NATIONAL REGISTER BULLETIN

Technical information on the National Register of Historic Places:
survey, evaluation, registration, and preservation of cultural resources.

U.S. Department of the Interior
National Park Service
Cultural Resources

GUIDELINES FOR EVALUATING AND DOCUMENTING HISTORIC AVIATION PROPERTIES

The mission of the Department of Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibility to tribes.

This material is partially based on work conducted under a cooperative agreement with the National Conference of State Historic Preservation Officers and the U.S. Department of the Interior.

Photograph caption, cover:

Air mail pilot Marvin O'Dell (Louisville to Cleveland route), Bowman Field, Louisville, KY, ca. 1930. Bowman Field Historic District, Jefferson County, KY.
(Photographer unknown, courtesy of Kentucky Heritage Council)

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with
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PREFACE

Much of America's 20th century history is inextricably linked to aviation. At times, American inventors, scientists, engineers, pilots, and military and civilian leaders headed pioneering efforts to develop aviation technology and uses. In different periods, the United States lagged behind other nations and needed highly dedicated and costly efforts to catch up.

Both the public and private sectors contributed to aviation's development in this country. The pioneers of America's aviation industry built the technological and industrial infrastructure that enabled aviation to succeed, while the exploits of daring flying heroes captured the public imagination and encouraged the support of aviation. The Federal government supported the development of military aviation, conducted important aeronautical research, and established, regulated, and encouraged the development of interstate passenger, postal, and freight commerce.

The American public has had a fascination with aviation throughout this century. Aerial combat in the First World War established heroes such as Lt. Edward Rickenbacker, "Ace of Aces" and winner of the Congressional Medal of Honor. The Golden Age of Aviation between the World Wars brought enthusiasm for flying to all parts of the country via air shows, air races, barnstormers, and wing walkers. The exploits of daring pilots, including Charles Lindbergh, Amelia Earhart, Jacqueline Cochran, and Howard Hughes, were closely followed as they set speed, distance, and endurance records. Hollywood captured America's love of the romance of flight in the movies; the first Academy Award for best motion picture was presented to the 1927 film *Wings*, the story of American Army Signal Corps pilots battling the Germans in the sky over France.

America's entry into World War II was precipitated by a Japanese aerial attack on Pearl Harbor in Hawaii on December 7, 1941. The United States responded with the massive mobilization of men and war materiel that eventually destroyed German Nazism and Italian fascism in Europe and the expansionist Japanese empire. The bombers, fighters, and transports produced by American industry contributed substantially to that victory. When the Soviet Union blockaded Berlin in 1948, the Western allies initiated the Berlin Airlift to supply the 2,100,000 residents of the beleaguered city. Over a 321 day period, American and British allied aircraft made 272,264 flights transporting 2.3 million tons of food and other supplies. This enormous air relief effort convinced the Soviet Union that America would not abandon Berlin to Soviet control.

After the Second World War, developments in aviation were spurred by the tensions of the Cold War and the expanded civilian growth of air travel for pleasure and business. The military focused on high-speed aircraft to maintain air superiority. On October 14, 1947, Capt. Charles E. Yeager became the first person to successfully fly an aircraft (the X-1) faster than the speed of sound. The airline industries built ever larger and faster passenger and cargo carriers, transporting people and goods around the globe at speeds and distances inconceivable to the generation that witnessed the birth of manned flight. General aviation experienced a great growth during this period. The Soviet Union's launching of Sputnik on October 4, 1957, was a pivotal event in the development of the American space program. The United States responded to this challenge with exceptional achievements: manned space flight, lunar landings, exploration of the solar system, and development of the space shuttle program.

The Nation's remarkable aviation history is reflected in numerous districts, sites, buildings, structures, and objects eligible for the National Register of Historic Places. These historic aircraft, airfields, research and testing facilities, aeronautical and engineering research laboratories, production plants, military installations, and launch sites are worthy of preservation for their contributions to aviation technology, and for their association with the historically significant people and events that made the United States the world's leader in aviation.

Carol D. Shull
Keeper of the
National Register of Historic Places
National Register,
History and Education

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I. INTRODUCTION

With the exception of a few earlier developments, aviation is basically a twentieth-century technology. The Wright brothers flew the world's first airplane in December 1903.

AVIATION IS MORE THAN AIRPLANES

Yet aviation is more than airplanes. It is a technology which broadly defined, includes aircraft and wrecks of aircraft, production and testing facilities, air terminals, and other components that support civil, military, and commercial flying. The airplane gradually became the vehicle of transportation and military revolutions, and aviation has permeated twentieth-century life. Aviation's significance is reflected in many aspects of American history, architecture, archeology, engineering, and culture. Under the National Register's areas of significance, aviation has played an important role in the history of agriculture, architecture, archeology, art, commerce, communications, education, engineering, entertainment/recreation, industry, invention, landscape architecture, military, science, social history, and transportation.

The purpose of this bulletin is to provide guidance in identifying, evaluating, and nominating historic aviation properties to the National Register. Nominations may be prepared by concerned citizens, historians, preservation specialists, archeologists, Indian tribes, Certified Local Governments, State Historic Preservation Officers, and Federal Historic Preservation Officers. *National Register Bulletin: How to Complete the National Register Registration Form,* provides general guidelines, and *How to Complete the National Register Multiple Property Documentation Form* is used to nominate groups of related properties. Also applicable are *National Register Bulletins: How to Apply the National Register Criteria for Evaluation; Researching a Historic Property;* and *Guidelines for Evaluating and Nominating Properties That Have Achieved Significance within the Last Fifty Years,* which is relevant to much of aviation history.

SIGNIFICANCE OF AVIATION PROPERTIES

The importance of aviation is not fully reflected by the small number of airplanes listed in the National Register. Historic aviation properties eligible for the National Register may be significant at the local, State, or National level. These properties may be listed individually (for example, as a type of aircraft) or as part of a group (a collection of buildings forming a historic district). In addition to aircraft, aviation wrecks, aviation development and production facilities, air terminals on land and water, military air bases and stations, aids to navigation, administrative, and educational facilities, and missile launch sites and complexes are examples of other aviation properties that may meet the National Register criteria.

This aviation bulletin supplements general publications that contain information useful to anyone nominating a property to the National Register of Historic Places. All publications mentioned in the text are cited in the Recommended Sources section at the back of this bulletin.

II. AVIATION IN AMERICAN HISTORY

Aviation in America began in the late eighteenth century with balloons. In 1783 John Quincy Adams and Benjamin Franklin watched a balloon flight in Paris. Soon thereafter, Americans imported the balloon. In the United States the 1830s opened a "golden age" of ballooning that continued into the 1860s. During the Civil War, Union and Confederate forces used balloons to fly reconnaissance and thereby began military aviation in this country. Balloons are the main lighter-than-air craft operating in aviation today; they are used for sport, show, and scientific research.

EARLY EXPERIMENTS IN AERONAUTICS

A few Americans, notably the engineer Octave Chanute and the scientist Samuel Pierpont Langley, conducted experiments in aeronautics in the late nineteenth century. Langley, Secretary of the Smithsonian Institution, designed a steam-powered model that made the first sustained flight of a heavier-than-air machine in May of 1896. His work continued into the early 20th century with a full-sized flying machine, which Langley named "Aerodrome A." It crashed into the Potomac River nine days before the Wright brothers' first successful flights on December 17, 1903. Flights by Wilbur and Orville were manned, powered, controlled, and sustained, and culminated their years of theoretical and experimental research. The Wright brothers developed the airplane as a practical flying machine, and they built the world's first military airplane in 1908 for the United States Army Signal Corps.

In late 1909 the Wright brothers incorporated a manufacturing company, the Wright Company. Earlier that year Glenn Curtiss had undertaken the design and manufacture of airplanes at his G.H. Curtiss Manufacturing Company in Hammondsport, New York. These companies represent the origin of the aviation industry in the United States. Aviation in this country, however, progressed slowly from the experimental and demonstration activities of the early twentieth century to civil, commercial, and military operations.

