capability also for use in the ROAM Operations Center. SWS researchers archived approximately four months of radio frequency spectrum monitoring data to help baseline the HDV flight testing environment. In turn, the HDV team shared scenarios and flight plans used during HDV's Advanced Onboard Automation (AOA) recent testing with SWS and provided ongoing updates on the status of the AOA simulations and flight testing. In

addition, and based on the above collaborations, SWS flight testing (SWS-21) conducted several live flight tests using HDV-based flight plans. Flight testing is scheduled to conclude in October 2022.

### **DIP Conducts TIM with Boeing for SFNP-Ops 2 MR-TBO Planning**

POC: [MIRNA JOHNSON](#) AND [GEORGE SZATKOWSKI](#)

On Aug. 30, the Air Traffic Management – eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team conducted a technical interchange meeting (TIM) with Boeing in Fairfax, Virginia. The purpose of the meeting was to discuss concepts to leverage the Flight and Flow Information for a Collaborative Environment work being demonstrated in the Multi-Regional Trajectory Based Operations (MR-TBO) activities led by the FAA and its international partners. This interchange was a follow-up meeting to the engagements that occurred July 19–21 in Seattle, where Boeing hosted the FAA, Japan Civil Aviation Bureau, LS Technologies, and other MR-TBO partners. At the meeting, the DIP team shared a notional concept for NASA's Sustainable Flight National Partnership Ops 2 (SFNP-Ops 2) flight deck service for contrail avoidance and the information needed to enable the capability. Boeing expressed interest

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

in a partnership where they could participate in design and testing, as well as the tools and data sources that could enable the flight deck service. The DIP team will continue to assess overall partnership strategy and mature the concept design.

### NASA Hosts Final Briefing About ETM Market Modeling

POC: [JAEWOO JUNG](#)

On Aug. 3, the Air Traffic Management – eXploration project’s Extensible Traffic Management subproject hosted a presentation led by an LMI team. In fiscal year 2021, LMI was tasked to: 1) elicit knowledge and information to understand the current and future opportunities associated with operations at high altitudes, and the risks and barriers to realizing those opportunities and 2) estimate the difference in the high-altitude operations market size with and without Upper Class E Traffic Management (ETM) for the United States. As part of their presentation, the LMI team demonstrated a model of the ETM market to estimate the market size associated with three use cases, fixed and mobile internet services, smart cities internet of things initiatives, and forest fire detection. Key findings from the task are as follows:

- Market potential is large and growing for services that can be

provided by the High Altitude Platform System (HAPS). In addition to use cases where HAPS can provide superior services to those provided by terrestrial or space-based systems, HAPS can provide supplemental infrastructure to meet the growing demands.

- Upper airspace is an underutilized resource, creating an opportunity to meet the American public’s needs while other domains may begin to encounter safety and environmental concerns related to expansion.
- Airspace demand is tied to geographic demand for services rather than evenly distributed. This is a common issue in all airspace classes and requires airspace management techniques to accommodate areas of congestion.
- ETM is necessary to accommodate operations at scale. The current approach relies on segregated volumes of airspace assigned to each vehicle to comply with existing separation standards. This does not allow an operator to deploy the number of vehicles necessary to serve a viable market, nor does it allow for competition between providers or services.
- ETM can enable services that are in the public interest that

go beyond the commercial services HAPS can provide, including public safety, disaster response, wildfire detection and monitoring, and environmental protection.

These findings and the associated ETM market model will be used to guide NASA’s ETM research and development and for engagement with the stakeholder community – including the FAA and other government agencies.

### xTM Completes ETM Collaborative Evaluation Research Concept Review

POC: [JAEWOO JUNG](#)

On Aug. 3, the Air Traffic Management – eXploration (ATM-X) project’s Extensible Traffic Management (xTM) subproject conducted a Collaborative Evaluation #1 (CE-1) Research Concept Review (RCR). The review was conducted by the xTM’s Upper Class E Traffic Management (ETM) team. During the RCR, the ETM team briefed stakeholders and reviewers on the project management, status, and technical work being undertaken by the team for the CE-1 activity. This included a prototype NASA research ETM system and its ability to support simulated cooperative operations in high altitudes which will be evaluated with partners in the CE-1,



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currently scheduled for August 2023. Reviewers and stakeholders were solicited to provide feedback and suggested actions to the ETM team to ensure that ETM CE-1 work is: 1) well-aligned with NASA, AOSP, and ATM-X objectives and goals; 2) appropriately scoped and resourced; 3) sufficiently rigorous that the work proposed and underway is likely to result in a viable study with meaningful results that can be used to further future work; and 4) that effective and robust project management and systems engineering practices and procedures are being prepared. The ETM team plans to incorporate the feedback, address the actions, and progress to an experimental review.

### DIP Completes First University Challenge

POC: [MIRNA JOHNSON](#)

On Aug. 3, the Air Traffic Management – eXploration project’s Digital Information Platform (DIP) subproject announced the winners from its first ever University Challenge. The challenge was to use machine learning to predict airport configuration changes for multiple airports, utilizing real-time air traffic and weather data, to assist flight operators, planners, and other decision makers with strategic and tactical planning. The challenge

### Top submissions

 <p><b>Kristin Mullaney &amp; Alejandro Sáez</b> 1st Place (\$20,000) New York University Data science undergraduates Private score: 0.0739</p>	 <p><b>Azin Al Kajbaf &amp; Kaveh Faraji</b> 3rd Place (\$6,000) University of Maryland Disaster resilience postdoc and graduate student Private score: 0.0912</p>
 <p><b>Spencer McDonald &amp; Marek Travník</b> 2nd Place (\$10,000) Massachusetts Institute of Technology Aeronautics and astronautics graduate students Private score: 0.0896</p>	 <p><b>Normen Yu &amp; Mehrdad Mahdavi</b> 4th Place (\$4,000) Pennsylvania State University Computer science undergraduate and professor Private score: 0.1058</p>

