# Next Generation Air Transportation System (NextGen)

## White Paper

GR0042-WPR
Rev: C
Date: 22-February 2021

**Global Aerospace Design Corporation**
151 W. 4th Street #50
Cincinnati, Ohio 45202
+1 513 304 9315

# Table of Contents

## LIST OF ACRONYMS AND ABBREVIATIONS

| Acronym | Definition |
|---|---|
| AC | Advisory Circular |
| ADS-B | Automatic-Dependent Surveillance Broadcast |
| ATC | Air Traffic Control |
| CATM | Collaborative Air Traffic Management (CATM) |
| CFR | Code of Federal Regulations |
| Corp. | Corporation |
| CPDLC | Controller Pilot Data Link Communication |
| Data Comm | Data Communications |
| EGNOS | European Geostationary Navigation Overlay |
| ERAM | En-Route Automation Modernization |
| FAA | Federal Aviation Administration |
| FANS | Future Air Navigation System |
| GAGAN | GPS Aided Geostationary Augmented Navigation |
| GBAS | Ground Based Augmentation System |
| Global | Global Aerospace Design Corporation |
| GPS | Global Positioning System |
| Hz | Hertz |
| LPV | Localizer Performance with Vertical Guidance |
| MSAS | Multifunctional Satellite Augmentation System |
| NAS | National Airspace System |
| NextGen | Next Generation Air Transportation System |
| PBN | Performance Based Navigations |
| RTCA | Radio Technical Commission for Aeronautics |
| SNAS | Satellite Navigation Augmentation System |
| STARS | Standard Terminal Automation Replacement |
| SWIM | System Wide Information Management |
| TAMR | Terminal Automation Modernization and Replacement |
| TBFM | Time Based Flow Management |
| U.S. | The United States of America |
| VHF | Very High Frequency |
| WAAS | Wide Area Augmentation System |

## REFERENCES

| Document | Title |
|---|---|
| AC 20-165B | Airworthiness Approval of Automatic Dependent Surveillance – Broadcast (ADS-B) Out Systems |
| 14 CFR Part 91.225 | Automatic Dependent Surveillance – Broadcast (ADS-B) Out Equipment and Use |
| 14 CFR Part 91.227 | Automatic Dependent Surveillance – Broadcast (ADS-B) Out Equipment Performance Requirements |
| NGATS v1 1204r | Next Generation Air Transportation System Integration Plan, Joint Planning & Development Office (nasea.faa.gov) |
| Edition 1.0 | Civil-Military CNS/ATM Interoperability Roadmap |
| Federal Register | Department of Transportation, ADS-B Part III, May 28, 2010 |
| RTCA/DO-260B | Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B) |
| N/A | FAA NextGen Implementation Plan 2018-2019 |
| N/A | FreeFlight Systems, April 30, 2010 |
| N/A | Honeywell – Upcoming Industry Mandates and Avionics Technology, March 8, 2011 |

# 1 ABOUT GLOBAL AEROSPACE DESIGN CORP.

Global Aerospace Design Corporation (Global) is a technical services organization comprised of a highly experienced engineering staff focused on meeting your aircraft certification needs both in front of and behind the cockpit door. Our depth of experience with projects, ranging from full interior modification projects to complete cockpit upgrades, permits Global to provide technical solutions from nose-to-tail on any aircraft.

Comprised entirely of aircraft engineers, Global has the dedicated focus of maintaining positive cash flow while keeping overhead costs extremely low. This permits direct cost savings to our customers and maximizes our ability to outperform other integration services competitors.

## 1.1 Document Overview

This white paper provides an overview of the Federal Aviation Administration's (FAA) vision for the Next Generation Air Transportation System (NextGen).

