

ARCHIVED REPORT

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Outlook

- After the U.S. ATC segment achieved record high statistics in the 2019 calendar year, the impact of the COVID-19 pandemic led to record lows in 2020
- The FAA achieved 30 out of 30 NextGen milestone goals in FY20
- Air transportation statistics are expected to continue their path to recovery through the rest of 2021, but still fall well below historical levels

Orientation

Description. This report surveys efforts to modernize air traffic management and control in the United States.

Sponsor. The U.S. government and its institutions, including the Federal Aviation Administration (FAA) and the Joint Planning and Development Office.

Status. Ongoing modernization and operation.

Application. The systems, software, hardware, protocols, and institutions used to manage air traffic in the United States.

Technical Data

Since 1981, the U.S. FAA has been executing a program to modernize the U.S. National Airspace System. NAS infrastructure includes the air traffic control system, which relies on an extensive array of information technology systems, including radars, automated data processing systems, navigation and communications equipment, and ATC facilities. NAS infrastructure also includes more than 215,000 commercial and recreational aircraft as well as more than 19,000 airports.

In 2003, Congress authorized the establishment of the Joint Planning and Development Office (JPDO) to produce and implement an integrated plan to develop the Next Generation Air Transportation System (NGATS or NextGen) for the United States capable of

meeting the air traffic demand expected by 2025. The infrastructure of the NGATS, like that of the NAS, will include the air traffic control system, commercial and recreational aircraft, and airports. In contrast with NAS modernization, which has occurred primarily under the purview of the FAA and has a 10-year planning horizon, the JPDO is charged with coordinating the activities of multiple U.S. government agencies, including the FAA, to plan and develop NGATS.

In the context of the overall U.S. ATC system, the majority of this report focuses on ATC modernization efforts under both the NAS modernization program and the JPDO's effort to develop a NGATS for the U.S. by 2025.

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Program Review

The following details recent ATC activity in the United States.

In March 2009, Raytheon announced it had received a contract to develop the NextGen Terminal Data Distribution System (TDDS), which will make more efficient use of the crowded airspace over the United States. The contract was awarded by the U.S. Department of Transportation's Volpe National Transportation Systems Center, part of the Research and Innovative Technology Administration. The Volpe Center provides key support to the FAA on the Next Generation Air Transportation System. According to Raytheon, the TDDS will automate flight information, resulting in improved capacity in the nation's airspace.

In May 2009, Raytheon was awarded a seven-month contract to study the NextGen Integrated Communications, Navigation and Surveillance architecture and determine the National Airspace System's needs for 2018 to 2025.

In May 2010, the FAA awarded Lockheed Martin a five-year, \$28 million contract to design and integrate a supply chain software platform that supports the maintenance, repair, and tracking of equipment used by the nation's NAS. Called the Logistics Center Support System, this commercial off-the shelf (COTS) solution optimizes the maintenance, inventory, and delivery of more than 100,000 pieces of equipment such as radar systems, lighting, and communications relay stations used by the NAS throughout its 41,000 facilities.

In May 2010, General Dynamics was one of three contractors selected for the FAA's System Engineering 2020 Research and Development/Mission Analysis Support program. The 10-year contract has a maximum potential value of \$1.2 billion if all options are exercised. Funding will be awarded through individual task orders. Through this program, GD will support the FAA's NextGen modernization program by providing research and development, as well as systems engineering services. The work will focus on achieving a series of operational capabilities, including trajectory-based operations; increased arrivals and departures at high-density airports; increased flexibility in the terminal environment; improved collaborative air traffic management (ATM); advanced flight-deck technologies; reduced weather impact; improved safety, security, and environmental performance; and facility transformations.

The General Dynamics team will provide mission-analysis support in areas such as ATM automation, airplane design and analysis, avionics systems

operations and maintenance, cost-benefit analysis, NAS security, and NAS air traffic facility certification. It will also assist in large-scale demonstrations. The company will provide systems integration, development and operations expertise, modeling and simulation capability, and ground- and air-based information and communications systems upgrades.

In June 2010, the FAA awarded Boeing a contract worth up to \$1.7 billion for NextGen R&D. Under the contract, Boeing will primarily provide ATM modeling and simulation. Specifically, Boeing will demonstrate NextGen procedures in real time on a large scale within the current air traffic system.

