FEDERAL AVIATION ADMINISTRATION

RESEARCH AND COMMERCIAL SOLUTIONS OPENING (RCSO)

AREAS OF INTEREST

The following Federal Aviation Administration (FAA) future Areas of Interest (AOI) topics are provided to inform industry of potential upcoming research and development opportunities. These AOIs identify areas where the FAA anticipates issuing future solicitations that will include specific problem statements requiring contractor support. Through these solicitations, the FAA seeks innovative research, emerging technologies, and industry-driven solutions to address identified challenges and advance the safety, efficiency, and effectiveness of the National Airspace System and related aviation operations. The FAA reserves the right to revise, modify, remove, or add AOI topics at any time based on agency priorities and mission needs.

Convective Weather (CW)

Convective weather causes significant problems in the National Airspace System (NAS) by contributing to delays, reducing safety and making operations less efficient. The problem includes oceanic regions where over 22 million square miles of offshore airspace controlled by the FAA has no weather radar coverage. Hazardous weather conditions can be undetectable in these offshore regions. The goals of the Aviation Weather Research Program (AWRP) Convective Weather Product Development Team are to develop new techniques and capabilities to detect and forecast convective weather throughout the NAS so all users can maximize efficiency and safety while minimizing delays. Specifically, areas of interest include (but are not limited to):

1) Exploring how thunderstorm information is used to make air traffic management (ATM) decisions and assessing the need for improved information.

2) Increasing the fundamental understanding of how thunderstorms form, behave, and impact the NAS.

3) Developing advanced thunderstorm analysis and predictive capabilities with the goal of ensuring that convective weather algorithms, products or methods developed through the AWRP are scientifically accurate, provide value in terms of forecast worth to the individual decision-maker within their operational aviation decision processes, and can be transitioned to appropriate FAA or National Weather Service systems

4) Developing capabilities to address Near-Term Traffic Flow Management requirements.

5) Enhancing the Offshore Precipitation Capability to meet requirements from FAA ATO/AJV-S.

6) Incorporating OPC avoidance polygons in ATM platforms such as Cloud Services for Aviation Weather (CSAW).

Clouds, Cloud Ceiling, and Visibility (C&V)

The goal of this project is to conduct research and development to improve information on clouds, cloud ceiling, and visibility (hereafter known as C&V) for use in aviation decision making to support safer and more efficient aviation operations. This includes developing advanced C&V diagnostic and predictive capabilities with the goal of ensuring that C&V algorithms, products or methods developed through the AWRP are scientifically accurate, provide value to the individual decision-maker within their operational aviation decision processes, and can be transitioned to appropriate FAA or National Weather Service systems.

Specific areas of interest include:

1. Developing capabilities to address the performance gap between currently available C&V forecasting capabilities and Traffic Flow Management Requirements (provided as GFI).

2. Using artificial intelligence to improve the diagnosis and forecasts of C&V elements.

3. Analyzing how well surface observations represent the local area and what methods can be used to provide a more accurate representation.

4. Assessing the impact of C&V hazards on new NAS entrants.

5. Developing automated decision support guidance for NAS operators during adverse C&V conditions.

6. Developing technologies that derive C&V elements from camera images to build upon the previous success of Visibility Estimation through Image Analytics (VEIA) and Cloud Estimation through Image Analytics (CEIA). This may include:

    a. Improving the accuracy of the visibility and cloud cover estimation.

    b. Developing or improving the accuracy of cloud ceiling estimation.

    c. Extracting additional C&V elements from the imagery to include but not limited to, cloud bases, cloud tops, cloud type, and obstruction to vision categories (e.g. fog, rain, smoke).

    d. Adapting VEIA and CEIA to new camera sources and exploring varied camera configurations to balance performance improvements with the cost of camera installations.

    e. Developing an edge-computing version of CEIA and VEIA to process images locally at a camera site.

7. Assimilating camera-derived C&V information into weather forecast models and assessing the improvement to C&V forecasts.

8. Expanding on previous FAA studies regarding the utility and optimal configuration of weather-sensing UAS to improve fog prediction. This may include:

    a. Expanding upon previous Observing System Experiments (OSE) and Observing System Simulated Experiments (OSSEs) to further the understanding of how UAS may impact C&V prediction.

    b. Deploying a prototype UAS network in a high impact location to test the impact of the UAS weather data collection for an entire year and assess the impact on C&V predictions.

