National Aeronautics and Space Administration

AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

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AOSP IN THE NEWS

Uncrewed Aircraft Systems Traffic Management Beyond Visual Line of Sight (UTM BVLOS)

NASA.gov (12/09) reports "NASA's Uncrewed Aircraft Systems Traffic Management Beyond Visual Line of Sight (UTM BVLOS) subproject aims to support the growing demand for drone flights across the globe."

NASA Flight Rerouting Tool Curbs Delays, Emissions

NASA.gov (12/20) reports "It's the holiday season — which means many are taking to the skies to join their loved ones. If you've ever used an app to navigate on a road trip, you've probably noticed how it finds you the most efficient route to your destination, even before you depart. To that end, NASA has been working to make flight departures out of major international airports more efficient — thereby saving fuel and reducing delays — in close collaboration with the aviation industry and the Federal Aviation Administration (FAA). The savings are possible thanks to a NASA-developed tool called Collaborative Digital Departure Rerouting."

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

ACERO performs flight testing at NASA Ames demonstrating the PAMS mesh network radio relay.

ACERO Completes Successful Shakedown Testing

POC: HILLARY SMITH

The Advanced Capabilities for Emergency Response Operations (ACERO) project successfully completed shakedown testing of airspace management functions, aerial communication relay, and fire information sharing this past quarter. Initial shakedown testing began in October and concluded with tests on Nov. 6 at the N248 hanger at NASA's Ames Research Center in California, and on Nov. 8 outside building N269. These tests were key steps for upcoming trials, with three at the Monterey Bay Academy Airport scheduled a few weeks later. In this final round of testing, three portable airspace management system (PAMS) units and a relay radio device (Doodle Lab Radio) were placed at different locations around buildings and the hanger, ensuring no two systems were within visual line of sight of each other. The objectives of these tests were twofold:

1. to access and confirm the robustness and reliability of the airspace systems, devices, and related software; and
2. to provide a final round of training for SSC researchers before the ACERO shakedown the following 2 weeks.

The successful completion of these tests was conducted on Nov. 12-21 at the Monterey Bay Academy Airport in La Selva

Engineers and researchers from NASA Ames, Langley, and Glenn supported a shakedown testing campaign for the ACERO project at Monterey Bay Academy Airport in La Selva Beach, CA.

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Beach, CA. The team ran 12 test scenarios and successfully met 124 design requirements. During a wildland fire, these technologies will enable uncrewed aircraft systems (UAS) beyond visual line of sight operations in degraded visual environments, which would expand the window of time crews have to aerially suppress and monitor a wildland fire. During these tests, more than 40 people, including researchers and engineers from NASA's Ames, Langley, and Glenn Research Centers, as well as the Overwatch Aero crew, supported the shakedown testing. Members of the NASA Ames digital team also captured photo and video of the testing to be used for future stories and videos on NASA.gov. This testing leaves the ACERO team well poised for a successful Technical Capability Level 1 field and flight test evaluation series slated for spring 2025 in the Salinas Valley.

NExCT COP Framework Presented to AMP Concepts Team

POC: WILLIAM GROSVENOR CUMMINGS-GRANDE

The Air Traffic Management-eXploration project's National Airspace System Exploratory Concepts and Technologies (NExCT) subproject presented an overview of the Cooperative Operating Practices (COP) Framework to the Air Mobility Pathfinders (AMP) project's Concepts team during their weekly meeting on Oct. 3. NExCT researcher Will Cummings-Grande provided the overview. Approximately 40 team members from the AMP team attended the meeting. The AMP team was interested in this work as they had recently completed a Technical Challenge tollgate and were given the recommendation to increase their efforts in the study of cooperative practices. The presentation covered an overview of NExCT's mission and objectives, the COP Framework and its intended use as a research guide, and upcoming plans for topic deep dives by the NExCT COP team. Immediate takeaways from this presentation were an enhanced visibility for NExCT's COP research, AMP's data mining of the COP Framework to inform their future research, and planned future collaborations between the two projects.

AMP and FAA Collaborate on "Innovate 28" AAM Research Milestone

POC: JASON PRINCE

Researchers from the Air Mobility Pathfinders (AMP) project's Airspace Operations subproject leveraged the NASA/FAA Laboratory Integrated Test Environment (NFLITE) to collaborate with the FAA on a key milestone in the "Innovate 28" initiative by demonstrating and evaluating simulated Advanced Air Mobility (AAM) operations at Los Angeles International Airport (LAX) on Oct. 15–17. The FAA's Innovate 28 initiative seeks to enable initial AAM operations at key sites by 2028. The collaboration with the FAA was focused on demonstrating and evaluating initial AAM operations in a Live, Virtual, Constructive simulation. Active controllers from LAX and NASA researchers participated as surrogate AAM pilots. NASA and the FAA used NFLITE capabilities to demonstrate and evaluate various alternative arrival and departure routings, procedures, pilot phraseology, and vertiport locations at LAX. The activity will inform industry partners and Los Angeles World Airports of the feasibility and challenges associated with initial operations proposed by AAM operators. The NASA side of the NFLITE,

Engineers and researchers from NASA Ames, Langley, and Glenn supported a shakedown testing campaign for the ACERO project at Monterey Bay Academy Airport in La Selva Beach, CA.

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developed over the past few years under interagency agreements between NASA and the FAA, served as the backbone for modeling the AAM operations, while the FAA's William J. Hughes Technical Center provided the conventional traffic operations as well as the air traffic controller environment for the research activity. The AMP researchers participating in this activity included Nelson Guerreiro, Terence McClain, Jason Prince, and Jim Chamberlain from NASA's Langley Research Center in Virginia. NASA Langley's Air Traffic Operations Laboratory supported the activities and the work is part of NASA's joint efforts and collaborations with the FAA to conduct near- and midterm AAM research.

DIP Hosts a Phase III SBIR Kickoff Meeting on XAI

POC: YOON JUNG

The Air Traffic Management-eXploration project's Digital Information Platform (DIP) subproject invited the Airborne Tactical Advantage Company (ATAC) to conduct a Phase III Small Business Innovation Research (SBIR) kickoff meeting at NASA's Ames Research Center in California on Oct. 17. ATAC has been awarded a Phase III SBIR contract to provide a preliminary deployment of ATAC's Explainable Artificial Intelligence (XAI) capabilities with a connection to DIP to enable researchers with access to human-understandable explanations of reasoning behind decisions made by one or more AI components of DIP's decision architecture. Under this contract, ATAC will develop explainable methods and apply them to DIP's Collaborative Digital Departure Rerouting (CDDR) service subcomponents and demonstrate the explainable techniques for the CDDR service. During the meeting, ATAC reviewed XAI concepts and methodologies developed through previous SBIR phases and outlined tasks for the next 12 months. DIP researchers provided inputs on specific use cases relevant to the current Sustainable Flight National Partnership operational demo, focusing on predeparture rerouting in the Houston area.