In September 2011, the FAA announced an initiative to implement NextGen capabilities to improve air traffic flow for an entire region, or metroplex. By optimizing airspace and procedures in a metroplex, the FAA provides solutions on a regional scale, rather than focusing on a single airport or set of procedures. The optimization plan takes into account all airports and airspace that support each metropolitan area, as well as how air traffic in those areas interacts with other metroplexes. It considers myriad factors, including safety, efficiency, capacity, access, and environmental impact.

Using a consistent, repeatable approach, study teams of FAA and aviation community experts analyze the operational challenges of metroplexes and explore airspace and procedure optimization opportunities. Collaborative design and implementation teams then carry out the solutions the study teams recommend, including performance-based navigation procedures and airspace redesign. The FAA has identified 21 metroplexes – geographic areas that include several proximate commercial and general aviation airports serving large metropolitan areas.

In August 2012, Harris Corporation was awarded a 15-year, \$291 million contract to provide the communications network that will serve as the cornerstone of NextGen. Under the National Airspace System (NAS) Voice System (NVS) contract, Harris will provide a secure, Internet Protocol-based voice communications network based on its VCS21 family of COTS voice communication solutions. NVS will be installed in ATC facilities across the U.S., creating a modern voice network for communications between air traffic controllers, pilots, and ground personnel.

Harris will integrate voice communications systems at ATC facilities nationwide. The company also will

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provide remote radio equipment and network integration and management services.

In August 2013, the FAA authorized Harris to begin work on the seven-year, \$150 million Data Communications Network Services (DCNS) element of its Data Communications Integrated Services program. Under DCNS, Harris will provide the terrestrial circuits and VHF datalinks that connect ground-based air traffic controllers and airborne flight crews. According to Harris, this will enable air traffic controllers and pilots to communicate more effectively by supplementing traditional voice communications with data to enhance departure clearances, as well as weather route and other air traffic procedures.

On September 19, 2013, the FAA and local officials dedicated a new, environmentally friendly airport traffic control tower at Palm Springs International Airport. The tower replaced a facility that had served the airport since 1967. The new tower is 150 feet tall – two and a half times the height of the old tower – and provides air traffic controllers with better sight lines as well as a more efficient work space. It sits atop a 7,000-square-foot base building.

During the Air Traffic Control Association conference held October 20-23, 2013, in Washington, DC, United Airlines announced it was committing itself to equipping its aircraft with digital avionics under the FAA's NextGen data communications equipage incentive program. The program adds digital text to the current voice-only messaging for pilot-to-controller communications and automates many of today's routine air traffic control and en route voice communications with specialized data messaging. United said that over the next six years, it planned to equip up to 397 of its aircraft with the avionics equipment necessary to provide pilot-to-controller digital communications.

In October 2013, Harris announced that it had delivered three demonstration voice communications platforms that will enable the FAA to optimize the new ATC communications system. The deliveries are part of the 15-year NVS contract awarded to Harris in 2012. The demonstration systems were installed at the William J. Hughes Technical Center in Atlantic City, New Jersey; the Mike Monroney Aeronautical Center in Oklahoma City, Oklahoma; and the Harris NVS Demonstration Laboratory in Melbourne, Florida.

On November 14, 2013, the FAA dedicated the \$33 million, state-of-the-art airport traffic control tower and Terminal Radar Approach Control (TRACON) at Boise Air Terminal/Gowen Field. The 255-foot-tall tower is nearly three times taller than the old tower, which was built in 1975, and provides air traffic controllers with better airfield views. The new tower

and TRACON also feature the latest radar and communications technology to ensure the safest and most efficient service into and out of Boise. The new tower is topped by a 525-square-foot cab with three air traffic controller positions and one supervisor position. An 11,000-square-foot base building houses the TRACON, equipment rooms, and administrative offices.

On November 14, 2013, the FAA dedicated the 236-foot-tall, environmentally friendly airport traffic control tower at Oakland International Airport. Construction of the tower and a 14,000-square-foot base building was partially funded by a \$33.2 million grant awarded via the American Recovery and Reinvestment Act. The grant was the FAA's largest single ARRA award. The new control tower replaced two air traffic control towers that had served Oakland International Airport for more than 40 years.

In April 2014, the FAA dedicated a new ATC facility that would better handle the anticipated growth in flight operations in the Houston, Texas, area. The 47,500-square-foot TRACON replaced an outdated structure that had been commissioned more than 40 years earlier. The new TRACON is located on 21 acres of land at George Bush Intercontinental Airport. The Houston TRACON is responsible for controlling air traffic over roughly 16,000 square miles of airspace stretching from the Texas-Louisiana border to approximately 35 miles east of Austin and from Galveston to 30 miles north of College Station.

