Pilot's Handbook of Aeronautical Knowledge

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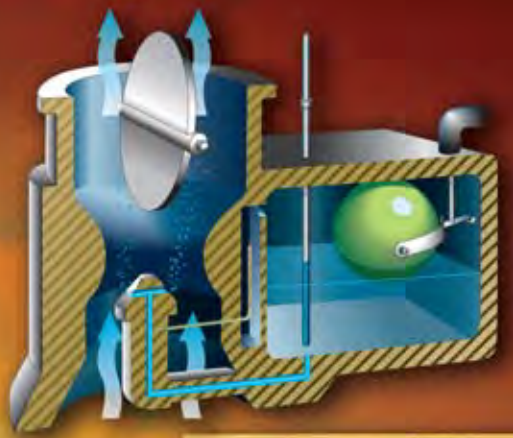
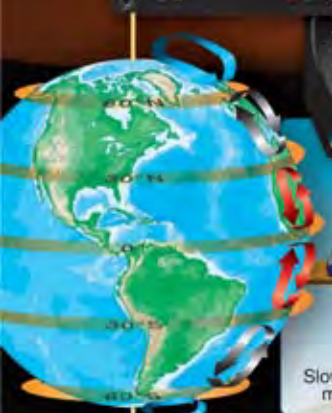
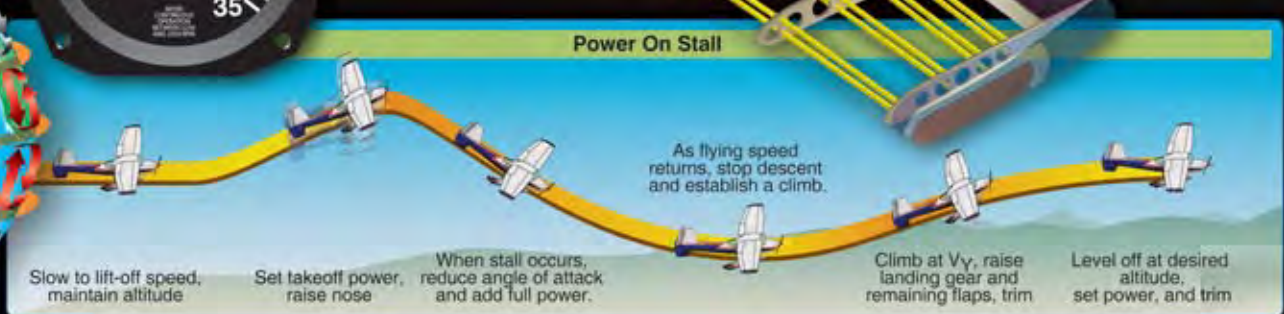
U.S. Department of Transportation

Federal Aviation Administration







Pilot's Handbook of Aeronautical Knowledge

2016

U.S. Department of Transportation
FEDERAL AVIATION ADMINISTRATION
Flight Standards Service

Pilot's Handbook of Aeronautical Knowledge
2016
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Preface

The Pilot's Handbook of Aeronautical Knowledge provides basic knowledge that is essential for pilots. This handbook introduces pilots to the broad spectrum of knowledge that will be needed as they progress in their pilot training. Except for the Code of Federal Regulations pertinent to civil aviation, most of the knowledge areas applicable to pilot certification are presented. This handbook is useful to beginning pilots, as well as those pursuing more advanced pilot certificates.

Occasionally the word "must" or similar language is used where the desired action is deemed critical. The use of such language is not intended to add to, interpret, or relieve a duty imposed by Title 14 of the Code of Federal Regulations (14 CFR).

It is essential for persons using this handbook to become familiar with and apply the pertinent parts of 14 CFR and the Aeronautical Information Manual (AIM). The AIM is available online at www.faa.gov. The current Flight Standards Service airman training and testing material and learning statements for all airman certificates and ratings can be obtained from www.faa.gov.

This handbook supersedes FAA-H-8083-25A, Pilot's Handbook of Aeronautical Knowledge, dated 2008.

This handbook is available for download, in PDF format, from www.faa.gov.

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Disclaimer: Information in Chapter 14 pertaining to Runway Incursion Avoidance was created using FAA orders, documents, and Advisory Circulars that were current at the date of publication. Users should not assume that all references are current and should check often for reference updates.