WORLD WAR I AVIATION

Though the first to fly, the United States fell behind other nations, especially France. When this country entered the First World War in April 1917, the Aviation Section of the Army Signal Corps (the military's air arm, which eventually became the U.S. Air Force) had only a small number of airplanes. Most of these were already obsolete or out of commission. The Naval Flying Corps had only 54 aircraft. Furthermore, the nation had only the rudiments of an aviation industry, few airplane factories, few aeronautical engineers, few workers skilled in producing and maintaining aircraft, almost no commercial aviation, and only a handful of airfields.

World War I was a major impetus for the development of American aviation. The wartime Aircraft Production Board initially concentrated its efforts on getting one airplane, a De Havilland design, and one aviation engine, the Liberty, into production and service. The Army Signal Corps organized logging and mill operations in the Pacific Northwest, the principal source of the spruce essential for the construction of airplane frames. These efforts enabled the nation to build aviation equipment for the war, and the United States produced more than 24,000 Liberty engines by the Armistice (November 11, 1918). The number of airplanes, airfields, and pilots increased considerably during the war.

During the war, the United States expanded the number of aircraft designs. Glenn L. Martin, an aviator, actor, and aircraft manufacturer who established one of the first airplane factories in the U.S. (in 1909 in Santa Ana, California) merged his company with newly formed Wright Aircraft Company in 1916. The Wright-Martin company produced the Hispano-Suiza aircraft engine. The H in the designation of the Curtiss JN-4H trainer (the Jenny,) stood for the Hispano engine made by Wright. The Army, Navy, and Marines used the Jenny as a primary trainer. The Army Engineering Division developed the USD-9A day bomber. During the war the Navy acquired flying boats, like the Curtiss N-9 primary trainer, and dirigibles, like the Goodyear B-ships.

Relatively few American-made aviation products reached the European battleground before the war ended. Yet, even so, the design and production achievements of World War I laid the foundation for the postwar aviation industry. When air mail service began in 1918,

Liberty and Curtiss engines powered the air mail planes. Also, pilots were able to buy affordable war-surplus equipment to barnstorm for recreation and entertainment. Barnstorming, air shows, and air races popularized aviation.

POST-WAR DEVELOPMENTS

American aviation suffered after the war ended. The surplus of aircraft and equipment limited the market for new products and designs and assured that the wood-fabric-wire construction of aircraft continued well into the 1920s. Army airfield construction around the country came to an immediate halt and some airfields were abandoned. The postwar period was one of instability and uncertainty for the (now) Army Air Service as its development was repeatedly scaled down over the next several years. America's retreat into isolationism led to limited funding for national defense, continued reliance on seapower for the country's primary defense, and diminishing support for the young air arm as the importance of airpower was debated. Shortages of men, equipment, and money were critical and the deteriorated condition of buildings and flying fields became a widely discussed issue.

In spite of the government's fiscal conservatism, interest in military aviation was maintained. In 1921, the Navy established its Bureau of Aeronautics to pursue naval air interests, and in 1922 the Navy completed conversion of one of its ships (a collier) into the first aircraft carrier, the *USS Langley.* The Army Air Service's first peacetime work after the Great War was the mapping and routing of "aerial roads," which were a primary need for development of aerial commerce and also served a military purpose. In 1921, the Air Service established a model airway as an example for a nationwide system of airways and landing fields. Scheduled flights began over the airway in 1922.

AERONAUTICAL RESEARCH

The National Advisory Committee for Aeronautics (NACA) began important aeronautical research during this period. NACA was established in 1915 "to supervise and direct the scientific study of the problems of flight, with a view to their practical solution." Its first aeronautical laboratory, at Langley Field in Hampton, Virginia, was dedicated in June 1920. This was the Federal government's only civilian aeronautical laboratory until World War II. The scope of its research programs encompassed the design, construction, and operation of airplanes, but the laboratory's emphasis was on aerodynamics research. By the late 1920s it was recognized as the premier aeronautical engineering laboratory in the world.

The elite Aero Club of America, founded in 1905, promoted private flying for sport and recreation. It issued flying licenses, awarded the prestigious Robert J. Collier Trophy for "greatest achievement in aviation in America" for the preceding year, and represented the Fédération Aeronautique Internationale in this country. Transformed in 1922 into the more egalitarian National Aeronautic Association, this organization verified national and international flying records like those set at the National Air Races of the 1920s and 1930s.

AIR MAIL SERVICE

The United States Post Office inaugurated air mail service in 1918 to serve the needs of national commerce. This was the first serious commercial use of aviation, and its purpose was to improve mail delivery and reduce costs. The Post Office planned air mail routes, including the first Transcontinental Air Route from New York to San Francisco.

Airports developed along Air Mail Service routes until the fall of 1925. The Kelly Air Mail Act of 1925 authorized the Post Office to contract with private operators to fly the mail. After 1927, the development of entirely new routes produced a boom period in airport construction.

The Air Commerce Act of 1926 was the first Federal legislation to regulate civil aeronautics. The Department of Commerce established an Aeronautics Branch that became responsible for air safety, development of a system of airways, and the promotion of aviation and airports. The airway routes were equipped with navigation aids like radio range beacons and lights, and control towers in congested airways. The Air Commerce Act prohibited the Department of Commerce from directly subsidizing airport construction, but relief funds were used for airport development during the Great Depression. In 1934, the Aeronautics Branch was replaced with the Bureau of Air Commerce.

The Kelly Air Mail Act and the Air Commerce Act encouraged private investment in aviation, as did the 1926 establishment of the Daniel Guggenheim Fund for the promotion of Aeronautics. One way that the Guggenheim Fund promoted aviation was by sponsoring aeronautical programs in American universities, including the California Institute of Technology, the Massachusetts Institute of Technology, and Stanford University.

GENERAL AVIATION

In May of 1927, the world's perception of aviation was impacted dramatically by Charles A. Lindbergh, Jr.'s flight. Lindbergh made the first solo nonstop transatlantic flight (from New York to Paris) in a small Ryan monoplane. This daring feat illustrated aviation's potential to the public and convinced American businessmen to invest in aviation. Lindbergh became a tireless advocate of aviation, and his status as a public hero assured press attention.

General aviation became increas-ingly popular and accessible as manufacturers began to construct

airplanes specifically for private and sports pilots. In 1927, Clyde V. Cessna organized the Cessna Aircraft Company in Kansas and built the prototype of the cantilever monoplane series for which his company became famous. That same year Taylor Brothers Aircraft Corporation was organized; a decade later and with a different company C.G. Taylor introduced the Taylorcraft line of aircraft. In 1937, William T. Piper acquired Taylor Brothers and changed the company's name to Piper. The Aeronautical Corporation of America—better known as Aeronca—began production of its C-2 light plane in 1929. Walter Beech formed the Beech Aircraft Company in 1932.

ROCKETRY

The science of rocketry was also being developed in this period. Robert H. Goddard, a physicist, and the "father of the modern rocket," developed a general theory of rocket action in 1912. Goddard undertook research during World War I that led to the development of a solid-projectile, which was used in World War II as the bazooka. Goddard's writings predicted the use of rockets for lunar, interplanetary, and intergalactic exploration. In 1926 he successfully launched the world's first liquid-fuel rocket at Auburn, Massachusetts, an event known as the "Kitty Hawk" of rocketry, and in 1930, at Roswell, New Mexico, he fired an 11-foot rocket to the height of 2,000 feet at a speed of 500 mph. In 1935 one of his liquid-propelled rockets exceeded the speed of sound.

COMMERCIAL AVIATION

Three large conglomerates emerged in the commercial aviation industry to produce and fly aircraft. Their manufacturing plants were scattered throughout the country, with concentrations on both coasts. One large conglomerate was United Aircraft and Transport Corporation. Its chairman was William E. Boeing in Seattle, Washington, and the president was Frederick B. Rentschler in Hartford, Connecticut. In 1933 this one holding company manufactured Boeing airplanes in Seattle; Hamilton Standard propellers, Pratt & Whitney aircraft engines, and Chance Vought military aircraft in East Hartford, Connecticut; Pratt & Whitney aircraft engines in Longueuil, Quebec, Canada; Sikorsky flying boats in Stratford, Connecticut; and Stearman aircraft in Wichita, Kansas. In addition, it operated airlines—United Airlines, Boeing Air Transport, National Air Transport, Pacific Air Transport, and Varney Air Lines, and other concerns, including the Boeing School of Aeronautics in California, United Aircraft Exports in Connecticut, United Airports Company in California, and United Airports of Connecticut.