Icing Weather Diagnostic and Forecasting

Aircraft icing is a well-known aviation hazard. Diagnosing and forecasting weather conditions conducive to airframe icing and engine ice crystal icing supports awareness of hazardous icing conditions as well as avoidance and exit strategies for aircraft safety of

flight. Airframe icing specifically relates to environments with supercooled liquid water, more commonly associated with cool season weather, while engine icing specifically relates to environments with high concentrations of ice crystals, more commonly associated with convective weather. Products that combine surface observations, ground-based weather radar, satellite, and numerical weather prediction (NWP) model output have been developed over the years to support operations across various scales when icing conditions may be present, with some products already operational and some not yet operational. Additionally, with novel aviation vehicle designs and operations emerging, adapting the existing diagnosis and forecasting products will be necessary. Addressing the near-term icing needs for aircraft while considering the long-term icing needs for aircraft is necessary.

Specific areas of interest include:

1. Adapting terminal area and in-flight icing diagnosis and forecast capabilities to provide explicit forecasts of icing conditions, possibly including characterization of liquid water content and drop size, among other fields TBD. This may include:

    a. Use of high-resolution NWP model runs to develop and enhance terminal area and in-flight icing diagnoses and forecasts over CONUS and Alaska.

    b. Use of advanced weather satellites and other emerging technologies to enhance existing terminal area and in-flight icing diagnosis over CONUS and Alaska. Use polar-orbiting satellite data to give high-resolution observations of cloud properties in high latitude areas where they are not available from Geostationary Operational Environmental Satellite (GOES).

    c. In the near term, incorporation of the Next Generation Weather Radar (NEXRAD) dual-polarization (dual-pol) fields for improved icing diagnosis.

    d. Longer term, identification of necessary radar research and potential changes to the terminal area and in-flight icing algorithms to address any operational changes to NEXRAD/radar systems (i.e., upgrades, system replacements, etc.).

2. Developing a combined in-flight icing diagnosis and forecast product for CONUS and Alaska that will provide greater benefits to the end user, with potential towards including terminal area components.

3. Addressing shortfalls in terminal area and low altitude weather measurements for icing diagnosis and forecasting.

4. Pursuing operational implementation of terminal area icing information, coordinating with available, and updated, in-flight icing information.

5. Developing and adapting automated algorithms, to incorporate NWP model, satellite, and radar data, at a minimum, to diagnose and forecast potentially hazardous engine icing conditions. This may include:

    a. Analyzing engine ice crystal icing case studies and implementing algorithm upgrades as appropriate.

6. Providing field campaign support, which may include:

    a. Real-time support of icing diagnosis and forecasting algorithms.

    b. Deployment of ground sensors and instrumentation.

    c. Data processing of ground- and airborne-based instrumentation.

    d. Data management during and post field campaigns.

    e. Archival of meteorological data from various data sources (e.g., aircraft, weather satellite, radar, surface instruments, etc.).

7. Providing comprehensive planning for a possible Operational Test and Evaluation (OTE), including the identification of product users, the venue for generating and distributing the product, the product format and information content both for ground-based and cockpit products, means to communication information to the cockpit, evaluations from initial testing to full OTE with the product essentially in final form.

Turbulence (TRB)

The goals of the Turbulence project are to enhance National Airspace System safety and increase capacity through improved observations and forecasting of turbulence for strategic and tactical use by traffic flow managers, pilots, airline dispatchers, and aviation forecasters. Urban air mobility applications may also benefit from improved turbulence observations and small-scale turbulence predictions. In addition, the program has a goal of reducing unnecessary rerouting of aircraft due to turbulence, which in turn reduces fuel-burn and carbon emissions. Research into long-term global turbulence patterns will enable better route planning in the future.