DIP Team Engages with ULI Team

POC: SWATI SAXENA

The Air Traffic Management-eXploration project's Digital Information Platform (DIP) subproject team gave a live demonstration of the Collaborative Digital Departure Rerouting (CDDR) tool to representatives from the Transformative Aeronautics Concepts Program's University Leadership Initiative (ULI) project team in the Aviation Systems Division's Verification & Validation Laboratory at NASA's Ames Research Center in California on Oct. 17. DIP subproject manager Swati Saxena gave an overview of the subproject, followed by DIP technical lead Jeremy Coupe presenting a demonstration of the CDDR tool using live traffic data from the North Texas area. The demonstration also included displays of the machine learning-based predictions of departure traffic from Houston and New York airports. The DIP and ULI teams engaged in a technical discussion about the data and the machine learning-based predictive engine, which offers a low-cost robust solution with the potential to expand capabilities to the National Airspace System (NAS). In addition, Saxena gave a DIP overview presentation

Swati Saxena briefs the ULI team in the Verification & Validation Laboratory at NASA Ames.

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to the entire ULI team, including university and industry members, at their kickoff meeting at the Airborne Tactical Advantage Company headquarters in Santa Clara, CA, on Oct. 18. The team has recently been awarded a contract to develop a tool to advance and test ideas for improving the resilience of the NAS and reducing disruptive impacts. Coupe participated in the discussion about how DIP's historical NAS traffic data can contribute to the analysis.

UTM BVLOS Team Attends ASTM F38 October 2024 Meeting

POC: JEFFREY HOMOLA

Representatives from the Air Traffic Management-eXploration project's Uncrewed Aircraft Systems Traffic Management Beyond Visual Line of Sight (UTM BVLOS) subproject attended the 2024 American Society for Testing and Materials (ASTM) F38 Meeting in West Conshohocken, PA, on Oct. 15–18. The team participated in workshops, colloquiums, and working sessions facilitated by leaders in the uncrewed aircraft systems industry and government organizations from the United States, Canada, France, Japan and the United Kingdom. During the meeting, session leaders addressed the latest updates to a subset of standards that affect the unmanned aerial vehicles industry. Teams from NASA's Ames Research Center in California and Langley Research Center in Virginia had the opportunity to share their knowledge and experience acquired during their time with UTM BVLOS, and learned about the process of creating, peer-reviewing, approving, and publishing ASTM standards. This F38 meeting focused on updates to standards in software dependability, meta-standards, airworthiness, detect and avoid, aviation safety, human factors, and weather. The team networked with leaders in the UTM industry and learned about the inner workings of standards publication. Attending this event is part of a concerted effort on behalf of the UTM BVLOS subproject to engage more directly with standards development organizations and contribute to their progression.

Representatives from the UTM BVLOS team attended the 2024 ASTM F38 meeting.

ACERO Team Visits Joby Aviation in Concord, CA

POC: MIN XUE AND HILLARY SMITH

Advanced Capabilities for Emergency Response Operations (ACERO) project manager Min Xue, along with other NASA Ames Research Center aeronautics project managers, visited Joby Aviation in Concord, CA, on Oct. 21. The purpose of their visit was to gain an in-depth understanding of the Joby-developed optionally piloted vehicle and to explore potential collaboration opportunities between NASA Ames and Joby. In particular, Joby has expressed interest in ACERO's field and flight evaluation of the portable airspace management system and other aeronautical research initiatives.

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PAAV Attends NRSAA Planning Meetings with Wisk Aero

POC: ANDREW GUION AND ARWA AWEISS

An Air Traffic Management-eXploration (ATM-X) project team met with Wisk representatives at Wisk's facilities on Oct. 21–22. The purpose of the meeting was to further plan future collaborative work under anticipated nonreimbursable space act agreement (NRSAA) planning meetings. Representing the NASA team were ATM-X project manager Shivanjli Sharma and researchers from the project's Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject, including Arwa Aweiss, Matt Gregory, Conrad Rorie, Jordan Sakakeeny, Andrew Guion, Stewart Nelson, David Zahn, and Sarah Eggum. Wisk invited the NASA team to visit their final integration and flight test facilities in Hollister, CA, as well as their headquarters and production facilities in Mountain View, CA. The teams held productive discussions to outline their future collaborative work in greater detail. The work will progress toward joint NASA-Wisk simulations with air traffic controller surrogates in the loop, followed by similar Live, Virtual, and Constructive (LVC) tests with Wisk's Bell helicopter electric vertical takeoff and landing surrogate. Eventual LVC tests involving their uncrewed aircraft system (UAS) will follow. The overall goal of this collaboration is to research and test operations and required elements that will allow integration of UAS into the National Airspace System. While in Hollister, the NASA team witnessed Wisk conducting a flight test demonstration with its automation testbed. The team eagerly anticipates finalizing the NRSAAs and beginning formal collaborative work toward the planned simulations and flight tests.

ATM-X and DIP Leadership Team Attends Kick-off Meeting with Boeing

POC: SWATI SAXENA

Leadership from the Air Traffic Management-eXploration project and its Digital Information Platform (DIP) subproject team attended a kick-off meeting with Boeing at their headquarters in Seattle on Oct. 23–24. The meeting initiated a collaborative effort between NASA and Boeing supporting NASA's Sustainable Flight National Partnership Operations Demonstration 2 (SFNP Ops-2), scheduled in fiscal years 2025–2027. NASA representatives included ATM-X project manager Shivanjli Sharma, DIP subproject manager Swati Saxena, as well as ATM-X and DIP leadership. Boeing participants included Sherry Yang, Chip Meserole, Chad Lloyd (Boeing Commercial Airplanes, ecoDemonstrator deputy project manager), and other Boeing leads and staff members. The group exchanged information about the

NASA-Boeing kickoff meeting group photo at Boeing headquarters in Seattle.

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One NASA-Boeing meeting, the FAA's Boeing 737 ecoDemonstrator Explorer Internet Protocol Suite Very Large Demonstration flight activities in 2025, NASA's and Boeing's needs for the SFNP Ops-2 flight demonstrations, and development of joint use cases. In two breakout sessions, the following two topics were discussed:

1. digital taxi clearance field demonstration and
2. contrail management research and development opportunities.

