

# AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

APR-JUN 2023 | Quarter 3



AAM National Campaign and Partner Complete Profile B Flight Test 4

HDV Accomplishments to Support SAO-BVLOS Simulation and Flight Tests 21

## AOSP IN THE NEWS

### [NASA Explores the Future of an Airspace Filled with Flying Taxis](#)

Federal News Network (4/3) reports “Aviation is changing thanks to the emergence of new types of manned and unmanned aircraft. NASA’s Advanced Air Mobility Mission seeks, in its words, to help emerging aviation markets operate safely. The program pulls in many public and private partners. Joining the Federal Drive with a flyover view, NASA research and test pilot Gerrit Everson.”

### [New York Port Authority, NASA Partner To Study AAM Integration](#)

Aviation Week (4/11) reports “the Port Authority of New York and New Jersey (PANYNJ) has entered into a Space Act agreement with NASA to collaborate on the integration of electric vertical-takeoff-and-landing (eVTOL) vehicles and uncrewed aircraft systems (UAS) in the Greater New York City area, part of an effort to prepare for...”

### [Reliable Robotics, NASA Test Detect-and-Avoid with FAA Radars](#)

Aviation Week (4/26) reports “during the test campaign, Reliable Robotics coordinated encounters of two of its aircraft in California while data was being collected by FAA ground-based radar.”

### [FAA’s Updated Blueprint for Air Taxi Services Places New Emphasis on Cooperation with Industry, Other Agencies](#)

Aerospace America (5/5) reports “aircraft developers and analysts are poring over FAA’s updates to its airspace blueprint for urban air mobility, the term for flights in and around cities by electric air taxis and cargo aircraft under the advanced air mobility movement. The 33-page ‘UAM Concept of Operations Version 2.0’ released by FAA May 3 provides more details about the air taxi ‘corridors’ the agency plans to establish — a traffic management concept developed together with NASA and first identified in the original blueprint released in 2020.”

### [U.S. Forms Team to Set Strategy on Flying Air Taxis](#)

Reuters (5/16) reports “the Biden administration said Tuesday it has formed an interagency team to develop a national strategy on advanced air mobility efforts like flying taxis. Electric vertical takeoff and landing aircraft (eVTOL) have been touted as the future of urban air mobility. The low-altitude urban air mobility aircraft has drawn intense interest around the world as numerous eVTOL companies have gone public. The U.S. Transportation Department said the team includes NASA, Transportation Security Administration, Federal Aviation

Administration and Federal Communications Commission.”

### [NASA Uses PC-12 for Advanced Air Mobility Flight Trials](#)

Aviation International News (5/18) reports “NASA is deploying a Pilatus PC-12 for test flights in the Cleveland area as part of its work to pave the way for the autonomous operations envisaged for the advanced air mobility sector. The flights started today and run through June 25, with the agency’s pilots following roadways over Cleveland, Lodi, Mansfield, and Medina in Ohio to test communications technology expected to be used by eVTOLs and other new air vehicles.”

### [Reliable Robotics and NASA Conduct Flight Tests to Advance Aircraft Automation Systems](#)

Aviation Today (5/24) reports “last month, Reliable Robotics and NASA announced that they had completed a series of flight tests to validate the use of existing primary surveillance radar (PSR) data from the FAA for improving safety in the airspace.”

### [UAM Business Models: Flying Taxis, Personal Drones and the 3rd Dimension of Vehicles](#)

AP (5/25) reports “the ‘Urban Air Mobility Business Models: Flying Taxis, Personal Drones and the 3rd Dimension of Vehicles’ report has

## AOSP IN THE NEWS

been added to ResearchAndMarkets.com's offering. This report captures the business models, technological innovation and emerging opportunities in Urban Air Mobility, from drones to flying taxis. ... NASA and the FAA are working with private-sector companies to determine the right regulatory processes and technical standards for a class of air vehicles that will help help full to overcome ground traffic and sets flying vehicle standards."

### [NASA Research Gathers Key Radar Data for Autonomous Air Cargo Delivery](#)

Space Daily (6/8) reports "when autonomous air taxis and cargo delivery vehicles fly above neighborhoods, safe operations will depend on their ability to detect and avoid other aircraft and obstacles. As part of the agency's broad portfolio of work on Advanced Air Mobility, NASA researchers visited

the Mountain View, California headquarters of industry partner Reliable Robotics in late February to observe flight testing."

### [Frontier Airlines and APiJET Announce Agreement to Test APiJET's Real-Time Route Optimization Technology Furthering Frontier's Commitment to Fuel Efficiency and Sustainability](#)

Space Daily (6/13) reports "Frontier Airlines (NASDAQ: ULCC), a leader in sustainable aviation and America's Greenest Airline, and APiJET, the technology leader in real-time flight optimization for fuel and carbon savings, today, announced an agreement to test APiJET's Digital Winglets™ for operations centers. 'We're very excited to partner with APiJET in testing Digital Winglets™' said Barry Biffle, CEO of Frontier Airlines. ... Digital Winglets utilizes TASAR

(Traffic Aware Strategic Aircrew Requests), a technology initially developed by NASA and refined and productized by APiJET, that analyses hundreds of variables and potential flight paths in real-time to provide route optimizations that result in significant fuel and carbon savings."



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

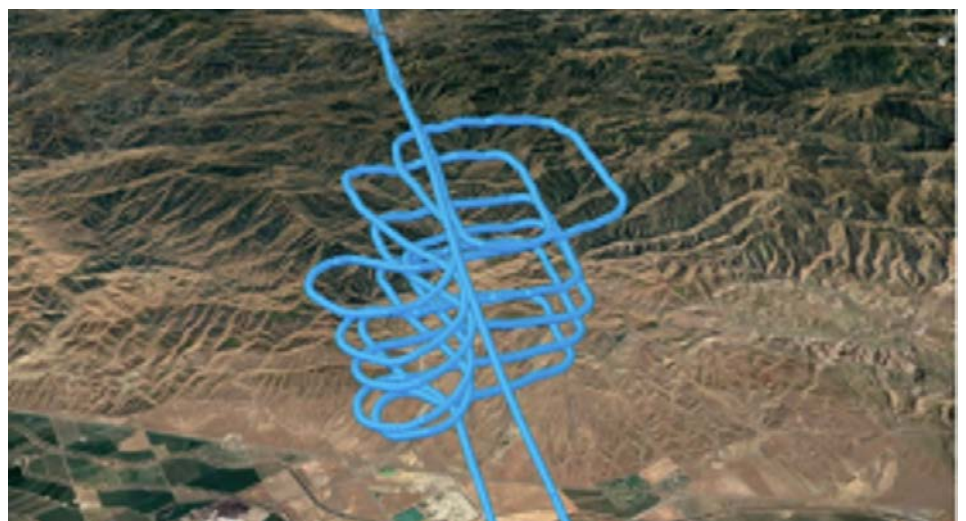


*Reliable Robotics' Cessna 208 test aircraft.*

### **AAM National Campaign and Partner Complete Profile B Flight Test**

POC: [MIKE MARSTON](#)

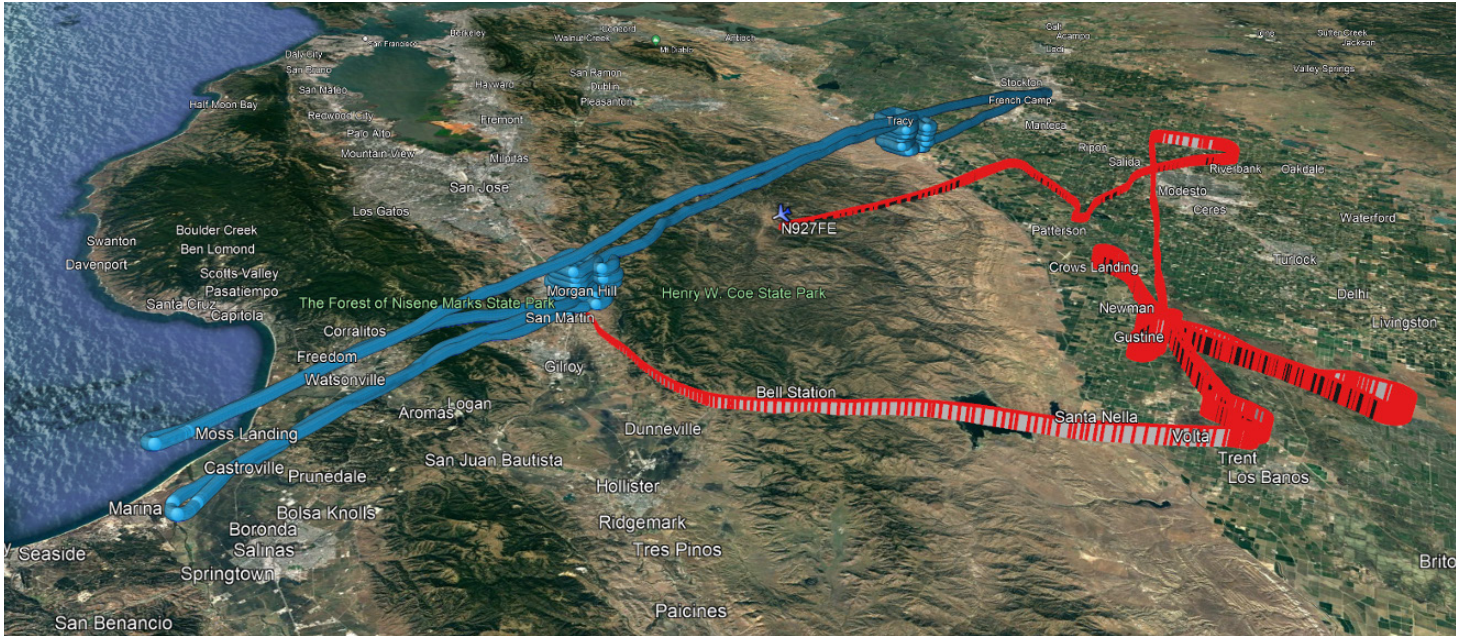
On April 21, test team members from Reliable Robotics, in partnership with the Advanced Air Mobility (AAM) project's National Campaign subproject, conducted the "Profile B" live flight test. The flight test was a culmination event of the two-part test series that began with Reliable Robotics conducting Profile A in March 2023 using their Cessna 172 test aircraft. Profile B



*Profile A required the Cessna 172 (shown in blue) to fly a series of maneuvers between Monterey and Stockton, California.*



# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



*Profile B required both the Cessna 172 (shown in blue) and Cessna 208 (shown in red) to fly intercept-type encounters in the general vicinity of Gustine Municipal Airport in California.*

included intercept-type encounters using both the 172 and Reliable's Cessna 208 test aircraft. The FAA requires all pilots to see and avoid other aircraft while flying in the National Airspace System. For unpiloted aircraft to meet this requirement, an equivalent level of safety to a pilot onboard the aircraft is required. One proposal to meeting this requirement is via a detect and avoid system. Both NASA and Reliable Robotics think the potential use of current FAA surveillance radars can be part of that solution. The purpose of this testing was to collect aircraft radar detection data sourced from multiple FAA-operated surveillance radar systems in central California. Additionally, aircraft flight data from both aircraft and onboard surveillance radar data installed

on the Cessna 208 was collected and will contribute to data analysis performed by the NASA team. Weather data was also collected for analysis. Pilot ability to visually see and identify the opposing aircraft was also evaluated. The research will provide three main benefits: 1) potentially developing or contributing to data that could justify a detect and avoid safety case based on integration of near real-time primary surveillance radar data; 2) development of a radar probability of detection prediction model that industry could use to substantiate the use of real-time surveillance radar data to support a detect and avoid safety case with the FAA; and 3) provide comparative analysis opportunities to determine if a proposed detect-and-avoid

system is as good as, or better than, the best possible human performance for see and avoid.