Specific areas of interest include:

1. Developing and operationalizing a global version of the Graphical Turbulence Guidance Nowcast (GTGN) at the National Weather Service in response to a Part 121 airline requirement;
2. Developing and operationalizing a global probabilistic Graphical Turbulence Guidance (GTG) product for the World Area Forecast System in response to an International Civil Aviation Organization requirement;
3. Developing and operationalizing a GTG upgrade that incorporates machine learning techniques to exploit the large availability of in-situ turbulence observations for training and combine turbulence indices in the GTG diagnostic ensemble;
4. Adapting the GTGN code package to assimilate Eddy Dissipation Rate (EDR) data calculated using the Automatic Dependent Surveillance - Broadcast (ADS-B) Vertical Rate (VR) algorithm;
5. Performing expanded studies of temporal and spatial variability of turbulence – during the past 40 years and future 40 years, globally and regionally – to identify impacts to air traffic routes;
6. Researching and developing products for urban turbulence observing and forecasting, for use in unmanned aerial systems (UAS)/advanced air mobility (AAM) operations;
7. Investigating new methods to infer turbulence location and intensity information from global remotely-sensed data such as satellite; and
8. Performing a sensitivity study of GTGN performance based on number of aircraft reporting EDR.

Space Weather Aviation (SWxA)

Space weather refers to the variable conditions on the Sun and in the space environment that can influence the performance and reliability of space and ground-based technological systems and endanger human health. Adverse space weather, such as solar flares, coronal mass ejections, solar radio bursts, solar energetic particles, galactic cosmic rays, and geomagnetic disturbances occur relatively regularly, with some having quantifiable effects on essential infrastructure systems and technologies. These can include unanticipated radio frequency communication and/or satellite communication (SATCOM) loss, global navigation satellite system (GNSS)-dependent navigation and surveillance performance degradation, unanticipated on-board electronics performance leading to reboots and anomalies, and problems with radiation exposure for both aircrew

and passengers. The goal of the Space Weather Aviation (SWxA) program is to improve space weather information used for aviation decision-making to support safer and more efficient aviation operations. Specifically, areas of interest include (but are not limited to):

1. Developing a capability to integrate space weather alerts and advisories into pilot flight planning and operational decision-support tools. This would enable changes in flight levels/routes or crew rostering, when necessary, while offering geographical visualizations for better decision-making. The development of example operational procedures linked to advisory levels could aid dispatchers, pilots, and air traffic control.
2. Capabilities to predict solar radio bursts with risk probabilities across frequency ranges, inspired by the December 14, 2023 event. Create tools to forecast solar flares with probabilities ranging from minutes to hours in advance.
3. Improve models predicting the impact of geomagnetic storms on GPS/GNSS systems and the occurrence of Sporadic-E. Provide location-specific probability maps (not just global indices) allowing users to decide route and altitude changes. Advance prediction capabilities for solar radiation storms and energetic particle events.
4. Develop a capability to develop and provide users with actionable, flight-level forecasts (e.g., radiation exposure at flight altitudes, HF/GNSS outage likelihood, scintillation risk along routes).

Model Development and Enhancement (MDE)

The goals of the Modeling and Development and Enhancement (MDE) project are to enhance aviation weather prediction capabilities to improve the safety of the National Airspace System (NAS) by supporting the transition from legacy Rapid Refresh (RAP) and High Resolution Rapid Refresh (HRRR) models to the unified, high-resolution Rapid Refresh Forecast System (RRFS). This system leverages advanced numerical weather prediction within the NOAA Unified Forecast System (UFS) framework, providing comprehensive, high-resolution weather forecasts across North America to better detect and mitigate weather hazards impacting aviation operations.

Specific areas of interest include:

1. Prototype Development and Enhancement
    - Developing prototype RRFS v2 with increased skill for aviation weather hazards
    - Continued development to enhance forecasting of aviation weather hazards

- Developing subsequent RRFS versions ensuring aviation needs are addressed

2. Code Management and Evaluation
    - RRFS v2 code freeze mitigations, management, and evaluations
3. Operational Implementation
    - RRFS v2 implementation into operations
4. Research and Innovation
    - Continued research and development for aviation weather hazards
    - Exploration of options for development and use of very high-resolution capability (< 3 km grid spacing)
5. Machine Learning (ML)
    - ML for Microphysics Parameterization – Developing ML-based replacements for traditional lookup tables to represent microphysical processes (e.g., accretion of rain on graupel)
    - Computational Efficiency in Weather Models – Improve the speed and efficiency of model computations through ML-driven parameterizations
    - Model Skill Evaluation Using ML Approaches – Assess how ML-based parameterizations impact model accuracy for winter snowstorms and summer convective weather events
    - Integration with Advanced Modeling Systems – Apply and test the ML-based methods within the latest versions of MPAS (Model for Prediction Across Scales) and Thompson-Eidhammer Microphysics Parameterization for Operations (TEMPO) frameworks

Weather Observation Research (WOR)

The goals of the weather observation research (WOR) project are to research, assess, and enhance surface weather observation capabilities in the National Airspace System (NAS) by integrating new sensor technologies and evolving user requirements, ensuring more accurate, timely, and reliable weather data for commercial and general aviation operations at departure and destination locations.

