

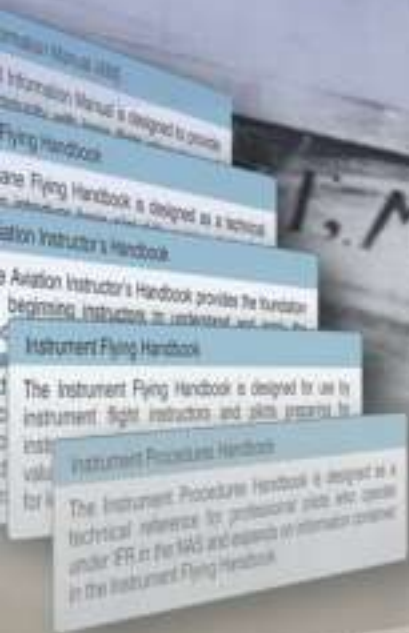
## Chapter 1

# Introduction To Flying

### Introduction

The Pilot's Handbook of Aeronautical Knowledge provides basic knowledge for the student pilot learning to fly, as well as pilots seeking advanced pilot certification. For detailed information on a variety of specialized flight topics, see specific Federal Aviation Administration (FAA) handbooks and Advisory Circulars (ACs).

This chapter offers a brief history of flight, introduces the history and role of the FAA in civil aviation, FAA regulations and standards, government references and publications, eligibility for pilot certificates, available routes to flight instruction, the role of the Certificated Flight Instructor (CFI) and Designated Pilot Examiner (DPE) in flight training, Practical Test Standards (PTS), and new, industry-developed Airman Certification Standards (ACS) framework that will eventually replace the PTS.



## History of Flight

From prehistoric times, humans have watched the flight of birds, and longed to imitate them, but lacked the power to do so. Logic dictated that if the small muscles of birds can lift them into the air and sustain them, then the larger muscles of humans should be able to duplicate the feat. No one knew about the intricate mesh of muscles, sinew, heart, breathing system, and devices not unlike wing flaps, variable-camber and spoilers of the modern airplane that enabled a bird to fly. Still, thousands of years and countless lives were lost in attempts to fly like birds.

The identity of the first “bird-men” who fitted themselves with wings and leapt off of cliffs in an effort to fly are lost in time, but each failure gave those who wished to fly questions that needed to be answered. Where had the wing flappers gone wrong? Philosophers, scientists, and inventors offered solutions, but no one could add wings to the human body and soar like a bird. During the 1500s, Leonardo da Vinci filled pages of his notebooks with sketches of proposed flying machines, but most of his ideas were flawed because he clung to the idea of birdlike wings. [Figure 1-1] By 1655, mathematician, physicist, and inventor Robert Hooke concluded that the human body does not possess the strength to power artificial wings. He believed human flight would require some form of artificial propulsion.

The quest for human flight led some practitioners in another direction. In 1783, the first manned hot air balloon, crafted by Joseph and Etienne Montgolfier, flew for 23 minutes. Ten days later, Professor Jacques Charles flew the first gas balloon. A madness for balloon flight captivated the public’s imagination and for a time flying enthusiasts turned their expertise to the promise of lighter-than-air flight. But for all its majesty in the air, the balloon was little more than a



Figure 1-1. Leonardo da Vinci's ornithopter wings.

billowing heap of cloth capable of no more than a one-way, downwind journey.

Balloons solved the problem of lift, but that was only one of the problems of human flight. The ability to control speed and direction eluded balloonists. The solution to that problem lay in a child’s toy familiar to the East for 2,000 years, but not introduced to the West until the 13th century—the kite. The kites used by the Chinese for aerial observation, to test winds for sailing, as a signaling device, and as a toy, held many of the answers to lifting a heavier-than-air device into the air.

One of the men who believed the study of kites unlocked the secrets of winged flight was Sir George Cayley. Born in England 10 years before the Montgolfier balloon flight, Cayley spent his 84 years seeking to develop a heavier-than-air vehicle supported by kite-shaped wings. [Figure 1-2] The “Father of Aerial Navigation,” Cayley discovered the basic principles on which the modern science of aeronautics is founded; built what is recognized as the first successful flying model; and tested the first full-size man-carrying airplane.



Figure 1-2. Glider from 1852 by Sir George Cayley, British aviator (1773–1857).

For the half-century after Cayley's death, countless scientists, flying enthusiasts, and inventors worked toward building a powered flying machine. Men, such as William Samuel Henson, who designed a huge monoplane that was propelled by a steam engine housed inside the fuselage, and Otto Lilienthal, who proved human flight in aircraft heavier than air was practical, worked toward the dream of powered flight. A dream turned into reality by Wilbur and Orville Wright at Kitty Hawk, North Carolina, on December 17, 1903.

The bicycle-building Wright brothers of Dayton, Ohio, had experimented for 4 years with kites, their own homemade wind tunnel, and different engines to power their biplane. One of their great achievements in flight was proving the value of the scientific, rather than a build-it-and-see approach. Their biplane, The Flyer, combined inspired design and engineering with superior craftsmanship. [Figure 1-3] By the afternoon of December 17th, the Wright brothers had flown a total of 98 seconds on four flights. The age of flight had arrived.

### History of the Federal Aviation Administration (FAA)

During the early years of manned flight, aviation was a free for all because no government body was in place to establish policies or regulate and enforce safety standards. Individuals were free to conduct flights and operate aircraft with no government oversight. Most of the early flights were conducted for sport. Aviation was expensive and became the playground of the wealthy. Since these early airplanes were small, many people doubted their commercial value. One group of individuals believed otherwise and they became the genesis for modern airline travel.

P. E. Fansler, a Florida businessman living in St. Petersburg, approached Tom Benoist of the Benoist Aircraft Company in St. Louis, Missouri, about starting a flight route from St.



Figure 1-3. First flight by the Wright brothers.

Petersburg across the waterway to Tampa. Benoist suggested using his "Safety First" airboat and the two men signed an agreement for what would become the first scheduled airline in the United States. The first aircraft was delivered to St. Petersburg and made the first test flight on December 31, 1913. [Figure 1-4]

A public auction decided who would win the honor of becoming the first paying airline customer. The former mayor of St. Petersburg, A. C. Pheil, made the winning bid of \$400.00, which secured his place in history as the first paying airline passenger.

On January 1, 1914, the first scheduled airline flight was conducted. The flight length was 21 miles and lasted 23 minutes due to a headwind. The return trip took 20 minutes. The line, which was subsidized by Florida businessmen, continued for 4 months and offered regular passage for \$5.00 per person or \$5.00 per 100 pounds of cargo. Shortly after the opening of the line, Benoist added a new airboat that afforded more protection from spray during takeoff and landing. The routes were also extended to Manatee, Bradenton, and Sarasota giving further credence to the idea of a profitable commercial airline.

The St. Petersburg-Tampa Airboat Line continued throughout the winter months with flights finally being suspended when the winter tourist industry began to dry up. The airline operated for only 4 months, but 1,205 passengers were carried without injury. This experiment proved commercial passenger airline travel was viable.

The advent of World War I offered the airplane a chance to demonstrate its varied capabilities. It began the war as a reconnaissance platform, but by 1918, airplanes were being

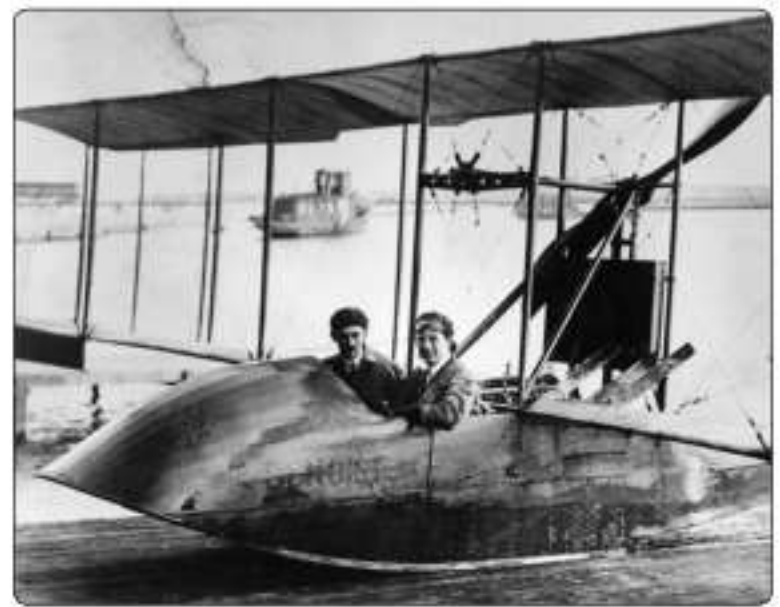


Figure 1-4. Benoist airboat.

mass produced to serve as fighters, bombers, trainers, as well as reconnaissance platforms.

Aviation advocates continued to look for ways to use airplanes. Airmail service was a popular idea, but the war prevented the Postal Service from having access to airplanes. The War Department and Postal Service reached an agreement in 1918. The Army would use the mail service to train its pilots in flying cross-country. The first airmail flight was conducted on May 15, 1918, between New York and Washington, DC. The flight was not considered spectacular; the pilot became lost and landed at the wrong airfield. In August of 1918, the United States Postal Service took control of the airmail routes and brought the existing Army airmail pilots and their planes into the program as postal employees.

### Transcontinental Air Mail Route

Airmail routes continued to expand until the Transcontinental Mail Route was inaugurated. [Figure 1-5] This route spanned from San Francisco to New York for a total distance of 2,612 miles with 13 intermediate stops along the way. [Figure 1-6] On May 20, 1926, Congress passed the Air Commerce Act, which served as the cornerstone for aviation within the United States. This legislation was supported by leaders in the aviation industry who felt that the airplane could not reach its full potential without assistance from the Federal Government in improving safety.

The Air Commerce Act charged the Secretary of Commerce with fostering air commerce, issuing and enforcing air traffic rules, licensing pilots, certificating aircraft, establishing airways, and operating and maintaining aids to air navigation. The Department of Commerce created a new Aeronautics Branch whose primary mission was to provide oversight for the aviation industry. In addition, the Aeronautics Branch took over the construction and operation of the nation's system of lighted airways. The Postal Service, as part of the Transcontinental Air Mail Route system, had initiated this system. The



**Figure 1-5.** The de Havilland DH-4 on the New York to San Francisco inaugural route in 1921.



**Figure 1-6.** The transcontinental airmail route ran from New York to San Francisco.

Department of Commerce made significant advances in aviation communications, including the introduction of radio beacons as an effective means of navigation.