*Top submissions to the Digital Information Platform University Challenge.*

was launched on Jan. 25, 2022 and participants had until Apr. 25, 2022 to submit. Out of 369 submissions, four teams were selected for award money. First place was a team from New York University, second from the Massachusetts Institute of Technology, third from the University of Maryland, and fourth from Pennsylvania State University. Winners’ algorithms showed substantial improvement over the baseline case where no changes of airport configuration were expected. The DIP team is evaluating how to use these results in their research. This University Challenge illustrated the use of these datasets for open innovation and encouraged engagement from universities. The DIP subproject team plans to set up a second University Challenge, which will be more complex, focusing on federated learning methods to

resolve the challenge of leveraging proprietary data without exposing it to develop prediction models.

### SWS Completes Identifying Key Gaps and Milestone Prioritization Needs

POC: [NATASHA NEOGI](#) AND [SUMMER BRANDT](#)

On Aug. 3, the System-Wide Safety (SWS) project completed an exercise for the identification of key gaps and prioritization of NASA SWS needs. Researchers supporting Technical Challenge-5, “Safety Demonstrator Series,” worked with colleagues supporting Technical Challenge-2, “In-Flight Safety Predictions for Emerging Operations,” to perform a gap analysis to document the state of the art and state of practice with respect to the availability, maturity, and assurance of the current services, functions, and capabilities

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under development for the In-Time Safety Management System.

### **AAM National Campaign ATI Hosts “Real-Time Visualization Using Grafana” Tech Talk**

POC: [JOHN SPRAGUE](#) AND [MICHELE CENCETTI](#)

On Sept. 2, the Advanced Air Mobility (AAM) project’s National Campaign (NC) subproject held a tech talk on real-time visualization. The talk was conducted by the NC’s Airspace Testing and Integration (ATI) team. The purpose of the tech talk series is to engage with the AAM community on types of technologies currently being used and developed during flight test activities and simulations. This was the fourth talk in the series and focused on the use of the Grafana platform as a real-time data visualization tool and the features that have been developed and customized to support the data collection process in the NC. The first half of the talk described what Grafana is, how this framework has been used within the context of the Unmanned Aircraft Systems Traffic Management (UTM) subproject, and how its features have been integrated and enhanced within the NC subproject. The second half of the talk was centered on the implementation details of this environment as used in the NC subproject – providing examples of the developed plug-ins including custom panel plug-ins, scatter

plots panel, two-dimensional map panel, three-dimensional map panel, table data panel, export/data control panel, radargram panel, and envisioning the development of additional features on future research. A recording of the tech talk will be posted here: <https://www.nasa.gov/aamnationalecampaign/techtalks>. The talk was well attended by multiple subprojects under the AAM ecosystem, aeronautics researchers, and others interested in this new technology, across all NASA centers.

### **AFCM Completes Hazard Perception and Avoidance Simulation**

POC: [CASEY SMITH](#) AND [CONRAD RORIE](#)

On Aug. 15–Sept. 2, the Advanced Air Mobility project’s Automated Flight and Contingency Management (AFCM) subproject team hosted a human-in-the-loop simulation test in the Vertical Motion Simulator at NASA’s Ames Research Center in California. The simulation was conducted by AFCM’s Hazard Perception and Avoidance research team and featured an FAA-sponsored prototype version of the Airborne Collision Avoidance System (ACAS) standard currently in design for rotorcraft, ACAS-Xr, in application for electric Vertical Takeoff and Landing vehicles and with assistive automation concept software. This motion-based testing

was designed to incite and evaluate varied avoidance maneuvers recommended by the system in response to a wide variety of encounter geometries and a range of flight phases in preparation for the spring 2023 flight testing as part of the National Campaign’s Integration of Automation Systems first series of research flight tests. Additionally, analysis of the system’s performance with feedback from pilots will be reported to the FAA’s Traffic Collision Avoidance System office to support continued ACAS-Xr standards development.

### **ATM-X Represents NASA at the Emerging UAM Roundtable**

POC: [SHIVANJLI SHARMA](#)

On Sept. 6, Shivanjli Sharma, deputy project manager of Air Traffic Management – eXploration (ATM-X), represented NASA at the Emerging Urban Air Mobility (UAM) Roundtable hosted by San Jose State University (SJSU) and the California Governor’s Office of Planning and Research. The Roundtable, “Governing Land Use for California and the European Union,” included members from the United States and Netherlands. Sharma presented perspectives on Advanced Air Mobility (AAM)/UAM, research for AAM/UAM, and the challenges to achieve mature AAM/UAM operations. Other panelists included members

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from Archer Air, the University of California, Berkeley's Institute of Transportation Studies, Caltran's Division of Airport Operations, the Community Air Mobility Initiative, and SJSU's Department of Aviation. This forum gave the ATM-X project connections with the California Governor's Office of Planning and Research and a pathway to building connections with localities in the state.