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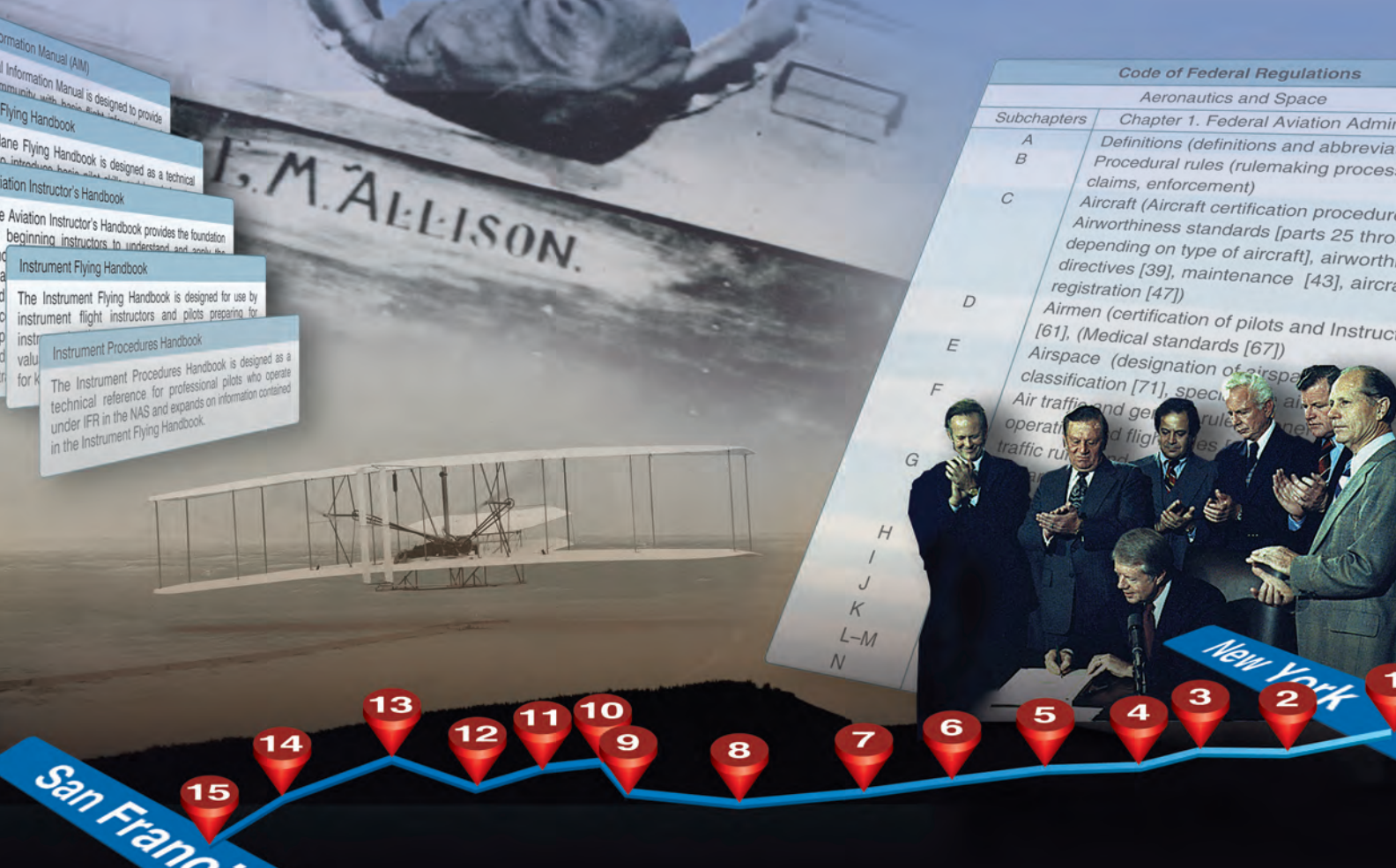
Chapter 1

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.