Specific areas of interest include:

1. Expansion of CASS (Cloud Automated Sensor System) and LTE (Long-Term Evolution) Telecommunications to Additional Weather Sensors
    - Explore and implement the integration of CASS and LTE telecommunications infrastructure to support a wider array of weather sensors, enhancing real-time data acquisition and transmission capabilities.
2. Field Study of CASS/LTE Paradigm to Address Weather Community Of Interest (Wx COI) Identified Observing Shortfalls
    - Conduct in-depth field research to evaluate the effectiveness and practicality of the CASS/LTE telecommunications paradigm in filling critical observational gaps identified by the Wx COI in weather monitoring. This includes prioritizing high-impact observation shortfalls to improve forecasting accuracy.
3. Collaboration with the National Weather Service (NWS) on Automated Surface Observing System 2 (ASOS2) Research and Development
    - Initiate and strengthen partnerships with the NWS to support the research, development, and deployment of the next-generation ASOS2, focusing on technological advancements and improved sensor integration.
4. Mitigation of Radio Frequency Interference for ASOS2 Implementation
    - Begin proactive efforts to identify, analyze, and mitigate radio frequency interference issues that could affect the operation and reliability of ASOS2 systems, ensuring robust and uninterrupted weather data collection.

Cloud Services for Aviation Weather (CSAW) Turbulence Weather Avoidance Polygons

The FAA is positioned at a pivotal juncture where emerging aviation weather capabilities—once seen as aspirational—are now ready for operational implementation through cloud-native environments. As part of the Cloud Services for Aviation Weather (CSAW) initiative, there is a strategic opportunity to integrate turbulence mitigation capabilities in parallel with the ongoing synthetic weather radar deployment, enabling a flexible, scalable, and capability-based approach that directly addresses longstanding National Airspace System (NAS) weather information shortfalls.

Recent developments in FAA weather strategy, research, and technology—particularly within the Aviation Weather Research Program (AWRP) and the Weather Technology in the Cockpit (WTIC) program—have produced operationally ready and maturing products that can support near-term implementation. These include the Graphical Turbulence Guidance versions 4 and 4.5 (GTG4/4.5), and the GTG-Nowcast (GTGN) product. These

innovations will significantly improve turbulence observation density, forecast accuracy, and real-time situational awareness—capabilities that were unattainable just a decade ago.

The following FAA-sponsored capabilities are primed for cloud integration under CSAW:

1. Graphical Turbulence Guidance (GTG4 and GTG4.5)
   GTG4, operational in early 2026, will utilize high-resolution (3 km) HRRR model data and include convective turbulence components, improving upon the legacy GTG3 product. GTG4.5, planned for 2027–2028, will incorporate machine learning to adaptively enhance forecast skill. These enhancements will significantly advance en route and preflight turbulence forecasting.

2. GTG-Nowcast (GTGN)
   Updating every 15 minutes, GTGN provides real-time turbulence awareness by blending model forecasts within situ and radar-based observations. With integration of ADS-B VR EDR data, GTGN's accuracy and resolution will be enhanced further. Operationalization at NWS is expected in Spring 2026, and outputs may support turbulence avoidance polygons and cockpit alerting via the Global Weather Note system.

As the FAA continues to expand its cloud-based weather services, integrating turbulence avoidance capabilities into the CSAW framework represents a critical and timely advancement. The maturity of multiple turbulence products, alignment with national safety priorities, and the flexibility of cloud infrastructure create a unique opportunity to transform turbulence forecasting and mitigation within the NAS. This integration will mark a significant step forward in improving aviation safety, operational efficiency, and resilience across all phases of flight.