Also in April 2014, the FAA announced the completion of a nationwide infrastructure upgrade that will enable air traffic controllers to track aircraft with greater accuracy and reliability while giving pilots more information in the cockpit. This upgrade is a key improvement in the Next Generation Air Transportation System. The nationwide installation of the Automatic Dependent Surveillance-Broadcast (ADS-B) radio network supports a satellite-based surveillance system that tracks aircraft with the help of GPS. This provides more accurate aircraft location information than the current radar system.

On June 19, 2014, the FAA joined local officials in breaking ground for a new \$26 million air traffic control tower at Tucson International Airport. At about 250 feet tall, the new tower, which became operational in 2016, is more than double the height of the old tower, which was 55 years old. It provides air traffic controllers with better airfield views and makes it easier for them to determine the positions of aircraft on the ground and in the skies around the airport.

In February 2015, the FAA dedicated a new \$16.4 million, state-of-the-art airport traffic control

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tower at Fort Lauderdale Executive Airport. The new tower is equipped with the latest radar, communications, and weather technology. The new facility includes a 117-foot-tall airport traffic control tower topped by a 525-square-foot tower cab. A 7,200-square-foot single-story base building houses training rooms, administrative offices, and equipment rooms.

As of February 2015, the FAA had installed 634 ADS-B ground stations throughout the U.S., completing baseline deployment of the network.

In 2016, the FAA planned to install three ADS-B ground stations in Mexico, improving coverage in the Gulf. The new stations would benefit aircraft flying over the Gulf between the United States and the Yucatán Peninsula, allowing for a 5-nautical-mile separation of aircraft where 100 nautical miles of separation was previously required. The FAA estimated that the additional ADS-B radios in Mexico would provide seamless surveillance coverage for Gulf of Mexico air traffic routes, allowing reduced aircraft separation and increasing capacity to about 85 aircraft per hour, up from the current 75.

New Initiatives, New Technology

En Route Automation Modernization (ERAM) is one of the foundational programs that make it possible for NextGen to realize its full potential. ERAM replaces the 30-year-old HOST computer system at the 20 air traffic control centers in the contiguous United States. All 20 ERAM sites have achieved Initial Operational Capability. Centers in Atlanta, Georgia and Jacksonville, Florida, achieved IOC in July and September 2014, respectively. Full deployment of ERAM at all centers was slated to be completed by March 2015.

The FAA planned to implement approximately 30 new Performance Based Navigation (PBN)/En Route Area Navigation (RNAV) procedures in the Atlanta Metroplex between February 2016 and September 2016. Whether this schedule was met is unconfirmed. The Charlotte Metroplex, meanwhile, planned to implement 39 new PBN/RNAV procedures between August 2015 and January 2017. These new metroplex projects would allow more efficient use of airspace and provide improved arrival and departure flows.

In February 2017, the U.S. FAA announced it had spent \$7.5 billion in congressionally appropriated funds on NextGen over the past seven years. According to the FAA, that investment had to date resulted in \$2.7 billion in benefits to passengers and the airlines, and is expected to yield more than \$160 billion in benefits through 2030.

During the same month, the FAA announced that Kenya now complied with international safety standards and had been granted a Category 1 rating under the agency's International Aviation Safety Assessment (IASA) program. According to the FAA, this rating means that Kenya's civil aviation authority meets International Civil Aviation Organization (ICAO) standards. It also means Kenyan air carriers that are able to secure the requisite FAA and DoT authority can establish service to the United States and carry the code of U.S. carriers.

In March 2017, the FAA announced that the NextGen technology known as Data Comm was helping to enhance safety and reduce departure delays at Miami International Airport, the 12th busiest airport in North America and the largest gateway to Latin America.

According to the FAA, the new technology supplements radio voice communication, enabling controllers and pilots to transmit important information, including clearances, revised flight plans, and advisories, with the touch of a button.

It was further announced that Data Comm was operational at 55 air traffic control towers, following a rollout that was under budget and more than two and a half years ahead of schedule. The FAA announced that Data Comm was up and running at five airports in the New York metropolitan area: John F. Kennedy, LaGuardia, Newark, Teterboro, and Westchester. One month later, the FAA announced that Data Comm was live at Minneapolis-Saint Paul International Airport.

In August 2017, the FAA announced that it would be bringing Data Comm to Seattle-Tacoma International Airport.

On July 6, 2017, the FAA announced that it would be accepting applications from candidates for entry-level air traffic controller positions later that month. Applicants were to be separated into two candidate pools based on whether they were graduates of the Collegiate Training Initiative program or from the general public.