### SWS Participates at Drone Safety Team Meeting

POC: [BECKY HOOEY](#)

On Sept. 6, Becky Hooley represented NASA's System-Wide Safety (SWS) project at the Drone Safety Team (DST) Quarter 3 plenary meeting. The meeting was held in conjunction with the Commercial Unmanned Aerial Vehicle Expo in Las Vegas. The DST is a government/industry group chartered in 2016 to develop consensus-based and data-driven safety enhancements for unmanned aircraft systems (UAS) and operations. The team consists of more than 80 leaders representing organizations that span the UAS community. At this meeting, agenda topics included status reports from three active working groups. The Data Working Group (WG) status report summarized the Aviation Safety Reporting System (ASRS) ad-hoc working group, of which

Hooley is a participating member. The Data WG chair described the group's two objectives: 1) focus on ways to make use of the available ASRS data for research initiatives and identifying best practices for UAS operators and 2) focus on suggestions to increase adoption and reporting into the ASRS by UAS operators. The Safety Assurances WG reported on three ongoing efforts. The first was an update on data analyses conducted under the FAA's Center of Excellence for UAS, otherwise known as the Alliance for System Safety of UAS through Research Excellence; the second was a discussion of scalable safety management system guidelines for UAS operators; the third was a description of the Academy of Model Aeronautics safety assurance practices. The Communications WG provided talking points for members to use when talking to others in industry to describe the DST. They also encouraged the DST membership to continue to share information about ASRS using the tagline "When in Doubt, Fill it Out." <https://dronesafetyteam.org>

### AEWG Conducts Crosscutting WG Crosscutting V&V Vision 2045 Roadmap Meetings

POC: [MISTY DAVIES](#)

The Advanced Air Mobility (AAM) Ecosystem Working Group's Crosscutting Working Group

convened twice this past quarter. The first meeting, held on July 19, was for an "Autonomy Verification and Validation (V&V) Deep Dive." The deep dive included an introduction and discussion of the development of the V&V Autonomy and Validation Roadmap. This work is being co-funded by NASA's Transformative Aeronautics Concepts Program and AOSP. To validate the roadmap, agreements were sought within the AAM community based on major gaps identified by the programs, NASA Research Announcements, industry needs, and the future market. The goal of the deep dive was to engage the audience for suggestions and comments.

The second meeting was held Sept. 8. Misty Davies, System-Wide Safety (SWS) project manager, moderated the discussion. She was followed by Huafeng Yu of Boeing, who gave an overview of the work conducted to date. Yu was followed by Darren Cofer of Collins, Chuchu Fan of the Massachusetts Institute of Technology, Ella Atkins of the University of Michigan, Szabolcs Borgyos and Baoluo Meng of General Electric Research, and Georgios Bakirtzis of the University of Texas, Austin; each participated in updates, discussion, and feedback on the Autonomy V&V Roadmap. For more information, visit: <https://nari.arc.nasa.gov/aam-portal/>

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## HDV Opens and Verifies Communication Ports Between Ames and Langley

POC: [LOUIS GLAAB](#)

In September 2022, the Advanced Air Mobility project's High Density Vertiplex (HDV) subproject completed an approximately five-month effort to establish an essential capability to support the HDV team's Scalable Autonomous Operations simulations. This effort has resulted in an Interconnection Security Agreement between NASA's Langley Research Center in Virginia and Ames Research Center in California, and involved support from the Office of the Chief Information Officer. Resolution of the communication ports enables integration testing to begin, which links systems at NASA Ames and NASA Langley and is required to support planned HDV testing.

## SWS-21 Flight Testing Transitions to Final Stages

POC: [STEVE YOUNG](#)

The System-Wide Safety (SWS) project team completed a series of tests demonstrating the ability of onboard services, functions, and capabilities (SFCs) to change autopilot flight commands when flight risk estimates exceed defined testing thresholds. Prior to the tests, the SWS team gave a presentation on Aug. 11 to the Airworthiness Review Board for



*Photos from NASA Langley flight testing activities.*

approval of Stage 3 flight testing that would enable testing this new capability. Tentative approval was received at the meeting and a series of flight tests followed, occurring in August and September. During these tests, flight mode autopilot commands were successfully triggered by the onboard SFCs. With this progress in SWS-21 flight testing, Technical Challenge-2, "In-Flight Safety Predictions for Emerging Operations," is projected to meet green success criteria for the assigned milestone and annual performance indicator.

## xTM Briefs ETM Research at the 5th Federal UxS Workshop

POC: [JEFF HOMOLA](#)

On Sept. 13, the Air Traffic Management – eXploration (ATM-X) project's Extensible Traffic Management (xTM) subproject team briefed NASA's Upper Class E Traffic Management (ETM) research at the 5th Federal UxS Workshop. The workshop was an in-person event at NASA's Ames Research Center in California that included an introduction to the xTM concept. The briefing included how core principles from the Unmanned Aircraft Systems Traffic Management (UTM) evolved to become xTM principles, the development of a prototype NASA research ETM system that inherits the xTM principles, and NASA's plan for collaborative evaluation of the prototype research ETM system for enabling simulated concurrent and co-located high-altitude operations in 2023. The ETM team plans to return to the next workshop to share more information about the collaborative evaluation. For more information,



*Presenter at 5th Federal UxS Workshop*

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visit: <https://www.usgs.gov/centers/national-innovation-center/science/5th-federal-uxs-workshop>

### ATM-X PAAV Conducts Collaborative Meeting with DLR

POC: [ARWA AWEISS](#) AND [HUSNI IDRIS](#)

On Sep. 15, members of the Air Traffic Management - eXploration project's Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject, held a virtual meeting with Felix Sievers from the German Aerospace Center (DLR). Representing the PAAV team were Dr. Jordan Sakakeeny, Dr. Husni Idris, Kurt Swieringa, Dr. Heather Arneson, and Tod Lewis. The purpose of the meeting was to discuss the outline of ongoing and future research, and to share initial analysis of the German air cargo market. The initial phase of the research is focused on a joint comparative analysis of regional air cargo operations in the United States and Germany and its potential for Unmanned Aircraft Systems (UAS). This joint comparative analysis will establish qualitative metrics by which airports in the United States and Germany can be compared for their accessibility and acceptability of cargo UAS. The focus of the collaboration will be on the airspace impacts of the introduction of UAS into the airspace, specifically around small, non-towered airports. This work will build on previous NASA

work, "Preliminary Characterization of Unmanned Air Cargo Routes Using Current Cargo Operations Survey," AIAA Aviation 2022. This meeting was one of a series of ongoing collaborative research meetings related to the NASA-DLR Work Package 2. This work will lay the foundation for future collaborative efforts in the coming years by identifying use cases or reference missions which can be used for future analysis and simulations, in addition to assisting in PAAV trajectory research. It is expected that the PAAV-DLR team will have an outline of this joint comparative analysis by the end of September.

