

## **APPENDIX A**

### **NATIONAL AIRSPACE SYSTEM OVERVIEW**

This appendix contains additional information to supplement the discussion of the National Airspace System, including aircraft separation, air traffic control facilities, and navigation, contained in Section 1.2.1.

# **NATIONAL AIRSPACE SYSTEM OVERVIEW**

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The airspace structure is a complex environment that requires the use of highly technical air traffic control (ATC) procedures. Many of the terms and descriptions used in the Environmental Impact Statement (EIS) require the reader to have a fundamental knowledge of aviation procedures. This appendix provides a brief overview of the ATC system used by the Federal Aviation Administration (FAA) to manage the nation's airspace.

The Federal Aviation Act of 1958 established the FAA and made it responsible for the control and use of navigable airspace within the United States. The FAA created the National Airspace System (NAS) to protect persons and property on the ground, and to establish a safe and efficient airspace environment for civil, commercial, and military aviation. The NAS is made up of a network of air navigation facilities, ATC facilities, airports, technology, and appropriate rules and regulations that are needed to operate the system. In addition, this appendix details the various components of the NAS, and then describes how these components interact to facilitate safe and efficient air travel.

## **A.1 FLIGHT RULES AND WEATHER CONDITIONS**

Weather is a significant factor in aircraft operations. Weather conditions determine the flight rules under which aircraft can operate, and can also affect aircraft separation (physical distance between aircraft). Aircraft are separated from each other to ensure safety of flight. The required separation varies depending on aircraft type, weather, and flight rules. Aircraft separation requirements can increase during poor weather conditions, as it is more difficult for a pilot to see other aircraft. Increased aircraft separation can reduce airport capacity, as less aircraft can use an airport during a given time interval. Reduced aircraft separation can increase airport capacity, as more aircraft can use an airport during a given time interval.

Aircraft operate under two distinct categories of operational flight rules: visual flight rules (VFR) and instrument flight rules (IFR). These flight rules are linked to the two categories of weather conditions: visual meteorological conditions (VMC) and instrument meteorological conditions (IMC). VMC exist during generally fair to good weather, and IMC exist during times of rain, low clouds, or reduced visibility. IMC generally exist whenever visibility falls below 3 statute miles (SM) or the ceiling drops below 1,000 feet above ground level (AGL). The ceiling is the distance from the ground to the bottom of a cloud layer that covers more than 50% of the sky.

During VMC, aircraft may operate under VFR, and the pilot is primarily responsible for seeing other aircraft and maintaining safe separation. Aircraft operating under VFR typically navigate by orientation to geographic and other visual references.

During IMC, aircraft operate under IFR. ATC exercises positive control (i.e., separation of all air traffic within designated airspace) over all aircraft in controlled airspace, and is primarily responsible for aircraft separation. Aircraft operating under IFR must meet minimum equipment requirements. Pilots must also be specially certified and meet proficiency requirements. IFR aircraft fly assigned routes and altitudes, and use a combination of radio navigation aids (NAVAIDs) and vectors from ATC to navigate.

Aircraft may elect to operate IFR in VMC; however, the pilot, and not ATC, is primarily responsible for seeing and avoiding other aircraft.

The majority of commercial air traffic (including all air carrier traffic), regardless of weather, operate under IFR as required by Federal Aviation Regulations. In an effort to increase airport capacity, ATC can allow IFR aircraft to maintain visual separation when weather permits.

## **A.2 TYPES OF AIRSPACE**

In the early days of aviation, aircraft only flew during VMC, which allows a pilot to maintain orientation (up/down, turning, etc.) by reference to the horizon and visual ground references. Flight through clouds (i.e., IMC) was not possible, as the aircraft instruments of the time did not provide orientation information, and thus a pilot could easily lose orientation and control of the aircraft. In a visual-only airspace environment, it was possible to see other aircraft and avoid a collision – and thus maintain aircraft separation.

Flight through clouds became possible with the use of gyroscopic flight instruments. Because it is not possible to see other aircraft in the clouds, ATC was established to coordinate aircraft positions and maintain separation between aircraft. Today, maintaining separation between IFR and VFR air traffic is still a fundamental mission of ATC. The evolution of the NAS, and existing ATC procedures, can be directly tied to this requirement.

### **A.2.1 AIRSPACE CLASSIFICATIONS**

The FAA has designated six classes of airspace, in accordance with International Civil Aviation Organization (ICAO) airspace classifications. **Figure A-1** and **Table A.1** identifies the airspace classifications and terminology. Airspace is broadly classified as either controlled or uncontrolled. Airspace designated as Class A, B, C, D, or E is controlled airspace. Class F airspace is not used in the United States. Class G airspace is uncontrolled airspace.

Controlled airspace means that IFR services are available to aircraft that elect to file IFR flight plans; it does not mean that all flights within the airspace are controlled by ATC. IFR services include ground-to-air radio communications, navigation aids, and air traffic (i.e., separation) services. Aircraft can operate under IFR in uncontrolled airspace; however, the aircraft cannot file an IFR flight plan and IFR services are not necessarily available. Controlled airspace is intended to ensure separation of IFR traffic from other aircraft, both IFR and VFR.