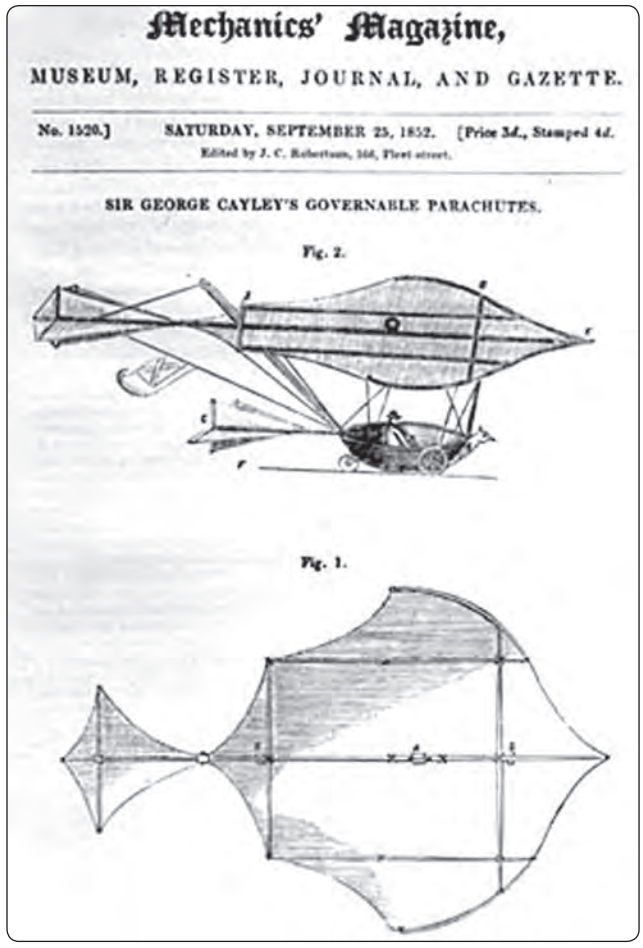
The identity of the first "bird-men" who fitted themselves with wings and leapt off of cliffs in an effort to fly are lost in time, but each failure gave those who wished to fly questions that needed to be answered. Where had the wing flappers gone wrong? Philosophers, scientists, and inventors offered 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 billowing heap of cloth capable of no more than a one-way, downwind journey.

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

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 Mongolfier 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.



Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1520.] SATURDAY, SEPTEMBER 25, 1852. [Price 3d., Stamped 4d.

SIR GEORGE CAYLEY'S GOVERNABLE PARACHUTES.

Fig. 2.

Fig. 1.

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. 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]*