NextGen is a comprehensive overhaul of our national airspace system to make air travel more dependable and safer. The NextGen initiative is about half-way through a multi-year implementation plant. The FAA plans to keep introducing technologies, procedures, and policies through 2025 and beyond. NextGen encompasses the following critical infrastructure programs and technologies:

1) **ADS-B** – Automatic Dependent Surveillance – Broadcast (In and Out)
2) **Data Comm** – Data Communications
3) **STARS** – Standard Terminal Automation Replacement
4) **ERAM** – En-Route Automation Modernization
5) **TAMR** – Terminal Automation Modernization and Replacement
6) **SWIM** – System Wide Information Management

Additional, less critical, NextGen programs include:

- Improved Surface Operations
- Improved Approaches and Low-Visibility Operations
- Improved Multiple Runway Operations
- Performance Based Navigation (PBN)
- Time Based Flow Management (TBFM)
- Collaborative Air Traffic Management (CATM)
- Separation Management
- On-Demand NAS Information
- Environment and Energy
- System Safety Management
- NAS Infrastructure

# 2 AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST

## 2.1 System Overview

Automatic Dependent Surveillance – Broadcast (ADS-B) is an aircraft and satellite-based transmission system. ADS-B can be broken into two primary functions: ADS-B Out and ADB-B In. An aircraft equipped with ADS-B Out functions by sending GPS-derived position and velocity data from onboard avionic systems. ADS-B In provides aircraft-to-aircraft position and velocity data on a cockpit display. ADS-B Out enhances safety by making an aircraft visible, real-time, to Air Traffic Control (ATC) and to other appropriately equipped (ADS-B In) aircraft with position and velocity data transmitted at a 1Hz rate. ADS-B will update activity on ATC displays with more frequency and with greater accuracy. With ADS-B Out, controllers can use airspace more efficiently.

## 2.2 Mandates

The FAA requires aircraft operating in most controlled U.S. airspace be equipped with ADS-B Out by January 1, 2020. However, there are no mandates for ADS-B In currently.

The European Union Aviation Safety Agency originally mandated ADS-B Out by June 6, 2020; however, due to the COVID-19 Pandemic, European Union Implementing Regulation 1207/2011 has been amended to grant the following extensions:

- December 7, 2020 for aircraft being issued with first individual Certificate of Airworthiness on or after December 7, 2020
- June 7, 2023 for aircraft being issued with first individual Certificate of Airworthiness between June 6, 1995 and June 6, 2020
- Aircraft with first individual Certificate of Airworthiness issued before June 6, 1995 will be exempt

Aircraft that have been granted an extension until June 7, 2023 must have a retrofit program established by December 7, 2020 demonstrating compliance prior to June 7, 2023.

# 3 DATA COMMUNICATION

## 3.1 System Overview

The Data Comm program will provide several communication services that aim to improve the quality and efficiency of communication between pilots, airlines, and air traffic controllers. This program will provide communication services between pilots and air traffic controllers, as well as enhanced information to airline operators. Data Comm will establish a data interface between ground automation and the flight deck. Thus, allowing the flight deck to provide the pilot with valuable information. The aim of the Data Comm program is to enhance the quality of communication between the flight crew and air traffic controls in hopes to reduce the amount of communication errors while increasing the safety and efficiency of every flight.

## 3.2 Implementation

Data Comm is the driver for Future Air Navigation System (FANS) 1/A+ which encompasses communicating over VHF Data Link Mode 2 and Inmarsat or Iridium. This communication is typically called Controller Pilot Data Link Communication (CPDLC). Coupled with voice communications across all networks, this increases efficiency and flexibility of the airspace.

# 4 AUTOMATION

## 4.1 System Overview

To ease controller's ability to handle growing air traffic volumes, the FAA is introducing two automation platforms: The Standard Terminal Automation Replacement System (STARS) and En-Route Automation Modernization (ERAM).