A second giant in the industry was North American Aviation, organized by Clement M. Keys. North American included the large National Air Transport airline. The third large conglomerate was Aviation Corporation of the Americas (AVCO) that involved Juan Trippe of Pan American Airways, airplane designer and manufacturer Sherman Fairchild, and others. Some companies, like Leroy R. Grumman's Grumman Aircraft, remained competitive outside of the consolidated concerns. Lockheed, founded by Allan and Malcolm Loughead, became a division of the Detroit Aircraft Corporation and later the Southern California Aviation Corporation. Donald Douglas's aircraft company had financial and stock ties to Transcontinental and Western Air and North American Aviation. With few though notable exceptions, like the Naval Aircraft Factory in Philadelphia, the aircraft industry manufactured military aircraft under contract with the services and according to military specifications. These military contracts spurred the growth of the industry.

A national airmail scandal in 1934 led to cancellation of airmail contracts due to fraud and brought on a reorganization in the aviation industry. A new law for private carriers with airmail contracts required the separation of equipment makers (manufacturers), from equipment operators (airlines). This resulted in the forced break-up of United Aircraft and Transport Corp. (William Boeing's giant conglomerate). Three companies emerged from the dissolution; Boeing Airplane Company built air-planes; United Aircraft Corporation made aircraft engines and propellers, as well as Sikorsky flying boats and Chance Vought fighter planes; and United Airlines flew the commercial equipment.

The airmail scandal affected the military when the Army Air Corps was ordered to carry the mail during what amounted to a national emergency. The Air Corps was not equipped or trained for this job, and the consequences were tragic—66 crashes and 11 deaths in 3 months. Army aviation subsequently underwent a major reorganization, directly attributed to the airmail fiasco, which Eddie Rickenbacker had called "legalized murder."

By the early 1930s, research at NACA's laboratory at Langley Field, Virginia, led to a new concept for aircraft design which featured a low-wing monoplane of all metal construction, with two or four air-cooled engines, retractable landing gear, and variable-pitch propellers. Some aircraft manufacturers, notably Boeing, Martin, and Douglas, adopted the new concept immediately and revolutionized air transport and military bombers. The Boeing 247 transport, the first truly modern airliner, followed NACA's new design concept. Next was the Douglas DC-3, which became the world's most successful airliner prior to the jet age. Boeing also used the same principles in designing its B-17 in 1935 for the Army Air Corps. The B-17 was the forerunner of all modern subsonic bombers, and it gave the military its first real American air power.

The Department of Commerce's Bureau of Air Commerce was replaced by an independent agency called the Civil Aeronautics Authority in 1938. Its independence was short-lived. In 1940 control of civil aviation was vested in the Civil Aeronautics Administration within the Department of Commerce. Congress transformed that organization into the Federal Aviation Agency, an independent regulatory agency, in 1958. That agency in turn became the Federal Aviation Administration within the Department of Transportation in 1967. These federal agencies administered civil aviation, though under heavy military influence during World War II and the first decade of the Cold War.

WORLD WAR II AVIATION

The start of World War II in Europe prompted large, direct federal funding of airports through the Development of Landing Areas for National Defense, or DLAND program, administered by the Civil Aeronautics Administration. Also for defense purposes, the Civil Aeronautics Administration assumed operation of airport traffic control and extended air traffic control to all airways. Airport construction, airport traffic control, and airway traffic control—all wartime measures—became permanent operations of the federal agency for civil aviation. The military reserved specified airspace for its use and developed its own navigation systems. The Federal Aviation Act of 1958 assigned domestic airspace to the new Federal Aviation Agency and thereby reduced tension between civil and military aviation.

The aerial attack on Pearl Harbor demonstrated that the use of air power had become decisive. World War II brought military aviation to the forefront of the industry and greatly increased industry's production. The magnitude of the wartime demand prompted manufacturing companies to convert from peacetime job shop methods to wartime line production techniques. This changed the nature, as well as the magnitude, of production. Industry expanded production of military equipment capable of operating from land, from water, and from aircraft carriers. Military aviation operations expanded greatly from the World War I and peacetime missions. The missions included training, coastal patrol, observation and reconnaissance, scouting, convoy protection and other escort services, logistical support in the form of transport and cargo operations, as well as all types of air combat (pursuit, attack, bombardment, and observation).

The war prompted advances in aircraft technology and the design of new aircraft. Range, load, speed, maneuverability, and armament were improved as new designs came into production. Fighter planes illustrate the variety of military aircraft. The streamlined Bell P-39 Airacobra, versatile Curtiss P-40 fighter, heavy Republic P-47 Thunderbolt, long-range North American P-51 Mustang, night-flying Northrop P-61 Black Widow, multi-purpose Vultee P-66 Vanguard, and jet Lockheed P-80A Shooting Star are a few examples. The Army's Air Transport Command developed international air routes flown by military and commercial carriers and prompted the development of aircraft designed specifically for transport purposes. In the name of air transport, wartime military contracts with commercial airlines greatly increased the number of domestic airlines with international experience.

New gas turbine and rocket technology yielded products introduced into combat in World War II, like the German V-2 liquid-fuelled rocket-propelled missile. The advent of jet-powered fighter aircraft during the war presaged revolutionary changes to come in aircraft design and military tactics. These wartime developments influenced postwar research, development, and production. The helicopter also entered production during the war. Sikorsky, Bell, Piasecki, and Hiller produced helicopters in quantity by the late 1940s.

These new technologies—helicopters, jets, and rockets—came to the fore during the Cold War that followed after World War II. Although jet aircraft served in World War II, they did not battle each other until the Korean Conflict, when North American F-86 Sabre fighters fought Russian MiG-15s in dogfights. Any fighter plane without jet power was soon obsolete. Jets powered the Lockheed U-2 spy plane and the Boeing 707 commercial airliner of the 1950s and most military and large commercial aircraft that entered service thereafter. On October 14, 1947, the first flight faster than the speed of sound was made by Capt. Charles "Chuck" Yeager flying the XS-1 (later renamed the X-1). Supersonic fighter planes replaced jet fighters just five years after jets replaced piston-engine aircraft.

The structure of the American aeronautical community was greatly changed by World War II. The aircraft industry had become the largest in the country. Following World War II general aviation increased dramatically in this country. The GI Bill made it possible for veterans to take flying lessons inexpensively. Airplanes were relatively affordable and large numbers of people learned to fly. Cessna and many other companies responded to this growing enthusiasm for general aviation, and produced large numbers of aircraft for the public and business. New general aviation airfields were constructed, and existing fields were upgraded. The spread of general aviation impacted many small communities around the nation not easily served by major airfields in metropolitan areas.

CHANGES IN THE AERONAUTICAL COMMUNITY

A major reorganization of the U.S. defense establishment occurred with the National Security Act (July 17, 1947) which created the Department of Defense, as well as the National Military Establishment which included three separate departments, the Army, the Navy, and the Air Force. The United States Air Force became a separate service on September 18, 1947, with equal status to the two other forces, after 40 years in the Army. Three major combat commands provided the Air Force's fundamental framework: Strategic Air Command, Tactical Air Command, and Air Defense Command.

Research and development of rocket technology led to the intercontinental ballistic missile (ICBM). This rocket-powered, long-range weapon, included the Atlas model of the 1950s, the Titan (a second generation ICBM developed in the 1950s), and the Minuteman in the 1960s. The U.S. and the U.S.S.R. announced that they would launch satellites as part of the International Geophysical Year of 1957–1958. On October 4, 1957, the Soviets launched *Sputnik,* the world's first man-made satellite. The United States was shocked by the Soviet Union's achievement, and *Sputnik* led directly to the establishment of the U.S. space program. The National Aeronautics and Space Act in July 1958 established the National Aeronautics and Space Administration (NASA) with a broad charter for aeronautical and space research. The National Advisory Committee for Aeronautics (NACA) was abolished, but its laboratories and personnel provided the nucleus of NASA.