## **SWS Hosts Workshop on Topological Data Analysis for Assurance for Safety-Critical Systems**

POC: [ALWYN GOODLOE](#)

On April 3, the System-Wide Safety (SWS) project hosted the second workshop on Topological Data Analysis Applied to Assurance of Safety-Critical Systems at NASA's Langley Research Center in Virginia. SWS project researcher Alwyn Goodloe organized the event, which was held in a hybrid style, and was joined by Terry Morris, Natasha Neogi, and other SWS researchers. Additional speakers included representatives from Geometric

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Data Analytics, the University of Virginia, Department of Defense, National Science Foundation, and other industry representatives. Leading off the workshop, Goodloe gave a short talk on introductions and motivation. He was followed by Danette Allen, lead for autonomy at NASA Headquarters in Washington, DC, who provided an overview of current autonomy research at NASA. Topologists from Geometric Data Analytics presented significant advances in applying the mathematical techniques in algebraic and differential topology, as well as algebraic and differential geometry to obtain actionable specifications from large high-dimensional datasets used in training machine learning systems. Tom Fletcher of the University of Virginia gave a talk on how he is applying these approaches in his research, prompting additional discussions. As a result of Goodloe's efforts, several government and industry attendees have reached out to him with respect to moving the work beyond the realm of basic research.

### HDV Achieves Breakthrough to Enable Comprehensive Voice Communications

POC: [LOU GLAAB](#)

On April 10, the Advanced Air Mobility project's High Density Vertiplex (HDV) subproject team completed a primary hurdle in-

volving voice communications for the flight operations team. There was a breakthrough regarding the Clear-Com voice communications equipment Plan-D to enable comprehensive voice communications. In transitioning from current operational capability and moving toward beyond visual line of sight operations (BVLOS), a series of intermediate steps are planned. At the end of the Advanced Onboard Automation schedule work package in fiscal year 2022, the HDV team achieved extended visual line of sight (EVLOS) capabilities with the ground control station operator located within the Remote Operations for Autonomous Missions (ROAM) Unmanned Aircraft Systems operations center. Safety pilots, range safety officers, and visual observers were still on the flight line. For the Scalable Autonomous Operations (SAO) schedule work package flight test that will begin in May, the range safety officer will be relocated to ROAM to establish EVLOS+ operations. Most of the SAO Prototype Assessment Operations flight testing will be performed in EVLOS+. Once the ground control station operators are trained to become pilots in command through usage of the SAO-BVLOS simulation, flight operations will transition to EVLOS++ with the removal of the safety pilot. This will leave only the visual observer on the flight line. Once the surveillance systems have been

evaluated and provided adequate situational awareness, the visual observers will be removed to establish BVLOS flight operations planned for the end of fiscal year 2023. Achieving adequate voice communications is essential for the progression of modes of flight operation. The HDV team was confronted with a challenge regarding voice communications when a key piece of equipment (Clear-Com Eclipse Matrix) was recently rendered unusable due to IT security issues. Several fallback plans and options were considered. Last week the HDV team identified that key functionality was present within an alternative Clear-Com Delta Matrix currently within use by the Research Services Directorate for piloted simulator voice communications. This discovery will enable communications to be established between ROAM and the flight line and enable multiple subchannels of communication.

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

POC: [WILLIAM CHAN](#)

On April 10–12, the Air Traffic Management – eXploration (ATM-X) project hosted a hybrid quarterly review with the FAA. The review was hosted by the NASA Aeronautics Research Institute at NASA's Ames Research Center in California. The first day started with a review of the Urban Air Mobility subproject, including discussions on a recent



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

simulation study, assistive see and avoid and secure airspace, and a tabletop on operational integration assessment. The second day focused on the Extensible Traffic Management (xTM) subproject's Upper Class E Traffic Management subproject, xTM-Air Traffic Services interactions, and the Pathfinding for Airspace with Autonomous Vehicles subproject. The last day began with an FAA briefing titled "National Airspace System (NAS) Landscapes" highlighting roadmaps of their focused research activities. This was followed by discussions on NASA's Sky for All Vision for 2045 and its near-term alignment with the FAA's Info-Centric NAS Vision for 2035. The day concluded with discussions focused on the Digital Information Platform subproject. Concluding the meeting, Diana Liang from the FAA provided a briefing on their Info-Centric NAS Vision for 2035. The next quarterly review is tentatively planned for July 2023.

### HDV Hosts Wisk Aero at NASA Langley

POC: [LOU GLAAB](#)

On April 13–14, the Advanced Air Mobility project's High Density Vertiplex (HDV) subproject hosted personnel from Wisk Aero for a technical interchange meeting at NASA's Langley Research Center in Virginia. HDV is performing research and testing ways to develop a vertiport automation system as



*Wisk Aero team visiting NASA Langley.*

well as performing system integration, prototyping, and assessments for an Urban Air Mobility (UAM) ecosystem. The meeting had the following objectives: 1) review Wisk's latest concept of operations, which features a UAM concept aircraft; 2) present latest results from HDV's Scalable Autonomous Operations Prototype Assessment Operations (SAO-PAO) simulation; 3) review the joint NASA/Wisk report; and 4) discuss and define future NASA/Wisk collaborative testing opportunities. Part of the meeting included several hours in the Remote Operations for Autonomous Missions Operations Center developed and used for HDV testing. For this visit, the Operations Center was configured to show video recordings from the SAO-PAO simulation that

was completed in March. Further collaborations are planned.

### NASA Langley HDV Researchers Visit NASA Ames

POC: [LOU GLAAB](#)

During the week of April 17, the Advanced Air Mobility project's High Density Vertiplex (HDV) subproject researchers Steve Alperin, Lou Glaab, and Robert McSwain travelled to NASA's Ames Research Center in California. The two objectives of the trip were to perform a site visit with Wisk Aero in Mountain View, California and to evaluate a Lightweight Surveillance and Track Acquisition Radar (LSTAR) enabling beyond visual line of sight flight operations for potential transfer to NASA's Langley Research Center in

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



HDV researchers Robert McSwain, Quang Dao, and Lou Glaab at Wisk Aero.



LSTAR-2 outside Hangar N248 at NASA Ames.

Virginia. The visit with Wisk Aero followed a meeting held on April 13–14 at NASA Langley to continue to discuss Wisk Aero's concept of operations and collaborate with

testing planned for the HDV sub-project. Wisk's concept of operations is directly related to Urban Air Mobility Maturity Level-4 – Urban Air Mobility ecosystem prototype

testing performed by HDV. A joint NASA/Wisk conference report is in development. Results from the recently completed Scalable Autonomous Operations Prototype Assessment Operations Human Hardware in the Loop simulation were presented along with plans for subsequent flight testing and plans for fiscal year 2024. For LSTAR radar testing, the initial LSTAR (LSTAR-1) transferred to Langley from Ames in 2021 has exhibited less-than-adequate performance as evaluated through a series of calibration flight tests. It will be removed from the radome and repaired at SRC. To fill the radar coverage gap created during the multi-month repair process, a second LSTAR will be temporarily loaned to Langley. The Ames/Langley HDV team performed checkout of LSTAR-2 on the ramp of Ames's Hangar N248 with good results for targets of opportunity. A meeting to discuss Ames/Langley small Unmanned Aircraft Systems operations collaboration was also performed.

### ACERO Participates in COSTA Live Flight Shakedown and NASA/FAA Executive Day

POC: [MARCUS JOHNSON](#)

On April 14, a NASA team including members from the Advanced Capabilities for Emergency Response Operations (ACERO) project visited Hollister Municipal Airport in California



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

to participate in the Crosscutting Operations Strategy and Technical Assessment (COSTA) live flight shakedown and NASA/FAA Executive Day. COSTA is an FAA-led activity that examines how information across service environments may support general aviation and common situational awareness (e.g. information exchange between Extensible Traffic Management systems and Air Traffic Services). One of COSTA's use cases focuses on the operational encounter between civil aircraft operations and incident response operations in the vicinity of wildfire suppression operations. ACERO project members guided the development of the simulated aerial firefighting operations – adding fidelity to the simulated flights. NASA participants included NASA's COSTA work management team,

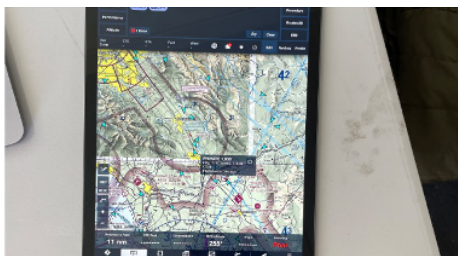
Steven Weidner and Christine Clark; Kee Palopo and Kevin Keenan from the Aviation Systems Software Facility at NASA's Ames Research Center in California; Joseph Rios and Steven Beard from the Aviation Systems Division; and Aaron Burns and Jaewoo Jung from the ACERO project. The outcome of the COSTA work is expected to inform the ACERO project as the project collaborates with the FAA and other government agencies, the scientific community, and commercial industries to develop a concept of operations for future wildland fire management. The NASA and FAA COSTA team will continue preparations for the live flight data collection scheduled in May – addressing the issues that may arise during the shakedown flights. COSTA is supported by the Aviation Systems Software Facility

for the development of a public safety network, which is based on the Unmanned Aircraft Systems Traffic Management system. This public safety network is used to simulate aerial firefighting operations and enables information related to wildfire suppression operations to be exchanged.

