REDAC / NAS Ops



New ATM Requirements BLI Number: 1A07C Presenter Name: Steve Bradford Date: September 1, 2020

Review of FY 2023 Proposed Portfolio

New ATM Requirements 1A07C

What are the benefits to the FAA

- The New Air Traffic Management (ATM) Requirements program is needed to identify new opportunities to improve the efficiency and effectiveness of air traffic management operations
- Activities include the research and development of procedures, tools, and systems in support of operational improvements
- These developments support the NextGen goal of expanding capacity and improving the strategic management of operations in the NAS

What determines program success

- The service analysis and operational demonstration activities within this program support the development of operational improvements that will increase the number of arrivals and departures at major airports
- The results of these early development efforts will transition into future standards, tools, guidance, and applications necessary for safe and effective airspace operations



New ATM Requirements / 1A07C Overview Capabilities

People:

- Portfolio Manager: David G. Howard, ANG C73
- Project Managers
- Subject Matter Experts (air traffic control specialists, meteorologists, information management and communications specialists)

Laboratories:

- Boeing Avionics Lab
- Honeywell IPS Labs
- Rockwell Collins Labs

- NASA Glenn Labs (communications standards development and validation work)
- NextGen Integration and Evaluation Capability (NIEC)
- Embry Riddle Florida Test Bed (FTB)



New ATM Requirements

FY20 Accomplishments

- Work started on Machine Learning/Artificial Intelligence applications which are being explored within aviation with a need to identify applications for use in the NAS, analyze applications for feasibility and benefits, and develop/deploy applications to improve airspace performance as well as users' operations
- Final Impact Analysis Support Documentation developed on Emerging Weather Requirements and Mitigation Plan
- Completed AGTS technical feasibility report and systems operational criteria. Continued work on the integration of AGTS prototype into the lab environment
- Continued work on the synchronization of trajectory information between Aircraft and Air Traffic Management (ATM) systems
- Completed suitability assessment for command and control systems, sub-systems and functions that can be re-architected for the cloud
- Continued work with FAA Cloud Service to install a Red Hat Enterprise Linux (RHEL) ERAM-in-a-Box Processor (EIBP) with the latest build in the Florida Test Bed (FTB). Work on-going to demonstrate various control interfaces to Cloud RHEL EIBP
- Developing ESI potential modernization alternatives, cloud migration strategies, potential NAS programs for re-hosting to other FAA programs via NAS Functional Analysis for Modernization (NMR)
- International Civil Aviation Organization (ICAO) and RTCA in development of standards for Aeronautical Telecommunications Network (ATN) over Internet Protocol (IP) communications
- Continued analysis of Connected Aircraft safety, risk, performance and security requirements
- Completed gathering of data distribution platform requirements surrounding the A/G SWIM Connected Aircraft concept. Continuing to develop a prototype data distribution environment



Weather Transition

This activity ensures that aviation weather research concepts are matured and technically developed under FAA guidelines to a level of readiness for operational use in the NAS. This includes Concept Maturity and Technology Development based work in support of the Research for Service Analysis and Service Analysis AMS lifecycle phases. The matured capabilities developed will support future weather information enabled decision support for the NAS.

Planned Research Activities

- FY21 Create, test and evaluate ceiling and visibility information support prototypes and conduct operational demonstrations to display pre-service functionality.
- FY22 Conduct studies surrounding the operational usage of convective weather information support capabilities, determine the performance level of current weather products and develop report.
- FY23 Analyze current inflight icing capabilities at low flight levels to validate gaps and develop report.

Expected Research Products

• Matured capabilities to support future weather information-enabled decision support for the NAS.



Future Communications

In collaboration with international partners, this activity will support the development of advanced communication technologies such as the Aeronautical Telecommunications Network (ATN) Internet Protocol Suite (IPS) standards for operational usage. This activity will result in the development and validation of Standards for Future Communications Infrastructure technologies. These advanced communications technologies will help to alleviate spectrum congestion issues and enable the achievement of more stringent NextGen performance requirements needed for future applications.

Planned Research Activities

- FY21 Complete report documenting requirements for a Software Defined Radio to support multi-modal operation
- FY22 Complete a report on the findings of investigating further usage of Software Defined Radios to support Multi-modal operations in the NAS environment.
- FY23 Document the findings of potential use of Commercial-off-the-Shelf (COTS) Equipment to meet future Data Communications requirements, including the quality service levels required and the regulatory and security considerations associated with the use of COTS hardware and software.

Expected Research Products

• Development and validation of Standards for Future Communications Infrastructure technologies.

Machine Learning/Artificial Intelligence in the NAS

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 seeks to engage with industry partners in digitization, to outline learning algorithm lessons and develop a path to integrating user benefit driven AI application for improving the NAS.

Planned Research Activities

- FY21 Complete initial analysis of requirements for potential use of ML/AI in support of controller functions.
- FY22 Complete initial safety risk management analysis for potential use of ML/AI in support of controller functions.
- FY23 Conduct initial study using a limited sample size to determine the effectiveness of AI learning on data related to aircraft separation.

Expected Research Products

- Determine assess capabilities and controller functions that may be enhanced by the use of artificial intelligence
- Learning algorithm lessons take advantage of the digitization industry knowledge and enables the FAA to develop a path toward integrating user benefits-driven application in the NAS.
- 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.