### AAM/NC Conducts Collaborative Simulator Tests with Joby Aviation

POC: [DAVID ZAHN](#)

Members of the Advanced Air Mobility project's National Campaign (NC) team conducted engineering flight simulator tests with Joby Aviation personnel in Marina, California, Sep. 12–16. The goal of the tests was to collaborate on developmental testing of potential future instrument flight procedure designs. The test team was joined by representatives of the FAA's Flight Standards Service and Unmanned Aircraft Systems Integration Office. This work was part of the ongoing NC-1 series, and directly related to the NC subproject's objective to develop instrument flight procedure

(IFP) criteria for Urban Air Mobility/ electric Vertical Takeoff and Landing (UAM/eVTOL) operations. The collaborative test effort between Joby Aviation, NASA, and the FAA involved four NASA research pilots who received simulator training from Joby Aviation, and then executed different variations of developmental UAM/eVTOL IFPs, including departures, approaches, missed approaches and en route portions. The tests involved an experimental candidate terminal airspace construct termed a "deproach," a circular wheel traffic profile which consolidates departure, approach and missed procedures to allow for conservation of airspace and streamlined tailoring to specific vertiports. The tests were accomplished using Joby Aviation's engineering aircraft simulator, which includes avionics, inceptors, and aircraft performance modeling representative of Joby Aviation's upcoming production aircraft. Testing involved manually flying the aircraft along the waypoints of the candidate IFPs and collecting the simulator data to analyze which versions of the IFPs score optimally across competing goals of obstacle avoidance, route efficiency and passenger comfort. This was the NC's first opportunity to test experimental UAM IFP concepts with an eVTOL industry partner's aircraft simulator. The tests will enable the NC to assess if the IFPs are compatible with the aircraft performance and identify which variations of the IFPs might

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be most successful considering the expected operating practices of a specific leading eVTOL aircraft. Planned next steps and future work include analyzing the simulator data and processing results, continuing efforts with the FAA to refine and produce Aeronautical Radio, Incorporated 424 IFP code for potential ingestion by the eVTOL flight management systems, and further work with Joby Aviation to collect additional IFP aircraft simulator data using Joby Aviation pilots.

### SWS-Funded Research Leads to MATLAB/Python Toolbox Development and Release

POC: [WENDY OKOLO](#) AND [MISTY DAVIES](#)

Research funded by the System-Wide Safety (SWS) project has culminated in a collection of customizable MATLAB/Python tools and functions to quantify and propagate uncertainty. This research was conducted in collaboration with the University of Texas at Arlington and principal investigator Kamesh Subbarao. The toolbox focuses on the quantification of uncertainties in small Unmanned Aircraft Systems' parameters and operating conditions, thus contributing to safer traffic management. This toolbox is applicable to any dynamic system, such as urban air mobility vehicles, other air vehicles, and even spacecraft containing uncertainties from the surrounding environment,

wind, aircraft weight, etc. In addition, the toolbox gives users the advantage of faster computations when compared to currently available MATLAB options for certain classes of systems. Potential end users and stakeholders such as operators and decision makers can customize the information used for processing or uncertainties to be quantified, and how the corresponding results are presented. The MATLAB/Python toolbox is available via GitHub at: <https://github.com/aslResearch/aslUQ/>

### DLR Visits Langley

POC: [SHIVANJLI SHARMA](#) AND [EVAN DILL](#)



*Photos from DLR visit.*

On Sept. 16, researchers from the German Aerospace Center (DLR) visited NASA's Langley Research Center in Virginia. Both the Air Traffic Management – eXploration (ATM-X) project, represented by Shivanjli Sharma and Kurt Swieringa, and the Advanced Air Mobility project, represented by Evan Dill,

participated in the meeting. The visit provided an opportunity to discuss the upcoming ATM-X visit to DLR, scheduled for late November through early December, to review research from the NASA/DLR collaboration – as well as the DLR HorizonUAM Symposium. The meeting included an overview of the ATM-X project presented by Kurt Swieringa. In addition, tours of various NASA Langley facilities and previews of the 2022 Digital Avionics System Conference presentation were also discussed. Both the ATM-X project and the System-Wide Safety project participated in the tours and discussions.



### UAM Revises Roadmap Using Machine Learning Natural Language Processing Algorithm

POC: [KEVIN WITZBERGER](#)

On Sept. 21–22, the Air Traffic Management – eXploration (ATM-X) project's Urban Air

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Mobility (UAM) Airspace subproject revised the UAM Airspace Research Roadmap (Roadmap), that uses model-based system engineering and machine learning for natural language processing. The Roadmap supports UAM research to achieve a highly automated and operationally flexible UAM airspace management system. Nipa Phojanamongkolkij, Braxton Van Gundy, and Ian Levitt described the use of these technologies at the Systems Engineering Research Center AI4SE & SE4AI Workshop 2022. The workshop was hosted by the Stevens Institute of Technology. The presentation, with a live demo, gave an overview of the natural language processing application.