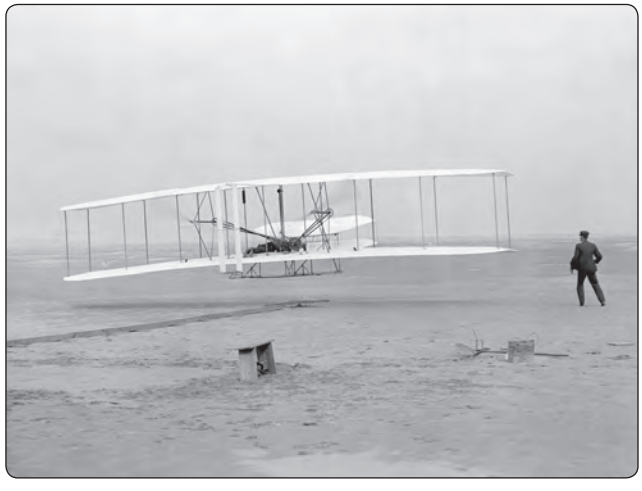


Figure 1-3. *First flight by the Wright brothers.*

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

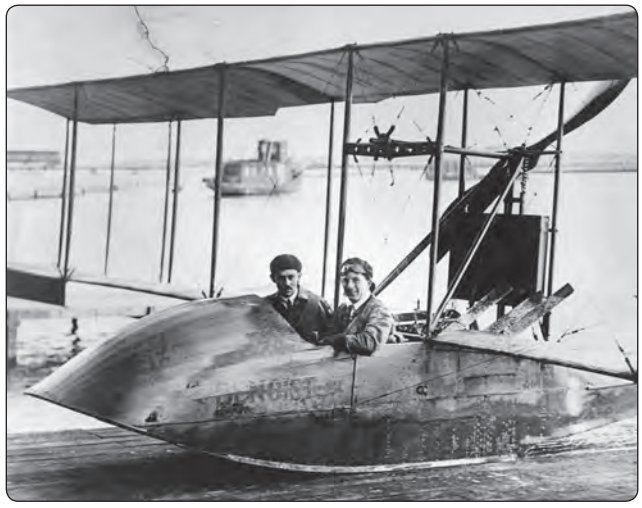


Figure 1-4. *Benoist airboat.*

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

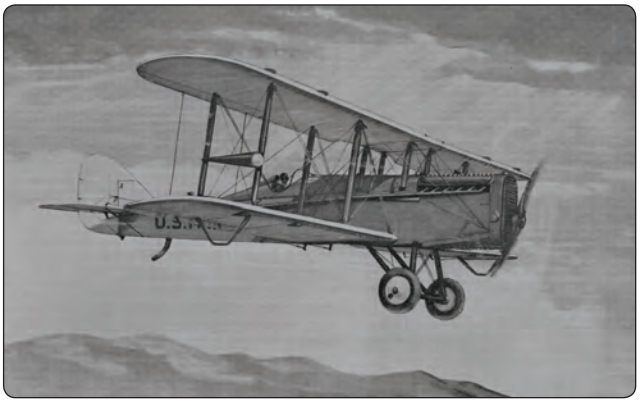


Figure 1-5. *The de Haviland DH-4 on the New York to San Francisco inaugural route in 1921.*

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

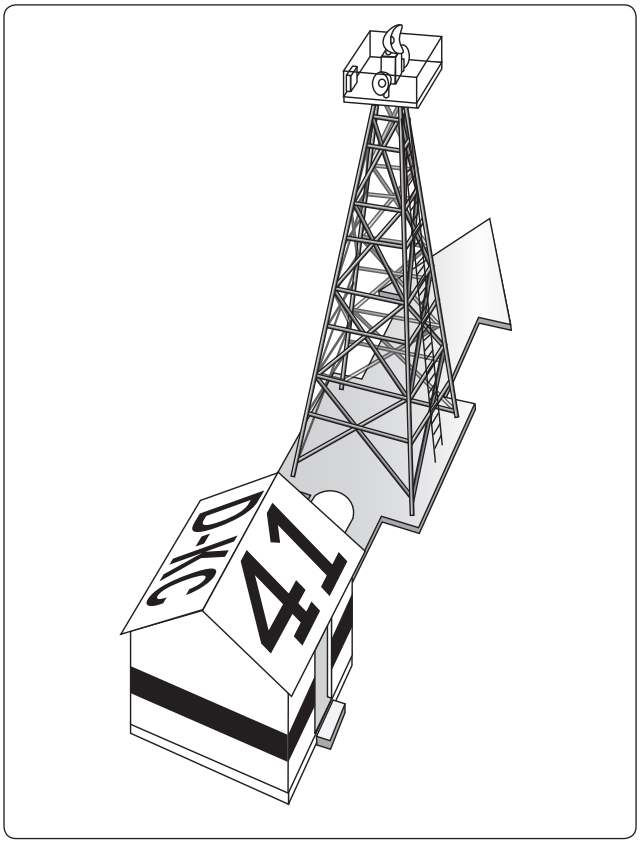


Figure 1-7. *A standard airway beacon tower.*


UNITED STATES OF AMERICA
DEPARTMENT OF COMMERCE
AERONAUTICS BRANCH
FORM R-18C

OFFICIAL NO. 1

This Certifies, That
WILLIAM P. MacCRACKEN, Jr.
whose photograph and signature accompany this license, is a
PRIVATE PILOT
of civil aircraft of the United States. The holder is not authorized to transport persons or property for hire or reward.
This license expires April 6th, 1928
Herbert Hoover
Secretary of Commerce

UNITED STATES OF AMERICA
DEPARTMENT OF COMMERCE
AERONAUTICS BRANCH

PILOT'S IDENTIFICATION CARD

This Identification Card, issued on the 6th day of April, 1927, accompanies Pilot's License No. 1
Age 38
Weight 200 Color hair Brown
Height 6' 1½" Color eyes Blue
Wm P MacCracken Jr
Pilot's Signature.

FORM R-19
GOVERNMENT PRINTING OFFICE

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 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).

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

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.

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 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.

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

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.