Built at intervals of approximately 10 miles apart, the standard beacon tower was 51 feet high, and was topped with a powerful rotating light. Below the rotating light, two course lights pointed forward and back along the airway. The course lights flashed a code to identify the beacon's number. The tower usually stood in the center of a concrete arrow 70 feet long. A generator shed, where required, stood at the "feather" end of the arrow. [Figure 1-7]

### Federal Certification of Pilots and Mechanics

The Aeronautics Branch of the Department of Commerce began pilot certification with the first license issued on April 6, 1927. The recipient was the Chief of the Aeronautics Branch, William P. MacCracken, Jr. [Figure 1-8] (Orville Wright, who was no longer an active flier, had declined the honor.) MacCracken's license was the first issued to a pilot by a civilian agency of the Federal Government. Some 3 months later, the Aeronautics Branch issued the first Federal aircraft mechanic license.

Equally important for safety was the establishment of a system of certification for aircraft. On March 29, 1927, the Aeronautics Branch issued the first airworthiness type certificate to the Buhl Airster CA-3, a three-place open biplane.

In 1934, to recognize the tremendous strides made in aviation and to display the enhanced status within the department, the Aeronautics Branch was renamed the Bureau of Air Commerce. [Figure 1-9] Within this time frame, the Bureau of Air Commerce brought together a group of airlines

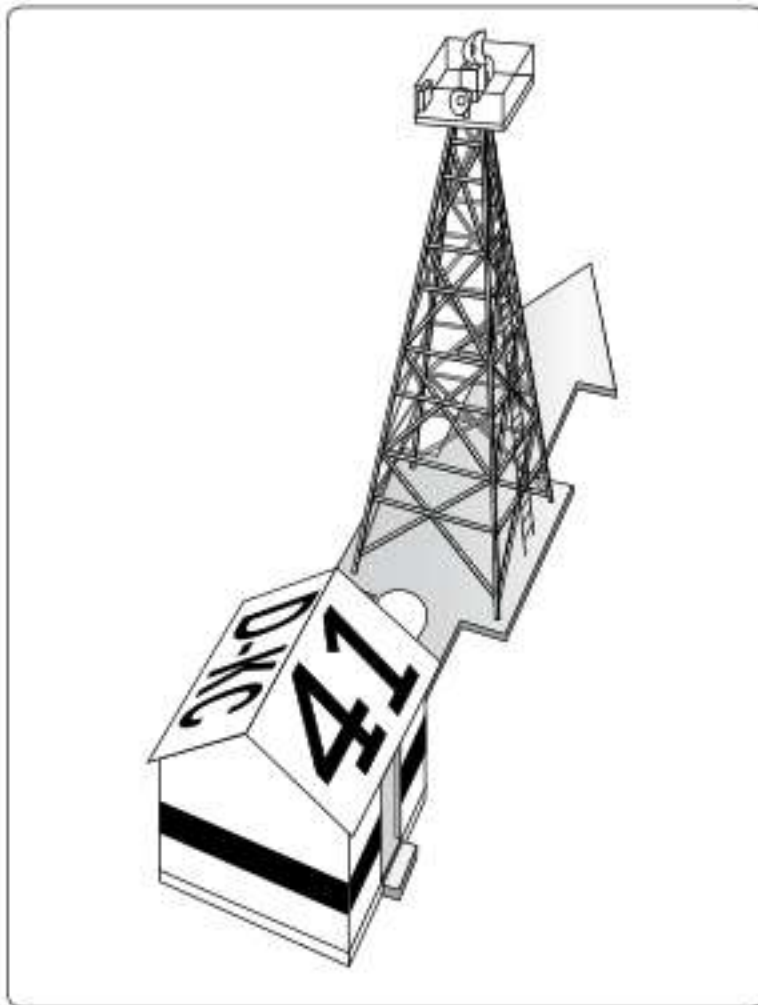


Figure 1-7. A standard airway beacon tower.



Figure 1-8. The first pilot license was issued to William P. MacCracken, Jr.



Figure 1-9. The third head of the Aeronautics Branch, Eugene L. Vidal, is flanked by President Franklin D. Roosevelt (left) and Secretary of Agriculture Henry A. Wallace (right). The photograph was taken in 1933. During Vidal's tenure, the Aeronautics Branch was renamed the Bureau of Air Commerce on July 1, 1934. The new name more accurately reflected the status of the organization within the Department of Commerce.

and encouraged them to form the first three Air Traffic Control (ATC) facilities along the established air routes. Then in 1936, the Bureau of Air Commerce took over the responsibilities of operating the centers and continued to advance the ATC facilities. ATC has come a long way from the early controllers using maps, chalkboards, and performing mental math calculations in order to separate aircraft along flight routes.

### The Civil Aeronautics Act of 1938

In 1938, the Civil Aeronautics Act transferred the civil aviation responsibilities to a newly created, independent body, named the Civil Aeronautics Authority (CAA). This Act empowered the CAA to regulate airfares and establish new routes for the airlines to service.

President Franklin Roosevelt split the CAA into two agencies—the Civil Aeronautics Administration (CAA) and the Civil Aeronautics Board (CAB). Both agencies were still part of the Department of Commerce but the CAB functioned independently of the Secretary of Commerce. The role of the CAA was to facilitate ATC, certification of airmen and aircraft, rule enforcement, and the development of new airways. The CAB was charged with rule making to enhance safety, accident investigation, and the economic regulation of the airlines. Then in 1946, Congress gave the CAA the responsibility of administering the Federal Aid

Airport Program. This program was designed to promote the establishment of civil airports throughout the country.

### **The Federal Aviation Act of 1958**

By mid-century, air traffic had increased and jet aircraft had been introduced into the civil aviation arena. A series of mid-air collisions underlined the need for more regulation of the aviation industry. Aircraft were not only increasing in numbers, but were now streaking across the skies at much higher speeds. The Federal Aviation Act of 1958 established a new independent body that assumed the roles of the CAA and transferred the rule making authority of the CAB to the newly created Federal Aviation Agency (FAA). In addition, the FAA was given complete control of the common civil-military system of air navigation and ATC. The man who was given the honor of being the first Administrator of the FAA was former Air Force General Elwood Richard "Pete" Quesada. He served as the administrator from 1959–1961. [Figure 1-10]

### **Department of Transportation (DOT)**

On October 15, 1966, Congress established the Department of Transportation (DOT), which was given oversight of the transportation industry within the United States. The result was a combination of both air and surface transportation. Its mission was and is to serve the United States by ensuring a fast, safe, efficient, accessible, and convenient transportation system meeting vital national interests and enhancing the quality of life of the American people, then, now, and into



**Figure 1-10.** First Administrator of the FAA was General Elwood Richard "Pete" Quesada, 1959–1961.

the future. The DOT began operation on April 1, 1967. At this same time, the Federal Aviation Agency was renamed to the Federal Aviation Administration (FAA).

The role of the CAB was assumed by the newly created National Transportation Safety Board (NTSB), which was charged with the investigation of all transportation accidents within the United States.

As aviation continued to grow, the FAA took on additional duties and responsibilities. With the highjacking epidemic of the 1960s, the FAA was responsible for increasing the security duties of aviation both on the ground and in the air. After September 11, 2001, the duties were transferred to a newly created body called the Department of Homeland Security (DHS).

With numerous aircraft flying in and out of larger cities, the FAA began to concentrate on the environmental aspect of aviation by establishing and regulating the noise standards of aircraft. Additionally, in the 1960s and 1970s, the FAA began to regulate high altitude (over 500 feet) kite and balloon flying. In 1970, more duties were assumed by the FAA in the addition of a new federal airport aid program and increased responsibility for airport safety.

### **ATC Automation**

By the mid-1970s, the FAA had achieved a semi-automated ATC system based on a marriage of radar and computer technology. By automating certain routine tasks, the system allowed controllers to concentrate more efficiently on the vital task of providing aircraft separation. Data appearing directly on the controllers' scopes provided the identity, altitude, and groundspeed of aircraft carrying radar beacons. Despite its effectiveness, this system required enhancement to keep pace with the increased air traffic of the late 1970s. The increase was due in part to the competitive environment created by the Airline Deregulation Act of 1978. This law phased out CAB's economic regulation of the airlines, and CAB ceased to exist at the end of 1984.

To meet the challenge of traffic growth, the FAA unveiled the National Airspace System (NAS) Plan in January 1982. The new plan called for more advanced systems for en route and terminal ATC, modernized flight service stations, and improvements in ground-to-air surveillance and communication.

### **The Professional Air Traffic Controllers Organization (PATCO) Strike**

While preparing the NAS Plan, the FAA faced a strike by key members of its workforce. An earlier period of discord between management and the Professional Air

Traffic Controllers Organization (PATCO) culminated in a 1970 “sickout” by 3,000 controllers. Although controllers subsequently gained additional wage and retirement benefits, another period of tension led to an illegal strike in August 1981. The government dismissed over 11,000 strike participants and decertified PATCO. By the spring of 1984, the FAA ended the last of the special restrictions imposed to keep the airspace system operating safely during the strike.

### **The Airline Deregulation Act of 1978**

Until 1978, the CAB regulated many areas of commercial aviation such as fares, routes, and schedules. The Airline Deregulation Act of 1978, however, removed many of these controls, thus changing the face of civil aviation in the United States. After deregulation, unfettered free competition ushered in a new era in passenger air travel.

The CAB had three main functions: to award routes to airlines, to limit the entry of air carriers into new markets, and to regulate fares for passengers. Much of the established practices of commercial passenger travel within the United States went back to the policies of Walter Folger Brown, the United States Postmaster General during the administration of President Herbert Hoover. Brown had changed the mail payments system to encourage the manufacture of passenger aircraft instead of mail-carrying aircraft. His influence was crucial in awarding contracts and helped create four major domestic airlines: United, American, Eastern, and Transcontinental and Western Air (TWA). Similarly, Brown had also helped give Pan American a monopoly on international routes.

The push to deregulate, or at least to reform the existing laws governing passenger carriers, was accelerated by President Jimmy Carter, who appointed economist and former professor Alfred Kahn, a vocal supporter of deregulation, to head the CAB. A second force to deregulate emerged from abroad. In 1977, Freddie Laker, a British entrepreneur who owned Laker Airways, created the Skytrain service, which offered extraordinarily cheap fares for transatlantic flights. Laker’s offerings coincided with a boom in low-cost domestic flights as the CAB eased some limitations on charter flights (i.e., flights offered by companies that do not actually own planes but leased them from the major airlines). The big air carriers responded by proposing their own lower fares. For example, American Airlines, the country’s second largest airline, obtained CAB approval for “SuperSaver” tickets.