### **NASA/CANSO/FAA Collaborating for our Future Skies Meeting**

POC: [PARIMAL KOPARDEKAR](#)

At the FAA's request, the NASA Aeronautics Research Institute and NASA's "Sky for All" initiative hosted a three-day in-person meeting to bring international stakeholders together on Sept. 20–22. The purpose of the meeting was to meet with innovators, present work on future airspace planning and strategy, and discuss how the Civil Air Navigation Services Organisation (CANSO), the FAA, and NASA can better collaborate to ensure stakeholder needs are met in the coming decades. The meeting,

held at NASA's Ames Research Center in California, included about 50 people and created a forum in which three future aviation plans could be discussed and harmonized. These included FAA's Info-Centric National Airspace System, CANSO's Complete Air Traffic System (CATS) Global Council Vision for 2045, and NASA's "Sky for All," a capability framework to inform NASA's research and development strategy through the mid-21st century. Industry was invited to share their perspectives and ideas throughout the meeting. The three future-focused plans shared many of the same key challenges and opportunities, including an emphasis on sustainable practices, ubiquitous communications, and highly automated and autonomous operations. Both the CATS Global Council Vision and "Sky for All" presented their strategies in five-year increments that built successively upon the last to achieve the respective visions by 2045. On Tuesday and Thursday, industry tours at Wisk, Wing, Microsoft, and Reliable Robotics introduced global representatives from CANSO to American Silicon Valley innovators. Follow-up meetings are in the process of being scheduled, and all three organizations are eager to continue working together toward a sustainable, highly automated future airspace system that will enhance the quality of life for all.

### **UAM Team Visits Archer Headquarters**

POC: [KEVIN WITZBERGER](#)

On Sept. 26, members of the Air Traffic Management – eXploration project's Urban Air Mobility (UAM) Airspace subproject visited Archer's headquarters in San Jose, California. NASA representatives met with key Archer leaders including Adam Goldstein, co-founder and chief executive officer; Mark Mesler, chief financial officer; Andy Missan, chief legal officer; Tom Muniz, chief operating officer; Tom Anderson, chief operating officer, UAM; Michael Romanowski, head of government relations; and Deborah Dias, board of directors member. Goldstein opened the meeting by providing an overview of Archer's business plan, Maker demonstration aircraft, and timeline to certification for the Midnight production aircraft by the end of 2024 to enable commercial operations in 2025. Anderson covered Archer's initial route structure options in the New York area that have been informed by an in-house proprietary software package and their partnership with United Airlines. Following these discussions, NASA received a tour of their engineering simulator and a couple of NASA researchers flew the simulator (some flew better than others!). After wrapping up at Archer's headquarters, the NASA team headed north to Palo Alto, California and received a

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*NASA team with Archer.*



*NASA team touring Archer facility.*

tour of Archer's manufacturing site to see their second Maker demonstration aircraft. Archer has two demonstration aircraft – one flying under an FAA Certificate of Authorization at Salinas Municipal Airport in Monterey County, California

and the second in Palo Alto. Archer's vice president of manufacturing, Glen Burks, provided an overview of Maker, lessons learned from flight testing, and expected differences with their Midnight production aircraft. Before ending the tour for the day, NASA

invited Archer to visit its Ames Research Center in California in the future and to learn about UAM Airspace's research and development efforts. Given NASA's expertise in airspace and Archer's in vehicles, there is anticipation for future research collaboration opportunities.



# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## ATM-X Hosts the NASA/FAA Quarterly Review

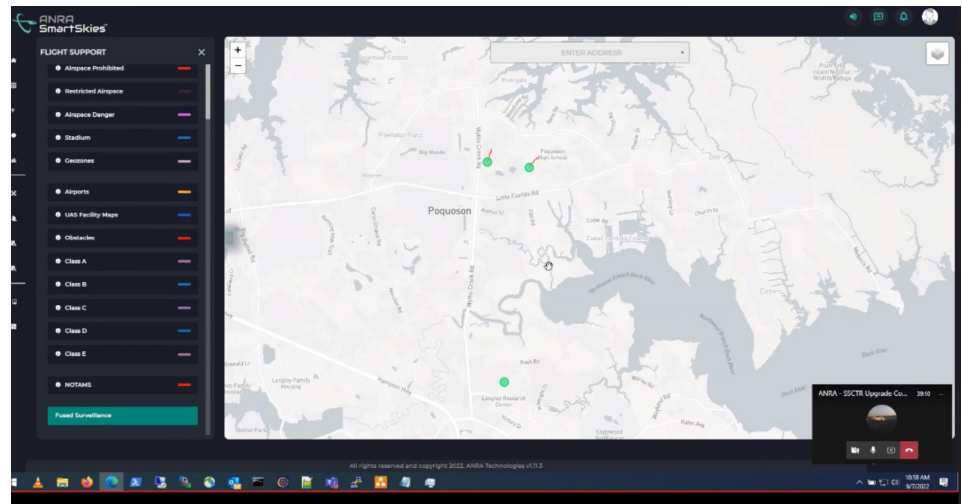
POC: [WILLIAM CHAN](#)

The Air Traffic Management – eXploration (ATM-X) project hosted a two-day hybrid NASA/FAA Quarterly Status Review Meeting at NASA’s Ames Research Center in California on Sept. 28–29. The review was hosted by the NASA Aeronautics Research Institute. Each day consisted of ATM-X presentations on research status and schedule updates from the ATM-X subprojects. Subprojects included the Digital Information Platform, Extensible Traffic Management, Urban Air Mobility (UAM) Airspace Management, Pathfinding for Airspace with Autonomous Vehicles, and “Sky for All.” Each subproject also conducted breakout sessions with the FAA which discussed coordination and more detailed topic-specific items. In addition to the ATM-X presentations, the FAA presented updates on their Info-Centric National Airspace System vision and updates to their Unmanned Aircraft Systems Traffic Management and UAM demonstrations. The next quarterly review is planned for December 2022.