### NASA Participation in SAE S-18 Committee Meeting

POC: [MALLORY GRAYDON](#)

On April 17–21, System-Wide Safety project researcher Mallory Graydon participated in the 2023 Quarter 2 plenary meeting of SAE's S-18, S-18A, and S-18H committees in Köln, Germany. Attending standards meetings allows NASA to provide guidance to the aviation community through our research efforts that influence the development of fair, safe, and realizable standards to design, develop, assess, and operate safe aviation systems. S-18 meetings revolve around “upgrading” two of the most important standards that the aviation community utilizes for both design and operations. Participation and contributions are important to NASA and the broader aviation community. S-18 has completed revisions to two well-known aviation safety standards: ARP4754A “Guidelines for Development of Civil Aircraft and Systems” and ARP4761 “Guidelines and Methods for Conducting the



*Top Left: NASA ACERO and COSTA team and the FAA lead, Collin Roche. Top Right: COSTA prototype display used in the shakedown. Bottom Left: COSTA partner aircraft – Xwing optionally piloted Cessna Caravan. Bottom Right: COSTA partner aircraft, SeaHunter UAS.*

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Safety Assessment Process on Civil Airborne Systems and Equipment.” Revised versions of these standards, ARP4754B and ARP4761A, are likely to be released later this year. S-18, S-18A, and S-18H are also writing reports on: 1) the subject of “generic errors,” including the meaning of the no single failure requirement for critical functions and whether this can be addressed by development assurance or diversity; 2) the use of the Systems Theoretic Process Analysis in a civil aviation context; 3) the applicability of ARP4754B and ARP4761A processes to unmanned aerial systems; 4) the interaction between human-factors-related assurance activities and the safety assessment process; and 5) the use of tools and modeling in aircraft development.

### ACERO and SWS Teams Attend TFRSAC Meeting at NASA Ames

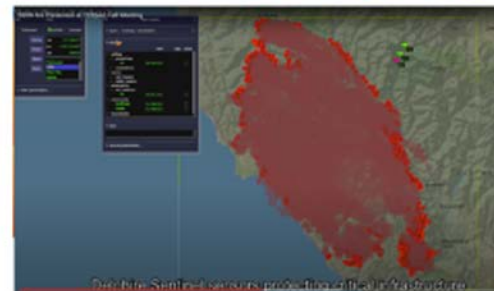
POC: [MARCUS JOHNSON](#) AND [SUMMER BRANDT](#)

On April 19–20, researchers from the Advanced Capabilities for Emergency Response Operations (ACERO) and System-Wide Safety (SWS) projects attended the Tactical Fire Remote Sensing Advisory Committee (TFRSAC) meeting hosted at NASA’s Ames Research Center in California. TFRSAC is a longstanding community of practice focusing on remote sensing support to wildland



SWS researcher Peter Melitz presented on *Open Data Integration Framework for Wildland Fire Management and the recent integration of micro-grid wind*.

fire operations and includes many NASA colleagues. It is a forum for remote sensing experts and wildfire support personnel to share ideas and build awareness of ongoing activities and needs in the wildfire and research and development communities. The meeting offered the ACERO team insight into work and research conducted in the remote sensing field by government agencies such as the United States Geological Survey, the National Oceanic and Atmospheric Administration, the United States Department of Agriculture/Forest Service, state agencies such as the California Department of Forestry and Fire Protection, academia, private sector companies, and other NASA mission directorates. The



event also highlighted emerging technologies and potential capabilities that could be useful to ACERO’s efforts. In addition, SWS researcher Peter Melitz presented on the Open Data Integration Framework for Wildland Fire Management (ODIN-Fire) and the recent integration of micro-grid wind. The goal of this presentation was to inform the remote sensing community of open data integration capabilities. This effort was in collaboration with Missoula Fire Sciences Laboratory and Delphire. The vision for ODIN-Fire is to create a free and extensible ecosystem for fire agencies, research organizations, and local communities to enable sharing of data, visualizations, and algorithms.



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

There was great engagement from the audience. For more information, visit: <https://nasarace.github.io/race-odin>.

### UAM Conducts Integration Demo for ARMD Leadership

POC: [KEVIN WITZBERGER](#)

On April 25, the Air Traffic Management – eXploration project’s Urban Air Mobility (UAM) subproject performed a demonstration at FutureFlight Central for leaders of NASA’s Aeronautics Research Mission Directorate (ARMD) from NASA Headquarters in Washington, DC. The demonstration showed airspace system technologies to enable future UAM electric vertical takeoff and landing operations. The demonstration highlighted how NASA technology can be used at Dallas Fort Worth International Airport to enable UAM operations while minimizing any additional



*Bob Pearce, NASA’s associate administrator for ARMD, and senior staff observe a demonstration by UAM team members at the FutureFlight Central facility at NASA Ames.*

workload to the FAA controllers. FutureFlight Central, which is located at NASA’s Ames Research Center in California, will be used later this year for a simulation with Joby Aviation to evaluate near- and far-term UAM airspace procedures.

### AOSP Participates at ATCA Technical Symposium

POC: [PAUL KROIS](#) AND [BARRY SULLIVAN](#)

On April 25-27, representatives from AOSP and its respective projects participated in the 2023 Air Traffic Control Association (ATCA) Technical Symposium in Atlantic City. The week’s events began with Aviation STEM Day at the William J. Hughes FAA Technical Center (FAATC). Students from the south New Jersey area toured FAATC throughout the day and were able to visit numerous booths highlighting FAA programs along with two booths representing NASA. AOSP hosted

a booth highlighting the program’s research portfolio and two Urban Air Mobility (UAM) Flyers from NASA’s Langley Research Center in Virginia. The UAM Flyers were crewed by Dave West, Saiedeh Samani, Terence McClain, and Neil O’Connor from NASA Langley and were clearly the hit of the show for Aviation STEM Day. Alina Eskiridge and Barry Sullivan crewed the AOSP booth. Joining them was Paolo Masci, also from Langley, who highlighted the Air Traffic Management – eXploration project’s Detect and Avoid in the Cockpit tool – a prototype electronic flight bag incorporating an assistance detective and avoid capability. The following day, Tech Center Tuesday, took place at FAATC. Opening remarks were provided by FAATC director Shelley Yak, Barry Sullivan of NASA, and Brian Bruckbauer of ATCA. The purpose of Tech Center Tuesday was to enable symposium



*The panel discussed the technical safety issues and challenges to enable safe operations in the future and was moderated by Deborah Kirkman of the Flight Safety Foundation.*

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

attendees an opportunity to see the various technologies and capabilities being developed by the FAA, NASA, and their industry partners in addition to participating on various tours of the FAATC. The following days, the symposium moved over to the Resorts Hotel in Atlantic City and included numerous plenary sessions and speakers. The theme of this year's symposium was "Enabling Technologies and Capabilities for the Future National Airspace System." Representing NASA, Kurt Swieringa participated on the Info-Centric National Airspace System panel, Paul Hoyt Nelson participated on the Cybersecurity panel, Paul Krois participated on the Integrated Safety Management panel, and Rich Wahls participated on the Aviation Sustainability panel.

### DIP Conducts Kickoff Meeting with Airline Partners at NTX

POC: [GILBERT WU](#)

On May 2–3, the Air Traffic Management – eXploration project's Digital Information Platform (DIP) subproject team held a kickoff meeting with major airline partners at NASA's North Texas Research Facility (NTX) in Fort Worth. The meeting included five partners who recently signed non-reimbursable Space Act Agreements with NASA; these included American Airlines, Delta Air Lines, JetBlue Airways,

Southwest Airlines, and United Airlines. This event facilitated in-person interactions between the airline partners and the mission integration manager of NASA's Sustainable Flight National Partnership (SFNP), Rich Wahls. Wahls and his team shared the vision for SFNP and discussed opportunities for broader industry partnership for sustainable aviation. A demonstration of SFNP-Ops-1A field evaluation of DIP's Collaborative Digital Departure Rerouting capability was also provided. The meeting included a visit to the Dallas-Fort Worth Air Route Traffic Control Center and American Airlines' Integrated Operations Center. The DIP team and major airline partners discussed alternative technical approaches for future SFNP-Ops demonstrations and announced DIP's SFNP-Ops-1 site: the Houston area's Air Route Traffic Control Center and I90. For more information, visit: <https://www.nasa.gov/image-feature/ames/nasa-partners-with-airlines-to-save-fuel-reduce-flight-delays>.

### SWS and ATM-X Participate at AUVSI Xponential 2023

POC: [MICHAEL VINCENT](#), [SHIVANJLI SHARMA](#) AND [HUSNI IDRIS](#)

On May 8–11, both the System-Wide Safety (SWS) and Air Traffic Management – eXploration (ATM-X) projects participated at the Association for Unmanned

Vehicle Systems International (AUVSI) Xponential Conference in Denver. Michael Vincent, associate project manager for SWS, and researcher Paul Krois represented the SWS team and supported the Advanced Air Mobility safety table at the NASA pavilion. Visitors attending the conference were able to experience the In-Time Aviation Safety Management virtual reality software and view the SWS Safety Demonstrator Series wildland firefighting video. Several contacts were made during the event which have potential for future collaboration or tech talks including MITRE, Draper Labs, and several other drone service providers and operators. Vincent and Krois also participated in a meeting of the Flight Safety Foundation Autonomous and Remotely Piloted Aviation System Advisory Committee, which reviewed the results of a recent airspace characterization study conducted by the Lincoln Laboratory at the Massachusetts Institute of Technology.

Representing the ATM-X project, Shivanjli Sharma participated on a panel discussion titled "Lessons Learned in Paving the Roadway to Autonomy." The panel comprised several subject matter experts who shared their valuable insights and personal experiences with different airspace and communication, navigation, and surveillance



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



Visitors were able to experience the SWS In-Time Aviation Safety Management virtual reality software and view the SWS Safety Demonstrator Series wildland firefighting video.

infrastructure projects. These projects have played a crucial role in establishing the foundation for advancing autonomous technologies. Kurt Swieringa, deputy project manager of ATM-X for technology, also took part in various panel discussions. These panels focused on topics such as Regional Air Mobility and the universal approach to future airspace integration. Prominent industry experts participated in these discussions and highlighted the transformative benefits that future aviation efforts, facilitated by Regional Air Mobility, will bring to the transportation of goods and people. The panelists emphasized the importance of ongoing planning, research, and development endeavors in enabling safe and equitable utilization of the national airspace by delivery drones, regional shuttles, and remotely piloted cargo aircraft. In addition, ATM-X project's Pathfinding for Airspace

with Autonomous Vehicles (PAAV) subproject researchers participated in a m:N workshop. The government/industry m:N working group has made significant progress on m:N operational approval. This working group has developed multiple use-cases that will inform analysis going forward. The efforts and plans for the future of m:N were discussed during this workshop. Husni Idris of PAAV participated with other NASA colleagues in an m:N panel and spoke about some of NASA's PAAV research in this domain.

### SWS Gives Invited Presentation at ICAO SMP Meeting

POC: [KYLE ELLIS](#)

On May 8–12, the International Civil Aviation Organization's (ICAO) Sixth Safety Management Panel (SMP)

meeting took place in Montreal. Kyle Ellis, System-Wide Safety (SWS) deputy project manager and technical advisor to the ICAO SMP, gave an invited presentation on the In-time Aviation Safety Management System (IASMS). The aim of the presentation was to share the advanced safety concepts included in the IASMS concept of operations necessary to assure safety in a transformed aviation industry. The main objective of this meeting was to review draft content for the fifth edition of the Safety Management Manual and new Safety Intelligence Manual in support of Amendment 2 to Annex 19 - Safety Management, as well as coordination with other ICAO expert groups. The SMP work program was also reviewed, with new consideration for inclusion of an IASMS job card to be reviewed by the ICAO Air Navigation Commission.