All of these events proved to be favorable for large-scale deregulation. In November 1977, Congress formally deregulated air cargo. In late 1978, Congress passed the Airline Deregulation Act of 1978, legislation that had been principally authored by Senators Edward Kennedy and

Howard Cannon. [Figure 1-11] There was stiff opposition to the bill—from the major airlines who feared free competition, from labor unions who feared non-union employees, and from safety advocates who feared that safety would be sacrificed. Public support was, however, strong enough to pass the act. The act appeased the major airlines by offering generous subsidies and pleased workers by offering high unemployment benefits if they lost their jobs as a result. The most important effect of the act, whose laws were slowly phased in, was on the passenger market. For the first time in 40 years, airlines could enter the market or (from 1981) expand their routes as they saw fit. Airlines (from 1982) also had full freedom to set their fares. In 1984, the CAB was finally abolished since its primary duty of regulating the airline industry was no longer necessary.

### **The Role of the FAA**

#### **The Code of Federal Regulations (CFR)**

The FAA is empowered by regulations to promote aviation safety and establish safety standards for civil aviation. The FAA achieves these objectives under the Code of Federal Regulations (CFR), which is the codification of the general and permanent rules published by the executive departments and agencies of the United States Government. The regulations are divided into 50 different codes, called Titles, that represent broad areas subject to Federal regulation. FAA regulations are listed under Title 14, “Aeronautics and Space,” which encompasses all aspects of civil aviation from how to earn a pilot’s certificate to maintenance of an aircraft. Title 14 CFR Chapter 1, Federal Aviation Administration, is broken down into subchapters A through N as illustrated in Figure 1-12.

For the pilot, certain parts of 14 CFR are more relevant than others. During flight training, it is helpful for the pilot to become familiar with the parts and subparts that relate



**Figure 1-11.** President Jimmy Carter signs the Airline Deregulation Act in late 1978.

Code of Federal Regulations				
Title	Volume	Chapter	Subchapters	
Title 14 Aeronautics and Space	1	I	A	Definitions and Abbreviations
			B	Procedural Rules
			C	Aircraft
	2		D	Airmen
			E	Airspace
			F	Air Traffic and General Rules
	3		G	Air Carriers and Operators for Compensation or Hire: Certification and Operations
			H	Schools and Other Certified Agencies
			I	Airports
			J	Navigational Facilities
			K	Administrative Regulations
			L–M	Reserved
			N	War Risk Insurance
	4	II	A	Economic Regulations
			B	Procedural Regulations
			C	Reserved
			D	Special Regulations
			E	Organization
			F	Policy Statements
		III	A	General
B			Procedure	
C			Licensing	
5	V			
	VI	A	Office of Management and Budget	
		B	Air Transportation Stabilization Board	

**Figure 1-12.** Overview of 14 CFR, available online free from the FAA and for purchase through commercial sources.

to flight training and pilot certification. For instance, 14 CFR part 61 pertains to the certification of pilots, flight instructors, and ground instructors. It also defines the eligibility, aeronautical knowledge, and flight proficiency, as well as training and testing requirements for each type of pilot certificate issued. 14 CFR part 91 provides guidance in the areas of general flight rules, visual flight rules (VFR), and instrument flight rules (IFR), while 14 CFR part 43 covers aircraft maintenance, preventive maintenance, rebuilding, and alterations.

### Primary Locations of the FAA

The FAA headquarters are in Washington, DC, and there are nine regional offices strategically located across the United States. The agency's two largest field facilities are the Mike Monroney Aeronautical Center (MMAC) in Oklahoma City, Oklahoma, and the William J. Hughes Technical Center (WJHTC) in Atlantic City, New Jersey. Home to FAA training and logistics services, the MMAC provides a number of aviation safety-related and business support services. The WJHTC is the premier aviation research and development and test and evaluation facility in the country. The center's programs include testing and evaluation in ATC, communication, navigation, airports, aircraft safety, and security. Furthermore, the WJHTC is active in long-range

development of innovative aviation systems and concepts, development of new ATC equipment and software, and modification of existing systems and procedures.

### Field Offices

#### Flight Standards Service

Within the FAA, the Flight Standards Service promotes safe air transportation by setting the standards for certification and oversight of airmen, air operators, air agencies, and designees. It also promotes safety of flight of civil aircraft and air commerce by:

- Accomplishing certification, inspection, surveillance, investigation, and enforcement.
- Setting regulations and standards.
- Managing the system for registration of civil aircraft and all airmen records.

The focus of interaction between Flight Standards Service and the aviation community/general public is the Flight Standards District Office (FSDO).

### *Flight Standards District Office (FSDO)*

The FAA has approximately 80 FSDOs. [Figure 1-13] These offices provide information and services for the aviation community. FSDO phone numbers are listed in the telephone directory under Government Offices, DOT, FAA. Another convenient method of finding a local office is to use the FSDO locator available at: [www.faa.gov/about/office\\_org/field\\_offices/fsdo](http://www.faa.gov/about/office_org/field_offices/fsdo).

In addition to accident investigation and the enforcement of aviation regulations, the FSDO is also responsible for the certification and surveillance of air carriers, air operators, flight schools/training centers, and airmen including pilots and flight instructors. Each FSDO is staffed by Aviation Safety Inspectors (ASIs) who play a key role in making the nation's aviation system safe.

### **Aviation Safety Inspector (ASI)**

The ASIs administer and enforce safety regulations and standards for the production, operation, maintenance, and/or modification of aircraft used in civil aviation. They also specialize in conducting inspections of various aspects of the aviation system, such as aircraft and parts manufacturing, aircraft operation, aircraft airworthiness, and cabin safety. ASIs must complete a training program at the FAA Academy in Oklahoma City, Oklahoma, which includes airman evaluation and pilot testing techniques and procedures. ASIs also receive extensive on-the-job training and recurrent training on a regular basis. The FAA has approximately 3,700 inspectors located in its FSDO offices. All questions concerning pilot certification (and/or requests for other aviation information or services) should be directed to the local FSDO.

### **FAA Safety Team (FAASTeam)**

The FAA is dedicated to improving the safety of United States civilian aviation by conveying safety principles and practices through training, outreach, and education. The FAA



**Figure 1-13.** Atlanta Flight Standards District Office (FSDO).

Safety Team (FAASTeam) exemplifies this commitment. The FAASTeam has replaced the Aviation Safety Program (ASP), whose education of airmen on all types of safety subjects successfully reduced accidents. Its success led to its demise because the easy-to-fix accident causes have been addressed. To take aviation safety one step further, Flight Standards Service created the FAASTeam, which is devoted to reducing aircraft accidents by using a coordinated effort to focus resources on elusive accident causes.

Each of the FAA's nine regions has a Regional FAASTeam Office dedicated to this new safety program and managed by the Regional FAASTeam Manager (RFM). The FAASTeam is "teaming" up with individuals and the aviation industry to create a unified effort against accidents and tip the safety culture in the right direction. To learn more about this effort to improve aviation safety, to take a course at their online learning center, or to join the FAASTeam, visit their website at [www.faasafety.gov](http://www.faasafety.gov).

### **Obtaining Assistance from the FAA**

Information can be obtained from the FAA by phone, Internet/e-mail, or mail. To talk to the FAA toll-free 24 hours a day, call 1-866-TELL-FAA (1-866-835-5322). To visit the FAA's website, go to [www.faa.gov](http://www.faa.gov). Individuals can also e-mail an FAA representative at a local FSDO office by accessing the staff e-mail address available via the "Contact FAA" link at the bottom of the FAA home page. Letters can be sent to:

Federal Aviation Administration  
800 Independence Ave, SW  
Washington, DC 20591

### **FAA Reference Material**

The FAA provides a variety of important reference material for the student, as well as the advanced civil aviation pilot. In addition to the regulations provided online by the FAA, several other publications are available to the user. Almost all reference material is available online at [www.faa.gov](http://www.faa.gov) in downloadable format. Commercial aviation publishers also provide published and online reference material to further aid the aviation pilot.

### ***Aeronautical Information Manual (AIM)***

The Aeronautical Information Manual (AIM) is the official guide to basic flight information and ATC procedures for the aviation community flying in the NAS of the United States. [Figure 1-14] An international version, containing parallel information as well as specific information on international airports, is also available. The AIM also contains information of interest to pilots, such as health and medical facts, flight



**Figure 1-14.** *Aeronautical Information Manual.*

safety, a pilot/controller glossary of terms used in the system, and information on safety, accidents, and reporting of hazards. This manual is offered for sale on a subscription basis or is available online at: <http://bookstore.gpo.gov>.

Order forms are provided at the beginning of the manual or online and should be sent to the Superintendent of Documents, United States Government Printing Office (GPO). The AIM is complemented by other operational publications that are available via separate subscriptions or online.

### **Handbooks**

Handbooks are developed to provide specific information about a particular topic that enhances training or understanding. The FAA publishes a variety of handbooks that generally fall into three categories: aircraft, aviation, and examiners and inspectors. [Figure 1-15] These handbooks can be purchased from the Superintendent of Documents or downloaded at [www.faa.gov/regulations\\_policies](http://www.faa.gov/regulations_policies). Aviation handbooks are also published by various commercial aviation companies. Aircraft flight manuals commonly called Pilot Operating Handbooks (POH) are documents developed by the airplane manufacturer, approved by the FAA, and are specific to a particular make and model aircraft by serial number. This subject is covered in greater detail in Chapter 8, “Flight Manuals and Other Documents,” of this handbook. [Figure 1-16]

### **Advisory Circulars (ACs)**

An AC is an informational document that the FAA wants to distribute to the aviation community. This can be in the form

#### **Aeronautical Information Manual (AIM)**

The Aeronautical Information Manual is designed to provide the aviation community with basic flight information and ATC procedures for use in the NAS of the United States. It also contains the fundamentals required in order to fly in the United States NAS, including items of interest to pilots concerning health/medical facts, factors affecting flight safety, etc.

#### **Aircraft Flying Handbooks (by category)**

The Aircraft Flying Handbooks are designed as technical manuals to introduce basic pilot skills and knowledge that are essential for piloting aircraft. They provide information on transition to other aircraft and the operation of various aircraft systems.

#### **Aviation Instructor's Handbook**

The Aviation Instructor's Handbook provides the foundation for beginning instructors to understand and apply the fundamentals of instructing. This handbook also provides aviation instructors with up-to-date information on learning and teaching, and how to relate this information to the task of conveying aeronautical knowledge and skills to students. Experienced aviation instructors also find the new and updated information useful for improving their effectiveness in training activities.

#### **Instrument Flying Handbook**

The Instrument Flying Handbook is designed for use by instrument flight instructors and pilots preparing for instrument rating tests. Instructors find this handbook a valuable training aid as it includes basic reference material for knowledge testing and instrument flight training.

#### **Instrument Procedures Handbook**

The Instrument Procedures Handbook is designed as a technical reference for professional pilots who operate under IFR in the NAS and expands on information contained in the Instrument Flying Handbook.

