

# Federal Aviation Administration



## National Airspace System (NAS) Overview

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## FAA Mission and NAS Definition

The FAA's mission is to provide the safest, most efficient aerospace system in the world. As the nation's air traffic service provider, the Federal Aviation Administration (FAA) handles nearly 70,000 flights per day and helps transport nearly 750 million passengers per year. FAA is responsible for day-to-day operation of the National Airspace System (NAS): the common network of U.S. airspace; air navigation facilities, equipment and services,

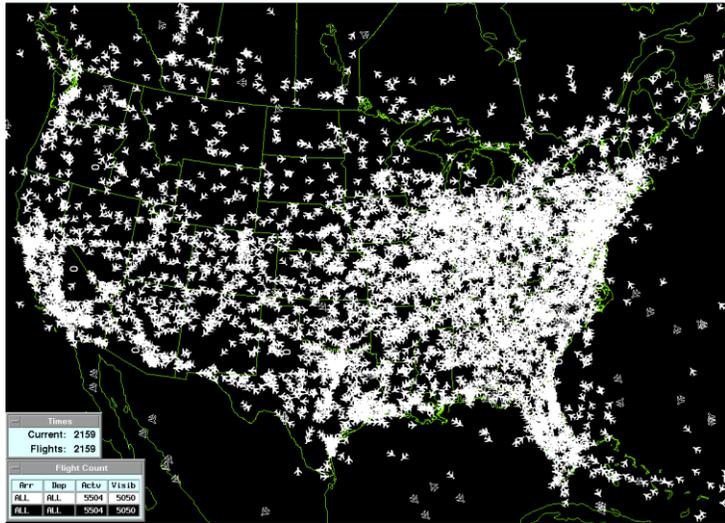


Figure 1: Aircraft Situation Display showing over 5000 aircraft operating at one time in the NAS on a typical day

airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material—in short, the infrastructure, people, and processes that support safest and busiest aviation system in the world.

## The NAS and Air Traffic Control

Air traffic control (ATC) services are provided for aircraft throughout all phases of flight from taxiing on the airport surface through take-off, operations in the terminal area around airports (typically about 40 miles), flight en route to the destination, terminal area approach to the arrival airport, final approach and landing, and airport taxi upon arrival.

The safe and efficient operation of the NAS is enabled by the efforts of the more than 30,000 professional FAA employees, including approximately 14,500 air traffic controllers, 5,000 air traffic supervisors and air traffic

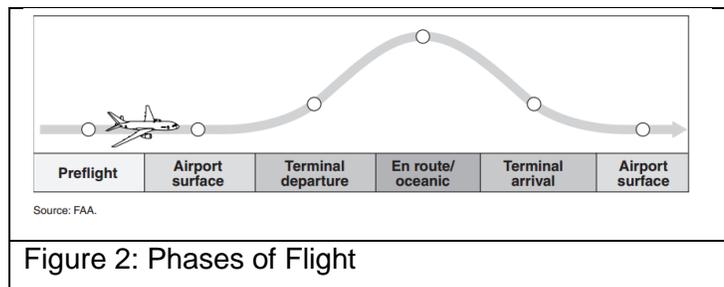


Figure 2: Phases of Flight

managers, 1,800 engineers, and 6,000 maintenance technicians who operate and maintain a complex infrastructure of manned control facilities and unmanned equipment sites that provide safety-critical services around the clock.

Airport ATC services are available from 263 federal and 252 contract towers. Terminal areas services are provided by 161 terminal radar control (TRACON) facilities, many of which are in an airport tower structure beneath the tower cab. The 21 en route air traffic control centers (ARTCC) along with two combined control facilities provide ATC services for more than 59 million square miles of airspace over the continental U.S. and the Atlantic and Pacific Oceans including the South Pacific, to the Northern Polar Routes, the North Atlantic, the Caribbean, and the Gulf of Mexico, including interfacing with the air navigation service providers of more than 18 other nations.

Provision of ATC services in the NAS requires high availability operation of over 36,000 pieces of infrastructure, much of which is located in unmanned facilities, often in remote locations far removed from the manned facilities using that infrastructure. Importantly, there are over 8,500 communications, navigation and surveillance facilities at over 4000 individual sites that provide critical air traffic control services. These include air-ground radios, surveillance radars, and electronic navigation aids. To obtain the maximum possible coverage for line-of-sight NAS systems, radios and radars are often located on mountain tops or other high locations that are also extremely remote.