## HDV LSTAR Fully Hooked Up to Langley Network

POC: [LOUIS GLAAB](#)

The Advanced Air Mobility project’s High Density Vertiplex (HDV)



*This picture shows simulated air traffic from the Sim Asterix data.*

subproject’s Lightweight Surveillance and Target Acquisition Radar (LSTAR) was successfully powered up this past quarter – remotely testing the power and internet connection to the LSTAR in its new location at NASA’s Langley Research Center in Virginia. This marks the conclusion of several months of work to get power/internet connectivity to the LSTAR so that the HDV team can proceed with LSTAR integration with the ANRA Technologies SmartSkies (SS) CTR airspace surveillance system. Given the recent relocation of the LSTAR to the roof of the building, the radar needed to be disassembled and reassembled in its new location. Subsequently, the GA-9120 radars were mounted on the gantry at NASA Langley and the HDV surveillance team completed the power and internet cabling work to those two radar panels. A quick demonstration was provided on July 8 showing live radar data displayed

on a computer in a lab area of the building. This opened the door for live radar data integration with the ANRA SS CTR system and display of traffic in the Remote Operations for Autonomous Missions laboratory’s Unmanned Aircraft Systems (UAS) Operations Center.

On Sept. 9, the team successfully integrated simulated radar data (Sim Asterix) with the ANRA Technologies SS CTR that replicates output from the LSTAR. This will enable the HDV team to perform comprehensive testing of the ANRA SS CTR surveillance data fusion and display system much more effectively than with actual sensors. In addition, the Anra SS CTR integration team installed the latest update of the system onto the NASA host computers and resolved a major issue regarding additional user accounts, removing a major challenge to the implementation team. For uses

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

in HDV, the ANRA SS CTR will integrate airspace surveillance information from a series of sensors and provide an Integrated Airspace Display (IAD). The UAS operations team will use the IAD to make decisions regarding launching aircraft for beyond visual line of sight (BVLOS) operations as well as when to potentially abort operations.

Lastly, on Sept. 30, the LSTAR was successfully powered up, remotely testing the power and internet connection to the LSTAR in its new location at NASA Langley. This marked the conclusion of several months of work to get power/internet connectivity to the LSTAR so that the HDV team can proceed with LSTAR integration with the ANRA SS CTR airspace surveillance system. When fully integrated, the HDV team will have the LSTAR radar on top of B1244, two smaller GA-9120 panel radars on the Langley gantry, ground-based ADS-B and flight alarm sensors all feeding into the ANRA SS CTR for display to the UAS operations team in the control lab to enable BVLOS operations.

### **SWS Completes Assessing NASA's Risk Monitoring and Assessment Tools**

POC: [NIKUNJ OZA](#) AND [CHAD STEPHENS](#)

NASA's System-Wide Safety (SWS) project recently completed important work regarding

extending NASA's risk monitoring and assessment tools for the inclusion of non-traditional data and analyzing the cost and benefit for including these sources. As of Sept. 30, two assessments were performed: costs and benefits of using Aviation Safety Reporting System (ASRS) reports, and costs and benefits of using Aviation Safety Action Program (ASAP) and ASAP Event Review Committee (ERC) debrief sessions/interviews. The key findings from this work were that the ASRS, together with associated Google Analytics and geographic information associated with the reports, seem promising to use together with other traditional/objective data such as System Wide Information Management (SWIM) and Flight Operations Quality Assurance (FOQA). Also, human factors expertise can provide additional information about ASAP reports beyond the information collected in a typical debrief. Therefore, having human factors experts present during debriefs would be valuable. The work has resulted in two reports being generated. One describes how ASRS and associated information can be used, together with traditional/objective data such as SWIM and FOQA, to obtain information beyond what each one could provide on its own. The other is a report giving an example of insights that a human factors expert can provide on an ASAP

report, some key questions about the ASAP ERC debrief process, and what additional value can be gained from the ASAP reports and ERC debrief information.

### **FSF and SWS Complete IASMS Roadmap Workshops**

POC: [MISTY DAVIES](#)

The Flight Safety Foundation (FSF) and the System-Wide Safety (SWS) project have collaborated to develop a high-level, long-term roadmap for the In-Time Aviation Safety Management System (IASMS). This roadmap will identify key dependencies, enablers, risks, and opportunities that facilitate the operations envisioned in the 2035–2045 timeframe and will help inform NASA's long-term research strategy. It will also identify external initiatives that NASA could encourage that contribute to aviation safety objectives. As of Sept. 30, FSF completed, through a series of "mini workshops," NASA-internal coordination on the high-level content that would be shared with external stakeholders during a planned in-person workshop in January 2023. Each mini workshop explored a number of themes, most of which were captured from stakeholder interviews conducted last fall.

## RECOGNITION

### AOSP Researchers Serve on Panels on Automation and Autonomy in General Aviation

POC: [KEN GOODRICH](#) AND [NATASHA NEOGI](#)

On July 13, Ken Goodrich, deputy project manager for technology for the Advanced Air Mobility project, along with Natasha Neogi, the subproject manager for the Safety Demonstrator Series within the System-Wide Safety (SWS) project, served as panelists for a webinar entitled “Automation and Autonomy in General Aviation: Opportunities and Challenges for Safety, Accessibility and Sustainability.” The webinar was co-sponsored by the American Institute for Aeronautics and Astronautics (AIAA) Intelligent Systems Technical Committee and the Partnership to Enhance General Aviation Safety, Accessibility and Sustainability which is an FAA Center of Excellence for General Aviation. The virtual event was joined by 149 attendees and will be archived on an AIAA website. Other panelists included Nicoletta Fala, assistant professor of Mechanical and Aerospace Engineering at Oklahoma State University; Joe Phillips, director of Engineering Flight Test at Textron Aviation; and John Valasek, professor of Aerospace Engineering at Texas A&M University. Bill Crossley, head of Purdue University’s School of Aeronautics and Astronautics, served as the panel moderator.