Air/Ground Trajectory Synchronization

The Air/Ground Procedure Synchronization activity will explore the aircraft trajectory synchronization concept of use and validate proposed solutions in collaboration with industry partners and operational stakeholders through simulations and potential flight trials. The activity will document and provide recommendations for the implementation of trajectory synchronization methodologies and integration of ATM functions to enable Trajectory Based Operations.

Planned Research Activities

- FY21 Complete Prototype and Integration document, Data Interaction and Exchange Requirements Document, Benefits and Evaluation Report, Enterprise Data Architecture integration planning document, and Technical Feasibility Document.
- FY22 Complete trajectory synchronization flight demonstration/trial and complete analysis on data collection/lessons learned from flight demonstration/trial.
- FY23 Develop preliminary air/ground trajectory synchronization implementation strategy with recommendations.

Expected Research Products

- Recommendations for the implementation of trajectory synchronization methodologies and integration of gate-togate ATM functions to enable Trajectory Based Operations.
- Requirements for exchange and synchronization of trajectory information between aircraft and ATM systems

Command & Control in a Cloud

This program evaluates the current information sharing infrastructure by focusing on the application of cloud infrastructures to provide for future NextGen needs. NextGen has started investigation of cloud solutions for its National Airspace System (NAS) operational systems. As a result, the Enterprise Services Infrastructure Framework (ESIF) was developed to support the allocation of NAS functional capabilities to infrastructure with a specific focus on cloud infrastructure. With ESIF providing this cloud- analysis framework, NextGen has started an analysis of ERAM in the Cloud, as a next step towards bringing these NAS operational systems into a cloud environment.

Planned Research Activities

- FY21 Develop prototype command and control instance in the cloud for a selected demonstrator system.
- FY22 Prepare and deliver a technology transfer package for Command and Control in the Cloud technologies.
- FY23 Identify, evaluate, and document NAS Systems potentially suitable for command and control in a cloud environment.

Expected Research Products

• Evaluation of and recommendations for cloud architecture to provide command and control services in the future.

Synchronization of Air/Ground SWIM (Connected Aircraft)

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 take advantage of the emerging air/ground connectivity. In order to ensure global interoperability, this activity will include the necessary 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

- FY20 Establishment of a data distribution platform that allows for the organization and distribution of connected aircraft software applications
- FY21 Identify ongoing projects and their activities that could potentially benefit from connected aircraft enhancements

Expected Research Products

• An integrated CA framework to further advance concepts that leverage the connected aircraft, including the exchange of safety critical information based on applicable performance standards



Next Generation Automation Input Devices

This activity will support the definition of requirements and concept development for an enterprise solution to next generation input devices for automation systems in the NAS.

Planned Research Activities

- FY21 Identify gaps in current input device capabilities for automation systems in the NAS and complete report.
- FY22 Identify and evaluate candidate technologies suitable for an enterprise solution for automation systems in the NAS and develop transition strategy.
- FY23 Down select identified candidate technologies for more in-depth assessment for automation systems in the NAS and complete report.

Expected Research Products

• Recommendations for next generation input devices for automation systems in the NAS.



IP Based Command and Control Data Links

This activity will conduct engineering and analysis to support the potential use of internet-based data exchange for command and control applications.

Planned Research Activities

- FY21 Complete initial analysis of performance, security requirements, and risk management analysis to support the potential use of internet-based data exchange for command and control applications.
- FY22 Complete final analysis of performance, security requirements, and risk management analysis to support the potential use of internet-based data exchange for command and control applications.
- FY23 Develop requirements for hardware application and link performance requirements to support the potential use of internet-based data exchange for command and control applications.

Expected Research Products

• Establish framework to potentially enable internet-based exchange of command and control information.



Emerging FY23 Focal Areas

- Machine Learning/Artificial Intelligence (ML/AI) for Air Traffic Management
 - Conducts engineering and analysis to support the potential use of ML/AI to support controllers in functions including aircraft separation.

New ATM Requirements

Research Requirements

The New ATM Requirements program is needed to identify new opportunities to improve the efficiency and effectiveness of air traffic management operations. Activities include the research and development of procedures, tools, and systems in support of operational improvements.

Outputs/Outcomes

- Weather data integrated into air traffic management systems.
- Requirements for exchange and synchronization of trajectory information between aircraft and ATM systems.
- Advanced communications technologies for data exchange between air and ground systems.
- Transition strategy and technology transfer package for Command and Control in the Cloud technologies.
- Enterprise solution to next generation input devices for automation systems in the NAS.
- Establish framework to enable internet-based exchange of command and control information
- Analysis in the potential use of AI to support controller functions

FY 2023 Planned Research

- Analyze current inflight icing capabilities at low flight levels to validate gaps and develop report.
- Develop preliminary air/ground trajectory synchronization implementation recommendations.
- Develop initial trajectory synchronization implementation strategy
- Complete final analysis of requirements for potential use of AI in support of controller functions.
- Identify, evaluate, and document NAS Systems potentially suitable for command and control in a cloud environment.

Out Year Funding Requirements

| -&F | FY21 | FY22 | FY23 | FY24 | FY25 |
|-----|---------|---------|---------|---------|---------|
| ~ | \$ 7.5M | \$ 7.5M | \$ 7.5M | \$ 7.0M | \$ 7.0M |