2018/19 News

The Trump administration issued a 132-page plan to streamline the Department of Transportation in June 2018. Among the changes proposed was a spin-off of the FAA into a non-profit, private sector enterprise, an idea that has been previously proposed with little enthusiasm from Congress and that was again met with disapproval. In October 2018, Congress passed a bill reauthorizing the FAA to conduct air traffic oversight for an additional five years.

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Flight traffic between the Northeast U.S., Florida, and the Caribbean improved greatly in 2018. On November 8, 2018, the FAA implemented 55 new PBN routes covering the area, a move that is expected to optimize traffic patterns.

One of the largest topics of discussion within the U.S. ATC sector of late was the deadline for implementation of ADS-B Out. The FAA had set a firm deadline of January 1, 2020, for aircraft to be equipped with ADS-B Out functionality, a date that the agency had reiterated many times, with a strongly worded reminder appearing in April 2019.

As part of a plan to reduce the burden of ADS-B Out upgrade costs on general aviation operators, in September 2016 the FAA launched a rebate system, with each rebate having a value of \$500. The program ran to September 2017; more than 10,000 payments were issued. The FAA relaunched the rebate program on November 15, 2018, and a month later, an additional 1,438 rebates had been claimed out of a total 9,792 rebate reservations available through October 11, 2019.

As of 2019, concern over the rise of unmanned aircraft system (UAS) activity had been growing for over a decade. As part of a remedy to the UAS problem, the FAA instituted the Low Altitude Authorization and Notification Capability (LAANC) in November 2017, a program that grants near-instantaneous flight approvals to UAV operators, allowing quick flight plan changes. As of November 2018, the FAA had approved 14 LAANC service providers, covering 300 air traffic facilities serving 500 airports, and approved more than 50,000 drone operator applications. In January 2019, the FAA began considering applicants to expand beyond the 14 LAANC service suppliers. The application window ran from January to March, and formal selection and startup would occur from August through October.

2018/2019 Shutdown

In late 2018 and early 2019, the U.S. government and the FAA were crippled after President Donald Trump refused to ratify a budget that did not include allocations for construction of a barrier, the so-called wall, along a large portion of the U.S.'s border with Mexico. This stance set in motion the shutdown of a large portion of the U.S. government, lasting a record 35 days. By late December 2018, FAA appropriations had lapsed.

The situation reached crisis levels at the FAA when, in January 2019, the National Air Traffic Controllers Association (NATCA) filed a lawsuit against the U.S. government on behalf of its unpaid members. Allegations included violations of the Fair Labor Standards Act for failure to pay at least minimum wage

to air traffic controllers and other NATCA members who were forced to work without pay during the government shutdown.

On January 25, with aviation safety at a modern low, six air traffic controllers (out of a rostered 13) called out "sick" – possibly in retaliation for unpaid duty – at a Virginia ATC facility. By mid-morning, air traffic across the United States was hamstrung, with delays growing to unprecedented levels and every flight, especially those in the Northeast, facing elevated danger. With air travel in the U.S. at a near standstill, President Trump agreed to resume funding the government through mid-February.

In the aftermath of the government shutdown, in February 2019, NATCA President Paul Rinaldi told the U.S. House of Representatives Committee on Transportation and Infrastructure that, although conditions had improved greatly since the shutdown ended, the NAS was ... "less safe today than it was before the shutdown began." A cited example was the 90-day delay of technological enhancements that would prevent wrong surface landings at eight major airports. Moreover, Rinaldi told Congress, the shutdown greatly harmed aviation safety professionals, creating a situation he believed would further exacerbate the FAA's air traffic controller staffing crisis and damage the system as a whole.

2019/2020 News

In its FY19 Performance and Accountability Report, the FAA noted that it had completed 61 of 65 NextGen program milestones on time. The agency achieved a 97.5 percent success rate in FY19, accomplishing 40 out of 41 NextGen milestone goals.

In FY19, the FAA implemented Data Comm services at all 20 of its "large air traffic control facilities" for high-altitude transit. As indicated above, the Data Comm service provides digital communication between pilots and air traffic controllers, alongside an enhanced ATC information stream to airline operations centers. The more robust communication capabilities and the depth of available flight data are expected to contribute to more efficient ATC movement and greater safety.

Following major ATC disruptions resulting from the government shutdown (2018 into early 2019), the U.S. air traffic industry recovered and achieved record operations in the 2019 calendar year. However, 2020 statistics would be severely impacted by the COVID-19 outbreak.