Additionally, the NASA team visited Boeing's Integrated Aircraft Systems Laboratory in Seattle and the Autonomy Concept Center in Everett, WA. The two-day meeting concluded with an agreement to establish a regular cadence of discussions between NASA and Boeing in preparation for the SFNP Ops-2 collaboration.

AOSP Participates at Multi-Vehicle Bi-Annual Working Group Meeting

POC: SUMMER BRANDT

Representatives from the System-Wide Safety project, Air Traffic Management-eXploration project, and AOSP office attended the Multi-Vehicle (m:N) Bi-Annual Working Group meeting in Fort Worth, TX, on Oct. 22–24. The meeting was hosted at the FAA's southwest regional office. The first day's agenda items included discussions on white paper publication plan status, including m:N metrics, safety cases and modeling; interventions and/or exceptions; integration; and small uncrewed aircraft systems. The second day included tours of Wing's Operations Center in Coppell and Frisco, TX, and discussions on third-party services to enable airspace integration, the FAA's Artificial Intelligence (AI) Roadmap, meaningful human control of AI-based systems, FAA

Photo of m:N Working Group meeting participants at FAA's Southwest Regional Facility.

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certifications, and a presentation on Zipline's airspace integration efforts. The last day concluded with presentations of NASA simulation efforts on m:N operations as well as government and industry discussions regarding challenges related to enabling multi-vehicle operations.

AOSP Researchers Attend FAA Autonomy Workshop

POC: NANCY BACCHESCHI, ARWA AWEISS AND NATASHA NEOGI

AOSP researchers attended the FAA's Autonomy Workshop held at Veracity Engineering in Washington, DC, on Oct. 28-29. Representing AOSP were Nancy Baccheschi from the Pathfinding for Airspace with Autonomous Vehicles subproject, and Natasha Neogi from the System-Wide Safety project. The workshop focused on the future of air traffic management and the integration of aircraft with advanced automation. The discussion focused on U.S. domestic airspace and provided a basis for industry and government priorities on timelines of importance to industry progress from the current state to the mature state. There was considerable dialogue between the FAA, industry, and other government agencies to shape early priorities in terms of data needs. The long-term national vision was also addressed, but the steps taken to achieve that vision were deemed considerable and would require further discussions.

UTM BVLOS Team Meets with Bay Area Public Operators

POC: GITA HODELL

The Air Traffic Management-eXploration project's Uncrewed Aircraft Systems Traffic Management Beyond Visual Line of Sight (UTM BVLOS) subproject team hosted a meeting with public small uncrewed aircraft system (sUAS) operators at NASA's Ames Research Center in California on Oct. 29. The purpose of the meeting was to engage with sUAS operators who currently use drones to perform public missions. The meeting included members from NASA Ames, the California Department of Transportation, and several local first responders from the Contra Costa, Alameda, San Mateo, and Santa Clara counties. Since public and commercial drone operations are on the rise in low altitude airspace (from 0-400 ft. above ground level), NASA emphasized commercial operations should not be allowed to block public missions, and priority access to the airspace should be granted when drones are deployed in emergency and life-saving situations. In addition, the Airspace Operations Laboratory supported an interactive demonstration in which visitors explored UTM concepts through simulated scenarios. The UTM BVLOS subproject will continue to build connections with public sUAS operators across the country to ensure vital needs are well understood and fed into regulatory and standards organizations.

Meeting with public sUAS operators at NASA Ames.

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ACERO Team Meet with Sikorsky Innovations and RAIN Aero

POC: HILLARY SMITH

Advanced Capabilities for Emergency Response Operations (ACERO) project representatives attended and observed the Rapid Aero's Wildfire Response Demonstration held by Sikorsky Innovations and RAIN Aero on Oct. 29–30. Representing the ACERO team were William Chan, Jonas Jonsson, and David Zahn. The team held discussions regarding the capabilities and possible applications of the ACERO project's technologies with representatives of Sikorsky Innovation and RAIN Aero, and also attended the flight demonstration. The ACERO team then toured the Sikorsky factory and listened to the autonomy, uncrewed aircraft system, and electric teams' presentations. Other attendees included representatives from the Federal Emergency Management Agency, Defense Advanced Research Projects Agency, Los Angeles County Fire Department, and Orange County Fire Authority. Moore Foundation, DBL Partners, and Kapor Capital representatives also participated. The ACERO team will continue to discuss future areas for collaboration with Sikorsky and RAIN with regards to their future activities and technical developments.

Integrated Airspace Team Briefs AOSP and ARD Leadership on NFLITE Demonstration

POC: JASON PRINCE

The Air Mobility Pathfinders project's Integrated Airspace subproject team briefed AOSP and ARD leadership on the Class B Simulation Evaluation (SimEval) performed this summer on midterm Urban Air Mobility (UAM) operations in the New York City airspace on Nov. 6. The SimEval evaluated the implementation of strategic conflict management strategies to effectively manage midterm UAM traffic demand. A tour of the NASA/FAA Laboratory Integrated Test Environment (NFLITE) and a live demonstration of a medium demand scenario with real-time interaction between piloted UAM simulators and air traffic controllers at the FAA William J. Hughes Technical Center followed the briefing. The tour included a walkthrough of the vertiport management stations adjacent but part of the NFLITE labs, highlights of the digital communications interface created to reduce frequency congestion and pilot in charge/air traffic controller workload, and the dynamic creation of a new UAM flight (emulating an on-demand trip request) that was strategically planned and injected into the scenario.

DIP Holds SFNP Ops-1b OERR with FAA and Flight Operators in Houston

POC: SWATI SAXENA

The Air Traffic Management-eXploration (ATM-X) project's Digital Information Platform (DIP) subproject's Sustainable Flight National Partnership Operations (SFNP Ops) team successfully conducted the Ops-1b Operational Evaluation Readiness Review (OERR) with FAA and airline partners at the FAA Houston Air Route Traffic Control Center (ARTCC) facility on Nov. 13. The team reviewed the preparation and action plan through December. The team presented the upcoming software deployments of the Predeparture Rerouting and Required Navigation Performance monitoring capabilities that will be used for the operational evaluation in the Houston airspace. The team presented analyses about the system performance and improvements, as well as candidate reroute opportunities that have been observed over the past 6 months. The team and their partners discussed remaining training and needs before the operational start. Representatives from Houston ARTCC, the National Air Traffic

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Meeting attendees outside the Houston ARTCC facility.

DIP air traffic control subject matter expert Greg Juro briefs the SNFP Ops-1b training status.