### ATM-X Participates at Future of Aviation Conference

POC: [SHIVANJLI SHARMA](#)

The Air Traffic Management – eXploration (ATM-X) project participated in the Future of Aviation Conference, hosted at San Francisco International Airport on Aug. 3–4. The goal of the conference was to advance key research and policy discussions around environmental impacts, safety, security, equity, multimodal integration, and the role of government. ATM-X deputy project manager Shivanjli Sharma spoke on a panel titled “Advancing Aerial Mobility: Current Practices, Innovations, and Emerging Futures,” where they discussed views on opportunities, risks, and indicators to watch in preparation for enabling Advanced Air Mobility. Kenneth Freeman also spoke on a panel titled “Securing Advanced Air Mobility – Clipper.” This panel discussed ensuring personal, personnel, physical, and cybersecurity of all aspects of Advanced Air Mobility that will be critical to maintaining safety and public trust.

### SWS-Sponsored Research Results in New Licensed Technology

POC: [CHAD STEPHENS](#)

On Aug. 4, research that was sponsored by NASA’s System-Wide Safety (SWS) project resulted

in a new license (DN-1710) with Rightvarsity Technologies, LLC (<https://rightvarsity.com/>) for a patented NASA technology (LAR-18880-1, U.S. patent US20180103867A1). Rightvarsity specializes in program improvement, new program/project implementation and program/project management, IT consulting, IT workforce apprenticeship training, and higher demand skills immersion/augmentation services. Rightvarsity training services include on-demand and value-added development and documentation for custom training, eLearning, remote job aids, instructor-led training, and leadership/technical training. Rightvarsity is an approved training provider of e-health (EPIC consulting services) and the Department of Homeland Security through the National Initiative of Cybersecurity Career Studies. The patented NASA technologies are expected to contribute to the Rightvarsity focus areas of eLearning and remote job aids (educational apps/games and instructional design and development). The co-inventors on the licensed patents include Chad Stephens and Alan Pope of NASA’s Langley Research Center in Virginia and William Hollingsworth, former NASA intern. For more information, visit: <https://ntts-prod.s3.amazonaws.com/t2p/prod/t2media/tops/pdf/LAR-TOPS-276.pdf>

## RECOGNITION

### **SWS Associate Project Manager Serves as Panelist on NASA Ames WoW Panel for Women's Equality Day**

POC: [WENDY OKOLO](#)

On Aug. 25, the Women's Influence Network and the African American Advisory Group at NASA's Ames Research Center in California hosted the Women of Worth (WoW) panel discussion. This insightful agencywide women's empowerment session highlighted the worth and value of women at NASA in commemoration of Women's Equality Day. The discussion was moderated by Deborah Feng, former associate director at NASA Ames, and featured Wendy Okolo, System-Wide Safety (SWS) associate project manager, as one of the panelists. The virtual event drew more than 150 attendees across the agency including NASA Ames Center Director Eugene Tu and Clayton Turner, director of NASA's Langley Research Center in Virginia.

### **SWS's Aviation Security Liaison Presents at COI Series**

POC: [PAUL HOYT NELSON](#)

The System-Wide Safety (SWS) project's aviation security liaison, Paul Nelson, in his role of senior cybersecurity advisor for NASA Aeronautics, gave a presentation on "UTM System Security Engineering and ASTM Standards

Development" on Aug. 25. The meeting was held via Webex as part of the Aeronautics Research Mission Directorate Cybersecurity Community of Interest (COI) series of presentations. Link to presentation recording: [https://nen.nasa.gov/web/sse/documents/-/document\\_library/h5fjYiGhs1eZ/view\\_file/28058233](https://nen.nasa.gov/web/sse/documents/-/document_library/h5fjYiGhs1eZ/view_file/28058233).

### **AAM Project Lead Strategist to Serve as a Member on the 2023 AVIATIONGC**

POC: [STARR GINN](#)

Starr Ginn, lead strategist in the Advanced Air Mobility (AAM) project office, was appointed and confirmed by the American Institute of Aeronautics and Astronautics to serve as a member on the 2023 AVIATION Forum Guiding Coalition (AVIATIONGC). This committee of thought leaders from throughout academia, industry, and government will provide the high-level vision and guidance for the continued development of this annual event. Under the leadership of the AVIATION executive producer, Ginn will advise on the event's development, provide insight into the theme and key topics/issues, identify and recruit relevant experts and speakers, and facilitate communication with peers, colleagues, and potential partner organizations.

### **SWS Researcher Contributes to New RTCA Document DO-397**

POC: [EVAN DILL](#)

As part of the RTCA SC-228 effort to develop minimum performance standards for Unmanned Aircraft Systems (UAS), four subgroups were established to investigate specific areas of interest. Evan Dill from the System-Wide Safety (SWS) project participated as a subject-matter expert in Working Group 4, studying gaps in navigation system performance for UAS. During this effort, Dill provided multiple technical contributions and editorial comments. The efforts of this working group recently led to the publication of new RTCA guidance material titled "DO-397, Guidance Material: Navigation Gaps for Unmanned Aircraft Systems" on Sept. 15.

### **ATM-X Participates in the ITS World Congress**

POC: [SHIVANJLI SHARMA](#)

On Sept. 20, Shivanjli Sharma, Air Traffic Management – eXploration (ATM-X) deputy project manager, was part of a panel titled "Policy and Governance Implications of Urban Air Mobility" at the Intelligent Transportation Systems (ITS) World Congress Meeting in Los Angeles. This meeting is a global event that brings together

## RECOGNITION

world leaders, practitioners, policy makers, researchers, and private industry to advance and unite the ITS industry. On the panel, they discussed the concept of Urban Air Mobility and how it impacts governance and policy. Some of the topics of discussion included ground operations, vehicle routing, impact on highways, routing in the sky, and integration into multi-modal hubs. The next ITS World Congress Meeting will be held in Atlanta in 2025.