THE SPACE RACE

In a dramatic "space race" with the Soviet Union, the U.S. was the first to put man on the moon. U.S. achievements included America's first man in space, Alan B. Shepard, Jr., on May 5, 1961, and John H. Glenn, Jr.'s first manned orbital flight on February 20, 1962. Apollo 11 astronauts Neil A. Armstrong and Edwin A. Aldrin, Jr., were the first men on the moon. Armstrong's first step on the moon, in the Sea of Tranquility, was made on July 20, 1969, a mere 66 years after Orville Wright's first flight in an airplane.

The Space Shuttle was the U.S. space program's next generation. Key aspects of the Shuttle's design and performance were based on a rocket-powered space plane, the X-15, the world's first transatmospheric vehicle. The Space Shuttle provided a new method of space flight, taking off like a rocket and landing like an airplane. The Space Shuttle Columbia, the first reusable manned spaceship, initiated the Space Shuttle flight program in April 1981, and a new era for the U.S. space program.

IMPORTANT DATES

1784 Americans in the newly independent United States made tethered flights in balloons.

1785 An American, John Jeffries, and a Frenchman, Jean Pierre Blanchard, flew across the English Channel in a hydrogen balloon.

1793 Jean Pierre Blanchard made the first manned, untethered balloon ascent in the United States, in Philadelphia.

1830 Charles Ferson Durant, after studying ballooning in France, made his American flying debut in a balloon and began his career as "The American Aeronaut."

1835 Immigrant and aeronaut Richard Clayton set a world distance record for free balloons by flying from Cincinnati, Ohio to Monroe County, Virginia (since 1863, West Virginia).

1844 Author Edgar Allan Poe foisted the hoax of a manned balloon crossing the Atlantic Ocean on the *New York Sun* and the American public.

1852 A Mr. Kelley made the first balloon ascension west of the Rocky Mountains, in Oakland, California.

1859 Three aeronauts—John Wise, O. Gager, and John La Mountain—flew from St. Louis, Missouri, to Henderson, New York, and set a world distance record.

1861 American military aviation began with Union and Confederate balloonists flying reconnaissance in the American Civil War; in 1861 a Balloon Corps was organized and the coal barge *G.W. Parke Custis* was converted into the world's first operational aircraft carrier (carrying balloons).

1873 John Wise failed in the first attempted transatlantic crossing by balloon. (The first successful transatlantic balloon voyage was in 1978.)

1883 John J. Montgomery made a glider flight near San Diego, California, apparently the first glider flight in the United States.

1884 The journal *Science* published a survey of the field of aeronautics, written by engineer Robert H. Thurston of Cornell University.

1894 Octave Chanute, the French-born American engineer, published *Progress in Flying Machines.*

1896 Octave Chanute began constructing gliders and eventually produced the

constant-chord biplane configuration.

1896 Samuel Pierpont Langley of the Smithsonian Institution flew an unmanned, steam-powered aerodrome, a large, heavier-than-air flying machine.

1903 On the coast of North Carolina, on December 17th, Orville Wright flew the first manned, powered, controlled, and sustained flight in an airplane.

1905 The Aero Club of America was organized.

1907 The U.S. Army Signal Corps organized an Aeronautical Division.

1907 Alexander Graham Bell, Glenn Curtiss, and others organized the Aerial Experiment Association.

1908 The Army Signal Corps let a contract for the construction of a Wright Model A biplane, its (and the world's) first military aircraft, which was delivered in 1909. The airplane could fly 40 mph.

1908 The Army received delivery from Thomas Baldwin of its first dirigible.

1909 Glenn Curtiss undertook the design and manufacture of airplanes at his G.H. Curtiss Manufacturing Company in Hammondsport, New York. The Curtiss No. 1 plane was called the Golden Flyer and sold for $5,000.

1909 Wilbur and Orville Wright incorporated the Wright Company in New York State; this company manufactured airplanes at a factory in Dayton, Ohio.

1910 The Navy created the position of Director of Naval Aeronautics, a position filled by Captain W.I. Chambers during three formative years of naval aviation.

1910 Eugene Ely, in a Curtiss biplane, took off from a launch platform aboard the U.S. scout cruiser *Birmingham*—the first airplane ascension from a floating base.

1911 The Collier Trophy established to be awarded by the Aero Club for the greatest achievement in aviation in America. Glenn L. Curtiss developed the seaplane, initially called a hydroaeroplane, and took off, and landed on water; Curtiss won the first Collier Trophy "for the successful development of the hydroaeroplane."

1911 The Navy acquired its first airplanes; the very first was the Curtiss A-1 Triad, a seaplane that the Navy also operated as a landplane and an amphibian.

1911 Flying a Burgess-Wright biplane named the *Vin Fiz* after the sponsoring soft drink company, Calbraith P. Rodgers flew from Sheepshead Bay, New York, to Pasadena, California, in the first transcontinental flight across the United States.

1911 The Army Signal Corps' first flying school established in Maryland, and then moved to its permanent location in San Diego in 1912.

1912 The U.S. Marine Corps for the first time sent officers to flight training in Annapolis and thereby qualified the first Marine pilots.

1914 The Signal Corps organized an Aviation Section which included the Aeronautical Division.

1915 Congress passed legislation that established the National Advisory Committee for Aeronautics (NACA), an independent Federal agency, to supervise and direct the scientific study of the problems of flight, with a view to their practical solution.

1916 Congress and President Woodrow Wilson authorized an Aerial Coastal Patrol as an auxiliary of the Coast Guard.

1916 William A. Boeing made his first airplane, designated the B&W after Boeing and his then-partner Conrad Westervelt, a commander in the Navy; later in the year Boeing organized his own company, the Pacific Aero Products Company which evolved into the Boeing Airplane Company; all of these ventures were based in Seattle, Washington.

1916 Malcolm and Allan Loughead (pronounced "Lock-heed" according to early advertisements) organized their second aviation venture and the first of several companies to bear their name—the Loughead Aircraft Manufacturing Company, in Santa Barbara, California.

1916 For the first time the Federal government purchases land for aviation purposes (in Hampton, Virginia), which becomes the Army Signal Corps' Langley Field. A portion of the field was allocated to NACA to build the Federal government's first aeronautical laboratory.

1917 The U.S. enters World War I (April 6,1917). The office of the Chief Signal Officer was responsible for planning the massive expansion of aviation necessitated by war,

including producing airplanes and equipment.

1918 The Army removes aviation from the Signal Corps and creates an Army Air Service with two agencies, a Dept. of Military Aeronautics (responsible for training and operations of the air arm) and a Bureau of Aircraft Production (production of aircraft, aircraft engines, and equipment).

1918 The Naval Aircraft Factory at the Philadelphia Navy Yard entered production; the first production aircraft was the Curtiss H-16 flying boat.

1918 The Post Office inaugurated airmail service by flying mail between New York and Washington; initially in cooperation with the Army, the Post Office soon assumed full responsibility for flying airmail.

1919 The Army Air Service begins operations to locate and report fires to the Forest Service. Experimental patrols begin in California and expand to Oregon in 1919.

1919 The first transcontinental airway was established when the Post Office opened a transcontinental route for airmail from New York to San Francisco, using 15 air fields.

1919 The NC-4, a Navy-Curtiss flying boat, became the first airplane to fly across the Atlantic Ocean.

1920 The National Air Races begin. This small race grows in subsequent years to become a major aviation event and encouraged the development of high-speed airplanes.

1920 A pioneer in aerial photography, Sherman M. Fairchild, organized the Fairchild Aerial Camera Corporation which manufactured automatic aerial cameras in New York.

1920 Donald Wills Douglas incorporates his Davis-Douglas Company to design and build airplanes. He begins operations in a rented blimp-hangar in Los Angeles.

1920 Dedication of the National Advisory Committee for Aeronautics' (NACA) first aeronautical laboratory, the Langley Memorial Aeronautical Laboratory, and wind tunnel at Langley Field, Virginia.

1921 Based out of Langley Field, Virginia, Brig. Gen. William (Billy) Mitchell conducted landmark bombing tests on battleships in the Atlantic Ocean, demonstrating their vulnerability to air attack.