Controllers Association (NATCA) (Article 114 Rep and NextGen NATCA Rep), FAA's NextGen Organization, and airline partners indicated their readiness and support to use the DIP system in an operational capacity. An official start date of Dec. 2 was discussed for the operational evaluation. The following ATM-X and DIP team members attended the meeting in person: Shivanjli Sharma, Faisal Omar, Wanessa Priesmeyer, Swati Saxena, Jeremy Coupe, Greg Juro, and Eric Chevalley.

DIP Hosts a Virtual Workshop for Service Providers

POC: PALLAVI HEGDE AND YOON JUNG

The Air Traffic Management-eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team hosted a virtual workshop for the service provider and platform provider community on Nov. 20. The purpose of the workshop was to exchange technical approaches and experiences in four key areas including:

1. data governance,
2. quality of services,
3. cybersecurity, and
4. interoperability.

Approximately 60 participants from industry and government sectors actively engaged in the technical interchange. The workshop aimed to provide a forum where the DIP team and the broader community present technical approaches, share perspectives, and exchange ideas to drive further enhancements to the digital ecosystem. DIP partner engagement lead Yoon Jung, representing the DIP team, kicked off the workshop, followed by DIP subproject manager Swati Saxena, who provided an overview of DIP's focus on aviation services, emphasizing efficient rerouting capabilities and the strategic

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partnership plan. DIP software lead Pallavi Hedge facilitated the technical session, which included DIP team and industry representative presentations on each topic, followed by open discussions. Saxena concluded the workshop by introducing future collaboration opportunities with DIP, encouraging follow-on discussions, and inviting participants to the ATM-X DIP Industry Day, scheduled for March 2025.

AMP Research in Class B Airspace Presented to Boeing Leadership

POC: JASON PRINCE

The Air Mobility Pathfinders (AMP) project's Integrated Airspace subproject lead presented a review of the Class B Airspace Simulation Evaluation (SimEval) for the midterm Urban Air Mobility operations activity performed this past summer to the Boeing Research and Technology leadership during their annual center visit on Nov. 21. This year's meeting was held virtually and included representatives from the leadership team at NASA's Langley Research Center in Virginia. The briefing included background information that culminated in the SimEval, research questions being addressed, midterm capabilities implemented to overcome identified operational barriers, and preliminary findings and next steps.

SWS and MITRE Schedule Technical Interchange Meeting

POC: LANCE PRINZEL, CHAD STEVENS AND NIKUNJ OZA

System-Wide Safety (SWS) project members met with colleagues from the MITRE Corporation to formalize a collaborative research agreement on Nov. 13. Representing the SWS team were subproject managers for commercial aviation safety, Chad Stephens and Nikunj Oza, and senior technical advisor for commercial aviation safety Lance Prinzel. In response to a meeting between AOSP Manager Akbar Sultan and MITRE Director Greg Tenille, areas of collaboration were identified during technical interchange meetings in 2024 held at MITRE headquarters in McLean, VA, and NASA's Langley Research Center in Virginia. The purpose of collaboration is focused on next evolution of Aviation Safety Information Analysis and Sharing (ASIAS) from direction of FAA to significantly enhance current ASIAS capabilities: https://portal.asias.aero/overview. The FAA-sponsored effort is in response to envisioned changes expected for the future National Airspace System. A critical need identified concerns how to develop the enabling technologies of ASIAS to include artificial intelligence-based (e.g., machine learning) data analytical methods, tools, and techniques for "in-time" proactive/predictive safety intelligence, which is a crucial feature of the SWS project's research and development for In-time Aviation Safety Management System concepts of operations and requisite services, functions, and capabilities. The meeting took place at Aviation Safety InfoShare event in Kansas City, MO. On Nov. 20, a follow-up virtual meeting was held to provide further information to MITRE to enable coordination. Another in-person meeting is anticipated to finalize the specifics of collaboration including other collaborative partners, such as Delta Airlines. The collaborative opportunity is part of a larger set of identified or to-be-identified ongoing and potential collaborative efforts that will be discussed at the upcoming Dec. engagement meeting between Tenille, the AOSP director, and select MITRE and NASA AOSP subject matter experts and project/technical managers. The meeting is tentatively scheduled at MITRE headquarters on Dec. 13.

ATM-X PAAV and Partners Conduct Initial HAE Flight Tests

POC: CONRAD RORIE, ARWA AWEISS, ANDREW GUION, AND MATTHEW GREGORY

The Air Traffic Management-eXploration (ATM-X) project held a joint flight test with Reliable Robotics and Collins Aerospace in Hollister, CA, on Nov. 21. The

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ATM-X project's Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject supported the effort. The test was executed within the recently developed "Hollister Airspace Ecosystem" (HAE), which is expected to support recurring flight test activities between NASA and a variety of industry partners over the coming years. The November flight activity served as the first coordinated test event where these three groups exchanged live data between their various systems and facilities. Reliable Robotics flew six different test cards (e.g., auto-takeoff, auto-landing, spiral climb maneuver), which were all scripted to occur within the expected range of Collins's Skyler ground-based surveillance system. The Skyler radar was deployed just north of the San Martin Airport and oriented to capture flights between the San Martin and Hollister airports that fall within its field of regard. The Reliable Robotics aircraft successfully flew all six flight cards and data from the Skyler radar was successfully routed to the Reliable Robotics ground control station in Mountain View, CA. The Skyler radar feed was also successfully received by NASA's Ames Research Center in California and displayed within the new Mission Visualization and Research Control Center (MVRCC). The MVRCC also received a live video feed from Reliable Robotics, which allowed PAAV team members and observers from other programs and projects to view the HAE flight test with a consolidated view of multiple data feeds. Data collected from this flight will be analyzed to assess the radar performance and provide input for further improvement. NASA's Aeronautics Research Mission Directorate and Ames Aeronautics Research Directorate leadership, congressional staff from Northern California, and executives from Collins Aerospace and Reliable Robotics also took the opportunity the flight presented to visit Reliable Robotics (both its hangar in San Martin and its headquarters in Mountain View), as well as the NASA Ames MVRCC and Wisk's headquarters. While Wisk did not participate in the initial HAE flight test, it will be engaged with ATM-X soon and begin participating in the HAE in 2025. The flight test and corresponding tours allowed the different groups to share their perspectives and further strategize on a course where these disparate organizations can work together to advance the state of remotely piloted aircraft systems.