Arising in China – with reports of the virus originating in December 2019 – the COVID-19 virus rapidly spread across the planet. By March 2020, the COVID-19 pandemic threatened the world's aerospace industry,

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with passenger numbers declining and the number of so-called ghost flights (empty or near empty) increasing, especially in the European region.

The U.S. Bureau of Transportation Statistics stated that airline traffic increased 1.9 percent, from 10,025,396

flights to 10,220,270 flights, in 2019. The total passenger count increased 3.9 percent to 1,052,974,628. The number of flights was the highest since 2008, and the passenger count was a record high.

Worldwide Distribution/Inventories

The U.S. FAA is responsible for modernizing air traffic control in the **United States**.

Forecast Rationale

In 2003, Congress authorized the establishment of the Joint Planning and Development Office to produce and implement an integrated plan to develop the Next Generation Air Transportation System (NGATS or NextGen) for the U.S. capable of meeting the air traffic demand expected by 2025. This program would revolutionize the U.S. Federal Aviation Administration's airspace in a program that is somewhat synonymous with overhauls being introduced by Europe's Single European Sky program.

NextGen Updates

In July 2019, the FAA published an updated NextGen Priorities Joint Implementation Plan covering the period 2019 through 2021. The updated plan included additional focus on data communications through the rollout of data communications services to seven towers, as well as a focus on Performance Based Navigation optimization through Time Based Flow Management decision supporting tools.

The 2019-2021 NextGen Priorities Joint Implementation Plan highlighted the need for improvements to the following areas:

- Data Communications
- Northeast Corridor ATC
- Multiple Runway Operations
- Performance Based Navigation
- Surface and Data Sharing

In its FY20 Performance and Accountability Report, the FAA noted that it had completed 30 out of 30 of its NextGen program commitments for the year. The agency originally had 35 commitments scheduled, but had to move five of these to FY21 due to impacts from the COVID-19 pandemic.

2020 Data

In 2020, the COVID-19 pandemic had huge impacts on commercial air travel. Based on the U.S. Bureau of

Transportation Statistics' official January through November figures, if travel trends continued through December, only 5,737,408 flights would be logged in 2020. The count was down 43.9 percent from 2019's 10,220,270 flights. Meanwhile, reflecting the decreased number of passengers per flight versus years past, total passengers dropped 62.0 percent, from 1,052,974,628 in 2019 to just 399,610,803. (These numbers are inclusive of domestic and international air travel.)

In its August 2020 Air Traffic by the Numbers report, the FAA revealed that in FY19, it handled 16.405 million flights. These broke down to 10.390 million scheduled flights and 6.015 million unscheduled flights. These flights were handled by 5,082 public airports and 14,551 private airports controlled by 264 federal ATC towers and 256 contracted towers.

The top five busiest airports in FY19, in terms of the number of airport tower operations (the sum of arrivals and departures), were as follows:

1. Chicago O'Hare (914,615)
2. Atlanta (903,135)
3. Dallas/Fort Worth (703,157)
4. Los Angeles International (694,975)
5. Denver (629,315)

At its "Core 30" airports, the 30 busiest airports in the U.S., the FAA measured a 1.8 percent increase in the total number of tower operations, from 13,018,200 in FY18 to 13,245,722 in FY19.

2020 News / 2021 Projections

The COVID-19 pandemic was the premier news in 2020, not only for the way it impacted day-to-day activities, but even more so for the way it wreaked devastation on the air transportation industry.

January 2020 started with strong flight and passenger statistics, with 830,172 flights and 80.573 million passengers counted by the U.S. Bureau of

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Transportation Statistics. Both of these figures were increases over the prior year's, boding well for the rest of 2020. However, as the virus spread, the number of flights and passengers decreased by a degree without precedent.

In April 2020, the U.S. counted only 3.276 million passengers (domestic and international), representing the lowest number of passengers in any given month for at least a decade. Total monthly flights experienced a year low of 222,249 in May 2020.

However, the air transportation industry recovered steadily through the year, achieving 462,263 flights and

29.805 million passengers in November. While impressive given the year's lows, these statistics were still 44.3 percent lower in flights and 63.0 percent in passengers versus January. They indicated that there would be a long path toward the industry's recovery.

Transportation statistics are expected to continue to recover through the rest of 2021. However, even with the portion of the population receiving COVID-19 vaccinations increasing and local and international "lockdowns" being lifted, it may be several years before U.S. air transportation can best its historical highs.

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