**Figure 1-15.** *A sample of handbooks available to the public. Most can be downloaded free of charge from the FAA website.*

of a text book used in a classroom or a one page document. Some ACs are free while others cost money. They are to be used for information only and are not regulations. The FAA website [www.faa.gov/regulations\\_policies/advisory\\_circulars/](http://www.faa.gov/regulations_policies/advisory_circulars/) provides a database that is a searchable repository of all aviation safety ACs. All ACs, current and historical, are provided and can be viewed as a portable document format (PDF) copy.

ACs provide a single, uniform, agency-wide system that the FAA uses to deliver advisory material to FAA customers, industry, the aviation community, and the public. An AC may be needed to:

- Provide an acceptable, clearly understood method for complying with a regulation

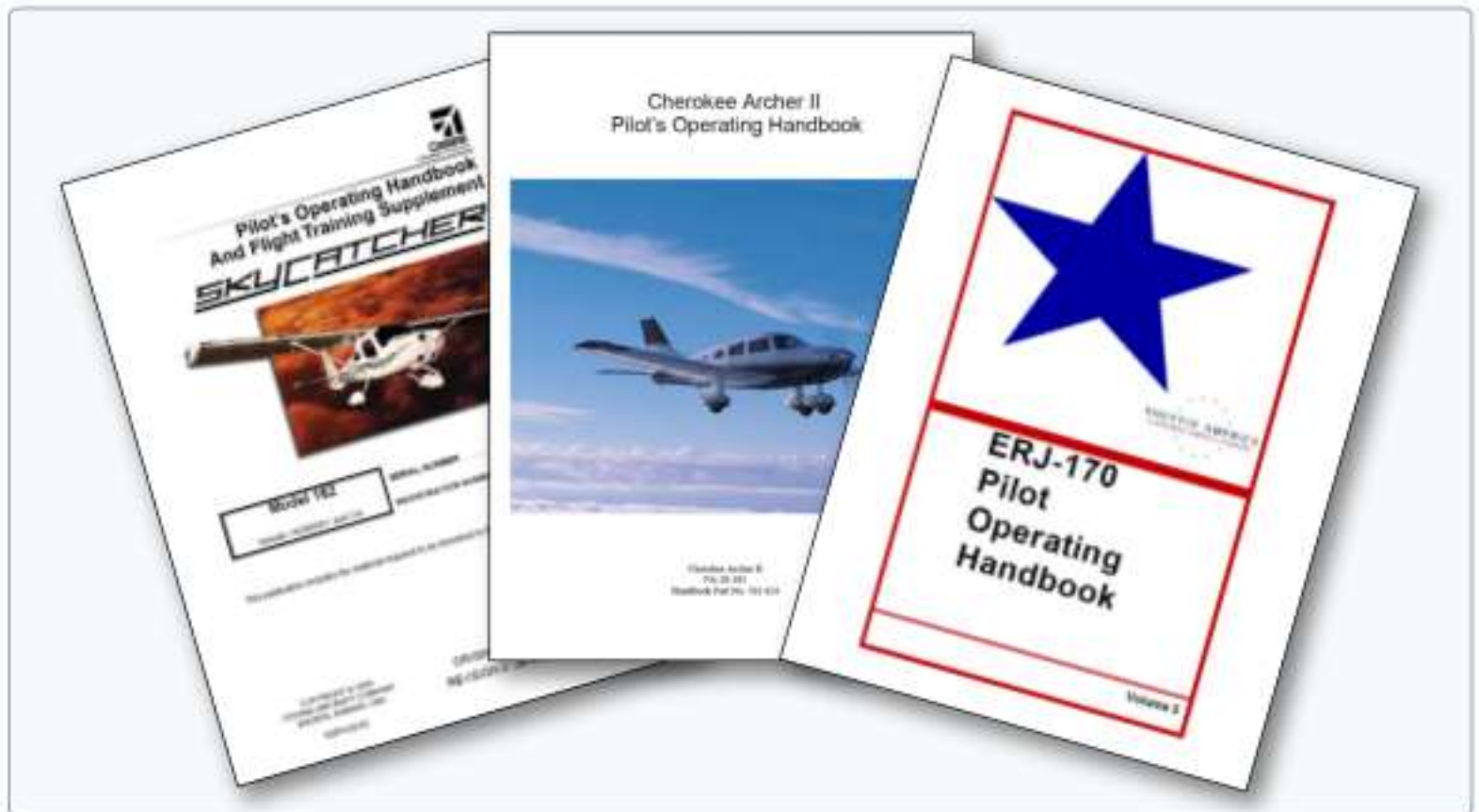


Figure 1-16. Pilot Operating Handbooks from manufacturers.

- Standardize implementation of a regulation or harmonize implementation for the international aviation community
- Resolve a general misunderstanding of a regulation
- Respond to a request from some government entity, such as General Accounting Office, NTSB, or the Office of the Inspector General
- Help the industry and FAA effectively implement a regulation
- Explain requirements and limits of an FAA grant program
- Expand on standards needed to promote aviation safety, including the safe operation of airports

There are three parts to an AC number, as in 25-42C. The first part of the number identifies the subject matter area of the AC and corresponds to the appropriate 14 CFR part. For example, an AC on “Certification: Pilots and Flight and Ground Instructors” is numbered as AC 61-65E. Since ACs are numbered sequentially within each subject area, the second part of the number beginning with the dash identifies this sequence. The third part of the number is a letter assigned by the originating office and shows the revision sequence if an AC is revised. The first version of an AC does not have a revision letter. In Figure 1-17, this is the fifth revision, as designated by the “E.”

### Flight Publications

The FAA, in concert with other government agencies, orchestrates the publication and changes to publications that are key to safe flight. Figure 1-18 illustrates some publications a pilot may use.

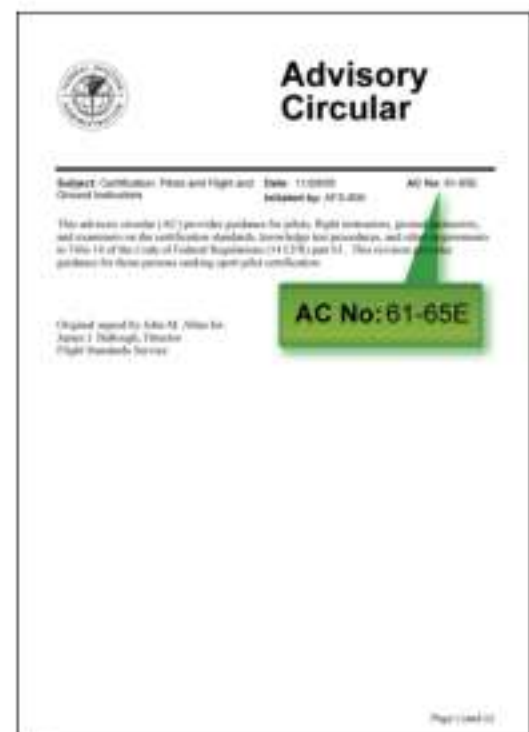
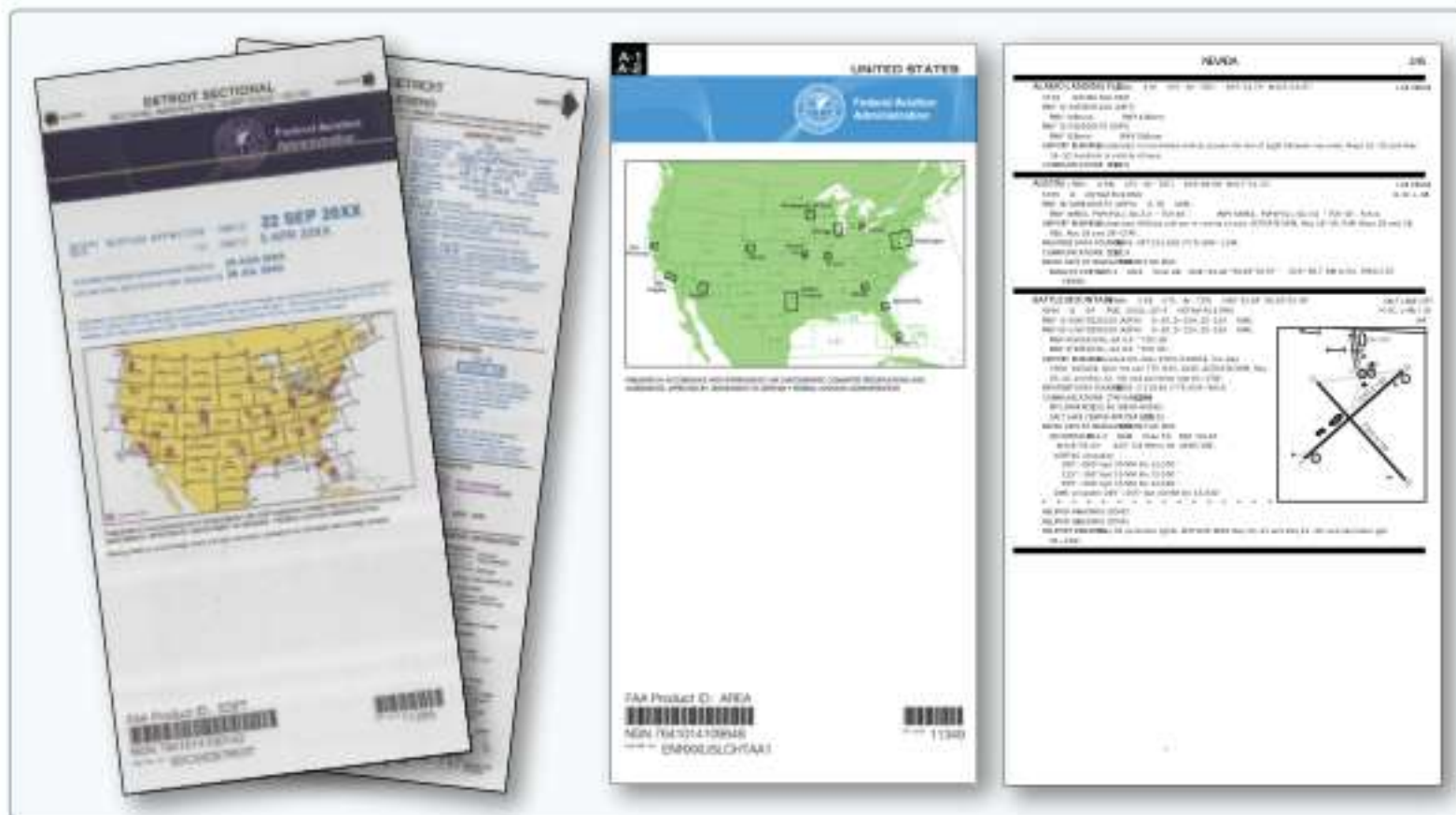


Figure 1-17. Example of an Advisory Circular in its fifth revision.