Ground Icing (Holdover Impacts)

There are two active areas of ground icing research in support of FAA's safety mission for operations during winter conditions. Both focus on the determination of holdover times for aircraft de/anti-icing fluids, i.e., the estimated duration these fluids are effective in absorbing falling precipitation to prevent freezing or frozen contamination on critical surfaces of aircraft. One area investigates snow conditions, while the other addresses scenarios where multiple precipitation types occur simultaneously.

The ground icing research for *snow conditions* has been centered on the development of an artificial snow generation system to enable testing of de/anti-icing fluids in a controlled laboratory environment. The system designed by the incumbent and funded by FAA has been shown to be superior to its predecessor in reproducing more homogenously distributed snow with a significantly improved control over user-specified test conditions,

such as snow particle size and snow precipitation rate. The system's success, however, is assessed based on its ability to reproduce fluid failure times obtained during outdoor snow testing and the methodology to determine fluid failure times is not currently well-established. The fluid is considered failed when an observer visually examines the fluid-covered test plate and determines that precipitation is no longer being absorbed over one-third of the tested fluid. This approach is prone to error and possibly contributing to the existing scatter in the collected data. Furthermore, it has been reported that correlations between indoor and outdoor test data can be improved by controlling the test plate temperature.

Future work is needed, first, to reduce the variability in the data collected, and then to establish industry standards for use of the artificial snow generation system with the following specific areas of interest:

1. Investigating scientifically based methods for the determination of fluid failure times.

2. Assessing the sensitivity of the fluid failure data to the test plate temperature and its relation to the test condition temperature.

3. Updating/revising the existing industry standards for laboratory snow testing with well-defined requirements for data, data handling and test procedures in collaboration with the FAA and the SAE International G-12 Holdover Time committee.

The ground icing research for *simultaneously occurring conditions* has been centered on establishing holdover times under frequently occurring combinations of mixed-phase precipitation types. Continued research is needed with the areas of interest listed below:

1. Performing statistical analyses of the existing weather information databases to identify additional high impact combinations of simultaneously occurring precipitation types for continued support of the FAA Flight Standards in establishing holdover times.

2. Investigating the relationship between weather information databases and the liquid water equivalent (LWE) measurements employed in establishing holdover times.

3. Exploring methods for measuring individual precipitation type LWE rates when multiple precipitation types are reported.

4. Identifying inaccuracies for mixed-phase precipitations with obscurations such as freezing fog and freezing mist.

Weather Technology in the Cockpit (WTIC) - remote, crewed, and uncrewed

The goals of the Weather Technology in the Cockpit (WTIC) Program are to resolve adverse-weather shortfalls in safety, route efficiency, operational efficiency, and schedule delays, that are at least in part attributable to gaps in cockpit weather technology, displays, and information, or gaps in pilot (on-board and remote) weather knowledge and training. To achieve the goals of resolving these weather-related gaps and shortfalls, research is performed to identify applications of emerging technologies and decision support tools for use in crewed, uncrewed, and remote cockpits. To resolve weather information gaps, research is conducted on using data fusion, correlation, crowd sourcing, and other techniques to enable the use of non-certified sensors to enhance their data quality and to produce associated metrics of data confidence in their output for use by weather automation including the use of machine-to-machine weather interfaces. Human Factors research is performed to enhance pilot weather training and human factors designs of pilot, automation, and display interfaces. Many of the research results of this project support the advancement of global metrological information standards and other guidance documents. Specific areas of interest include, but are not limited to:

1. Research techniques and emerging technologies to perform acceptance, qualification, and self/calibration type testing of weather information from non-standard sensors and sources when there is a lack of a “gold standard or truth” for comparisons.

2. Enhance pilot weather training and the effectiveness of pilot preflight weather briefings with the use of emerging technologies including augmented and virtual reality, and artificial intelligence.

3. Develop techniques to enable weather information to be compatible with automation that has full or limited decision authority for aircraft adverse weather avoidance decisions of various levels of safety criticality, and methods for assessing the criticality of the avoidance decisions to enable aligning the confidence of the weather information with the decision criticality.

4. Perform human factors research on human-machine weather interfaces to enable pilots to monitor weather automation that lacks full decision authority and support standards development to safely implement these interfaces.