1921 The Navy organized a Bureau of Aeronautics, BuAer.

1921 The Navy's first air station for airships became operational at Lakehurst, New Jersey, where the Navy explored lighter-than-air aeronautics until termination of the program in 1961.

1922 The National Aeronautic Association organized by combining the Aero Club of America and the National Air Association. Until 1926 the Aero Club and later the National Aeronautic Association issued pilot licenses in the United States.

1922 G.M. Bellanca introduced his high-speed C.F. monoplane with an enclosed passenger cabin and an open cockpit; the initial aircraft was built by hand in Omaha, Nebraska.

1923 Reuben Hollis Fleet founded the Consolidated Aircraft Corporation, which leased facilities in Greenwich, Rhode Island.

1923 The U.S. Navy wins the Schneider Trophy (established in 1913 to promote the development of high-speed seaplanes) against international competition in Cowes, England. The Navy aircraft won first and second places in the Schneider Cup race and established a new world record for seaplanes with a speed of 169.89 mph for 200 kilometers.

1924 Four Army Air Service pilots completed the first flight around the world. Starting and finishing at Sand Point near Seattle, Washington, they accomplished the circumnavigation in open-cockpit, single-engine airplanes made by the Douglas company. The flight took 175 days and was then the longest air journey in history. They are awarded the Collier Trophy "for having accomplished the first flight around the world."

1925 The Air Mail Act of 1925, also known as the Kelly Act after Congressman Clyde Kelly of Pennsylvania, becomes law. The act authorized the Post Office Department to contract for the carriage of mail (airmail) with commercial air transport companies.

1925 Lt. James (Jimmy) H. Doolittle, a U.S. Air Service pilot, won the Schneider Cup Race flying the Curtiss-R3 C-2 seaplane *Racer*, and broke the speed record for seaplanes by attaining 245.7 mph, at Baltimore, Maryland.

1925 Commander John Rodgers flew a Navy PN-9 flying

boat, a patrol plane built by the Naval Aircraft Factory, 1,730 nautical miles from California to a Pacific island northeast of Hawaii. This flight set a record for non-stop distance, but failed in the attempt to cross the Pacific Ocean.

1926 The Air Commerce Act of 1926 assigned the Department of Commerce responsibility for overseeing development and safe operation of the national air transportation system. The Department established an Aeronautics Branch to regulate and promote aviation.

1926 The Army Air Corps Act establishes the Army Air Corps, with status equal to the infantry, cavalry, and artillery.

1926 Ford introduced the 4-AT trimotor, an all-metal, open-cockpit, enclosed-cabin, eight-passenger transport plane, developed after trimotor designs of Fokker and Stout.

1927 Charles A. Lindbergh, flying the Ryan monoplane *Spirit of St. Louis*, completed the first solo non-stop crossing of the Atlantic Ocean (New York to Paris). Lindbergh's achievement and personality generated great popular enthusiasm for aviation.

1927 Sherman Fairchild entered aircraft production in Farmingdale, New York, with the FC-2, a five-seat, high-wing, cabin monoplane with folding wings.

1927 The first Lockheed Vega, the S-1, was assembled and flown in southern California; a total of 128 single-engine and high-speed Vegas were produced, built by hand, over several years.

1927 Pan American Airways began its first regular international service, with an exclusive airmail contract on the Miami-Havana route.

1927 The Cessna Aircraft Company organized and began making the cantilever monoplane series of private planes in Wichita, Kansas.

1927 Lieutenants Lester J. Maitland and Albert F. Hegenberger made the first flight from California to Hawaii, in an Army Fokker C-2.

1928 The Aeronautics Branch of the Department of Commerce awarded the Collier Trophy for the development of airways and air navigation facilities.

1929 Lieutenant James Doolittle, flying blind by instrument in the hooded cockpit of a Consolidated NY-2, demonstrated and tested the developing equipment for flying in all weather and all visibility conditions.

1929 The Aeronautical Corporation of America, known by the trade name Aeronca, organized and entered production of the C-2 light plane, an affordable personal airplane.

1929 The Grumman Aircraft Engineer Corporation was incorporated.

1929 The Goodyear-Zeppelin Corporation constructed an airdock in Akron, Ohio, to support the development of a commercial airship industry in the United States.

1930 Taylor Aircraft, under the leadership of William T. Piper, introduced the E-2 Cub, a two-seat light plane with enclosed cockpit, which became popular with flight schools and private pilots.

1930 Western Air Express and Transcontinental Air Transport merged into the new Transcontinental and Western Air, (TWA; renamed Trans World Airlines in 1950).

1930 The U.S. Coast and Geodetic Survey issued its first sectional map made specifically for aeronautical use. The 87th and final section appeared in 1936 and completed the chart of the entire country.

1932 Walter Beech organized the Beech Aircraft Company in Wichita, Kansas, and flight-tested his streamlined model 17-R, a biplane with negatively staggered wings.

1933 The Commerce Department's Aeronautics Branch and the federal Civil Works Administration initiated a nationwide program of airport development, a relief program aimed at employing people during the Great Depression.

1934 Senator Hugo Black of Alabama led a Congressional investigation of the national scandal of fraud in airmail contacts; President Franklin D. Roosevelt canceled airmail contracts; the Army Air Corps flew the mail for several months; commercial carriers of airmail reorganized; and the Post Office awarded new airmail contracts.

1934 The Department of Commerce reorganized its aviation activities and changed the name of its Aeronautics Branch to Bureau of Air Commerce.

1935 Amelia Earhart became the first pilot to fly solo between the mainland and Hawaii.

1935 Flying a Martin clipper ship, Pan American inaugurated

scheduled airmail service across the Pacific Ocean; in 1936 the airline began scheduled passenger service on the same route.

1935 Boeing introduced and completed the first flights of the four-engine Model 299 bomber, prototype of the B-17.

1936 The Douglas Sleeper Transport (known as the DST) for transcontinental service, and the day transport version, the DC-3 (without sleeping berths), entered service with American Airlines. They offered greater speed and comfort than other airlines. The DC-3 became the world's most successful airliner until the jet age.

1937 After a flight from Frankfurt, Germany, and during landing operations at Lakehurst, New Jersey, the airship *Hindenburg* exploded; thirty-six people died, and commercial transport by airship lost public confidence.

1937 Based in Pennsylvania, William T. Piper changed the name of Taylor Aircraft to Piper.

1937 Amelia Earhart, flying a Lockheed Electra, disappeared on the New Guinea to Howland Island segment of an intended round-the-world flight.

1937 The Army Air Corps' first B-17 was delivered to Langley Field for service testing.

1938 The Civil Aeronautics Act of 1938 replaced the Commerce Department's Bureau of Air Commerce with an independent Civil Aeronautics Authority, and recognized airlines as common carriers.

1939 Flying a Boeing 314 flying boat, Pan American inaugurated scheduled transatlantic service.

1939 The Aircraft Owners and Pilots Association was founded.

1939 The Civil Aeronautics Authority began a Civilian Pilot Training Program that provided training to over 400,000 pilots by the close of the program in 1944 (by which time it was called the War Training Service).

1939 The Army Air Corps undergoes an unprecedented expansion due to the war in Europe.

1940 Boeing's pressurized Model 307 entered commercial service, but the war interrupted the spread of pressurized commercial aircraft.

1940 The Civil Aeronautics Authority, an independent agency, became the Civil Aeronautics Administration, a part of the Department of Commerce.

1940 Congress approved the Development of Landing Areas for National Defense, or DLAND program, the first airport construction project directly administered by the federal agency for civil aviation, a program that funded construction at 535 airports during the World War II.

1941 The Civil Aeronautics Administration assumed operation of airport traffic control.

1941 The War Department created the Army Air Forces in June; the predecessor Army Air Corps was discontinued in March 1942.

1941 In June, the Civil Aeronautics Administration changed the system for numbering runways to the method of indicating—with the addition of a zero—the compass heading of a runway during takeoff or landing.

1941 Within the Office of Civil Defense, the Civil Air Patrol was established in December.

1941 On December 7, Japanese carrier-based airplanes attack American military installations in Hawaii and the Philippines, leading to America's entry in World War II.