**Figure 1-18.** From left to right, a sectional VFR chart, IFR chart, and chart supplement U.S. (formerly Airport/Facility Directory) with a sample of a page from the supplement.

## Pilot and Aeronautical Information

### Notices to Airmen (NOTAMs)

Notices to Airmen, or NOTAMs, are time-critical aeronautical information either temporary in nature or not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications. The information receives immediate dissemination via the National Notice to Airmen (NOTAM) System. NOTAMs contain current notices to airmen that are considered essential to the safety of flight, as well as supplemental data affecting other operational publications. There are many different reasons that NOTAMs are issued. Following are some of those reasons:

- Hazards, such as air shows, parachute jumps, kite flying, and rocket launches
- Flights by important people such as heads of state
- Closed runways
- Inoperable radio navigational aids
- Military exercises with resulting airspace restrictions
- Inoperable lights on tall obstructions
- Temporary erection of obstacles near airfields
- Passage of flocks of birds through airspace (a NOTAM in this category is known as a BIRDTAM)
- Notifications of runway/taxiway/apron status with respect to snow, ice, and standing water (a SNOWTAM)

- Notification of an operationally significant change in volcanic ash or other dust contamination (an ASHTAM)
- Software code risk announcements with associated patches to reduce specific vulnerabilities

NOTAM information is generally classified into four categories: NOTAM (D) or NOTAMs that receive distant dissemination, distant and Flight Data Center (FDC) NOTAMs, Pointer NOTAMs, and Military NOTAMs pertaining to military airports or NAVAIDs that are part of the NAS. NOTAMs are available through Flight Service Station (FSS), Direct User Access Terminal Service (DUATS), private vendors, and many online websites.

#### NOTAM (D) Information

NOTAM (D) information is disseminated for all navigational facilities that are part of the NAS, and all public use airports, seaplane bases, and heliports listed in the Chart Supplement U.S. (formerly Airport/Facility Directory). NOTAM (D) information now includes such data as taxiway closures, personnel and equipment near or crossing runways, and airport lighting aids that do not affect instrument approach criteria, such as visual approach slope indicator (VASI). All D NOTAMs are required to have one of the following keywords as the first part of the text: RWY, TWY, RAMP, APRON, AD, OBST, NAV, COM, SVC, AIRSPACE, (U), or (O). [Figure 1-19]

### FDC NOTAMs

FDC NOTAMs are issued by the National Flight Data Center and contain information that is regulatory in nature pertaining to flight including, but not limited to, changes to charts, procedures, and airspace usage. FDC NOTAMs refer to information that is regulatory in nature and includes the following:

- Interim IFR flight procedures:
  1. Airway structure changes
  2. Instrument approach procedure changes (excludes Departure Procedures (DPs) and Standard Terminal Arrivals (STARs))
  3. Airspace changes in general
  4. Special instrument approach procedure changes
- Temporary flight restrictions (discussed in Chapter 15):
  1. Disaster areas
  2. Special events generating a high degree of interest
  3. Hijacking

- Flight restrictions in the proximity of the President and other parties
- 14 CFR part 139 certificated airport condition changes
- Snow conditions affecting glide slope operation
- Air defense emergencies
- Emergency flight rules
- Substitute airway routes
- Special data
- U.S. Government charting corrections
- Laser activity

### NOTAM Composition

NOTAMs contain the elements below from left to right in the following order:

- An exclamation point (!)
- Accountability Location (the identifier of the accountability location)

Keyword	Example	Meaning
RWY	RWY 3/21 CLSD	Runways 3 and 21 are closed to aircraft.
TWY	TWY F LGTS OTS	Taxiway F lights are out of service.
RAMP	RAMP TERMINAL EAST SIDE CONSTRUCTION	The ramp in front of the east side of the terminal has ongoing construction.
APRON	APRON SW TWY C NEAR HANGARS CLSD	The apron near the southwest taxiway C in front of the hangars is closed.
AD	AD ABN OTS	Aerodromes: The airport beacon is out of service.
OBST	OBST TOWER 283 (245 AGL) 2.2 S LGTS OTS (ASR 1065881) TIL 0707272300	Obstruction: The lights are out of service on a tower that is 283 feet above mean sea level (MSL) or 245 feet above ground level (AGL) 2.2 statute miles south of the field. The FCC antenna structure registration (ASR) number is 1065881. The lights will be returned to service 2300 UTC (Coordinated Universal Time) on July 27, 2007.
NAV	NAV VOR OTS	Navigation: The VOR located on this airport is out of service.
COM	COM ATIS OTS	Communications: The Automatic Terminal information Service (ATIS) is out of service.
SVC	SVC TWR 1215-0330 MON -FRI/1430-2300 SAT/1600-0100 SUN TIL 0707300100 SVC FUEL UNAVBL TIL 0707291600  SVC CUSTOMS UNAVBL TIL 0708150800	Service: The control tower has new operating hours, 1215-0330 UTC Monday Thru Friday, 1430-2300 UTC on Saturday and 1600-0100 UTC on Sunday until 0100 on July 30, 2007. Service: All fuel for this airport is unavailable until July 29, 2007, at 1600 UTC. Service: United States Customs service for this airport will not be available until August 15, 2007, at 0800 UTC.
AIRSPACE	AIRSPACE AIRSHOW ACFT 5000/BLW 5 NMR AIRPORT AVOIDANCE ADZD WEF 0707152000-0707152200	Airspace. There is an airshow being held at this airport with aircraft flying 5,000 feet and below within a 5 nautical mile radius. Avoidance is advised from 2000 UTC on July 15, 2007, until 2200 on July 15, 2007.
U	ORT 6K8 (U) RWY ABANDONED VEHICLE	Unverified aeronautical information.
O	LOZ LOZ (O) CONTROLLED BURN OF HOUSE 8 NE APCH END RWY 23 WEF 0710211300-0710211700	Other aeronautical information received from any authorized source that may be beneficial to aircraft operations and does not meet defined NOTAM criteria.

Figure 1-19. NOTAM (D) Information.

- Affected Location (the identifier of the affected facility or location)
- KEYWORD (one of the following: RWY, TWY, RAMP, APRON, AD, COM, NAV, SVC, OBST, AIRSPACE, (U) and (O))
- Surface Identification (optional—this shall be the runway identification for runway related NOTAMs, the taxiway identification for taxiway-related NOTAMs, or the ramp/apron identification for ramp/apron-related NOTAMs)
- Condition (the condition being reported)
- Time (identifies the effective time(s) of the NOTAM condition)

Altitude and height are in feet mean sea level (MSL) up to 17,999; e.g., 275, 1225 (feet and MSL is not written), and in flight levels (FL) for 18,000 and above; e.g., FL180, FL550. When MSL is not known, above ground level (AGL) will be written (304 AGL).

When time is expressed in a NOTAM, the day begins at 0000 and ends at 2359. Times used in the NOTAM system are universal time coordinated (UTC) and shall be stated in 10 digits (year, month, day, hour, and minute). The following are two examples of how the time would be presented:

*!DCA LDN NAV VOR OTS WEF  
0708051600-0708052359*

*!DCA LDN NAV VOR OTS WEF  
0709050000-0709050400*

#### *NOTAM Dissemination and Availability*

The system for disseminating aeronautical information is made up of two subsystems: the Airmen's Information System (AIS) and the NOTAM System. The AIS consists of charts and publications and is disseminated by the following methods:

Aeronautical charts depicting permanent baseline data:

- IFR Charts—Enroute High Altitude Conterminous U.S., Enroute Low Altitude Conterminous U.S., Alaska Charts, and Pacific Charts
- U.S. Terminal Procedures—Departure Procedures (DPs), Standard Terminal Arrivals (STARs) and Standard Instrument Approach Procedures (SIAPs)
- VFR Charts—Sectional Aeronautical Charts, Terminal Area Charts (TAC), and World Aeronautical Charts (WAC)

Flight information publications outlining baseline data:

- Notices to Airmen (NTAP)—Published by System Operations Services, System Operations and Safety, Publications, every 28 days)
- Chart Supplement U.S. (formerly Airport/Facility Directory)
- Pacific Chart Supplement
- Alaska Supplement
- Alaska Terminal
- Aeronautical Information Manual (AIM)

NOTAMs are available in printed form through subscription from the Superintendent of Documents, from an FSS, or online at PilotWeb ([www.pilotweb.nas.faa.gov](http://www.pilotweb.nas.faa.gov)), which provides access to current NOTAM information. Local airport NOTAMs can be obtained online from various websites. Some examples are [www.fltplan.com](http://www.fltplan.com) and [www.aopa.org/whatsnew/notams.html](http://www.aopa.org/whatsnew/notams.html). Most sites require a free registration and acceptance of terms but offer pilots updated NOTAMs and TFRs.

#### ***Safety Program Airmen Notification System (SPANS)***

In 2004, the FAA launched the Safety Program Airmen Notification System (SPANS), an online event notification system that provides timely and easy-to-assess seminar and event information notification for airmen. The SPANS system is taking the place of the current paper-based mail system. This provides better service to airmen while reducing costs for the FAA. Anyone can search the SPANS system and register for events. To read more about SPANS, visit [www.faasafety.gov/spans](http://www.faasafety.gov/spans).

## **Aircraft Classifications and Ultralight Vehicles**

The FAA uses various ways to classify or group machines operated or flown in the air. The most general grouping uses the term aircraft. This term is in 14 CFR 1.1 and means a device that is used or intended to be used for flight in the air.

Ultralight vehicle is another general term the FAA uses. This term is defined in 14 CFR 103. As the term implies, powered ultralight vehicles must weigh less than 254 pounds empty weight and unpowered ultralight vehicles must weigh less than 155 pounds. Rules for ultralight vehicles are significantly different from rules for aircraft; ultralight vehicle certification, registration, and operation rules are also contained in 14 CFR 103.