ATM-X Team Hosts NASA Deputy Administrator During North Texas Visit

POC: YOON JUNG

The Air Traffic Management-eXploration (ATM-X) project hosted NASA Deputy Administrator Pam Melroy in North Texas on Dec. 3. NASA Ames Associate Center Director Amir Deylami joined Melroy. The purpose of their visit was to view progress across two key research efforts in the ATM-X project. During their visit, they learned about NASA's continuing collaboration to operationalize Uncrewed Aircraft Systems Traffic Management (UTM) through North Texas key site activities with multiple companies such as Wing and Walmart. In addition, the partnership with the FAA was highlighted and the team's efforts toward understanding how to qualify UTM Beyond Visual Line of Sight operations in a routine and scalable fashion. They also visited the North Texas Research Station and learned about the Digital Information Platform subproject team's efforts by engaging with their airline operator partners, FAA executives, and the National Air Traffic Controllers Association to learn about the operational demonstrations that are accelerating the National Airspace System's transformation toward advanced, data-driven, digital services to promote efficient aviation.

ATM-X and DIP Leadership Meet with Leidos

POC: SWATI SAXENA

The Air Traffic Management-eXploration (ATM-X) project and its Digital Information Platform (DIP) subproject leads met with representatives from Leidos in Gaithersburg, MD, on Dec. 3.

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Leidos is a prime contractor for the FAA's cloud-based Enterprise-Information Display System that provides real-time access to weather, aeronautical, and National Airspace System information. The Leidos approach and technologies are highly relevant to DIP. ATM-X project manager Shivanjli Sharma and DIP technical lead Jeremy Coupe attended the meeting in person. A few other key ATM-X advisors attended remotely. The main objective of the meeting was to assess the topics of common interest that can be the basis of a future nonreimbursable space act agreement between the ATM-X project and Leidos. The discussions went well, and the group identified the following four high-level topics of mutual interest:

1. operational demonstrations focusing on oceanic flight trajectory management, as well as airspace irregular operations policy;
2. artificial intelligence and machine learning;
3. technology transfer; and
4. new entrants' operations.

The group plans on having a technical interchange meeting to further discuss and explore potential collaboration opportunities.

ATM-X Team Participates in NASA/FAA Quarterly Review

POC: KEN FREEMAN

The Air Traffic Management-eXploration (ATM-X) project participated in the NASA/FAA Quarterly Review at NASA's Ames Research Center in California on Dec. 3–5. The NASA Aeronautics Research Institute hosted the review and provided a more in-depth review of the project's research activities. Updates on research status and project schedules for the Uncrewed Aircraft Systems Traffic Management Beyond Visual Line of Sight (UTM BVLOS) and National Airspace System Exploratory Concepts and Technologies subprojects were presented at the review. Discussions focused on UTM BVLOS progress as well as Upper Class E Traffic Management progress to date. Additionally, the Extensible Traffic Management's Discovery and Synchronization Service and aviation large language modeling were also discussed.

ACERO Team Discusses Upcoming Flight Evaluations at Face-to-Face Meeting

POC: HILLARY SMITH

Advanced Capabilities for Emergency Response Operations (ACERO) project management and team members gathered at NASA's Langley Research Center in Virginia on Dec. 3–5. The purpose of the meeting was to hold a face-to-face meeting to discuss the project's recent shakedown testing series and lessons learned. Discussions included the first flight evaluations for Technical Capability Level-1 (TCL-1), and the kick-off of the second flight evaluation (TCL-2). Discussions also included the system readiness review for the airspace system tested in the shakedown and plans

ACERO team members gather at NASA Langley.

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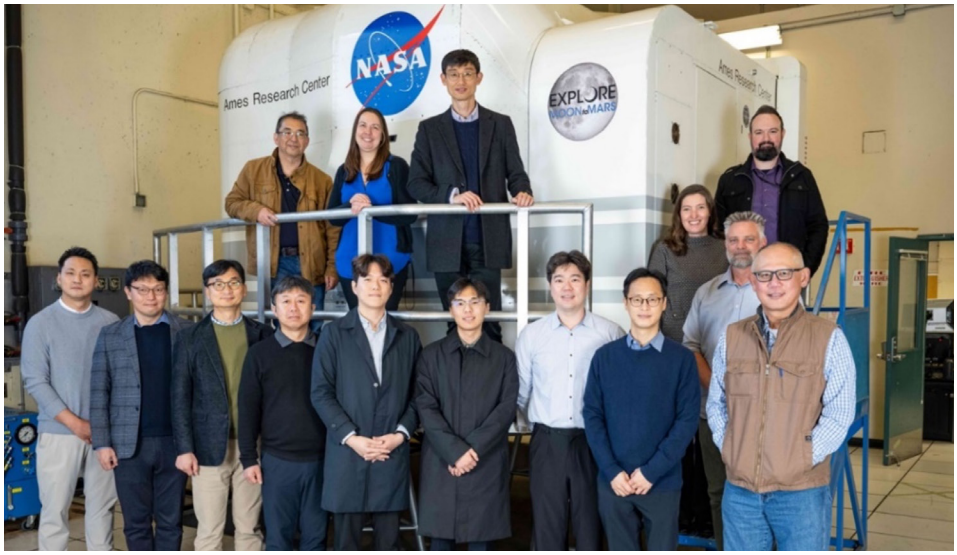
for data collection of the TCL-1 activities, as well as the status of the ACERO-developed Concept of Operations document for wildland fire operations. ACERO's first flight evaluation, which will validate ACERO-developed air traffic management and other advanced technologies, is set to occur in the Salinas Valley, CA, in March 2025.

SWS-FAA Research Transition Team Planning Meeting Held

POC: MICHAEL VINCENT

System-Wide Safety (SWS) project members and the FAA's Office of Accident Investigation and Prevention held an in-person meeting at NASA Headquarters in Washington, DC, on Dec. 4. The purpose of the meeting was to plan the next phase of collaboration between the SWS project and FAA. Attendees discussed the future working group structure of the SWS-FAA research transition team, the topic areas that will be covered, and potential research transition products (RTPs). The working group structure and RTPs will be finalized in the first quarter of 2025. AOSP Director Akbar Sultan, SWS associate project manager Michael Vincent, and SWS Technical Challenge-1 subproject manager Nikunj Oza attended in person with several other project members attending virtually.

Group photo of FAA and SWS research transition team participants.



NASA researchers and KARI visitors at Vertical Motion Simulator facility at NASA Ames.