### SWS Has Significant Representation at DASC 2022

POC: [TERRY MORRIS](#) AND [JEFF HOMOLA](#)

The Digital Avionics Systems Conference (DASC) took place this year in Portsmouth, Virginia

on Sept. 18–22. The conference focused on industry, academia, and government research and analyses from aeronautics and space domains. The theme for the conference was “Roadmap for Increasingly Autonomous Systems in Air Transportation.” There were more than 47 paper sessions with up to four papers per session and more than 165 papers in the proceedings. NASA contributed substantially as authors and presenters, as well as organizers and managers of the conference. System-Wide Safety (SWS) team members Natasha Neogi, Evan Dill, Daniel Hulse, and Mahyar Malekpour all chaired sessions at the conference, while Steve Young served as track chair and Terry Morris served as general chair. Kaitlyn Fox,

SWS strategic communications manager, served as publicity chair for DASC 2022. Consistent with the conference theme, sessions were held on machine learning and artificial intelligence tools and concepts for Urban Air Mobility (UAM)/Advanced Air Mobility (AAM); Navigation Performance, Test, Verification and Certification; and Safety, Risk, and Security, with a clear focus this year on small Unmanned Aircraft Systems operations and UAM autonomy and automation. Two distinctive panels were presented at the DASC. The first panel focused on industry perspectives provided by Cirrus, Joby, Xwing, and Reliable Robotics – industry leaders who are introducing new autonomy-related vehicle technologies into



(Top left to lower) Sequoia Andrade receiving 2nd place Best of Conference Award at DASC. Some of SWS team members who attended DASC. SWS / Air Traffic Management - eXploration booth at DASC. IASMS panel at DASC.

## RECOGNITION

the National Airspace System (NAS). To provide a balanced perspective on autonomy and automation, SWS team members moderated and served as panelists on a government perspective's panel called, "In Time Safety Management Systems for Future Operational Transitions," which discussed how assuring safety as new entrants and expanding traditional operations become more integrated in the future NAS, which poses significant challenges due to increasing operational complexity. The panel discussed the benefits of the In-Time Aviation Safety Management System (IASMS) concept for AAM including carriers and cargo operators, and the implications for the FAA, industry standards, and cybersecurity. Michael Vincent, SWS associate project manager, served as the moderator. Panelists included SWS team members Misty Davies, Jim Ackerson, and Paul Hoyt Nelson. Other panelists were Scott LeMay, director of the Safety Analytical Services Division at the FAA and Deborah Kirkman, director of the Flight Safety Foundation. The audience was highly engaged, resulting with good questions and discussions. SWS-sponsored research won several DASC 2022 team awards. SWS researchers Sequoia Andrade and Hannah Walsh's paper, "What Went Wrong: A Survey of Wildfire UAS

Mishaps Through Named Entity Recognition," won best of session, best of track, and 2nd place best of conference awards. In the area of Test, Verification & Certification, SWS researcher Michael Holloway's paper "False Beliefs About the Overarching Properties and Overarching Properties Related Arguments" won the best of session award. In the area of UAM/AAM Safety, Risk, and Security, the SWS IASMS team's paper, "The In-Time Aviation Safety Management System Concept for Part 135 Operators," also won the best of session award. SWS personnel staffed a booth at DASC, complete with SWS graphics display and virtual reality experience. Special thanks to Meghan Woodcock and Dan Coleman for booth and display setup and dismantling.

In addition, the AAM project's High Density Vertiplex subproject team received the best of session automation and teaming award for their paper titled "Usability Evaluation of Fleet Management Interface for High Density Vertiplex Environments" at the conference.

### **AAM Lead Strategist Gives Keynote Speech at the Drones and Robotics Summit**

POC: [STARR GINN](#)

Starr Ginn, the Advanced Air Mobility (AAM) project office lead



*Starr Ginn presenting at the Drones and Robotics Summit.*

strategist, provided the opening keynote speech at the Drones and Robotics Summit in New York on Sept. 20. This event focused on automation of vehicle, airspace, and infrastructure, the digital thread that needs to close the loop on this system, and then communicate to other missions and use cases. Ginn spoke about Small Business Innovation Research (SBIR) opportunities for small businesses and venture capitalists. An SBIR example was used to show how NASA invests in low technology readiness level to buy down risk and identify commercial use cases. Attending the conference was Genius VC, Empire State Development New York Ventures, and Silicon Valley Bank, among others. Most small businesses attending were based in New York, including NUAIR, TRUweather, and Circle Optics. Representatives from the United Kingdom and Israel were also present.

## RECOGNITION

### **xTM Paper Accepted for Publication in IEEE TOR**

POC: [KRISHNA KALYANAM](#)

In September, a paper written by the Air Traffic Management – eXploration (ATM-X) project’s Extensible Traffic Management (xTM) subproject was accepted for publication in the prestigious “Institute of Electrical and Electronics Engineers (IEEE) Transactions on Robotics (TRO)” journal. The paper was authored by Krishna Kalyanam, Unmanned Aircraft Systems Traffic Management (UTM)

research lead, in collaboration with representatives from the Air Force Research Laboratory, Texas A&M University, and Los Alamos National Laboratory. The paper, titled “Bounds on Optimal Revisit Times in Persistent Monitoring Missions with a Distinct and Remote Service Station,” presents a novel algorithm that solves the problem of determining Unmanned Aerial Vehicle (UAV) routes that minimizes time spent on recharging when the targets and recharging stations are not co-located. The solutions from this algorithm are compared with

optimal ones and found to be within 0.01 percent on average. This computationally difficult “NP-Hard” problem presents itself when realistic constraints, such as propulsion energy capacity of UAV and recharging time, are considered in UAV route generation and this work brings the UTM and Advanced Air Mobility community one step closer to designing energy-saving routes with operational constraints. The work delivers a bounding algorithm with performance guarantees on the quality of the solution.

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