Kyle Ellis, SWS deputy project manager and technical advisor to the ICAO SMP, gave an invited presentation on IASMS to the ICAO Sixth SMP in Montreal.

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## ATM-X Hosts NATCA at NASA Ames

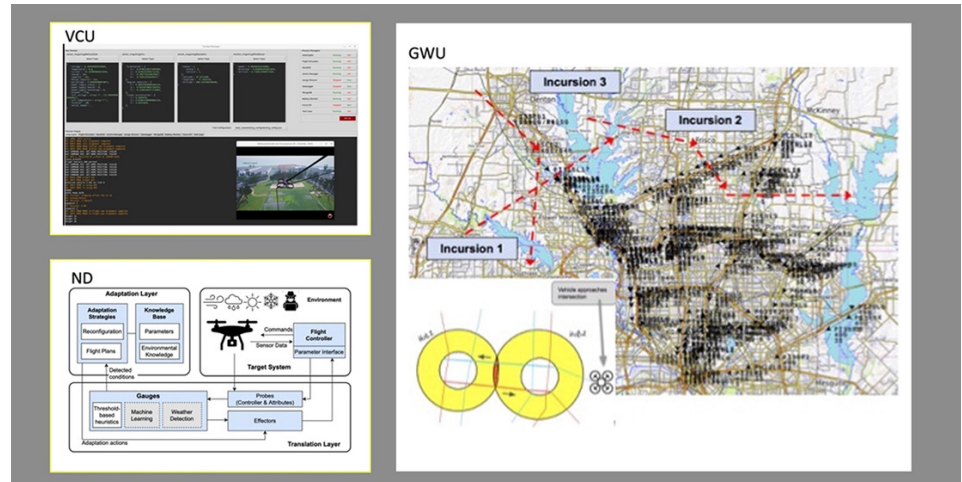
POC: [SHIVANJLI SHARMA](#)

On May 15–16, the Air Traffic Management – eXploration (ATM-X) project hosted the National Air Traffic Controllers Association (NATCA) at NASA’s Ames Research Center in California. There were briefings on projects within ATM-X subprojects and demonstrations given in various labs. Included in the demonstrations were: Urban Air Mobility subproject Airspace Management; Sustainable Flight; and Unmanned Aircraft Systems Traffic Management. In addition, a tour of the Vertical Motion Simulator was conducted. ATM-X and NATCA plan to have follow-on activities from this visit to include an FAA NATCA meeting in North Texas focused on the rollout of 1B for the Digital Information Platform subproject, briefings for specific NATCA representatives for the Sky for All Vision, Upper Class E Traffic Management efforts, and assessment of the best manner for NASA to continue regular engagement with NATCA.

## Joint Design Reviews Completed for SWS Partners

POC: [STEVE YOUNG](#), [LILLY SPIRKOVSKA](#) AND [EVAN DILL](#)

On May 23, three teams of external partners supporting the System-Wide Safety (SWS) project presented systems they have



*Representative design concepts provided by SWS partners in support of In-time Aviation Safety Management System—design concepts for future operations.*

designed to support testing, as well as some preliminary results. The projects and their teams are: 1) “In-time Learning-based Aviation Safety Management System (ILASMS)” by George Washington University/Massachusetts Institute of Technology/Lincoln Laboratory, Vanderbilt University, and the University of Texas at Austin; 2) “Safe Deployment of Small Unmanned Aerial Systems (sUAS) On-Board Monitoring and Assessment” by University of Notre Dame and Iowa State University; and 3) “Pervasive Runtime Monitoring for Detection and Assessment of Emerging Hazards for Advanced Urban Air Mobility (UAM) Systems” by Virginia Commonwealth University and the National Institute of Standards and Technology.

The joint design review enabled coordination and collaboration

across the three complementary activities and with NASA’s internal research, which in turn provides more comprehensive coverage of a broad concept for future safety management systems.

## SWS Continues Support for JIMDAT Meetings

POC: [LANCE PRINZEL](#) AND [KYLE ELLIS](#)

The System-Wide Safety (SWS) project continued to support the Joint Implementation Measurement Data Analysis Team (JIMDAT) this past quarter. The first meeting was held at the Air Line Pilots Association (ALPA) Headquarters in Virginia on April 4–6. Kyle Ellis and Lance Prinzel represented SWS. JIMDAT monitors the implementation and effectiveness of Commercial Aviation Safety Team (CAST) safety enhancements and recommends modifications and changes to the CAST Safety



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Portfolio. JIMDAT, in conjunction with Aviation Safety Information Analysis and Sharing, also identifies emerging risks and additional areas of study. Although the proceedings of the JIMDAT meetings are sensitive and restricted, the SWS project did provide several critical briefings to secure new research safety enhancements. Prinzel developed extensive briefing materials that were presented by the ALPA Committee Chairperson on potential design safety enhancements focused on new flight deck technologies. Ellis also presented a proposal to develop an In-time Aviation Safety Management System research safety enhancement. Both proposals were well received and will be promoted for consideration by CAST. Additionally, a Sky for All overview briefing was also provided by Jeanne Yu, Sky for All's chief strategist, and Shawn Engelland, NASA's technical lead for Sky for All. Ellis presented an overview of small Unmanned Aircraft Systems research and development in the Hampton Roads, Virginia area. NASA continues to work on multiple safety enhancements and other actions in support of JIMDAT and CAST, leveraging SWS's internationally renowned experts in aviation safety.

A second meeting was held at the National Air Carrier Association (NACA) Headquarters in Virginia on May 30–31. Lance Prinzel represented the SWS team again. At

this meeting, NASA was requested to contribute to a JIMDAT go-around working group (pending) and received an invitation to attend an FAA go-around workshop to address etiologies and potential mitigations later this year. This invitation represents an opportunity to inform on this critical safety issue to include predictive safety intelligence. For more information, visit: <https://www.cast-safety.org>.

### xTM Hosts BVLOS Workshop

POC: [JEFF HOMOLA](#) AND [MIN XUE](#)

On June 1, the Air Traffic Management – eXploration project's Extensible Traffic Management (xTM) subproject, in collaboration with the FAA, hosted an Unmanned Aircraft Systems (UAS) Traffic Management (UTM) Beyond Visual Line of Sight (BVLOS) workshop at NASA's Ames Research Center in California. The purpose of the workshop was to solicit industry feedback on several topics related to enabling routine BVLOS operations for small UAS (sUAS). This hybrid meeting consisted of approximately 50 participants. The FAA provided a recap of their UTM Field Test and a representative from law enforcement discussed their use of sUAS for public safety. Following these presentations were breakout groups to solicit industry feedback on standards progression, test harness for service assessment, navigation requirements for BVLOS, and

operationalization of a service for BVLOS. The second day included follow-up discussions with the FAA to discuss future UTM work based on prior day's feedback and discussions about the alignment of that work with the UTM research transition team deliverables.

### DIP Completes Phase I of University Challenge #2

POC: [AMELIA SCOTT](#)

On June 1, the Air Traffic Management – eXploration project's Digital Information Platform (DIP) subproject team completed the Phase I University Challenge #2, "Pushback to the Future: Predict Pushback Time at US Airports." Predicting pushback times is valuable but difficult to compute using only publicly available data. To better predict pushback, airline proprietary data must be used. However, there are data privacy concerns that must be addressed before being able to use such data. Federated learning is a machine learning technique which allows models to be trained on private data without compromising the privacy of that data. For Phase I, the student teams trained a "traditional" (non-federated) model on public data to predict pushback times. This will be used as a baseline and starting point for Phase II, where the teams will federate their models, and compare the performance and accuracy of

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

the federated vs. non-federated models using private airline data. This first phase engaged a total of 458 participants from across the United States. The five winning teams, from New York University, the California Institute of Technology, Weill Cornell Medicine, University of Washington Tacoma, and Syracuse University will start on Phase II in early June 2023.

### SWS Produces Human Factors Training Video for American Airlines

POC: [CHAD STEPHENS](#)

American Airlines' director of training reached out to the System-Wide Safety (SWS) project to help address an identified issue that American Airlines pilots were experiencing. As part of the NASA and American Airlines collaboration, the teams worked together to produce a nine-minute human factors video that is being shown to more than 14,000 pilots during recurrent training – required training which started on June 1. Kyle Ellis, Chad Stephens, and Kaitlyn Fox of SWS coordinated with Dan Kiggins, a NASA subject matter expert and American Airlines pilot, to develop a script and shoot the footage remotely and also in the studio at NASA's Langley Research Center in Virginia. This project was a collaborative effort involving the NASA Langley Media Solutions Branch and Public Affairs,



*NASA and American Airlines teams worked together to produce a nine-minute human factors video that will be shown to more than 14,000 pilots during recurrent training.*

as well as NASA Headquarters in Washington, DC. Content presented in the video demonstrates the feasibility of the concept of the In-time Aviation Safety Management System. Feedback from American Airlines regarding the production has been positive. After the video was shown to pilot management, the American Airlines director of training gave feedback that the NASA video is “the most popular part of the training class.”

The video is titled “The Future of Aviation Safety.”

### SWS Hosts the University of Lorraine at NASA Ames

POC: [CHETAN KULKARNI](#)

On June 7–8, researchers from the System-Wide Safety (SWS) project's Diagnostics and Prognostics Group at NASA's Ames Research Center in California hosted professors Mayank Jha and Hugues Garnier from the



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



Professors Hugues Garnier (left) and Mayank Jha (right) from the University of Lorraine present to NASA Ames's Intelligent Systems Division.

University of Lorraine in France. The professors presented a talk titled “Safe Reinforcement Learning and System Identification Enabled Deep Learning for Prognostics” to the Intelligent Systems Division. The work demonstrates a safe reinforcement learning approach for learning control laws for nonlinear dynamical systems that guarantee stability and optimal performance and, most importantly, safety of the system under continuous time model development. A demonstration of the Continuous-Time System Identification toolbox for MATLAB and its use for data augmentation was also presented. The professors conducted discussions with SWS team members and toured the Systems Health Analytics Resilience and Prognostics lab to explore future collaborations. There is interest in integrating prognostics frameworks developed by SWS researchers with control optimization work being done by the University of Lorraine, closing the loop on the monitoring, prediction, and mitigation facets

of the SWS emerging operations technical challenge. Currently the application is targeted toward autonomous electric drones which complements work being conducted under the SWS project.