### 4.1.1 Standard Terminal Automation Replacement System (STARS)

STARS enables core NextGen NAS capabilities at terminal sites:

- Processes ADS-B data
- Backup capabilities to prevent system failure
- Enables controllers to track more aircraft, expands local weather surveillance, and increases airspace surveillance radius
- Aids controllers with separation sequencing, conflict/terrain avoidance alerts, weather advisories, and radar vectoring for departing and arriving aircraft traffic

### 4.1.2 En-Route Automation Modernization (ERAM)

ERAM automation platform enables core NextGen NAS capabilities at en-route sites:

- Provides open software that can be updated as NAS operational needs evolve
- Provides two full-functional channels
    - Eliminates system downtime as a result of scheduled and unscheduled outages
    - Increases flexibility for scheduled maintenance
- Provides separation of mission-critical and non-mission-critical functions

# 5 SYSTEM WIDE INFROMATION MANAGEMENT (SWIM)

System Wide Information Management (SWIM) serves as the digital data-sharing platform for NextGen. SWIM improves the FAA's ability to securely deliver information by providing access to real-time relevant information, ultimately increasing collaborating among the aviation community, and reducing overhead costs.

## 6 PERFORMANCE BASED NAVIGATION (PBN)

Performance Based Navigation (PBN) utilizes advanced satellite-based navigation, to create more accurate and precise flight path procedures. PBN aims to free up airspace by reducing the length of flight paths.

Aircraft that rely on GPS or Wide Area Augmentation (WAAS) are capable of navigating airspace with greater precision and accuracy.

### 6.1 Wide Area Augmentation System (WAAS)

The Wide Area Augmentation System (WAAS) is an air navigation aid funded by the Federal Aviation Administration to augment the Global Positioning System (GPS), with the goal of improving its accuracy, integrity, and availability. Essentially, WAAS is intended to enable aircraft to rely on GPS for all phases of flight, including precision approaches to any airport within its coverage area. WAAS permits a Localizer Performance with Vertical guidance (LPV) approach enabling descent as low as 200-250 feet above the runway and a precise 40m lateral limit. There are over 1800 LPV approaches in use today and the FAA is publishing over 300 new LPV approaches per year.

The list below identifies WAAS and other countries similar systems:

| | | |
|---|---|---|
| WAAS | Wide Area Augmentation System | US, Canada, Mexico |
| EGNOS | European Geostationary Navigation Overlay | Europe |
| MSAS | Multifunctional Satellite Augmentation System | Japan |
| GAGAN | GPS Aided Geostationary Augmented Navigation | India |
| SNAS | Satellite Navigation Augmentation System | China |
| GBAS | Ground Based Augmentation System | Australia |

## 7 CONCLUSION

NextGen is an ambitious modernization effort to increase the efficiency and safety of U.S. controlled airspace. It encompasses innovative policies and technologies that aim to usher the aviation industry into a new age for years to come.

## 8 GLOBAL EXPERIENCE


### ABOUT US

Located in Cincinnati, Ohio and established in 2012, by a group of talented ex-airline professionals with over 30 years of industry experience, *GLOBAL* is a highly talented engineering team dedicated to meeting all aircraft certification and modification needs.

### WHY CHOOSE US

*GLOBAL* will always treat our customers as though our business depends on it! Our team is known for being highly reactive and responsive to any and all customer needs. We are dedicated to supporting our customers to the highest standard.

### AVIONICS

*GLOBAL* has experience on the flight deck as well as in the cabin. Our team can integrate any system on every type of aircraft.

### CABIN INTERIORS

*GLOBAL* has gone on to complete several interior programs for a wide variety of customers. These programs ranged from minor LOPA changes to complete interior retrofits.

### CABIN ELECTRONICS

*GLOBAL* is able to provide cabin electronics solutions as well. The *GLOBAL* team can provide system integration solutions for all cabin equipment and ensure that everything is fully qualified to be on the airplane.

### T-PED TESTING

Transmitting Portable Electric Device testing demonstrates that an aircraft is tolerant to the use of portable electric devices from gate to gate. This testing is a necessary step for the integration of Wi-Fi and wireless in-flight entertainment.

**Global Aerospace Design Corp.**
Address: 151 W 4th Street #50, Cincinnati, OH 45202
Phone: +1.513.304.9315 | Web: www.gadc.aero | Email: info@gadc.aero