AMP Project Hosts KARI Workshop for International Collaboration on AAM

POC: HANBONG LEE

The Air Mobility Pathfinders (AMP) project team hosted a workshop with the Korea Aerospace Research Institute (KARI) at NASA's Ames Research Center in California on Dec. 4–5. The workshop focused on international collaboration on Advanced Air Mobility (AAM). At this workshop, the AMP team met with representatives from KARI and academia in South Korea and held technical discussions on various topics related to Urban Air Mobility (UAM) research, simulation, and flight test. The AMP project team provided briefings about the AMP project updates; UAM vehicle flight test plan; Communication, Navigation, and Surveillance (CNS) test; and assistive Detect

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and Avoid capability for UAM flights. Researchers from the Advanced Air Vehicles Program's Revolutionary Vertical Lift Technology project also participated in the discussions about noise measurements and ride quality of UAM aircraft. During the two-day event, the KARI team gave presentations related to its K-UAM Grand Challenge (GC) activities, including GC-1 progresses; cooperative flight simulator; Live, Virtual, Constructive simulation for a future project; GC integrated Communication, Navigation, Surveillance (CNS) system; noise impact assessment; and ride quality evaluation research. In addition, the Korean visitors toured and experienced flight simulators at the ACEL-RATE Lab and Vertical Motion Simulator, including a demonstration of the Automation Enabled Pilot 2.

AOSP and MITRE Leadership Engagement and Collaborative Opportunity Discussion Meeting

POC: LANCE PRINZEL AND MATTHEW GREGORY

AOSP and MITRE leadership met along with System-Wide Safety (SWS) project and subproject managers at MITRE headquarters in McLean, VA, on Dec. 13. The purpose of the meeting was to examine potential collaboration opportunities. Representing AOSP were Program Director Akbar Sultan, Deputy Program Director Cheryl Quinn, Misty Davies, and Kevin Witzberger. During the meeting, MITRE presented proposals on multiple potential collaboration opportunities between AOSP and MITRE and each respective organization's existing partners. The objective was twofold:

1. for MITRE to present to AOSP leadership identifying potential collaborative efforts that have either been actively in-works in proposal development between NASA and MITRE, and ready to begin effort on formally establishing the collaboration, or relatively nascent opportunities MITRE identified would be of interest to AOSP leadership; and
2. provide for an in-person one-to-one leadership meeting between AOSP and MITRE directors.

The morning session consisted of MITRE presenting two collaborative opportunity proposals, co-developed with SWS senior technical advisor Lance Prinzel and SWS subproject managers Nikunj Oza and Chad Stephens, which was defined over the course of two in-person calendar year 2024 technical interchange meetings—held at MITRE headquarters (in February) and NASA's Langley Research Center in Virginia (in June)—and multiple virtual meetings for information exchanges and technical discussion.

SWS/MITRE Proposal One: With concurrence from the SWS project management office, the STA and SPMs have been working with MITRE counterparts on how the In-Time Aviation Safety Management System (IASMS) Concept of Operations (ConOps) and services, functions, and capabilities (SFCs) can help enable the FAA's envisioned Aviation Safety Information Analysis and Sharing (ASIAS) 3.0 ConOps for the future National Airspace System (NAS), as part of ASIAS evolution initiative. The collaborative effort involves participation between key major airline stakeholders, the FAA, MITRE, and the SWS project with the objective to explore how diverse and disparate safety management systems' data sets can be securely fused within a collaborative research environment, a critical enabler of ASIAS evolution, IASMS, and future of safety management and assurance. The phased progression to mature system implementation involves trusted data integration and sharing methods. Therefore, a limited capability federated data fusion collaborative research environment system model approach was selected for a feasibility and utility demonstration to the FAA intended as a use case example that is sufficiently extensible to that envisioned for at-scale future ASIAS SFCs.

SWS/MITRE Proposal Two: The second collaborative proposal, requested from the FAA, focuses

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on use of a novel safety data type SWS and collaborative partners (e.g., Flight Safety Foundation) have substantially contributed to its crescive use in Part 121 safety management systems. Known as "Learning from All Operations" (aka safety-II), this second collaborative effort will focus on how these novel data types—to include how advances in artificial intelligence-based safety data analytical methods may be applied to these data types for enhanced "in-time" safety intelligence—can help inform safety policy and guidance from the regulator perspective.

Both collaborative proposals directly support SWS Technical Challenge-6, IASMS for Commercial Operations, Level 1 milestones and successful accomplishment will have substantive impact on achieving them. The deliverables of these two collaborative efforts also have substantial value as research transition products in support of the newly established SWS/FAA/MITRE Research Transition Team Working Group focused on "in-time" safety analytics, risk synthesis, and operational safety. The AOSP director gave program-level concurrence to these collaborative proposals, which supplemented SWS project manager Kyle Ellis's earlier approval to execute formalizing the collaboration with exigency to initiate technical work efforts, as both have a 6-month FAA imposed deadline for first deliverables.

The afternoon meeting session consisted of three additional MITRE proposed collaborative opportunities titled:

a. "Identifying Emerging Hazards Through AI Methods,"
b. "Drone Data Analysis System" (note: currently collaborating with Becky Hooey from the Aviation Safety Reporting System), and
c. "Future of Safety Oversight" (e.g., strategy, safety management system effectiveness).

These proposals have significant relevance to AOSP projects and were assessed by AOSP director for further action to identify the appropriate AOSP and MITRE teams for further exploration and potential development of these MITRE-presented opportunities.

DIP Team and FAA Partners Visit United Airlines' Arlington Heights NOC

POC: ERIC CHEVALLEY

The Air Traffic Management-eXploration project's Digital Information Platform (DIP) subproject team met with representatives from FAA and the National Air Traffic Controllers Association Article 114 group at the United Airlines Arlington Heights Network Operations Center (NOC) on Dec. 17. Representing the FAA were members from the NextGen Office Houston traffic management office, and supervisor traffic management coordinator. The United Airlines team provided an in-depth introduction of their NOC. The tour provided useful information, which then led to a productive discussion about operational challenges and opportunities to evaluate during the DIP team's Sustainable Flight National Partnership Operation-1b Pre-Departure Rerouting demonstration in Houston. The DIP team and partners discussed the next and final steps to start the operational evaluation with Arlington Heights NOC and FAA personnel. In addition, interests in leveraging DIP to process missing System Wide Information Management data elements and to integrate Trajectory Option Sets between United Airlines and DIP were discussed.