1941–1945 The United States and its air forces fought in World War II. During the war the United States produced 300,000 airplanes, 700,000 propellers, and 800,000 aircraft engines. Military contracts with commercial airlines provided domestic airlines, in addition to Pan American, with international air transport experience. Domestically, the Army accounted for 85% of all activity on the nation's airways. Military aircraft and avionics were rapidly developed.

1942 The Civilian Pilot Training Program became the War Training Service.

1942 Grumman produced and flew the first production F6F Hellcat fighter planes, which entered combat action in 1943, and thereafter destroyed more enemy aircraft than any other airplane of the war.

1943 The Civil Air Patrol transferred from the Office of Civil Defense to the War Department.

1944 The Boeing B-29 bomber entered combat service on raids against Bangkok and Japan in June; this Superfortress was a long-range bomber, pressurized, with

remote-controlled gun turrets, with wing loading in excess of previous experience, and the world's heaviest production airplane.

1945 On August 6, at 8:15 A.M. (Japanese time) an American B-29, the *Enola Gay*, dropped an atomic bomb on the Japanese city and military base of Hiroshima. The bomb, with an explosive force of 20,000 tons of TNT, destroyed over four square miles of the city and killed or injured over 160,000 people. Three days later, an atomic bomb was dropped on the Japanese city and naval base of Nagasaki. On August 14th, the Japanese accepted the Allies terms of surrender.

1945 Luis W. Alvarez of the Massachusetts Institute of Technology won the Collier Trophy for his role in developing ground controlled approach, a ground-based radar and controller system for landing aircraft.

1946 The Army Air Forces established the Strategic Air Command and the Tactical Air Command.

1947 The United States created the Department of the Air Force as a military branch equal to the departments of the Army and Navy, all under the Department of Defense.

1947 While flying the rocket-powered Bell XS-1 research plane out of Muroc Army Airfield (later renamed Edwards Air Force Base) in California, Capt. Charles "Chuck" Yeager exceeded the speed of sound in level flight (670 MPH or Mach 1.06).

1947 The Collier Trophy awarded to John Stack, NACA research scientist, for pioneering research to determine the physical laws affecting supersonic flight and for his conception of transonic research airplanes; to Lawrence D. Bell, President of Bell Aircraft Corp., for the design and construction of the research airplane X-1; and the Capt. Charles E. Yeager, who with that airplane, first achieved human flight faster than sound.

1947 Braniff became the first airline to use the instrument landing system adopted as the primary landing aid of the Civil Aeronautics Administration.

1947 The journals *Aviation*, begun in 1938, and *Aviation News*, founded in 1943, merged to create *Aviation Week*.

1948 The Radio Technical Commission for Aeronautics issued a report recommending a common civil-military navigation system consisting of very-high-frequency omniranges (VORs) and distance measuring equipment (DMEs), as well as airborne transponders, ground-based radar for airport surveillance (ASR) and precision approach (PAR), and instrument landing system (ILS).

1948 Albert W. Mooney organized the Mooney Aircraft Corporation; based in Wichita, Kansas, this company's first product was the M-18 single-seat, low-wing monoplane with retractable tricycle gear.

1950 The first very-high-frequency omnirange (VOR) airways, called Victor airways, became operational.

1950-1953 United States military forces engaged in the Korean Conflict (1950–1953). The first jet-to-jet air combat occurred.

1952 Boeing began production of the four-engine, jet-powered B-52 Stratofortress bomber. After production ceased in 1962, post-production modifications improved the structural and electronic features of the B-52 and extended its operational usefulness.

1952 Airport surface detection equipment went into a successful trial operation in an effort to curb congestion on the ground at airports.

1952 The International Civil Aviation Organization adopted a standardized, English-based, international phonetic alphabet.

1953 The American Medical Association recognized aviation medicine as a specialty and certification of qualified physicians in the specialty.

1954–1975 Military aviation missions during the Vietnam Conflict included reconnaissance, transport, support and rescue, as well as offensive and carrier operations.

1955 Lockheed began flight testing its new U-2 spy plane, an high-altitude, intelligence-gathering, jet-powered airplane, given the U for utility designation to mask its real purpose.

1957 Both the Soviet Union and the United States had satellite projects as parts of their national programs for the International Geophysical Year, and the Soviets successful launch of the first artificial satellite—*Sputnik*—into orbit around the Earth spurs America to increase dramatically its space program.

1958 Congress created the Advanced Research Projects Agency (ARPA) as a mili-

tary space program, the National Aeronautics and Space Administration (NASA) as the civilian space agency exercising control over aeronautical and space activities, and the National Aeronautics and Space Council (an advisory body of all agencies concerned with space) reporting to the President.

1958 Congress reorganized the federal administration of civil aviation with the abolishment of the Civil Aeronautics Administration and the creation of the independent Federal Aviation Agency (FAA).

1958 The Boeing 707 jet liner (America's first commercial jet) introduced; Pan American Airways initiated transatlantic passenger jet service; the 707 entered the jet transport market already served by the British Comet.

1958 The Federal Aviation Agency (FAA) created to regulate all commercial and military aviation in the U.S.

1959 The Douglas DC-8 jet liner received federal certification; Douglas produced 556 DC-8s before ending production of that model in 1972.

1959 The X-15 research plane made its first powered flight, eventually attaining records for altitude and speed for winged aircraft that were unbroken until the space shuttle Columbia's first orbital flight in 1981.

1960 NASA launched its first meteorological satellites, *Tiros I* in April and *Tiros II* in November.

1960 The Glenn L. Martin company delivered its last airplane and shifted its business to the space and missile fields; Glenn Martin had built airplanes in California starting in 1908, in Ohio starting in 1918, and Maryland starting in 1929.

1961 The Air Force continued flight testing the experimental X-15A airplane, including one flight to an altitude of 169,600 feet and another flight attaining the speed of 4,093 miles per hour.

1961 Alan B. Shepard, in May, aboard a Mercury capsule, became the first American in space—twenty three days after Yuri Gagarin of the Soviet Union became the first man in space.

1962 John H. Glenn orbited the Earth three times in a Mercury capsule and became the first American to orbit Earth.

1962 The Cuban Missile Crisis prompted the United States to speed the installation and operational status of Minuteman missiles.

1963 The prototype of the Boeing 727 jet transport was flown and tested.

1963 William J. Lear's prototype Model 23 Lear Jet made its initial flights near the Wichita, Kansas, base of his new operations. Out of the Model 23 evolved the production Model 24 and Model 25 business jets.

1964 American pilots Jerrie Mock and Joan Merriam became the first and second, respectively, women to fly solo around the world.

1964 A sailplane piloted by A.H. Parker set a distance record of 1,040 kilometers (646 miles), the first sailplane distance record over 1,000 kilometers.

1965 The United States launched *Gemini* spacecraft numbers 3 through 7, each with a two-man crew, into orbit.

1966 NASA's *Surveyor I* lunar probe made a controlled, soft landing on the Moon.

1966 The National Transportation Safety Board (NTSB) was organized as an independent safety board with accident investigation responsibility.

1967 In a tragic accident, the crew of *Apollo 1*, U.S. astronauts Virgil I. Grissom, Edward H. White, and Roger Chaffee, were killed when a flash fire swept their craft on the launch pad at Cape Kennedy (January 27, 1967).

1967 The McDonnell Company and the Douglas Aircraft Company merged to form the McDonnell Douglas Corporation.

1967 The Federal Aviation Agency, an independent agency, became the Federal Aviation Administration, part of the Department of Transportation.

1968 Boeing and General Electric worked to develop the airplane and engines, respectively, for an American SST, supersonic transport.

1968 Lockheed introduced its new C-5A Galaxy, capable of airlifting heavy military equipment and powered by the world's first high-bypass-ratio turbofan engine in service.

1969 NASA's *Apollo 11* mission reached the Moon, and astronaut Neil Armstrong became the first man to walk on the Moon.

1970 The Boeing 747 Jumbo Jet entered commercial service; normal loading and unloading techniques had been

modified for this large-capacity, wide-bodied aircraft.