The FAA differentiates aircraft by their characteristics and physical properties. Key groupings defined in 14 CFR 1.1 include:

- Airplane—an engine-driven fixed-wing aircraft heavier than air, that is supported in flight by the dynamic reaction of the air against its wings.
- Glider—a heavier-than-air aircraft, that is supported in flight by the dynamic reaction of the air against its lifting surfaces and whose free flight does not depend principally on an engine.
- Lighter-than-air aircraft—an aircraft that can rise and remain suspended by using contained gas weighing less than the air that is displaced by the gas.
  - Airship—an engine-driven lighter-than-air aircraft that can be steered.
  - Balloon—a lighter-than-air aircraft that is not engine driven, and that sustains flight through the use of either gas buoyancy or an airborne heater.
- Powered-lift—a heavier-than-air aircraft capable of vertical takeoff, vertical landing, and low speed flight that depends principally on engine-driven lift devices or engine thrust for lift during these flight regimes and on nonrotating airfoil(s) for lift during horizontal flight.
- Powered parachute—a powered aircraft comprised of a flexible or semi-rigid wing connected to a fuselage so that the wing is not in position for flight until the aircraft is in motion. The fuselage of a powered parachute contains the aircraft engine, a seat for each occupant and is attached to the aircraft's landing gear.
- Rocket—an aircraft propelled by ejected expanding gases generated in the engine from self-contained propellants and not dependent on the intake of outside substances. It includes any part which becomes separated during the operation.
- Rotorcraft—a heavier-than-air aircraft that depends principally for its support in flight on the lift generated by one or more rotors.
  - Gyroplane—a rotorcraft whose rotors are not engine-driven, except for initial starting, but are made to rotate by action of the air when the rotorcraft is moving; and whose means of propulsion, consisting usually of conventional propellers, is independent of the rotor system.
  - Helicopter—a rotorcraft that, for its horizontal motion, depends principally on its engine-driven rotors.
- Weight-shift-control—a powered aircraft with a framed pivoting wing and a fuselage controllable only in pitch and roll by the pilot's ability to change the aircraft's

center of gravity with respect to the wing. Flight control of the aircraft depends on the wing's ability to flexibly deform rather than the use of control surfaces.

Size and weight are other methods used in 14 CFR 1.1 to group aircraft:

- Large aircraft—an aircraft of more than 12,500 pounds, maximum certificated takeoff weight.
- Light-sport aircraft (LSA)—an aircraft, other than a helicopter or powered-lift that, since its original certification, has continued to meet the definition in 14 CFR 1.1. (LSA can include airplanes, airships, balloons, gliders, gyro planes, powered parachutes, and weight-shift-control.)
- Small Aircraft—aircraft of 12,500 pounds or less, maximum certificated takeoff weight.

We also use broad classifications of aircraft with respect to the certification of airmen or with respect to the certification of the aircraft themselves. See the next section, Pilot Certifications, and Chapter 3, for further discussion of certification. These definitions are in 14 CFR 1.1:

- Category
  1. As used with respect to the certification, ratings, privileges, and limitations of airmen, means a broad classification of aircraft. Examples include: airplane; rotorcraft; glider; and lighter-than-air; and
  2. As used with respect to the certification of aircraft, means a grouping of aircraft based upon intended use or operating limitations. Examples include: transport, normal, utility, acrobatic, limited, restricted, and provisional.
- Class
  1. As used with respect to the certification, ratings, privileges, and limitations of airmen, means a classification of aircraft within a category having similar operating characteristics. Examples include: single engine; multiengine; land; water; gyroplane, helicopter, airship, and free balloon; and
  2. As used with respect to the certification of aircraft, means a broad grouping of aircraft having similar characteristics of propulsion, flight, or landing. Examples include: airplane, rotorcraft, glider, balloon, landplane, and seaplane.
- Type
  1. As used with respect to the certification, ratings, privileges, and limitations of airmen, means

a specific make and basic model of aircraft, including modifications thereto that do not change its handling or flight characteristics. Examples include: 737-700, G-IV, and 1900; and

- As used with respect to the certification of aircraft, means those aircraft which are similar in design. Examples include: 737-700 and 737-700C; G-IV and G-IV-X; and 1900 and 1900C.

This system of definitions allows the FAA to group and regulate aircraft to provide for their safe operation.

## Pilot Certifications

The type of intended flying influences what type of pilot's certificate is required. Eligibility, training, experience, and testing requirements differ depending on the type of certificates sought. [Figure 1-20] Each type of pilot's certificate has privileges and limitations that are inherent within the certificate itself. However, other privileges and limitations may be applicable based on the aircraft type, operation being conducted, and the type of certificate. For example, a certain certificate may have privileges and limitations under 14 CFR part 61 and part 91.



Figure 1-20. Front side (top) and back side (bottom) of an airman certificate issued by the FAA.

- Privileges—define where and when the pilot may fly, with whom they may fly, the purpose of the flight, and the type of aircraft they are allowed to fly.
- Limitations—the FAA may impose limitations on a pilot certificate if, during training or the practical test, the pilot does not demonstrate all skills necessary to exercise all privileges of a privilege level, category, class, or type rating.

Endorsements, a form of authorization, are written to establish that the certificate holder has received training in specific skill areas. Endorsements are written and signed by an authorized individual, usually a certificated flight instructor (CFI), and are based on aircraft classification. [Figure 1-21]

## Sport Pilot

To become a sport pilot, the student pilot is required to have flown, at a minimum, the following hours depending upon the aircraft:

- Airplane: 20 hours
- Powered Parachute: 12 hours
- Weight-Shift Control (Trikes): 20 hours
- Glider: 10 hours
- Rotorcraft (gyroplane only): 20 hours
- Lighter-Than-Air: 20 hours (airship) or 7 hours (balloon)

To earn a Sport Pilot Certificate, one must:

- Be at least 16 years old to become a student sport pilot (14 years old for gliders or balloons)
- Be at least 17 years old to test for a sport pilot certificate (16 years old for gliders or balloons)
- Be able to read, write, and understand the English language
- Hold a current and valid driver's license as evidence of medical eligibility

When operating as a sport pilot, some of the following privileges and limitations may apply.

## Privileges:

- Operate as pilot in command (PIC) of a light-sport aircraft
- Carry a passenger and share expenses (fuel, oil, airport expenses, and aircraft rental)
- Fly during the daytime using VFR, a minimum of 3 statute miles visibility and visual contact with the ground are required

Recreational pilot to conduct solo flights for the purpose of obtaining an additional certificate or rating while under the supervision of an authorized flight instructor: section 61.101(i).

*I certify that (First name, MI, Last name) has received the required training of section 61.87 in a (make and model aircraft). I have determined he/she is prepared to conduct a solo flight on (date) under the following conditions: (List all conditions which require endorsement, e.g., flight which requires communication with air traffic control, flight in an aircraft for which the pilot does not hold a category/class rating, etc.).*

**Figure 1-21.** Example endorsement for a recreational pilot to conduct solo flights for the purpose of determining an additional certificate or rating.

### **Limitations:**

- Prohibited from flying in Class A airspace
- Prohibited from flying in Class B, C, or D airspace until you receive training and a logbook endorsement from an instructor
- No flights outside the United States without prior permission from the foreign aviation authority
- May not tow any object
- No flights while carrying a passenger or property for compensation or hire
- Prohibited from flying in furtherance of a business

The sport pilot certificate does not list aircraft category and class ratings. After successfully passing the practical test for a sport pilot certificate, regardless of the light-sport aircraft privileges you seek, the FAA will issue you a sport pilot certificate without any category and class ratings. The Instructor will provide you with the appropriate logbook endorsement for the category and class of aircraft in which you are authorized to act as pilot in command.

### **Recreational Pilot**

To become a recreational pilot, one must:

- Be at least 17 years old
- Be able to read, write, speak, and understand the English language
- Pass the required knowledge test
- Meet the aeronautical experience requirements in either a single-engine airplane, a helicopter, or a gyroplane.
- Obtain a logbook endorsement from an instructor
- Pass the required practical test
- Obtain a third-class medical certificate issued under 14 CFR part 67

As a recreational pilot, cross-country flight is limited to a 50 NM range from the departure airport but is permitted with additional training per 14 CFR part 61, section 61.101(c). Additionally, recreational pilots are restricted from flying at night and flying in airspace where communications with ATC are required.

The minimum aeronautical experience requirements for a recreational pilot license involve:

- 30 hours of flight time including at least:
  - 15 hours of dual instruction
  - 2 hours of en route training
  - 3 hours in preparation for the practical test
  - 3 hours of solo flight

When operating as a recreational pilot, some of the following privileges and limitations may apply.

### **Privileges:**

- Carry no more than one passenger;
- Not pay less than the pro rata share of the operating expenses of a flight with a passenger, provided the expenses involve only fuel, oil, airport expenses, or aircraft rental fees

### **Limitations:**

- A recreational pilot may not act as PIC of an aircraft that is certificated for more than four occupants or has more than one powerplant.

### **Private Pilot**

A private pilot is one who flies for pleasure or personal business without accepting compensation for flying except in some very limited, specific circumstances. The Private Pilot Certificate is the certificate held by the majority of

active pilots. It allows command of any aircraft (subject to appropriate ratings) for any noncommercial purpose and gives almost unlimited authority to fly under VFR. Passengers may be carried and flight in furtherance of a business is permitted; however, a private pilot may not be compensated in any way for services as a pilot, although passengers can pay a pro rata share of flight expenses, such as fuel or rental costs. If training under 14 CFR part 61, experience requirements include at least 40 hours of piloting time, including 20 hours of flight with an instructor and 10 hours of solo flight. [Figure 1-22]

### Commercial Pilot

A commercial pilot may be compensated for flying. Training for the certificate focuses on a better understanding of aircraft systems and a higher standard of airmanship. The Commercial Pilot Certificate itself does not allow a pilot to fly in instrument meteorological conditions (IMC), and commercial pilots without an instrument rating are restricted to daytime flight within 50 NM when flying for hire.

A commercial airplane pilot must be able to operate a complex airplane, as a specific number of hours of complex (or turbine-powered) aircraft time are among the prerequisites, and at least a portion of the practical examination is performed in a complex aircraft. A complex aircraft must have retractable landing gear, movable flaps, and a controllable-pitch propeller. See 14 CFR part 61, section 61.31(e) for additional information. [Figure 1-23]

### Airline Transport Pilot

The airline transport pilot (ATP) is tested to the highest level of piloting ability. The ATP certificate is a prerequisite for serving as a PIC and second in command (SIC) of scheduled airline operations. It is also a prerequisite for serving as a PIC in select charter and fractional operations. The minimum pilot experience is 1,500 hours of flight time. In addition, the pilot must be at least 23 years of age, be able to read, write, speak,



Figure 1-23. A complex aircraft.

and understand the English language, and be “of good moral standing.” A pilot may obtain an ATP certificate with restricted privileges enabling him/her to serve as an SIC in scheduled airline operations. The minimum pilot experience is reduced based upon specific academic and flight training experience. The minimum age to be eligible is 21 years. [Figure 1-24]

### Selecting a Flight School

Selecting a flight school is an important consideration in the flight training process. FAA-approved training centers, FAA-approved pilot schools, noncertificated flying schools, and independent flight instructors conduct flight training in the United States. All flight training is conducted under the auspices of the FAA following the regulations outlined in 14 CFR parts 142, 141, or 61. Training centers, also referred to as flight academies, operate under 14 CFR part 142 and are certificated by the FAA. Application for certification is voluntary and the training center must meet stringent requirements for personnel, equipment, maintenance, facilities, and must teach a curriculum approved by the FAA. Training centers typically utilize a number of flight simulation training devices as part of its curricula. Flight training conducted at a training center is primarily done under contract to airlines and other commercial operators in transport or turbine aircraft, however many also provide



Figure 1-22. A typical aircraft a private pilot might fly.