### AFCM Begins Flight Testing

POC: [TRISH GLAAB](#)

On June 5–9, the Advanced Air Mobility project's Automated Flight and Contingency Management (AFCM) team's tactical and strategic automation technologies conducted flight tests in Connecticut. These tests used the Sikorsky Autonomous Research Aircraft, a S-76B helicopter specially equipped with a fault-tolerant research interface, and the Sikorsky Optionally Piloted Vehicle (OPV), a S-70 helicopter that can additionally be remotely piloted. The AFCM team delivered strategic flight path management algorithms and tactical conflict detection and avoidance algorithms for in-flight testing with two live vehicles deliberately planning conflicting

trajectories that must safely be mitigated by the strategic or tactical algorithms. Dozens of virtual traffic aircraft were integrated in the tests to constrain the solution space and demonstrate efficient resolution in densely populated airspace without creating new conflicts. The flight testing is helping validate key components of simulation systems being used by AFCM to inform performance standards and governance for advanced air vehicles operating in the future airspace, where automation technologies can potentially enable higher densities of operation without compromising safety. As part of the buildup process to flight, the algorithms will complete a final on-site verification and validation in Sikorsky's high fidelity simulation lab and the research pilots will conduct dry runs of flight cards in simulation for familiarization of these complex two-vehicle operations. Though the pre-flight activities were completed for the strategic flight path management algorithms, heavy smoke from recent wildfires in Canada significantly limited visibility in the test range and forced an early termination of the flights for this cycle with very limited data collection. A second attempt to flight test the strategic flight path management algorithms is tentatively planned for late June. The tactical algorithms are planned to complete their verification and validation process in August, with flight testing scheduled for September.

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## SWS Hosts DLR Visitors at NASA Ames

POC: [CHRISTOPHER TEUBERT](#)

On June 8–9, System-Wide Safety (SWS) project researchers within the Diagnostics and Prognostics group at NASA's Ames Research Center in California hosted visitors from the German Aerospace Center (DLR) Institute of Maintenance, Repair, and Overhaul. Kai Wicke presented a summary of his team's work in product lifecycle management. The Diagnostics and Prognostics researchers, many of whom work on the SWS project, conducted discussions with the DLR team which included a new technology DLR is exploring for vertiport-integrated sensing for unmanned aircraft systems flight readiness assessment for firefighting missions. While visiting, the group toured the NASA Ames supercomputing facilities and the large wind tunnel.

## UAM CNS Team Completes Flight Testing

POC: [RAFAEL APAZA](#)

On June 12, the Air Traffic Management – eXploration project's Urban Air Mobility (UAM) subproject Communication, Navigation, and Surveillance (CNS) team at NASA's Glenn Research Center in Cleveland successfully completed Phase 1 of its Cellular Receive Signal Quality Characterization flight testing. The



*NASA Glenn team conducting flight tests onboard the Pilatus PC-12.*

testing was conducted aboard NASA Glenn's new Pilatus PC-12 aircraft, passively scanning cellular signal quality along urban, suburban, and rural routes in the northeast Ohio area. A total of 14 flights were conducted from May 18 through June 12. The flight data collection campaign consisted of five flight routes, and each route was designed to measure signal performance at different altitudes and in diverse urban areas. While the aircraft is unavailable during its first annual inspection from June 13-July 14, the CNS team will analyze the

data collected and determine if supplemental flights are needed in the area.

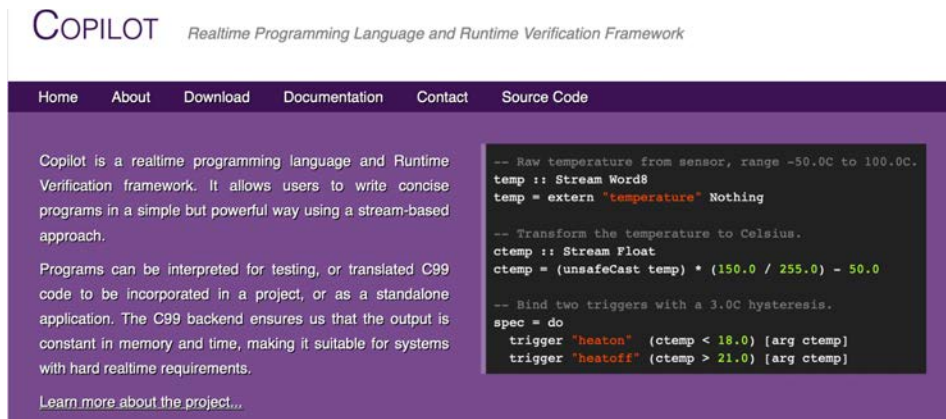
## Copilot Class D Runtime Verification Framework Officially Released as Open Source

POC: [IVAN PEREZ DOMINGUEZ](#) AND [ALWYN GOODLOE](#)

NASA's System-Wide Safety project is excited to announce the approval of the open-source release of the Copilot runtime verification framework as NASA Procedural



# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



New website banner for Copilot at <https://copilot-language.github.io/>.

Requirement 7150.2C Class D software in early June. Copilot is a runtime verification framework for monitoring embedded systems, with an emphasis on correctness and hard real-time requirements. It is typically used as a high-level monitoring language and supports temporal logic, clocks, and voting algorithms. Users of Copilot can use it to generate hard real-time C99 code that can be easily integrated as part of a larger system of a hardware description intended to run on a field programmable gate array. Among other cases, Copilot has been used for monitoring test flights of drones at NASA's Langley Research Center in Virginia. A key component of the Class D release is the new Copilot Verifier, which outputs a machine-verified proof that the C99 code produced, and when compiled with the low-level virtual machine compiler, is correct with respect to the original specification. Such a proof can be used for further assurance of

the correctness of the process implemented by the Copilot compiler. Copilot is an ongoing project and is publicly available under BSD-3 license at: <https://github.com/copilot-language/copilot>. New versions of Copilot are published every two months. Users are encouraged to participate by opening issues and asking questions via our GitHub repository.

## UAM Conducts Interoperability Simulation Tabletop

POC: [ANNIE CHENG](#)

On June 14–15, the Air Traffic Management – eXploration project's Urban Air Mobility (UAM) subproject held a tabletop exercise at NASA's Ames Research Center in California. The purpose of the tabletop was to explore notional procedures and information exchange requirements between Air Traffic Control and a pilot. A set of use cases and routes was developed jointly by NASA and Joby Aviation

for the Dallas-Fort Worth area. These use cases will be simulated and evaluated during the Air Traffic Management Interoperability Simulation to be conducted at the FutureFlight Central simulation facility at NASA Ames in September 2023. This tabletop exercise was conducted with a broad set of stakeholders, including representatives from the FAA, National Air Traffic Controllers Association, Dallas Fort Worth International Airport, and industry. The purpose was to validate assumptions for the simulation activity. The exercise exceeded expectations and all stakeholders applauded the NASA-Jobly team for their work in developing these initial procedures and hypothetical letters of agreements. Some discussions dove deeply into how to scale UAM operations and this diverse group of stakeholders provided valuable inputs from their unique perspectives. Participants expressed that corridors and modified procedures may provide benefits for scalability, while acknowledging that reduced communication is only one piece of a bigger solution toward scalability. Finally, there was recognition that some of the discussion topics need to be informed by data to make further progress and that the September simulation, and its results from data collection, will provide valuable insight to some of the open questions.

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

### ACERO Participates in JAHAAX Exercise

POC: [MARCUS JOHNSON](#)

On June 15, Xavier Elder and David Fuller of the Advanced Capabilities for Emergency Response Operations (ACERO) project's Wildfire Airspace Management team attended the Joint All Hazards Awareness and Assessment Exercise (JAHAAX) at the Air Operations Center in Sacramento. JAHAAX is an annual hands-on inter-agency integrated training with live flights ensuring preparation for all-hazard civil support. Combined exercises supported collaboration on life-saving technologies and tactics with numerous federal, state, and local partners including: NASA, the United States Forest Service, Federal Emergency Management Agency, Cybersecurity and Infrastructure Security Agency, and National Guard Bureau; California's Office of Emergency Services, Department of Forestry and Fire Protection, Civil Air Patrol, Department of Transportation, and Military Department; Arizona's Air National Guard; and New Mexico's National Guard. Elder and Fuller took the opportunity to meet and exchange ideas, concepts, and contact information with as many of the participants as possible, including Sierra Nevada Corporation, system integrator for the airborne radio system demonstrated. Discussions focused on the need for

improvement in communications and data transfer between agencies – as well as overall communications during emergency situations. Each agency has implemented a different common operating picture and used this meeting to demonstrate how they could organize data from live flights and display that information to its users. Interoperability between multiple common operating procedures is important for similar enhanced awareness applications and data-collecting systems like the Fire Integrated Real-Time Intelligence System plane.

### SWS Reports on Analyses of Data from 2021-2022 Testing

POC: [STEVE YOUNG](#), [LYNNE MARTIN](#), AND [EVAN DILL](#)

During fiscal years 2021 and 2022, the System-Wide Safety (SWS) project performed testing in simulation and flight environments on a diverse set of services, functions, and capabilities in its investigation of design concepts for an In-time Aviation Safety Management System (IASMS). As of June 16, SWS completed a first round of data analysis on these tests – producing findings and lessons learned informing the design of future tests as well as summary recommendations to be produced at the end of fiscal year 2025. Generally, all tests produced data well aligned with testing goals and have been documented in

13 NASA-authored papers and 10 papers by NASA Research Agreement partners – with eight pending submissions to date. An overarching and positive outcome was a consensus to collaborate and share as much as possible across the activities moving forward. Due to the complementary nature of the activities, this should result in more complete coverage of the broad IASMS concept and what NASA can contribute in terms of research-informed requirements and/or recommendations.

### xTM Meets with AeroStar

POC: [MIN XUE](#)

On June 20, the Air Traffic Management – eXploration project's Extensible Traffic Management (xTM) subproject team met with AeroStar International engineering leads and management. Representing xTM was the Upper Class E Traffic Management team. Prior to the meeting, a non-reimbursable Space Act Agreement was signed between NASA and AeroStar. The purpose of the meeting was to prepare AeroStar for the upcoming collaborative evaluation (CE-1), which is designed to develop and test the cooperative operating concept for high-altitude airspace operations. The discussion covered various topics, including a CE-1 overview, CE-1 system diagram, capabilities at AeroStar, data application



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

programming interface, and connectivity. To support CE-1, a biweekly meeting series was set up for further in-depth discussions. The collaboration will continue through the CE-1 evaluation scheduled for November 2023.

### DIP Meets with FAA and NATCA

POC: [GILBERT WU](#), [JEREMY COUPE](#),  
AND [SHIVANJLI SHARMA](#)

The Air Traffic Management – eXploration (ATM-X) project’s Digital Information Platform (DIP) subproject team hosted two meetings with representatives from the FAA and the National Air Traffic Controllers Association (NATCA) this past quarter. The first meeting was held May 30 at NASA’s North Texas facility, where participants discussed follow-on deployment of DIP technology outside of Dallas Fort Worth International Airport, where DIP is currently conducting evaluations, to another site. The DIP team along with the FAA has decided to evaluate the benefits of the DIP Collaborative Digital Departure Rerouting tool in the Houston area. This next site will evaluate its fuel savings and workload benefits in a different environment as well as the ease of deployment using cloud-based technologies.

The second meeting was held in Washington, DC on June 20.