1970 The Airport and Airway Development Act expanded federal aid to airport and airway development and changed the method of funding such development to aviation-user taxes.

1971 The McDonnell Douglas DC-10 entered commercial service; like the Boeing 747, the DC-10 was a commercial outgrowth of the military C-5 cargo competition won by Lockheed.

1971 Congress terminated the SST, supersonic transport, program. (The British SST, called the Concorde, continued in development and entered commercial service in 1976.)

1972 After several years of tension between the Federal Aviation Administration and controllers organized (since 1968) in the Professional Air Traffic Controller Organization, Congress passed the Air Traffic Controller Career Act.

1972 The Lockheed 1011 TriStar entered commercial service, one year after Congress provided financial relief in the form of a government loan to the troubled company.

1973 General Dynamics introduced two prototype YF-16 lightweight fighter planes.

1974 The National Space and Aeronautics Administration awarded the development contract for a Spacelab orbiting laboratory to a nine-nation consortium.

1976 Two Air Force pilots fly a Lockheed SR-71A reconnaissance aircraft to a new world speed record of 3,529.56 kilometers per hour (2,193.17 miles per hour).

1976 The Concorde, a supersonic transport developed by a British-French consortium, began to fly routes between Europe and the United States (Washington, D.C., and New York City), and demonstrated the strength of foreign competition in the aviation industry.

1978 Eastern Airlines placed an order for A-300 transports made by the European consortium Airbus and thereby highlighted the increasing foreign competition faced by manufacturers in the United States.

1978 The Federal Government began deregulating commercial airline operations.

1979 General Dynamics lightweight F-16 entered Air Force service; commonality of engine and armament with the McDonnell Douglas F-15 promised economies to the Air Force.

1981 The Space Shuttle *Columbia,* the first reusable manned spaceship, initiated the Space Shuttle flight program, and begins a new era for the U.S. space program.

1981 Air traffic controllers went on strike and the Federal Aviation Administration dismissed striking controllers; disruption of air traffic control operations continued until replacements acquired training and experience.

1982 Amidst an airline recession, Braniff International terminated operations; it emerged briefly from bankruptcy in 1984.

1986 The Space Shuttle *Challenger* exploded after lift-off, killing the seven crew members.

1988 The National Space and Aeronautics Administration resumed Space Shuttle missions.

1989 The Lockheed F-117 Nighthawk, a stealth fighter-bomber, made its combat debut when the United States invaded Panama.

1990–1991 The United States employed fighters, bombers, tankers, helicopters, transports, and missiles during Desert Storm, the war to liberate Kuwait from an Iraqi invasion.

1991 Pan American ceased operations.

1994 The General Aviation Revitalization Act limited the liability of general aviation manufacturers to 18 years. The Act enables Cessna to renter single-engine aircraft production and helped the renamed New Piper Aircraft company to emerge from bankruptcy.

1995 The Lockheed and Martin Marietta corporations merged into a new Lockheed Martin Corporation.

III. TYPES OF HISTORIC AVIATION PROPERTIES

The National Register of Historic Places recognizes **tangible properties that are relatively fixed in location**. They are classified as districts, sites, buildings, structures, or objects. In the aviation field, they include aircraft, wrecks of aircraft, development facilities, production plants, air terminals, military air bases and air stations, aids to navigation, missile launch sites and complexes, and administrative and educational facilities. As Clement M. Keys, head of the Curtiss Aeroplane and Motor Company, once said, "ten percent of aviation is in the air, and 90 percent is on the ground." Even flying equipment has a base on ground, or on water.

AIRCRAFT

Aircraft present special challenges to cultural resource managers. The variety of makes and models, the quantities of production, the replacement parts acquired through routine overhaul and maintenance, the conversion of aircraft from one use to another during its operational life, the craft's operational status, its airworthiness, and its mobility affect both the documentation and the evaluation of aircraft as historic properties. The large size of some aircraft, cost associated with care and storage, evolving standards for restoration, and deterioration due to outside storage also affect the management of aircraft as cultural resources.

At the basic level, aircraft are divided into two categories: heavier-than-air and lighter-than-air. The heavier-than-air category includes airplanes, seaplanes, amphibians, rotorcraft, and gliders. Airplanes may be land-based (once called landplanes) or carrier-based planes. They may be powered by either reciprocating or by gas turbine (jet) engines, or rocket engines; the atomic aircraft engine never reached application. Seaplanes as a class include both float or pontoon planes and flying boats. Amphibians can operate from either land or water. Rotorcraft may be autogiros or helicopters, again powered by either reciprocating or gas turbine engines. The glider class includes sailplanes. Lighter-than-air craft encompass balloons and airships (dirigibles). Dirigibles are either rigid airships (constructed with a metal-lattice frame), or nonrigid (blimps).

The National Register classifies aircraft as structures, that is, a construction distinct from a building. Aircraft can be listed individually in the National Register, as are the Wright Flyer III and a Fairchild Pilgrim 100B, each listed as a historically significant structure. Aircraft may be contributing features of a historic district.

AVIATION WRECKS

An aviation wreck is any aircraft that has been crashed, ditched, damaged, stranded, or abandoned. The wreck may be intact or scattered, may be on land or in water, may be—in National Register terms—a structure or a site. A "structure" remains relatively intact, while a wreck "site" lacks the structural integrity of an aircraft, although the site may contain the structural elements of the aircraft.

An example of an aviation wreck which qualifies as a structure is the B-29 Serial No. 45-21847 (Heavy Bomber) which was forced to "ditch" in a lake in 1949. The aircraft settled on the lakebed and has been protected in an environment of deep, fresh water, anaerobic conditions, protective silt layers with very limited accessibility to divers. It is significant as one of a group the "Superfortresses" that were the first high altitude pressurized heavy bombers powered by the heaviest production type aircraft engines of the time. The airplane represents the design, use of materials, and functional significance as a preserved example of various modification programs serving major missions of the U.S. Air Force's highly secret program of high altitude atmospheric research. The wreck has the potential to yield information on early Atomic Era atmospheric scientific research and aviation technological conversion methods. Other airplanes in the same group have been much altered, reconstructed, and/or reassembled. The property is eligible for listing in the National Register under Criterion C as an example of a significant type of aircraft construction and under Criterion D for it potential to yield important information.

In some cases, a crash site may be eligible for the National Register even if there are no remains of the

aircraft. In the case of the Will Rogers-Wiley Post crash site near Barrow, Alaska, the wreckage was removed years ago, but the site is listed in the National Register because of the association of the site with the crash that killed two famous promoters of aviation.