Figure 1-24. Type of aircraft flown by an airline transport pilot.

flight training for the private pilot certificate, commercial pilot certificate, instrument rating, and ATP certificate.

Flight schools operating under 14 CFR part 141 are certificated by the FAA. Application for certification is voluntary and the school must meet stringent requirements for personnel, equipment, maintenance, facilities, and must teach an established curriculum, which includes a training course outline (TCO) approved by the FAA. The certificated schools may qualify for a ground school rating and a flight school rating. In addition, the school may be authorized to give its graduates practical (flight) tests and knowledge (computer administered written) tests. The FAA Pilot School Search database located at <http://av-info.faa.gov/PilotSchool.asp>, lists certificated ground and flight schools and the pilot training courses each school offers.

Enrollment in a 14 CFR part 141 flight school ensures quality, continuity, and offers a structured approach to flight training because these facilities must document the training curriculum and have their flight courses approved by the FAA. These strictures allow 14 CFR part 141 schools to complete certificates and ratings in fewer flight hours, which can mean a savings on the cost of flight training for the student pilot. For example, the minimum requirement for a Private Pilot Certificate is 35 hours in a part 141-certificated school and 40 hours in a part 61-certificated school. (This difference may be insignificant for a Private Pilot Certificate because the national average indicates most pilots require 60 to 75 hours of flight training.)

Many excellent flight schools find it impractical to qualify for the FAA part 141 certificates and are referred to as part 61 schools. 14 CFR part 61 outlines certificate and rating requirements for pilot certification through noncertificated schools and individual flight instructors. It also states what knowledge-based training must be covered and how much flight experience is required for each certificate and rating. Flight schools and flight instructors who train must adhere to the statutory requirements and train pilots to the standards found in 14 CFR part 61.

One advantage of flight training under 14 CFR part 61 is its flexibility. Flight lessons can be tailored to the individual student, because 14 CFR part 61 dictates the required minimum flight experience and knowledge-based training necessary to gain a specific pilot's license, but it does not stipulate how the training is to be organized. This flexibility can also be a disadvantage because a flight instructor who fails to organize the flight training can cost a student pilot time and expense through repetitious training. One way for a student pilot to avoid this problem is to ensure the flight instructor has a well-documented training syllabus.

## **How To Find a Reputable Flight Program**

To obtain information about pilot training, contact the local FSDO, which maintains a current file on all schools within its district. The choice of a flight school depends on what type of certificate is sought, and whether an individual wishes to fly as a sport pilot or wishes to pursue a career as a professional pilot. Another consideration is the amount of time that can be devoted to training. Ground and flight training should be obtained as regularly and frequently as possible because this assures maximum retention of instruction and the achievement of requisite proficiency.

Do not make the determination based on financial concerns alone, because the quality of training is very important. Prior to making a final decision, visit the schools under consideration and talk with management, instructors, and students. Request a personal tour of the flight school facility.

Be inquisitive and proactive when searching for a flight school, do some homework, and develop a checklist of questions by talking to pilots and reading articles in flight magazines. The checklist should include questions about aircraft reliability and maintenance practices, and questions for current students such as whether or not there is a safe, clean aircraft available when they are scheduled to fly.

Questions for the training facility should be aimed at determining if the instruction fits available personal time. What are the school's operating hours? Does the facility have dedicated classrooms available for ground training required by the FAA? Is there an area available for preflight briefings, postflight debriefings, and critiques? Are these rooms private in nature in order to provide a nonthreatening environment in which the instructor can explain the content and outcome of the flight without making the student feel self-conscious?

Examine the facility before committing to any flight training. Evaluate the answers on the checklist, and then take time to think things over before making a decision. This proactive approach to choosing a flight school will ensure a student pilot contracts with a flight school or flight instructor best suited to their individual needs.

## **How To Choose a Certificated Flight Instructor (CFI)**

Whether an individual chooses to train under 14 CFR part 141 or part 61, the key to an effective flight program is the quality of the ground and flight training received from the CFI. The flight instructor assumes total responsibility for training an individual to meet the standards required for certification within an ever-changing operating environment. A CFI should possess an understanding of the learning process, knowledge of the fundamentals of teaching, and

the ability to communicate effectively with the student pilot. During the certification process, a flight instructor applicant is tested on the practical application of these skills in specific teaching situations. The flight instructor is crucial to the scenario-based training program endorsed by the FAA. He or she is trained to function in the learning environment as an advisor and guide for the learner. The duties, responsibilities, and authority of the CFI include the following:

- Orient the student to the scenario-based training system
- Help the student become a confident planner and inflight manager of each flight and a critical evaluator of their own performance
- Help the student understand the knowledge requirements present in real world applications
- Diagnose learning difficulties and help the student overcome them
- Evaluate student progress and maintain appropriate records
- Provide continuous review of student learning

Should a student pilot find the selected CFI is not training in a manner conducive for learning, or the student and CFI do not have compatible schedules, the student pilot should find another CFI. Choosing the right CFI is important because the quality of instruction and the knowledge and skills acquired from their flight instructor affect a student pilot's entire flying career.

## The Student Pilot

The first step in becoming a pilot is to select a type of aircraft. FAA rules for obtaining a pilot's certificate differ depending on the type of aircraft flown. Individuals can choose among airplanes, gyroplanes, weight-shift, helicopters, powered parachutes, gliders, balloons, or airships. A pilot does not need a certificate to fly ultralight vehicles.

### Basic Requirements

A student pilot is one who is being trained by an instructor pilot for his or her first full certificate, and is permitted to fly alone (solo) under specific, limited circumstances. Before a student pilot may be endorsed to fly solo, that student must have a Student Pilot Certificate. There are multiple ways that an aspiring pilot can obtain their Student Pilot Certificate. The application may be processed by an FAA inspector or technician, an FAA-Designated Pilot Examiner, a Certified Flight Instructor (CFI), or an Airman Certification Representative (ACR). If the application is completed electronically, the authorized person will submit the application to the FAA's Airman Certification Branch (AFS-760) in Oklahoma City, OK, via the Integrated

Airman Certification and Rating Application (IACRA). If the application is completed on paper, it must be sent to the local Flight Standards District Office (FSDO), who will forward it to AFS-760. Once the application is processed, the applicant will receive the Student Pilot Certificate by mail at the address provided on the application.

The aforementioned process will become effective on April 1, 2016. The new certificate will be printed on a plastic card, which will replace the paper certificate that was issued in the past. The plastic card certificate will not have an expiration date. Paper certificates issued prior to the new process will still expire according to the date on the certificate; however, under the new process, paper certificates cannot be renewed. Once the paper certificate expires, the Student Pilot must submit a new application under the new process. Another significant change in the new process is that flight instructors will now make endorsements for solo privileges in the Student Pilot's logbook, instead of endorsing the Student Pilot Certificate.

To be eligible for a Student Pilot Certificate, the applicant must:

- Be at least 16 years of age (14 years of age to pilot a glider or balloon).
- Be able to read, speak, write, and understand the English language.

### Medical Certification Requirements

The second step in becoming a pilot is to obtain a medical certificate (if the choice of aircraft is an airplane, helicopter, gyroplane, or an airship). (The FAA suggests the individual get a medical certificate before beginning flight training to avoid the expense of flight training that cannot be continued due to a medical condition.) Balloon or glider pilots do not need a medical certificate, but do need to write a statement certifying that no medical defect exists that would prevent them from piloting a balloon or glider. The new sport pilot category does not require a medical examination; a driver's license can be used as proof of medical competence. Applicants who fail to meet certain requirements or who have physical disabilities which might limit, but not prevent, their acting as pilots, should contact the nearest FAA office. Anyone requesting an FAA Medical Clearance, Medical Certificate, or Student Pilot Medical Certificate can electronically complete an application through the FAA's MedXPress system available at <https://medxpress.faa.gov/>.

A medical certificate is obtained by passing a physical examination administered by a doctor who is an FAA-authorized AME. There are approximately 6,000 FAA-authorized AMEs in the nation. To find an AME near

you, go to the FAA's AME locator at [www.faa.gov/pilots/amelocator/](http://www.faa.gov/pilots/amelocator/). Medical certificates are designated as first class, second class, or third class. Generally, first class is designed for the airline transport pilot; second class for the commercial pilot; and third class for the student, recreational, and private pilot. A Student Pilot Certificate can be processed by an FAA inspector or technician, an FAA Designated pilot examiner (DPE), an Airman Certification Representative (ACR), or a Certified Flight Instructor (CFI). This certificate allows an individual who is being trained by a flight instructor to fly alone (solo) under specific, limited circumstances and must be carried with the student pilot while exercising solo flight privileges. The Student Pilot Certificate is only required when exercising solo flight privileges. The new plastic student certificate does not have an expiration date. For airmen who were issued a paper certificate, that certificate will remain valid until its expiration date. A paper certificate cannot be renewed. When the paper certificate expires, a new application must be completed via the IACRA system, and a new plastic certificate will be issued.

### ***Student Pilot Solo Requirements***

Once a student has accrued sufficient training and experience, a CFI can endorse the student's logbook to authorize limited solo flight in a specific type (make and model) of aircraft. A student pilot may not carry passengers, fly in furtherance of a business, or operate an aircraft outside of the various endorsements provided by the flight instructor. There is no minimum aeronautical knowledge or experience requirement for the issuance of a Student Pilot Certificate, however, the applicant must be at least 16 years of age (14 years of age for a pilot for glider or balloon), and they must be able to read, speak, write and understand the English language. There are, however, minimum aeronautical knowledge and experience requirements for student pilots to solo.

## **Becoming a Pilot**

The course of instruction a student pilot follows depends on the type of certificate sought. It should include the ground and flight training necessary to acquire the knowledge and skills required to safely and efficiently function as a certificated pilot in the selected category and class of aircraft. The specific knowledge and skill areas for each category and class of aircraft are outlined in 14 CFR part 61. Eligibility, aeronautical knowledge, proficiency, and aeronautical requirements can be found in 14 CFR part 61.

- Recreational Pilot, see subpart D
- Private Pilot, see subpart E
- Sport Pilot, see subpart J

The knowledge-based portion of training is obtained through FAA handbooks such as this one, textbooks, and other sources

of training and testing materials which are available in print form from the Superintendent of Documents, GPO, and online at the Regulatory Support Division: [www.faa.gov/about/office\\_org/headquarters\\_offices/avs/offices/afs/afs600](http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs600).