5. Research techniques for pilots and automation to reconcile conflicting and disparate weather sensor observations that are due to various sensor technologies, limitations, and update rates to enable safe weather avoidance decisions.

6. Develop artificial intelligence for use in weather aggregation by autonomously categorizing various types of non-certified (visibility, wind, ceiling, etc.) weather sensor outputs.

7. Research how the criticality of autonomous adverse-weather avoidance decisions impacts the necessary level of weather information accuracy and representativeness of the flight path, and the techniques of automation to confirm the quality/confidence of its weather inputs.

8. Research methods to aid pilots and cockpit weather automation in selecting the appropriate weather information and sources based on their aircraft type(s), avionics, operations, and weather-related decisions (i.e. go/no-go, divert, reroute, etc.). Aligning weather information with tasks and decisions.

9. Perform evaluations and assessments to identify design criteria for incorporation into standards for EFB weather applications to resolve issues related to the ease of information access, overlay confusion, functional complexity, and ability of pilots to verify the integrity and accuracy of the application's outputs.

Commercial Space

Currently, the method used to integrate commercial space traffic into the National Airspace System (NAS) results in restrictions being sized for the largest space vehicles that may use the airspace. The resulting fixed boundaries are typically activated for extended periods. Aircraft are rerouted around these larger restricted areas. These methods also affect space vehicle operators, as they require extensive coordination with various Air Traffic Control (ATC) entities and can make it challenging to accommodate launch delays and scrubs.

The FAA hopes to reduce the airspace restricted for each launch and the duration of the restriction. FAA also hopes to schedule the restrictions to accommodate conventional air traffic while still achieving the safety and space mission objectives. FAA will examine potential automation capabilities across multiple platforms, including the Traffic Flow Management System (TFMS), En Route Automation Modernization (ERAM), and the Standard Terminal Automation Replacement System (STARs). The use of ERAU for future demonstrations of commercial space concepts has been discussed at a high level

and is attractive due to its local expertise and proximity to the Cape Canaveral Space Launch Complex.

Research will examine the reduction in airspace restrictions for each space launch and the duration of these restrictions required to accommodate conventional air traffic while still achieving safety and space mission objectives. This research will help mature the concept and strengthen capabilities.

Pilot Safety and Training

Research examines how pilots are selected, trained, and gain aeronautical experience in civilian and military environments. Results improve understanding of how these factors affect pilot proficiency and aviation safety outcomes. The scope includes three human factors, research, engineering, and development (RE&D) tasks.

Class E (Upper Airspace) Traffic Management (ETM)

The project will explore and demonstrate the feasibility of integrating new entrants, including balloons, solar-powered Unmanned Aircraft Systems (UAS) hypersonic aircraft, and other technologies, into the NAS in Class E airspace above FL600. Traditionally used for military operations, Class E above FL600 currently has no specific regulations or mechanisms governing expanded commercial applications.

Many potential ETM applications are being developed by industry, such as weather monitors, Internet signal repeaters, pseudo-stationary UAS, pseudo-space vehicles, and hypersonic vehicles. These operations introduce complex challenges that must be addressed, including, but not limited to, integrating traditional Air Traffic Management (ATM) operations with ETM operations through the transition airspace and ensuring the safe and efficient management of traffic in the upper airspace.

The ETM project will plan and execute a demonstration of these emerging flight operations and their interaction with the National Airspace System by validating the ETM concept of operation, completing a gap analysis, developing the necessary system prototypes, and executing the demonstrations required in partnership with industry stakeholders to support the advancement and implementation of ETM.

Enterprise Information Management (EIM)/Automation Evolution Strategy (AES)

Enterprise Information Management identifies the key operational and infrastructure requirements for the NAS computing, platform, and mission software layers to support the proposed Automation Evolution Architecture. The activity will integrate Operating Environments, Information Security, and Mission and Common Service perspectives.

The FAA utilizes Artificial Intelligence (AI)/Machine Learning (ML)/)/Deep Learning (DL) in its EIM platform to enhance data management and decision-making processes. The FAA has developed AI/ML/DL products and chatbot applications that process multiple data sources and provide GenAI-generated answers. These solutions are part of the FAA's strategic plans to leverage technology for safety and operations, particularly in the context of the FAA Aerospace Forecast FY 2024-2044, which anticipates significant growth in the aviation sector.