DIP Kicks Off its Sustainable Flight National Partnership Operation-1b in Houston

POC: JEREMY COUPE

The Air Traffic Management-eXploration project's Digital Information Platform (DIP) subproject team kicked off the operational evaluation of the Sustainable Flight National Partnership Operation-1b in Houston on Dec. 18. The kick off

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coincided with a DIP software release providing cloud-based capability the FAA and airlines operators will use daily. The operational evaluation follows over a year of preparation, which consisted of regular discussions among the DIP team, the FAA, and airlines partners; careful analyses; identification of use cases and system requirements; mock-up designs; development and refinements of artificial intelligence and machine learning models; a series of software implementations; 6 months of shadow evaluation of the system; data analyses; ongoing feedback; FAA's Safety Review Management Evaluation; and extensive training of all FAA and airline users on the DIP's decision support tools. The DIP team plans to release subsequent enhancements of the capability based on user feedback and aims to collect data formally during the stormy spring and summer seasons of 2025. The support from partners and NASA management, as well as the expertise of the DIP team members, have been instrumental for this operational evaluation.

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AOSP Projects Participate at Digital Avionics Systems Conference

POC: TERRY MORRIS, RAQUEL REDHOUSE, ARWA AWEISS AND PAUL LEE

Tien Nguyen and Paul Lee at the 43rd annual Digital Avionics Systems Conference.

Representatives from AOSP projects participated at the 43rd Digital Avionics Systems Conference in San Diego, CA, on Sep. 29–Oct. 3. Representing the System-Wide Safety (SWS) project, SWS subproject manager Terry Morris served as general chair of the conference and was involved directly in many of the events as far as planning and actual participation. Additionally, several researchers served as moderators and participants on technical panels, many provided oversight to the Technical Paper Committee, technical track and session chairs, and in presenting papers. The SWS project received two Best of Session Awards, including Truong Nguyen's paper, "HIRF Tolerance and Avoidance for Advanced Air Mobility Vehicles," and Carlos Paradis's paper, "Textual and Network Analysis of Part 107 Waivers." Also, Misty Davies presented a poster at the poster session, Michael Holloway provided a tutorial, Steve Young and Ivan Perez served as track chairs, and SWS project senior technical advisor for assurance Natasha Neogi moderated a Machine Learning and Regulators panel. Neogi also created and coordinated the "Women in Engineering Reception" with Maria Consiglio and Sarah Lehman. Also participating was Cesar Munoz, assisted by Jason Prince and team, who provided the DANTI flyer exhibit. Misty Davies, Lauren White, Michael Holloway, Sarah Lehman, Evan Dill, Paolo Masci, and others assisted in the UAS Drone Competition, which involved nine local San Diego high school teams.

Representatives from the Air Traffic Management-eXploration (ATM-X) project's Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject also attended. Team members included Conrad Rorie, Jordan Sakakeeny, Aastha Acharya, Husni Idris, Vishwanath Bulusu, and Raquel Redhouse. Sakakeeny presented the paper "Initial Assessment of Lost Command and Control Link Procedures." The FAA, industry, and others confirmed throughout the conference that lost link was a crucial hurdle to overcome for the integration of large uncrewed aircraft systems (UAS) into the National Airspace System. FAA NextGen, NASA, Radio Technical Commission for Aeronautics, and industry representatives who attended the presentation reiterated the importance of the team's work and validated PAAV's current

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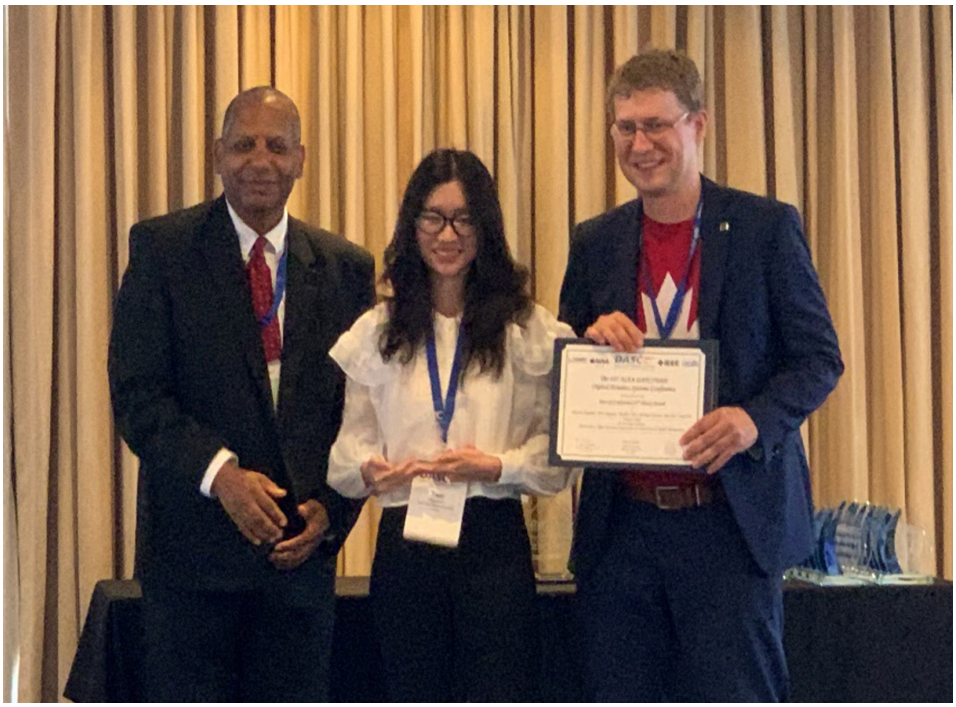

Tien Nguyen at the 43rd annual Digital Avionics Systems Conference award ceremony.

research approach. Additionally, PAAV's suggestions were aligned with feedback from the audience. Sakakeeny also served as session chair for the Separation and Trajectory Management and Surveillance session. Acharya presented the paper "Visual Flight Rules (VFR) Trajectory Forecasting using Deep Generative Model for Autonomous Airspace Operations." The novelty of the method was well received and showed the benefit of introducing advanced artificial intelligence/machine learning methods for airspace operations. Rorie presented the paper "Detect and Avoid and Collision Avoidance Flight Test Results with ACAS Xr," which won a Best of Session Award. Rorie also served as session chair for the Urban Air Mobility Traffic Management session. Idris was a panelist in "Converting Today's Human-Centric Operational Norms into Future Requirements for UAS and other Automated Novel Aircraft: The High-Hanging Fruit." All the presentations were well received and generated interest from the attending avionic systems expert community. In addition to presenting at the conference, PAAV members engaged with a diverse international audience of scholars and industry members, attended numerous research paper presentations and tutorials, and promoted the increasingly autonomous aircraft research ongoing in the PAAV subproject.