This time the DIP subproject’s Sustainable Flight National Partnership-Ops-1 team met with the FAA’s Air Traffic Services (AJT) and Office of NextGen, as well as with members of NATCA. This was the first in-person meeting with NASA’s point of contact for AJT and was an important step toward building the relationship with AJT and NATCA. The team continued the discussion from the previous meeting at the North Texas facility on May 30, with FAA and NATCA regarding the Ops-1b deployment plan in the Houston airspace. The team received more clarity about the current capabilities and processes at the Houston Terminal Radar Approach Control Facility I90. The next step is an I90 area facility leadership meeting in Texas targeting the end of July to begin the information and requirements gathering phase for Ops-1b.

### SWS Participates in DARPA ARCOS Meeting

POC: [MALLORY GRAYDON](#)

On June 21–22, System-Wide Safety (SWS) researchers Mallory Graydon, Paul Miner, and Natasha Neogi participated in a principal investigators meeting of the Defense Advanced Research Projects Agency (DARPA) Automated Rapid Certification of Software (ARCOS) project. The meeting was virtual, however Miner participated in person. ARCOS participants discussed plans

to refine assurance-case-related tooling that they are constructing. Graydon, Miner, and Neogi provided expert feedback in safety assessment and safety assurance, which will help keep participants 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 develops may have applications to software used in aviation and spaceflight applications.

### HDV Accomplishments to Support SAO-BVLOS Simulation and Flight Tests

POC: [LOU GLAAB](#)

This past quarter, the Advanced Air Mobility project’s High-Density Vertiplex (HDV) subproject team achieved several significant accomplishments in support of the Scalable Autonomous Operations Beyond Visual Line of Sight (SAO-BVLOS) simulation and flight tests. The team successfully completed the Flight Experiment Review on April 28, which covered numerous goals, objectives, success criteria, results, lessons learned, and more. The review closed with Eastern Region Aviation Review Board and Operational Readiness Review status. The presentation was well received with good engagement and comments. Subsequently, the

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



*Brayden Chamberlain, sUAS safety pilot at NASA's Langley Research Center in Virginia.*

team initiated flight operations May 1–5. This flight test expanded on results from the preceding SAO Prototype Operation Assessments (PAO) Human-Hardware-in-the-Loop flight test completed earlier. The objectives of the SAO-PAO flight test are to: 1) leverage surrogate small Unmanned Aircraft Systems (sUAS), airborne autonomous systems, and ground systems to create a realistic Urban Air Mobility (UAM) ecosystem prototype; 2) perform assessment of prototype Vertiport Automation System with relevant human factor flight test results; and 3) as defined within the HDV UAM concept

of operations, demonstrate the integration of vehicle, airspace, and Vertiport Automation System technologies as required for UAM Ecosystem prototype using sUAS surrogate test techniques for high-density operations. Flight testing is planned to extend through June 15 with the operation of five vehicles simultaneously. Additionally this past quarter, the team received a 91.113 Line-of-Sight Waiver from the FAA. This is a major step toward BVLOS flight at NASA. The application for the Certificate of Authorization which was subsequently submitted will help clear the way for BVLOS operations later this summer.

As of June 23, a total of four ground control station operators (GCSOs) have completed simulation training to transition to GCSO Pilots in Command (GCSO-PICs). The SAO BVLOS simulation test will start June 29 and acquire human factors data for a total of five GCSO-PICs. An Operational Readiness Review will be held on June 27 to enable transition into Extended Visual Line of Sight++ (EVLOS++) mode of flight operations that will enable operations without the Safety/ Visual Remote Control pilot. While visual observers are still included in the EVLOS++ operations, this will be a major step toward



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

BVLOS flight. EVLOS++ flights are planned in mid-July. Several major improvements to Independent Configurable Architecture for Reliable Operations of Unmanned Systems (ICAROUS) integration and operation were also realized this week by the team. One development was the ability to update ICAROUS's flight path when return to launch mode is selected. This allows a sUAS to continue to proceed toward the landing location after a traffic incursion has been resolved during fully lost-link scenarios. Another major development was the checkout of complex geofences to enable the sUAS to route around obstructions (i.e., the Gantry) during completely lost-link return to launch. Actual BVLOS flights are planned for August and September.

### HDV Team Successfully Lifts LSTAR-2 into NASA Langley's Radome

POC: [LOU GLAAB](#)

On June 26, the Advanced Air Mobility project's High Density Vertiplex (HDV) subproject successfully lifted the Lightweight Surveillance Target Acquisition Radar-2 (LSTAR-2) into the radome on top of Building 1244 at NASA's Langley Research Center in Virginia. This particular radar unit has been on loan since April 2023 from NASA's Ames Research Center in California; it has supported checkout flight operations in May



*The LSTAR-2 being lifted into the radome.*

while located on the temporary radar checkout pad on B1230. The existing LSTAR radar (LSTAR-1), also on loan from NASA Ames, exhibited periodic operational issues as well as having large elevation angle errors. The swap out of radars will provide greatly improved operational capabilities as well as significant reduction in elevation errors. In addition, the LSTAR-1 radar will be sent to SRC for inspection and repair then

returned to NASA. Connection of the LSTAR-2 to NASA Langley's network was successfully accomplished along with routing the radar data to the Anra SmartSkies Control Traffic Regions integrated surveillance system. A subsequent test with NASA general aviation aircraft will be completed in July to fully characterize the resulting surveillance system and pave the way for beyond visual line of sight (BVLOS) operations



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

planned for the August/September timeframe. In addition, the HDV subproject team started the Scalable Autonomous Operations (SAO) BVLOS human-hardware-in-the-loop human factors test on June 29. The SAO BVLOS simulation test, performed in the Remote Operations for Autonomous Missions Unmanned Aircraft Systems Operations Center will yield essential data regarding operators' ability to manage autonomous vehicles through a series of off-nominal conditions. Ground control station operators (GCSOs) previously completed training in support of BVLOS operations and have transitioned to GCSO Pilots in Command (GCSO-PIC). Results from the SAO BVLOS simulation test will establish a baseline for one-to-one autonomous vehicles operations that can form the foundation for envisioned m:N>1 operations.

### DIP Hosts Workshop on Predictive Engine for New York Airspace

POC: [YOON JUNG](#)

On June 27, the Air Traffic Management – eXploration project's Digital Information Platform (DIP) subproject team hosted a virtual workshop to discuss NASA's predictive engine of machine learning airport surface model for New York airspace. The DIP team has developed a scheduler to predict off and on times of flights at New

York's three major airports. This was accomplished by integrating machine learning models that generate predictions of airport configuration, runways, and taxi times. These machine learning services are available on the DIP platform. In the workshop, the DIP team presented the architecture and initial validation results of machine learning models trained by historical data archived in the Fuser data warehouse. The DIP team also showed a real-time demonstration of the scheduler for New York's airports. The goal is to enable airline partners to use the models in their operational environment and technology transfer of the models via open source. The DIP team plans to host subsequent monthly workshops to report the progress of New York airspace predictive engine efforts, as well as engage with airline partners and subject matter experts.

### DIP Conducts Virtual Information Session for Service Provider ACO

POC: [YOON JUNG](#) AND [SWATI SAXENA](#)

The Air Traffic Management – eXploration project's Digital Information Platform (DIP) subproject conducted a virtual information session on June 28. The virtual information session was for the service provider Announcement of Collaborative Opportunity, which was released June 9. This Announcement aims to establish partnership with service providers

to collaborate with NASA and existing flight operator partners to develop and register services to DIP that are addressing challenging aviation operations and use cases. Partners will also contribute to information and requirements gathering toward definitions of the Application Programming Interface standards, performance metrics, and infrastructure enabling adaptability and scalability. Partners will also participate in partner services evaluation where partners will provide feedback on platform features and services of other providers and share their user experience with the platform. DIP aims to partner with service providers who will register their integrated data or digital decision-making aviation services onto the DIP and may also consume existing NASA services on the platform to build more complex services. Approximately 70 people attended the two-hour session. The DIP team presented the details of the Announcement of Collaborative Opportunity, evaluation criteria, Space Act Agreement, and the partner onboarding process. There was a dedicated question-and-answer session. As a follow-up to this session, the DIP team will send personalized messages to the registrants and encourage them to submit their proposals. The meeting recording and slides will be posted on the DIP website and the team will also be monitoring any queries coming through the website or DIP email.

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## UAM Hosts Workshop on Mid-Term UAM Operations at NASA Langley

POC: [JASON PRINCE](#)

On June 28–29, the Air Traffic Management – eXploration project’s Urban Air Mobility (UAM) subproject’s Operational Integration Assessment (OIA) team hosted a workshop at NASA’s Langley Research Center in Virginia. Participants included representatives from NASA, the FAA, Department of Transportation, National Air Traffic Controllers Association, AFWERX (a technology directorate of the Air Force Research Laboratory), MITRE, the Johns Hopkins University Applied Physics Laboratory, Joby Aviation, Boeing, and Wisk Aero. The purpose of the workshop was to inform the direction of the next OIA checkpoint, which will advance the complexity of UAM operations under joint simulation between NASA and the FAA’s William J. Hughes Technical Center. Key objectives and outcomes from the workshop were a confirmation of assumptions for Class B airspace integration and identifying several stakeholder priorities for the NASA-led research activity. These priorities included strong support from the stakeholder community for more simulation and analysis of New York airspace, continued development of assistive detect and avoid procedures in controlled airspace, the importance of studying instrument flight rules

procedures to examine opportunities for UAM operations in reduced visibility, and the need for additional research into other visual flight rules airspace areas to align the definition of UAM corridors.

## ACERO Attends PSCR Innovation Summit

POC: [MARCUS JOHNSON](#)

On June 28–30, researchers from the Advanced Capabilities for Emergency Response Operations (ACERO) project attended the Public Safety Communications Research (PSCR) Innovation Summit held in San Diego sponsored by the National Institute of Standards and Technology. PSCR is the primary federal laboratory conducting research, development, testing, and evaluation for public safety communications technologies. The efforts are focused on driving research to advance communications technologies in support of the public safety community in partnership with stakeholders across public safety, industry, government, and academia. The event brought leaders together to discuss the latest innovations in these technologies, through demonstrations, presentations, breakout sessions, and other collaborative engagements. ACERO researchers attended this event for the first time to better understand the possible connections that could be made between the PSCR

community and ACERO. The project established contacts with industry representatives and other government agencies with requests for follow-on discussions.

## SWS Applies for Release of its ReFlow Software

POC: [AARON DUTLE](#) AND [TERRY MORRIS](#)

On June 30, the System-Wide Safety (SWS) project applied for the release of its ReFlow software. ReFlow is a fully automatic tool that generates an instrumented floating-point implementation of a given program specification. In particular, ReFlow takes as input a program specification written in the PVS code specification and outputs the corresponding C implementation, which contains program contracts ensuring that the floating-point rounding error accumulated during the computation is bounded. ReFlow detects the cases in which the floating-point control flow differs from the ideal real number one, and a warning is issued in the generated program to advise the user that the output may suffer from excessive rounding error. ReFlow uses PRECiSA (LAR-19739-1), which has been approved under NASA’s Open Source Agreement, in order to compute the error bounds used in the program contracts.