### Telecommunications in the NAS Today

The vast, diverse, and widely distributed NAS infrastructure is linked by about 25,000 telecommunications services that support a broad spectrum of requirements ranging from critical air traffic control operations (e.g., connecting control consoles in air traffic control centers to remote air-ground radios or transporting radar data to automation systems) to routine administrative functions. These include voice services, synchronous and asynchronous data services, Internet Protocol (IP) network services, and “enterprise messaging services.” FTI

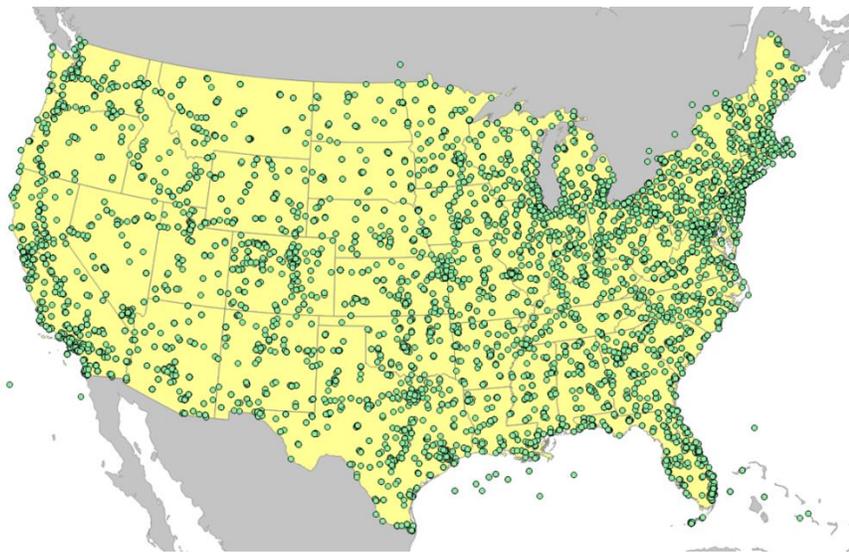


Figure 3: Approximately 75% of the FAA enterprise communications service delivery locations are in remote areas with limited telco access

services are provided over a dedicated optical backbone infrastructure and interexchange carrier (IXC) private line services as well as dedicated microwave and satellite resources. Due to the critical nature of the NAS, the FAA imposes unique requirements on FTI services not found in commercial service offerings. The emphasis on high availability and survivability is due to the potential impacts of service interruptions that may range from the safety of the flying public to costly airline delays. These requirements include:

- **High availability for critical NAS services:** A substantial number of telecommunications services support NAS applications that require high availability of up to 0.9999971. This is typically achieved through automated protection switching of physically diverse access paths into NAS facilities and diverse transport paths across the backbone network.
- **Performance:** NAS services require low latency connections (as low as 50 milliseconds) to meet FAA requirements. This applies to IP-routed services as well as TDM-based services including long-haul services that traverse the entire continental United States.
- **NAS Sites:** NAS facilities requiring telecommunications services can range from large Air Route Traffic Control Centers (ARTCCs) in major metropolitan areas to many (3,000+) small unmanned facilities in remote and rural locations. A limited number of facilities consist solely of outdoor equipment cabinets.
- **Diversity:** The criticality of NAS services requires physically diverse access paths to ensure availability requirements are met. This diversity cannot be compromised by circuit re-grooming that is often performed by carriers. As a result, the FAA's service provider must conduct diversity audits to ensure circuit diversity remains intact.
- **Survivable Network Infrastructure:** The telecommunications infrastructure must be protected against system-wide failures even those caused by rare events.
- **Legacy interfaces:** Many of the dedicated telecommunications services in the NAS rely upon low-speed serial data or analog voice interfaces. These interfaces are present at a large number of NAS sites that provide navigation, surveillance and air/ground voice. The majority of the sites are located in very remote locations.

- **Network Operations, Monitoring and Reporting:** The FAA requires read-only access to real-time network management information to maintain situational awareness of all FTI infrastructure and services (e.g. components, support systems, circuits). Access to network management data is provided through a network management user interface. Network management data traverses a dedicated sub network that is separate from NAS data. The FAA's enterprise operations organization utilizes the network management data to identify impacts to FAA operations.
- **Security Operations, Monitoring and Reporting:** The FAA requires read-only access to real-time security management information to maintain situational awareness of all FTI security infrastructure and cyber security posture. Access to security management data is provided through a security management user interface. Security management data traverses a dedicated sub network that is separate from both NAS and network management data. The FAA's security operations organization utilizes this information to ensure that the operation of the network complies with all applicable FAA policies for security monitoring, incident reporting and information management.

## Future Trends in NAS Communications

Looking to the future, the current NAS continues to reflect its origins as a system in which aircraft flew directly between ground-based navigational aids along FAA-defined routes. The existing airspace structure and boundary restrictions strongly reflect the constraints that communication and computer systems imposed as the NAS developed over the past 80 years. While the requirement for the widely distributed and high performance NAS communications will continue, the advanced information technology available today holds potential to improve decision making across the NAS by making the right information available at the right place, at the right time, to the responsible person. This transition will affect FAA telecommunications services by likely increasing the demand for enterprise messaging and other advanced information management and dissemination services among a large and diverse group of NAS stakeholders.