This activity conducts engineering and analysis to support the potential use of Machine Learning/Artificial Intelligence (ML/AI) to support controllers in functions including aircraft separation. The ML/AI in the NAS program will engage with industry partners on digitization, outline lessons from learning algorithms, and develop a path to integrating user-benefit-driven AI applications to improve the NAS.

- **Planned Research Activities**

    a. Complete initial analysis of requirements for potential use of AI in support of controller functions.

    b. Complete initial safety risk management analysis for potential use of AI in support of controller functions.

    c. Complete final analysis of requirements for potential use of AI in support of controller functions. Complete final safety risk management analysis for potential use of AI in support of controller functions

    d. Conduct an initial study using a limited sample size to determine the effectiveness of AI learning on data related to aircraft separation.

- **Expected Research Products**

    a. Assess capabilities and controller functions that may be enhanced using AI.

    b. Learning algorithm lessons take advantage of the digitization industry knowledge and enable the FAA to develop a path toward integrating user benefits-driven applications in the NAS.

    c. Develop initial digital backbone, architectures, key metrics dashboard, identify critical deep learning algorithms and certification methods, as well as recommend the initial set of capabilities to be explored.

Trajectory-Based Operations (TBO)

TBO, a major goal of the FAA, is an air traffic management concept that enhances traffic flow planning to maximize throughput and flight predictability while minimizing fuel consumption. When optimized, TBO provides 4-D trajectory tools to air traffic managers and controllers to improve the balance between demand and capacity and to remove unnecessary static restrictions.

A main element of TBO is time-based management, which is conducted or supported through three decision support systems: the Traffic Flow Management System (TFMS), Time-Based Flow Management (TBFM), and the Terminal Flight Data Manager (TFDM).

From a systems engineering perspective, several future NAS programs will be connected to improve these systems, which support TBOs. The NAS Systems Engineering and Integration Office (ANG-B) aims to improve simulation capabilities to inform program priorities.

Advanced Air Mobility (AAM) Demonstration

This research project will focus on:

- **Connected Aircraft**
    a. New applicants

    b. Demonstration in FY27

- **Smart Routing**
    a. The Smart Routing for Connected Aircraft Smart Automated Routing (CASAR) project aims to develop a prototype system to validate the Connected Aircraft and Smart Routing Concepts. This prototype will be developed in collaboration with select industry partners to demonstrate the seamless integration of digital infrastructures, smart routing communications, and data-centric systems within the air traffic management domain. The project focuses on utilizing commercial data links to enable smart routing of information exchanges, enhancing performance for real-time communication between airspace users and ATM.

    b. As part of this initiative, information exchanges with varying priority levels will occur between aircraft and ground systems. These exchanges will leverage a combination of existing communication links and next-generation commercial technologies, such as satellite and 5G networks, to ensure data flow that meets the required performance. In this context, Smart Routing refers to the use of intelligent algorithms and data-driven

techniques to optimize and prioritize message delivery through performance-based communication links.

c. The CASAR prototype will validate these concepts in simulated environments, demonstrating the potential of the Smart Routing for the Connected Aircraft Concept.

Hyperconnected Airspace

The activity will evaluate system architecture alternatives, performance, and safety requirements, and establish an integrated roadmap for the development of future air traffic management services and policies that leverage emerging air/ground connectivity. To ensure global interoperability, this activity will include coordination with applicable International Civil Aviation Organization (ICAO) technical panels to mature the development of a global Connected Aircraft concept in accordance with the Aviation System Block Upgrade (ASBU)

framework.

- **Planned Research Activities.**

    a. Deploy a Data Distribution Platform that allows for the organization and distribution of connected aircraft software applications

    b. Conduct Hyper Connected ATM Systems Test/Analysis, Develop Concept Framework for Aircraft-to-Aircraft information exchange to expand from procedural "visual separation" to digital maneuvers.

    c. Develop concept and analysis on performance and implementation tradeoffs of various multi-path communications architectures and complete an Integrated Framework update to include findings of Hyperconnected ATM Test/Analysis.

- **Expected Research Products**

    a. An integrated CA framework to further advance concepts that leverage the connected aircraft, including the exchange of safety-critical information based on applicable

    b. performance standards.