## RECOGNITION

### UAM Team Simulation Team to Receive NASA Group Achievement Award

POC: [WILLIAM CHAN](#)

On April 3, the Air Traffic Management – eXploration project’s Urban Air Mobility (UAM) subproject’s Strategic Conflict Management Simulation team was notified they will receive a NASA Group Achievement Award. This is one of the most prestigious awards a group can receive and is presented to selected groups who have distinguished themselves by making outstanding contributions to NASA’s mission. The award will be presented to Kevin Witzberger, UAM subproject manager, on behalf of the team at the annual NASA Honor Awards Ceremony on May 17.

### SWS Participates at the 29th IWC on Requirement Engineering

POC: [ANASTASIA MAVRIDOU](#) AND [TOM PRESSBURGER](#)

On April 17–20, System-Wide Safety (SWS) researchers attended and presented two papers at the 29th International Working Conference (IWC) on Requirement Engineering: Foundation for Software Quality in Barcelona, Spain. The two papers described work being performed to support automated, formal analysis requirements for autonomous systems. The paper titled “Authoring,

Analyzing, and Monitoring Requirements for a Lift-Plus-Cruise Aircraft” authored by Tom Pressburger, Andreas Katis, Aaron Dutle, and Anastasia Mavridou described how to develop state machine requirements and check for realizability using SWS’s Formal Requirements Elicitation Tool. The second paper, titled “Exploring Requirements for Software that Learns: A Research Preview” and authored by Marie Farrell, Anastasia Mavridou, and Johann Schumann, identified unique characteristics of software requirements that are specific to machine-learning enabled components. The paper provides a foundation for developing a taxonomy of requirements for software that learns.

### NASA Participates at the 2023 ICNS Conference

POC: [PAUL HOYT NELSON](#)

Paul Hoyt Nelson, ARMD’s senior cybersecurity advisor and aviation security liaison to the System-Wide Safety project, provided a plenary panel talk during the 2023 Integrated Communications Navigation and Surveillance (ICNS) Conference in Virginia held April 18. The panel titled “The Role of Information Centricity in the Future of ATM,” was chaired by Stéphane Mondoloni, chief engineer for National Airspace System vision and research at

MITRE, and Parimal Kopardekar, director of the NASA Aeronautics Research Institute. Nelson’s talk addressed future digital identity, cybersecurity and safety, and non-human (automation) mediated security operations.

### ATM-X Leads Awarded ESGR Patriot Award

POC: [WILLIAM CHAN](#)

On April 19, William Chan, project manager of the Air Traffic Management – eXploration (ATM-X) project, and James Chartres, lead systems engineer for ATM-X, were awarded the Employer Support of the Guard and Reserve (ESGR) Patriot Award by John Fisher. ATM-X risk manager Joshua Moody (U.S. Navy Reserve) nominated both awardees for their efforts in support of his duties. The Patriot Award reflects the efforts made to support citizens through a wide



From left: William Chan, Joshua Moody, James Chartres, and John Fisher.



## RECOGNITION

range of measures including flexible schedules, time off prior to and after deployment, caring for families, and granting leaves of absence if needed.

### ATM-X's Shivanjli Sharma Moderates Panel at Mobility Tech Salon

POC: [SHIVANJLI SHARMA](#)



*Shivanjli Sharma moderates the “Digital Infrastructure Needs for Ground and Air Autonomy panel.”*

On April 20, Air Traffic Management – eXploration deputy project manager Shivanjli Sharma moderated the “Digital Infrastructure Needs for Ground and Air Autonomy” panel at Mobility Tech Salon in California. Some of the topics discussed included digital infrastructure, different technologies needed for

group and air, and interfaces and information requirements for surface transportation and air. This panel also included Dean Donovan of Diamond Stream, Todd Petersen of Ellis and Associates, and attendees representing a wide range of groups involved in mobility technology that includes electric vertical

takeoff and landing companies.

### xTM Achieves Best Paper at AIAA Aviation Forum 2022

POC: [PAUL LEE](#)

On April 21, the paper “Identifying Common Coordination Procedures across Extensible Traffic Management (xTM) to

Integrate xTM Operations into the National Airspace System” by Paul Lee and his team was selected by the AIAA Aviation Aircraft Operations Technical Committee as the best paper within the technical committee for Aviation Forum 2022. There will be an awards ceremony where authors will be given certificates. This paper was the final output of an xTM subproject milestone to study interactions between xTM and the Air Transportation System. This award shows the community recognition of NASA’s xTM work.

### SWS Presents Results on GPS Hazards at Low Altitude at IEEE/ION Symposium

POC: [KYLE ELLIS](#)

On April 24-27, Julian Gutierrez and Andrew Moore, two researchers supported by the System-Wide Safety (SWS) project, presented novel results central to navigation at low altitudes at the Institute of Electrical and Electronics Engineers (IEEE)/Institute of Navigation (ION) Position Location and Navigation Symposium (PLANS) 2023 in California. In collaboration with the Lonestar Unmanned Aircraft Systems Center, an FAA test site, “Accuracy Assessment of Two GPS Fidelity Prediction Services in Urban Terrain” compared several days of actual GPS receiver readings

## RECOGNITION



*The physics of satellite signal interaction with rich 3D terrain data was computed by two independent prediction services and validated with thousands of ground-truth measurements.*

collected in the urban canyons of Corpus Christi, Texas with state-of-the-art navigation fidelity predictions. The physics of satellite signal interaction with rich 3D terrain data was computed by two independent prediction services and validated with thousands of ground-truth measurements. The paper was nominated for the highly prestigious Walter R. Fried Award for best paper at the symposium. A second paper, “Predicting GPS Fidelity in Heavily Forested Areas,” quantified GPS degradation by foliage – a ubiquitous hazard at low altitudes – at several sites for the first time. PLANS is a biennial technical conference that occurs in the spring of odd numbered years. Its mission is to

provide an international forum to share the latest advances in navigation technology.

### **SWS Work Reported at the HCSS Symposium**

POC: [ALWYN GOODLOE](#) AND [MALLORY GRAYDON](#)

On May 8–12, System-Wide Safety (SWS) project researchers Mallory Graydon, Alwyn Goodloe, and C. Michael Holloway participated in three co-located meetings. On May 8-10, Goodloe attended the High Confidence Software and Systems Symposium (HCSS) in Maryland, where he also moderated a session. This was the 23rd of an annual security-focused formal methods meeting started in 2001 by Brad Martin (then National Security

Agency, now Defense Advanced Research Projects Agency). The program for this year included a talk by Jen Davis of Collins Aerospace titled “A Framework for Assuring Increasingly Autonomous Systems in Human-Machine Teams” reporting on work performed under a recently completed SWS-funded NASA Research Announcement with the same name. Also on the program was a talk by Darren Cofer, also of Collins Aerospace, titled “Next Steps for Trustworthy Machine Learning.” Later that week, there were two additional co-located meetings. Holloway moderated a panel discussion at the Software Certification Consortium. Graydon supported both. On May 11, she participated at the Trusted Computing Center of Excellence Summit on a panel discussion on software and assurance moderated by Ray Richards, former project manager for Automated Rapid Certification of Software. She then presented a talk titled “Safety Expertise Matters More Than You Might Think” at the Software Certification Consortium meeting.

### **SWS Researchers Participate in HFE TAG Meeting**

POC: [JON HOLBROOK](#)

On May 9-12, representing the System-Wide Safety (SWS) project, Jon Holbrook and Cynthia Null participated in the Department of Defense Human Factors Engineering

## RECOGNITION



*Left to right: Kathy Abbott (FAA), Jon Holbrook (NASA SWS), and Cynthia Null (NASA NESC) as they participated in the HFE TAG plenary panel discussion.*

(HFE) Technical Advisory Group (TAG) in Virginia. Holbrook gave an invited plenary address on the topic “Designing with Human Resilience in Mind.” In addition, Holbrook organized a plenary panel including Kathy Abbott, the FAA’s chief scientific and technical advisor for Flight Deck Human Factors, and Cynthia Null, the NASA Engineering and Safety Center’s (NESC) technical fellow for Human Factors. In addition to the plenary panel, Holbrook provided a technical briefing on the work of the Human Contributions to Safety initiative titled “Leveraging Human Performance Data to Change the Narrative that People are the Safety Problem.”

The major goal of the HFE TAG is to provide a mechanism for the timely exchange of technical information in the development and application of human factors by enhancing the coordination among U.S. government agencies involved in human factors research,

technology development, and application. The meeting was attended by more than 200 technical representatives from the Department of Defense, Department of Homeland Security, Veterans Administration, the FAA, and NASA.

### **SWS External Partner Wins Best Student Paper Award**

POC: [LILJANA SPIRKOVSKA](#)

Graduate students Salil Purandare and Urjoshi Sinha from Iowa State University and Md Nafee Al Islam from the University of Notre Dame, along with their advisors Myra Cohen and Jane Cleland-Huang, won best student paper at this year’s Symposium on Software Engineering for Adaptive and Self-Managing Systems (SEAMS) 2023 held in May. Their research, funded through a grant from the System-Wide Safety (SWS) project’s Technical Challenge 2: In-Time Safety Nets for Emerging Operations, focuses on understanding the impact of configurations on

drone flight behavior. The paper presents Controller Instability-preventing Configuration Aware Drone Adaptation – a technique to dynamically detect unstable behavior in small drones and provide an adaptive mechanism allowing missions to recover from misconfigurations. In their experiments, they demonstrated several types of adaptations that can be applied to either complete the mission or stabilize and land it when that is not possible. SEAMS is a CORE-A ranked conference on applying software engineering processes to self-adaptive and autonomous systems that adapt and change to their changing environment, and is a collated event with the yearly International Conference on Software Engineering Systems.

### **SWS Participates at the Annual NFM Symposium 2023**

POC: [AARON DUTLE](#)

On May 16–18, the NASA Formal Methods (NFM) Symposium 2023 was held in Texas at the University of Houston, Clear Lake. System-Wide Safety (SWS) project researchers Ivan Perez and Aaron Duttie each chaired a session at the symposium. Duttie was on the steering committee, and served on the program committee along with Alwyn Goodloe, Anastasia Mavridou, Natasha Neogi, Corina Pasareanu, Ivan Perez Dominguez,



## RECOGNITION

and Laura Titolo. Andreas Katis presented a paper that was prepared jointly with colleagues from the European Organization for Nuclear Research (CERN), “From Natural Language Requirements to the Verification of Programmable Logic Controllers: Integrating FRET into PLCverif.” NFM 2024 will be hosted in May 2024 at NASA’s Ames Research Center in California.