The CFI may also use commercial publications as a source of study materials, especially for aircraft categories where government materials are limited. A student pilot should follow the flight instructor's advice on what and when to study. Planning a definite study program and following it as closely as possible will help in scoring well on the knowledge test. Haphazard or disorganized study habits usually result in an unsatisfactory score.

In addition to learning aeronautical knowledge, such as the principles of flight, a student pilot is also required to gain skill in flight maneuvers. The selected category and class of aircraft determines the type of flight skills and number of flight hours to be obtained. There are four steps involved in learning a flight maneuver:

- The CFI introduces and demonstrates flight maneuver to the student.
- The CFI talks the student pilot through the maneuver.
- The student pilot practices the maneuver under CFI supervision.
- The CFI authorizes the student pilot to practice the maneuver solo.

Once the student pilot has shown proficiency in the required knowledge areas, flight maneuvers, and accrued the required amount of flight hours, the CFI endorses the student pilot logbook, which allows the student pilot to take the written and practical tests for pilot certification.

## **Knowledge and Skill Tests**

### **Knowledge Tests**

The knowledge test is the computer portion of the tests taken to obtain pilot certification. The test contains questions of the objective, multiple-choice type. This testing method conserves the applicant's time, eliminates any element of individual judgment in determining grades, and saves time in scoring.

FAA Airman Knowledge Test Guides for every type of pilot certificate address most questions you may have regarding the knowledge test process. The guides are available online (free of charge) at [http://www.faa.gov/training\\_testing/testing/test\\_guides/](http://www.faa.gov/training_testing/testing/test_guides/).

### ***When To Take the Knowledge Test***

The knowledge test is more meaningful to the applicant and more likely to result in a satisfactory grade if it is taken after beginning the flight portion of the training. Therefore, the FAA recommends the knowledge test be taken after the student pilot has completed a solo cross-country flight. The operational knowledge gained by this experience can be used to the student's advantage in the knowledge test. The student pilot's CFI is the best person to determine when the applicant is ready to take the knowledge test.

### **Practical Test**

The FAA has developed PTS for FAA pilot certificates and associated ratings. [Figure 1-25] In 2015, the FAA began transitioning to the ACS approach. The ACS is essentially an "enhanced" version of the PTS. It adds task-specific knowledge and risk management elements to each PTS Area of Operation and Task. The result is a holistic, integrated presentation of specific knowledge, skills, and risk management elements and performance metrics for each Area of Operation and Task. The ACS evaluation program will eventually replace the PTS program for evaluating and certifying pilots.

The practical tests are administered by FAA ASIs and DPEs. Title 14 CFR part 61 specifies the areas of operation in which

knowledge and skill must be demonstrated by the applicant. Since the FAA requires all practical tests be conducted in accordance with the appropriate PTS and the policies set forth in the Introduction section of the PTS book. The pilot applicant should become familiar with this book during training.

The PTS book is a testing document and not intended to be a training syllabus. An appropriately-rated flight instructor is responsible for training the pilot applicant to acceptable standards in all subject matter areas, procedures, and maneuvers. Descriptions of tasks and information on how to perform maneuvers and procedures are contained in reference and teaching documents such as this handbook. A list of reference documents is contained in the Introduction section of each PTS book. Copies may be obtained by:

- Downloading from the FAA website at [www.faa.gov](http://www.faa.gov)
- Purchasing print copies from the GPO, Pittsburgh, Pennsylvania, or via their official online bookstore at [www.access.gpo.gov](http://www.access.gpo.gov)

The flight proficiency maneuvers listed in 14 CFR part 61 are the standard skill requirements for certification. They are outlined in the PTS as "areas of operation." These are phases of the practical test arranged in a logical sequence within the standard. They begin with preflight preparation and end with postflight procedures. Each area of operation



**Figure 1-25.** Examples of Practical Test Standards.

contains “tasks,” which are comprised of knowledge areas, flight procedures, and/or flight maneuvers appropriate to the area of operation. The candidate is required to demonstrate knowledge and proficiency in all tasks for the original issuance of all pilot certificates.

### ***When To Take the Practical Test***

14 CFR part 61 establishes the ground school and flight experience requirements for the type of certification and aircraft selected. However, the CFI best determines when an applicant is qualified for the practical test. A practice practical test is an important step in the flight training process.

The applicant will be asked to present the following documentation:

- FAA Form 8710-1 (8710.11 for sport pilot applicants), Application for an Airman Certificate and/or Rating, with the flight instructor’s recommendation
- An Airman Knowledge Test Report with a satisfactory grade
- A medical certificate (not required for glider or balloon), a Student Pilot Certificate, and a pilot logbook endorsed by a flight instructor for solo, solo cross-country (airplane and rotorcraft), and for the make and model aircraft to be used for the practical test (driver’s license or medical certificate for sport pilot applicants)
- The pilot log book records
- A graduation certificate from an FAA-approved school (if applicable)

The applicant must provide an airworthy aircraft with equipment relevant to the areas of operation required for the practical test. He or she will also be asked to produce and explain the:

- Aircraft’s registration certificate
- Aircraft’s airworthiness certificate
- Aircraft’s operating limitations or FAA-approved aircraft flight manual (if required)
- Aircraft equipment list
- Required weight and balance data
- Maintenance records
- Applicable airworthiness directives (ADs)

For a detailed explanation of the required pilot maneuvers and performance standards, refer to the PTS pertaining to the type of certification and aircraft selected. These standards may be downloaded free of charge from the FAA at [www.faa.gov](http://www.faa.gov). They may also be purchased from the Superintendent of Documents

or GPO bookstores. Most airport fixed-base operators and flight schools carry a variety of government publications and charts, as well as commercially published materials.

### ***Who Administers the FAA Practical Tests?***

Due to the varied responsibilities of the FSDOs, practical tests are usually given by DPEs. An applicant should schedule the practical test by appointment to avoid conflicts and wasted time. A list of examiner names can be obtained from the local FSDO. Since a DPE serves without pay from the government for conducting practical tests and processing the necessary reports, the examiner is allowed to charge a reasonable fee. There is no charge for the practical test when conducted by an FAA inspector.

### ***Role of the Certificated Flight Instructor***

To become a CFI, a pilot must meet the provisions of 14 CFR part 61. The FAA places full responsibility for student flight training on the shoulders of the CFI, who is the cornerstone of aviation safety. It is the job of the flight instructor to train the student pilot in all the knowledge areas and teach the skills necessary for the student pilot to operate safely and competently as a certificated pilot in the NAS. The training includes airmanship skills, pilot judgment and decision-making, and good operating practices.

A pilot training program depends on the quality of the ground and flight instruction the student pilot receives. The flight instructor must possess a thorough understanding of the learning process, knowledge of the fundamentals of teaching, and the ability to communicate effectively with the student pilot. Use of a structured training program and formal course syllabus is crucial for effective and comprehensive flight training. It should be clear to the student in advance of every lesson what the course of training will involve and the criteria for successful completion. This should include the flight instructor briefing and debriefing the student before and after every lesson. Additionally, scenario-based training has become the preferred method of flight instruction today. This involves presenting the student with realistic flight scenarios and recommended actions for mitigating risk.

Insistence on correct techniques and procedures from the beginning of training by the flight instructor ensures that the student pilot develops proper flying habits. Any deficiencies in the maneuvers or techniques must immediately be emphasized and corrected. A flight instructor serves as a role model for the student pilot who observes the flying habits of his or her flight instructor during flight instruction, as well as when the instructor conducts other pilot operations. Thus, the flight instructor becomes a model of flying proficiency for the student who, consciously or unconsciously, attempts to imitate the instructor. For this reason, a flight instructor

should observe recognized safety practices, as well as regulations during all flight operations.

The student pilot who enrolls in a pilot training program commits considerable time, effort, and expense to achieve a pilot certificate. Students often judge the effectiveness of the flight instructor and the success of the pilot training program based on their ability to pass the requisite FAA practical test. A competent flight instructor stresses to the student that practical tests are a sampling of pilot ability compressed into a short period of time. The goal of a flight instructor is to train the “total” pilot.

### **Role of the Designated Pilot Examiner**

The Designated Pilot Examiner (DPE) plays an important role in the FAA’s mission of promoting aviation safety by administering FAA practical tests for pilot and Flight Instructor Certificates and associated ratings. Although administering these tests is a responsibility of the ASI, the FAA’s highest priority is making air travel safer by inspecting aircraft that fly in the United States. To satisfy the need for pilot testing and certification services, the FAA delegates certain responsibilities to private individuals who are not FAA employees.

Appointed in accordance with 14 CFR part 183, section 183.23, a DPE is an individual who meets the qualification requirements of the Pilot Examiner’s Handbook, FAA Order 8710.3, and who:

- Is technically qualified
- Holds all pertinent category, class, and type ratings for each aircraft related to their designation
- Meets requirements of 14 CFR part 61, sections 61.56, 61.57, and 61.58, as appropriate
- Is current and qualified to act as PIC of each aircraft for which he or she is authorized
- Maintains at least a Third-Class Medical Certificate, if required
- Maintains a current Flight Instructor Certificate, if required

Designated to perform specific pilot certification tasks on behalf of the FAA, a DPE may charge a reasonable fee. Generally, a DPE’s authority is limited to accepting applications and conducting practical tests leading to the issuance of specific pilot certificates and/or ratings. The majority of FAA practical tests at the private and commercial pilot levels are administered by DPEs.

DPE candidates must have good industry reputations for professionalism, integrity, a demonstrated willingness to

serve the public, and must adhere to FAA policies and procedures in certification matters. The FAA expects the DPE to administer practical tests with the same degree of professionalism, using the same methods, procedures, and standards as an FAA ASI.

## **Chapter Summary**

The FAA has entered the second century of civil aviation as a robust government organization and is taking full advantage of technology, such as Global Positioning System (GPS) satellite technology to enhance the safety of civil aviation. The Internet has also become an important tool in promoting aviation safety and providing around-the-clock resources for the aviation community. Handbooks, regulations, standards, references, and online courses are now available at [www.faa.gov](http://www.faa.gov).

In keeping with the FAA’s belief that safety is a learned behavior, the FAA offers many courses and seminars to enhance air safety. The FAA puts the burden of instilling safe flying habits on the flight instructor, who should follow basic flight safety practices and procedures in every flight operation he or she undertakes with a student pilot. Operational safety practices include, but are not limited to, collision avoidance procedures consisting of proper scanning techniques, use of checklists, runway incursion avoidance, positive transfer of controls, and workload management. These safety practices are discussed more fully within this handbook. Safe flight also depends on Scenario-Based Training (SBT) that teaches the student pilot how to respond in different flight situations. The FAA has incorporated these techniques along with decision-making methods, such as aeronautical decision-making (ADM), risk management, and crew resource management (CRM), which are covered more completely in Chapter 2, Aeronautical Decision-Making.