The airspace classifications discussed in this section are designed primarily to manage VFR traffic in controlled airspace. The controlled airspace classifications do not affect IFR operations, as IFR traffic is cleared through controlled airspace automatically by ATC. VFR aircraft may operate in Class E controlled airspace without control by ATC, so long as weather conditions permit visual separation of aircraft (during IMC, VFR traffic is prohibited and thereby ensures separation between VFR and IFR traffic). Also, air traffic service is provided to VFR aircraft in Class E airspace only when ATC workload permits. VFR aircraft operating in class B, C, and D airspace must be in contact with ATC; this gives ATC the authority to manage VFR

aircraft in the proximity of busy airports. Essentially, the controlled airspace system protects IFR aircraft from VFR aircraft during IMC and in close proximity to busy airports.

Note that the boundaries of airspace class areas do not necessarily correlate with the boundaries and sectors of ATC facilities.

Table A.1

**Airspace Classifications**

Airspace Class	Description
A	Class A encompasses the en route, high-altitude environment used by aircraft to transit from one area of the country to another. All aircraft in Class A must operate under IFR. Class A airspace exists within the United States from 18,000 feet MSL to and including 60,000 feet MSL.
B	All aircraft, both IFR and VFR, in Class B airspace are subject to positive control from ATC. Class B airspace exists at 29 high-density airports in the United States as a means of managing air traffic activity around the airport. It is designed to regulate the flow of air traffic above, around, and below the arrival and departure routes used by air carrier aircraft at major airports. Class B airspace generally includes all airspace from an airport's established elevation up to 12,000 feet MSL, and, at varying altitudes, out to a distance of about 30 nautical miles from the center of the airport. Aircraft operating in Class B airspace must have specific radio and navigation equipment, including an altitude encoding transponder, and must obtain ATC clearance.
C	Class C airspace is defined around airports with airport traffic control towers and radar approach control. It normally has two concentric circular areas with a diameter of 10 and 20 nautical miles. Variations in the shape are often made to accommodate other airports or terrain. The top of Class C airspace is normally set at 4,000 feet AGL. The FAA had established Class C airspace at 120 airports around the country. Aircraft operating in Class C airspace must have specific radio and navigation equipment, including an altitude encoding transponder, and must obtain ATC clearance. VFR aircraft are only separated from IFR aircraft in Class C airspace (i.e., ATC does not separate VFR aircraft from other VFR aircraft, as this is the respective pilot's responsibility).
D	Class D airspace is under the jurisdiction of a local Air Traffic Control Tower (ATCT). The purpose of an ATCT is to sequence arriving and departing aircraft and direct aircraft on the ground; the purpose of Class D airspace is to provide airspace within which the ATCT can manage aircraft in and around the immediate vicinity of an airport. Aircraft operating within this area are required to maintain radio communication with the ATCT. No separation services are provided to VFR aircraft. The configuration of each Class D airspace area is unique. Class D airspace is normally a circular area with a radius of five miles around the primary airport. This controlled airspace extends upward from the surface to about 2,500 feet AGL. When instrument approaches are used at an airport, the airspace is normally designed to encompass these procedures.
E	Class E airspace is a general category of controlled that is intended to provide air traffic service and adequate separation for IFR aircraft from other aircraft. Although Class E is controlled airspace, VFR aircraft are not required to maintain contact with ATC, but are only permitted to operate in VMC. In the eastern United States, Class E airspace generally exists from 700/1200 feet AGL to the bottom of Class A airspace at 18,000 feet MSL. It generally fills in the gaps between Class B, C, and D airspace at altitudes below 18,000 feet MSL. Federal Airways, including Victor Airways, below 18,000 feet MSL are classified as Class E airspace.
F	Not Applicable within United States
G	Airspace not designated as Class A, B, C, D, or E is considered uncontrolled, Class G, airspace. ATC does not have the authority or responsibility to manage air traffic within this airspace. In the Eastern U.S., Class G airspace lies between the surface and 700/1200 feet AGL.

Source: Airman's Information Manual

**A.2.2 SPECIAL USE AIRSPACE**

Large segments of controlled and uncontrolled airspace have been designated as special use airspace. Operations within special use airspace are considered hazardous to civil aircraft operating in the area. Consequently, civil aircraft operations may be limited or even prohibited, depending on the area. Special use airspace is divided into prohibited, restricted, warning, military operations, and alert areas as described in **Table A.2**.

Table A.2

**Special Use Airspace**

<b>Type</b>	<b>Description</b>
Prohibited	Areas where, for reasons of national security, the flight of an aircraft is not permitted are designated as prohibited areas. Prohibited areas are depicted on aeronautical charts. For example, a prohibited area (P-56) exists over the White House and U.S. Capitol.
Restricted	In certain areas, the flight of aircraft, while not wholly prohibited is subject to restrictions. These designated often have invisible hazards to aircraft, such as artillery firing, aerial gunnery, or guided missiles. Aircraft operations in these areas are prohibited during times when it is “active.”
Warning	A warning area contains many of the same hazards as a restricted area, but because it occurs outside of U.S. airspace, aircraft operations cannot be legally restricted within the area. Warning areas are typically established over international waters along the coastline of the United States.
Alert	Alert areas are shown on aeronautical charts to provide information of unusual types of aerial activities such as parachute jumping areas or high concentrations of student pilot training.
Military Operations Area	Military operations areas (MOA) are blocks of airspace in which military training and other military maneuvers are conducted. MOA’s have specified floors and ceilings for containing military activities. VFR aircraft are not restricted from flying through MOAs while they are in operation, but are encouraged to remain outside of the area.