### DIP Expands ML/AI Industry Connections

POC: [SHIVANJLI SHARMA](#)

On May 18, Swati Saxena, Jeremy Coupe, and William Chan participated in a panel at the 2023 Artificial Intelligence and Big Data Expo in California. The NASA panel members discussed the application of machine

learning to improving airline operations during the panel titled “Real World Application of Artificial Intelligence/Machine Learning (AI/ML) for Managing Airspace Operations.” A goal for the Digital Information Platform (DIP) team was to expand NASA’s connections within this community to accelerate the development and deployment of DIP’s ML/AI-based technologies. The approximately 100-person audience heard how NASA is working with the FAA and airlines to provide sustainable aviation benefits today by saving fuel upon departure out of the Dallas-Fort Worth area. The panelists discussed NASA’s rich history of air traffic management research, DIP technology, and lessons learned in fielding NASA technology for operational use.

### SWS Contributes to Federal AI Research and Development Plan

POC: [NIKUNJ OZA](#)

The latest National Artificial Intelligence (AI) Research and Development (R&D) Strategic Plan was released on May 23. The plan was coauthored by NASA Discovery and Systems Health Data Sciences Group lead and System-Wide Safety (SWS) researcher Nikunj Oza. Oza led the sub-team that wrote Strategy 1: “Make long-term investments in fundamental and responsible AI research,” and was also a member of the sub team that wrote Strategy 5: “Develop shared public datasets and environments for AI training and testing.” The document is an update to the 2019 Federal AI R&D Plan and lays out a strategic plan for federally funded AI R&D. The latest Strategic Plan can be viewed here: <https://www.whitehouse.gov/wp-content/uploads/2023/05/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf>.

### SWS Participates at International Symposium on Aviation Psychology

POC: [JON HOLBROOK](#) AND [CHAD STEPHENS](#)

Researchers funded by the System-Wide Safety (SWS) project presented eight papers at the International Symposium on Aviation Psychology (ISAP)



From left: Jeremy Coupe, Swati Saxena, and William Chan.

## RECOGNITION

held May 31-June 3 in Rochester. The conference is a venue for research on human performance within aviation systems and for design solutions tailored to human aptitudes and constraints. This forum enables attendees to share and discuss basic and applied research that speaks to issues of human performance in sociotechnical aviation systems. ISAP provides excellent visibility for research within a highly targeted community of relevant stakeholders. The eight papers were: 1) Extracting Lessons of Resilience using Machine Mining of the ASRS Database by Barshi, Matthews, and Feldman; 2) Psychophysiological Research Methods to Assess Airline

Flight Crew Resilient Performance in High-Fidelity Flight Simulation Scenarios by Stephens, Fettrow, Prinzel, Holbrook, Ballard, and Kiggins; 3) Examining the Relationship between Self-Reported Workload and Resilient Performance in Airline Flight Crews by Stewart, Ballard, Stephens, Prinzel, Holbrook, Fettrow, and Kiggins; 4) Resilient Strategies in Commercial Aviation by Stewart and Matthews; 5) Learning About Routine Successful Pilot Techniques Using a Cued Retrospective Think-Aloud Task by Holbrook, Stephens, Prinzel, Bastami, and Kiggins; 6) What Can We Learn from Resilient Pilot Behaviors? The Case of Energy Management while Flying a STAR

by Mumaw, Billman, and Baron; 7) Survey Development and Initial Data: Flight Context and Pilot Techniques in Everyday Flights by Billman, Hobbs, Cusano, and Szladovics; and 8) Formal and informal learning in aviation: Might understanding their relationships benefit each? by Billman, Baron, and Mumaw. The conference was attended by 120+ technical representatives from government, academia, and industry in the area of aviation human factors.

### DIP Participates in Panel Discussions at ATIEC

POC: [JEREMY COUPE](#)

Jeremy Coupe, subproject researcher for the Air Traffic Management – eXploration project’s Digital Information Platform (DIP) subproject, participated in two panel discussions at the Air Transportation Information Exchange conference (ATIEC) hosted at George Mason University in Virginia on June 1-2. ATIEC is cohosted by the FAA and Eurocontrol and provides a forum to discuss and exchange concepts and practices related to major global changes in information management focusing on information in operation, information services, information exchanges, and information security. The theme of the 2023 conference was “Deciding with Data Leveraging information to



*Dorrit Billman (top left), Chad Stephens (top right), and Jon Holbrook (lower) all presented NASA’s SWS project research in human performance within aviation systems to the ISAP conference audience.*

## RECOGNITION

make better data-driven choices.” Attendees at the conference included representatives from airlines, third-party service providers, air navigation service providers, and research/government organizations. The first panel discussion focused on System Wide Information Management (SWIM) and was titled “SWIMposium: Consuming SWIM Services from a Customer Perspective.” Coupe participated on this panel which also included participants from Lufthansa Systems, Flight Aware, and the FAA’s Traffic Flow Management System team. The panel members discussed use cases for consuming SWIM services and lessons learned from a consumer perspective that could be transferred to organizations working to consume SWIM data. The second panel discussion was a fireside chat between Coupe and Trung Pham, FAA’s chief scientific and technical advisor for artificial intelligence and machine learning (AI/ML). The two discussed AI/ML pertaining to aviation and participants shared thoughts on unique challenges that are introduced using AI/ML compared to other traditional methods.

### UAM Participates in Intelligent Infrastructure Conference

POC: [KEN FREEMAN](#)

On June 6–7, Kenneth Freeman, subproject manager for the Air

Traffic Management – eXploration project’s Urban Air Mobility (UAM) Airspace Management subproject, participated as a panelist at the Intelligent Infrastructure Conference held in Austin. Freeman discussed data exchange issues and requirements for UAM environments. The Intelligent Infrastructure Conference brings together government and technologists to build the efficient, future-proof platform for public digital services.

### SWS Participates at International Flight Safety Foundation Safety Forum 2023

POC: [JON HOLBROOK](#) AND [IMMANUEL BARSHI](#)

The Flight Safety Foundation Safety Forum 2023 took place June 7-9 at EUROCONTROL Headquarters in Brussels, Belgium. The Forum and subsequent Learning from All Operations working group meeting provided internationally attended forums for discussing current practices, thinking, and research on the knowledge, skills, and experience needed to enable safer aviation operations. The meetings represented opportunities to raise awareness of NASA’s System-Wide Safety (SWS) research, as well as to share and discuss ideas with an international audience of aviation safety practitioners. Immanuel Barshi and Jon Holbrook, both funded under the SWS project, each presented at the Safety Forum. Barshi presented “A Holistic



Upper left: Jon Holbrook of NASA, Hassan Shahidi, president and chief executive officer of Flight Safety Foundation, and Immanuel Barshi of NASA. Holbrook (upper right) and Barshi (bottom) discuss applications of their research to sustaining and leveraging the knowledge, skills, and experience supporting safe aviation operations.

Approach to Procedures” and Holbrook presented “Strategies for Improving Safety Learning.” Tzvetomir Blajev, the Flight Safety Foundation’s director for Europe, noted the audience loved their briefings and helped to advance the discussions at the meetings. The Forum was attended by more than 250 front-line aviation safety professionals, trainers, and managers representing industry and government from around the planet.

### AOSP Projects Participate at AIAA Aviation 2023 Forum

POC: [TRISH GLAAB](#), [SHIVANJLI SHARMA](#), [KYLE ELLIS](#), AND [PORTIA BANERJEE](#)

AOSP was well represented at the AIAA Aviation 2023 Forum



## RECOGNITION



Upper left: the System-Wide Safety (SWS) Team at AIAA Aviation 2023 Forum. Upper right: SWS researcher Matteo Corbetta. Bottom Right: Ahmad Ali Pohya, German Aerospace Center. Bottom Left: SWS researcher Portia Banerjee.

and Exposition Conference in San Diego held June 12-16. The Advanced Air Mobility project's Automated Flight and Contingency Management team presented several research papers and served on panel sessions. Mike Feary presented "Evaluation of Novel Electric Vertical Takeoff and Landing Aircraft Automation Concepts." Thomas Lambaerts presented "Command and Control Concepts for a Lift Plus Cruise Electric Vertical Takeoff and Landing Vehicle." Casey Smith presented "Helicopter Pilot Assessments of the Airborne Collision Avoidance System Xr with Automated Maneuvering." Feary also participated on the "Stepping Stones Towards Increasingly Autonomous Flight" panel featuring members of NASA, the FAA, and industry. This

panel discussed challenges and opportunities in the move toward highly automated or autonomous future aircraft and airspace. Casey Smith, Advanced Air Mobility researcher and panelist, presented "Integration of Automation Systems Flight Testing," where NASA panelists described the research technologies and supporting middleware systems developed to enable advanced aircraft autonomy testing in collaboration with Sikorsky in fiscal year 2023.

Shivanjli Sharma, deputy project manager for the Air Traffic Management – eXploration (ATM-X) project, spoke on Forum 360: "Advanced Air Mobility Cadence of Operations" as the moderator and participated in the "NASA Sustainable Flight National Partnership project

Managers" panel. There were also multiple papers presented by ATM-X researchers, and ATM-X's Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject participated in the Multi-Modal Integration Steering Committee meeting and the Air Transportation Systems Technical Challenge meeting. Vishwanath Bulusu, PAAV researcher, presented a paper titled "Analysis of VFR Traffic Uncertainty and its Impact on Uncrewed Aircraft Operational Capacity at Regional Airports."

### SWS Participates at FAA Data Challenge Forum

POC: [MISTY DAVIES](#)

On June 21-22, the FAA hosted its inaugural Data Challenge at MITRE. The Data Challenge is a student competition in which undergraduate students are challenged to use artificial intelligence and machine learning to address aviation-related problems and opportunities. As a result, the participating students were provided an opportunity to present their work. System-Wide Safety's project manager Misty Davies, served on the steering committee and helped to judge the competition at the forum. Students used published NASA data and research in their solutions including data from the Aviation Safety Reporting System, Sherlock Data Warehouse, and ATMOnto.

## RECOGNITION

For more information, visit: <https://faadatachallenge.nianet.org/>.

### **PAAV and SWS Contribute to Publication of RTCA DO-400**

POC: [TOD LEWIS](#)

Tod Lewis and Paul Volk, supporting the Air Traffic Management – eXploration project’s Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject, and Steven Young, supporting the System-Wide Safety

(SWS) project, provided significant contributions to the development of RTCA DO-400, “Guidance Material: Standardized Lost C2 Link Procedures for Uncrewed Aircraft Systems” published on June 22. The document contains guidance, gaps, and recommendations for the FAA and applicable stakeholders to use in the development of standardized Lost C2 Link (LC2L) procedures for large uncrewed aircraft in all phases of flight. It provides

recommended actions for: 1) the uncrewed aircraft flying on an Instrument Flight Rules flight plan; 2) air traffic control; and 3) the remote pilot while the uncrewed aircraft is in a LC2L state.

National Aeronautics and Space Administration

**Headquarters**

300 E. Street, SW

Washington, DC 20024

[www.nasa.gov/aeroresearch](http://www.nasa.gov/aeroresearch)

[www.nasa.gov](http://www.nasa.gov)