Additionally, Tien Nguyen, one of the student interns from the ATM-X project's National Airspace System Exploratory Concepts and Technologies subproject, submitted and presented a paper on multi-party negotiation technique for Upper Class E Traffic Management based on game-theory models, titled "Multi-Party Flight Trajectory Negotiation for Upper Class E Traffic Management." Paul Lee, Min Xue, and San Jose State University Prof. Wenbin Wei are mentoring Tien Nguyen. The team was alerted earlier this year that the paper was awarded the Best of Track Paper Award, making it one of the top 10 papers at the conference, and it was also in the running for the Best of Conference Paper Award, which would be announced at the Award Luncheon on Oct. 16, 2024. Tien Nguyen's paper was awarded second place for the Best of Conference; given there were approximately 250 papers at the conference, this is quite an accomplishment.

System-Wide Safety Manager Participates at IATA World Safety and Operations Conference

POC: KYLE ELLIS

System-Wide Safety project manager Kyle Ellis moderated

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a session titled "Innovation in Action" at this year's International Air Transport Association (IATA) World Safety and Operations Conference in Marrakesh, Morocco, on Oct. 1-3. The IATA requested the session following the positive reception of NASA's presentation of the In-Time Aviation Safety Management System concept at last year's event and explored the innovative landscape and how safety management systems could adapt to meet the needs of an evolving aviation paradigm. The session involved a panel of leading industry experts, including Tzveotmir Blajev, Director of Europe, Global Operational Safety at Flight Safety Foundation; Alan Sternber, CEO of Beams AI; and Jodi Baker, Deputy Associate Administrator for Aviation Safety at the FAA.

ATM-X Representative Provides Keynote Address at AUVSI Summit

POC: KEN FREEMAN

Air Traffic Management-eXploration (ATM-X) project deputy project manager Ken Freeman was the cybersecurity keynote speaker during the session 4 panel for uncrewed aircraft systems and advanced air mobility, titled "Cybersecurity Challenges for Advanced Air Mobility," at the Association for Uncrewed Vehicle Systems International (AUVSI) Summit in Cambridge, MA, on Oct. 29-31. Freeman is also the National Airspace System Exploratory Concepts and Technologies subproject manager. The panel addressed safeguarding networks and systems that are crucial and compromised environments with a focus on building operational resilience. The panel examined strategies for ensuring the safe operation of aviation systems within this adversarial environment. Other support staff on this panel included moderator Noel Zamot, Advisor, Aeronautics Division, Massachusetts Department of Transportation; Kevin Clark, Chief of Aviation Facilities and Business Services Division, U.S. Department of Transportation Volpe Center of Transportation; and William "Buck" Dowdell, Chief Information Security Officer, Massachusetts Department of Transportation.

DIP Team Awarded Prestigious ATCA Industry Award

POC: KEN FREEMAN

The Air Traffic Management-eXploration project's Digital Information Platform (DIP) subproject team received the prestigious Air Traffic Control Association's (ATCA's) Industry Award at the annual ATCA Connect Conference in Washington, DC, on Nov. 6. The award recognized the team's efforts in supporting NASA's Sustainable Flight National Partnership. This recognition highlights their commitment to advancing aviation safety and efficiency, reflecting nearly 70 years of ATCA's tradition of promoting best practices. The DIP team demonstrated how cutting-edge aviation decision support services can improve operational efficiency for conventional and emerging flight operators. A key innovation is the Collaborative Digital Departure Rerouting tool, which transforms traditional on-premises air traffic management systems into a modern, cloud-based, artificial intelligence-driven architecture. Since January 2023, operational testing with air traffic controllers and airline partners in the North Texas region has laid a foundation for expanding into Houston's complex, multicenter airspace.

SWS Participates at Prognostics and Health Management Conference

POC: HANNAH WALSH

System-Wide Safety (SWS) project researchers participated at the Prognostics and Health Management Conference in Nashville, TN, on Nov. 11-14. Representing the SWS project were Chris Teubert, Chetan Kulkarni, Rajeev Ghimire, and Katelyn Griffith from the Diagnostics

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and Prognostics Group, who supported a 90-minute tutorial on the NASA ProgPy software. This tutorial covered the basics of building prognostics models, configuring those models, parameter estimation, and using those models for state estimation and prognostics. Attendance at the session was estimated between 100-150 people and the talk was well received. After the talk, several people approached the team to discuss how they are currently using ProgPy or how to collaborate in the future. Yuning He from the Robust Software Engineering technical area presented a paper, "SYSAI for System Health Management - a Statistical Framework for the Analysis of Diagnosis Systems," which describes how the SYSAI (Statistical Analysis for Systems with AI) components framework can support intelligent analysis and testing of a diagnosis component on the system level by exploring high-dimensional state and parameter spaces and identify failure regions and their boundaries. Beyond the tutorial and papers, Kulkarni is part of the conference organization committee as Technical Program Committee chair, served on a panel, and presented some of his work in a paper session. Kulkarni and Ghimire also visited Prof. Gautam Biswas's lab at Vanderbilt University, learning about various research efforts at the facility.

SWS Team Virtually Presents Paper at University of York

POC: ALWYN GOODLOE AND IVAN PEREZ

System-Wide Safety (SWS) project representatives virtually presented a paper at the University of York on Nov. 27. Alwyn Goodloe and Ivan Perez presented the paper, titled "Runtime Verification with Copilot." The University of York has one of the top computer science departments in the United Kingdom with a long history on interacting with NASA due to their pioneering work focusing on safety-critical systems and safety cases. The RoboStar group is leveraging York's pioneering work in safety and formal methods for software engineering to assure robotic systems. They are interested in using runtime verification to complement formal methods and testing but lack experience in the area. The talk on the Copilot runtime verification framework and the supporting Ogma tool was well received. Ogma is a JavaScript library for interactive graph visualizations that stands for "Linkurious' JavaScript graph visualization library." It offers features for displaying, exploring, and interacting with graph data, connecting to various sources to import and export data, and more. The SWS project has begun discussions with York researchers who have expressed interest in using NASA's Copilot language and runtime verification framework in their own work. They have particularly highlighted the fact Ogma makes it easy to connect Copilot monitors to systems built using the Robot Operating System that is ubiquitous in robotics.

Air Mobility Pathfinders Publication in Rotorhub International

POC: CASEY BAKULA

RotorHub International published Paul Eden's "Connectivity," an interview with Air Mobility Pathfinders project's Communication, Navigation, and Surveillance research lead Casey Bakula, on Dec. 12. The interview focused on communications for helicopters and air taxis. RotorHub International is the only international media portfolio dedicated to the civil and parapublic rotorcraft industry. The link to the article is: https://www.rotorhub.com/mags/UkhJX0RlYzI0L0phbjI1Yw_Dec_Jan_24c/index.html.

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