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. 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 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

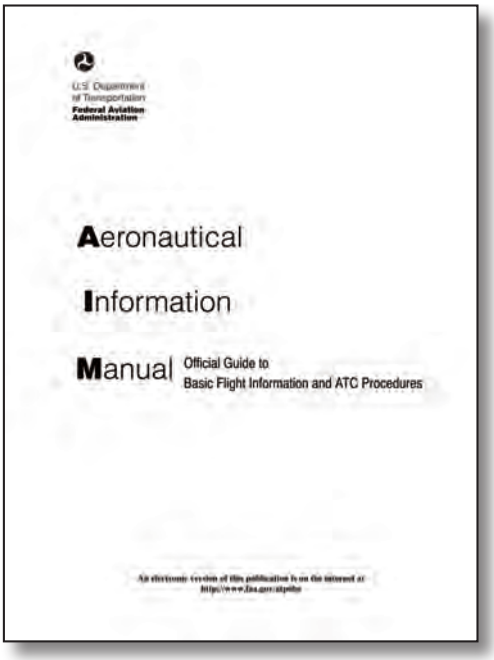


Figure 1-14. *Aeronautical Information Manual.*

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. 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]*

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.*

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 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/ 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

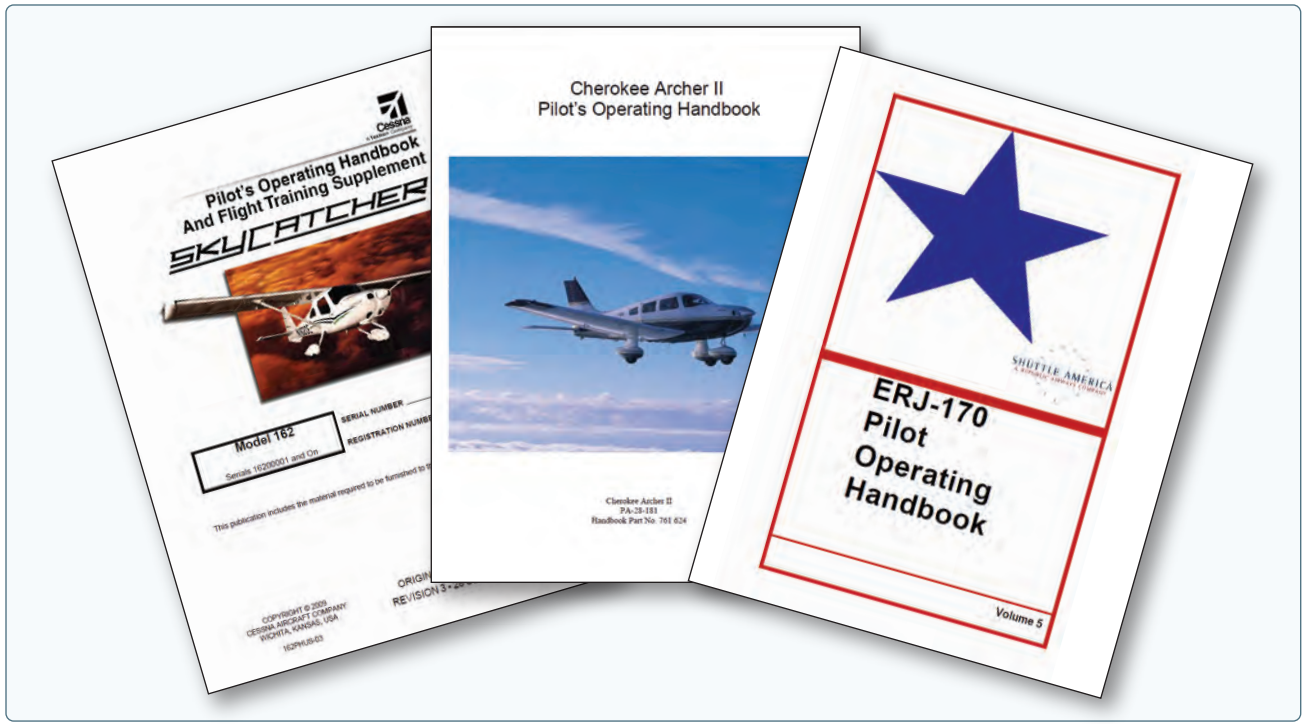


Figure 1-16. *Pilot Operating Handbooks from manufacturers.*

- 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.

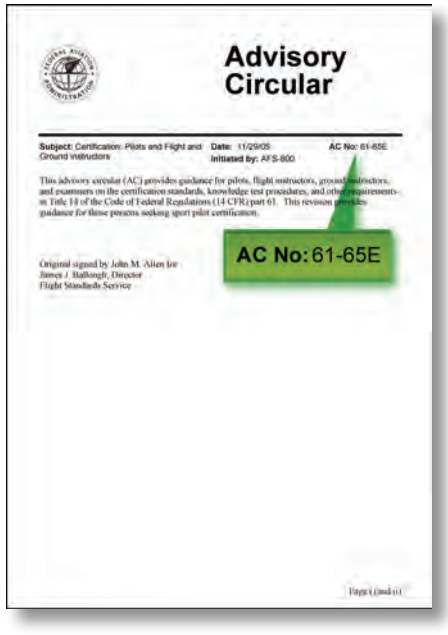


Figure 1-17. *Example of an Advisory Circular in its fifth revision.*

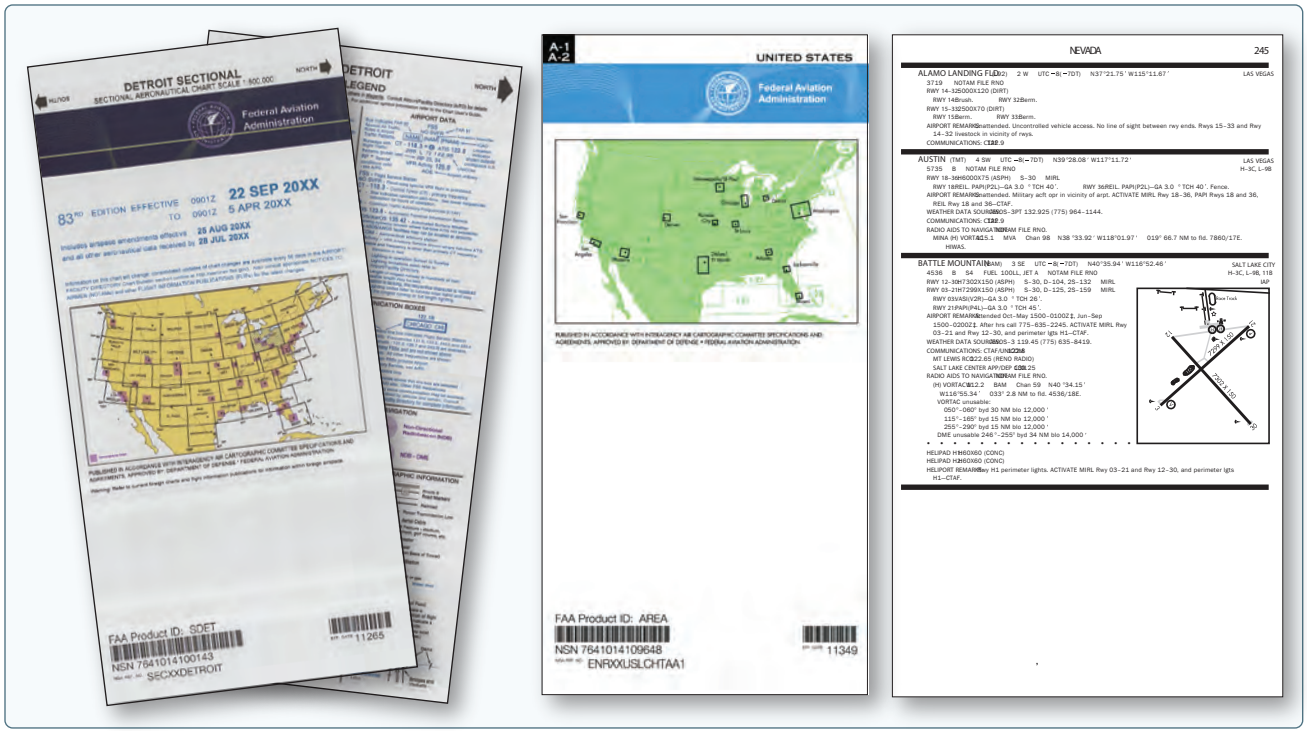


Figure 1-18. *From left to right, a sectional VFR chart, IFR chart, and chart supplement U.S. (formerly Airport/Facility Directory) with a sample of a page from the supplement.*

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	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.
	SVC FUEL UNAVBL TIL 0707291600	Service: All fuel for this airport is unavailable until July 29, 2007, at 1600 UTC.
	SVC CUSTOMS UNAVBL TIL 0708150800	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), which provides access to current NOTAM information. Local airport NOTAMs can be obtained online from various websites. Some examples are www.fltplan.com and 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.

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, gilder, balloon, landplane, and seaplane.
- Type
  1. As used with respect to the certification, ratings, privileges, and limitations of airmen, means