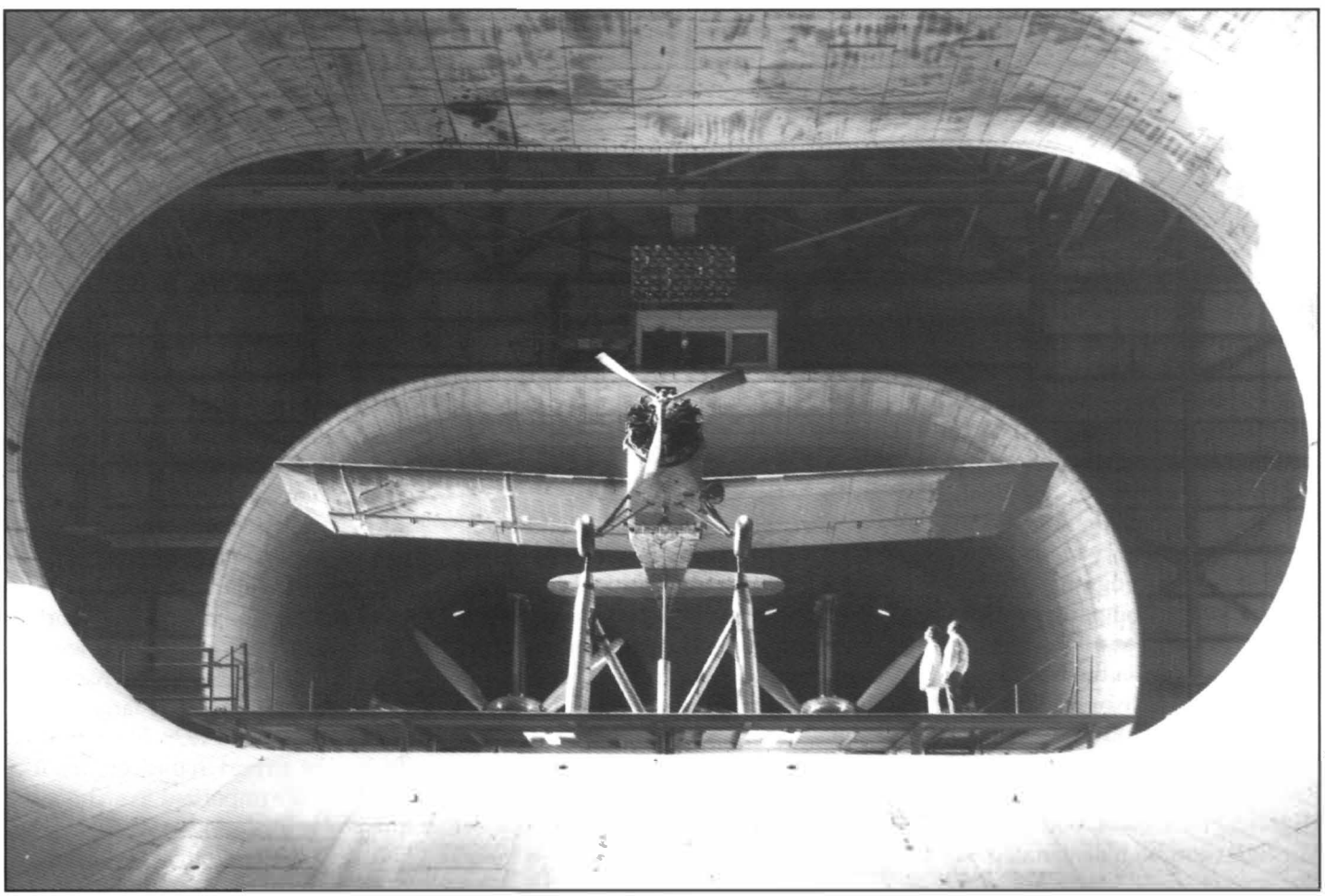
Wreck sites can be particularly vulnerable to looting (to salvage parts) or to vandalism. Confidentiality is designed to protect the site, the property, and the data there. Section 304 of the National Historic Preservation Act, as amended, provides that if disclosure of a site's location risks harm to the site, causes a significant invasion of privacy, or impedes the use of a traditional religious site by practitioners, then information about the location, character, or ownership of a historic property may be kept confidential by being withheld from the public. The National Register registration form includes a box which may be checked to request that locational information be withheld from public disclosure.

AVIATION DEVELOPMENT FACILITIES AND PRODUCTION PLANTS

Chief among aviation development facilities are research and engineering laboratories, including wind tunnels, in industry, government, and academe. Test facilities, whether structures such as test cells and experimental hangars, or sites like test fields and flight courses, are also development facilities. The Wright brothers, for example, used Huffman Prairie in Ohio as a flight test site in 1905. The prairie flying field is now a National Historic Landmark.

Production of aircraft occurred mostly in factories, including main factories, shadow and branch plants, component and parts shops. While most aircraft production in this country occurred in private industry, there was government production. Techniques for constructing fuselages, wings, and stabilizers from wood differ from the later production of metal planes, and production facilities reflected these differences.

An early example is Building 105 of the Boeing Airplane Company, in Seattle. Building 105, also known as



From its construction in 1931 until the end of World War II, the Full-Scale Tunnel in Hampton, Virginia, was the only wind tunnel in the world large enough to accommodate full scale aircraft for testing. During World War II, nearly every high performance aircraft used by the United States was drag-tested in this tunnel. It continues to be used for military and space craft testing. (Official NASA photograph, 1978)

In the 1930s, Wichita, Kansas was widely acknowledged as the "air capital of the world." The Art-Deco style Wichita Municipal Airport administration building was considered to be one of the finest terminal buildings in the country, and was noted for the huge cast stone panels adorning its entrance. The building now serves McConnell Air Force Base. (Sandy Kent, February, 1990)

the Red Barn, is a balloon-frame building constructed in 1909 and purchased by William E. Boeing in 1910. When Boeing later established himself in aviation, he used Building 105 as the original building of his aviation ventures, including the Boeing Airplane Company. The building became significant in the early history of the development and production of aircraft, and in the industrial history of Seattle and the State of Washington.

Ford Motor Company provides two later examples of production properties listed in the National Register. During World War II the Ford company produced military, including aviation, equipment at its River Rouge Complex and its Highland Park Plant, both in Michigan and both designated National Historic Landmarks.

Development occurred at government, as well as at private industrial sites. NACA conducted research and development at facilities in Hampton City, Virginia. Listed in the National Register are the eight-foot wind tunnel and the full-scale tunnel there, both National Historic Landmarks.

AIR TERMINALS ON LAND AND WATER

Aircraft usually take off and land at air terminals, which may be on land or water. Air terminals may include a variety of properties. On land, there are airfields, runways, and taxi ways. Seaplane bases may include anchorages, decks, docks, piers, and ramps. Aircraft carriers are ships specially designed and equipped for aviation duty. Flight decks, armament, tonnage, and internal arrangements reflected their aviation mission. Special docks, hangars, and mooring masts accommodated airships, both rigid and nonrigid, on land and water. Passenger terminals for commercial and general aviation may consist of hangars and other shelters for aircraft, control towers, flying schools, administration buildings, and ground service facilities for fuel, maintenance, and storage.

Among the air terminals currently listed in the National Register are the Douglas Municipal Airport in Arizona (an early international airport), Newark Metropolitan Airport in New Jersey, Pan American Seaplane Base at Dinner Key in Florida, Rhode Island State Airport Terminal in Warwick, and Shirley Field in Tallulah, Louisiana. Newark is an example of an early large airport. From 1930 to 1939, Newark was the busiest airport in this country. Its buildings are important in architecture and engineering as well as in the history of transportation and communications, as documented in the National Register nomination. The Rhode Island State Airport Terminal opened in 1933. Located at the "first state-owned airport in the United

States," according to the nomination, it illustrates the merger of public works and transportation. In contrast, the terminal and hangars at Dinner Key comprised the Pan American seaplane or clipper ship base in 1930s. From there, Pan American flew international, commercial routes to Central and South America and the Caribbean. Shirley Field, in this final example, is historically significant for its association with the use of airplanes in agriculture. There, in the early 1920s, the U.S. Department of Agriculture, through its Delta Laboratory, conducted experimental aerial dusting of cotton crops with calcium arsenate powder to control the boll weevil.

MILITARY AIR BASES AND AIR STATIONS

Over the years the Army, Navy, Marines, Air Force, and Coast Guard established air stations and air bases. In Florida, the Pensacola Naval Air Station and Cape Canaveral Air Force Station, both National Historic Landmarks, are two examples of air stations listed in the National Register. The Pensacola Naval Air Station Historic District encompasses 55 buildings and structures on 80 acres of land. Among the significant buildings are six metal seaplane hangars constructed between 1916 and 1918, while the historic structures include four amphibious aircraft launch ramps built during the same period. Established at the site of a former Navy yard, Pensacola became an air station in 1913. It immediately began training naval pilots and testing naval aircraft, two missions of the air station throughout its history.

Parts of air bases and air stations may qualify for listing in the National Register. Two examples are Hangar No. 9 at Brooks Air Force Base in San Antonio, Texas, and Hangar No. 1 at Lakehurst Naval Air Station in New Jersey. Also listed in the National Register are three Quonset huts used during World War II by an Army Air Corps Reserve Unit and the Civil Air Patrol in Lansing, Michigan. In Fayetteville, North Carolina, the Pope Air Force Base Historic District includes 32 buildings constructed in 1933 and 1934 for administrative, residential, and support purposes. One building originally housed the flight surgeon's clinic. A separate National Register entry includes aircraft Hangars 4 and 5, the oldest aircraft-related buildings at Pope AFB and important examples of bowstring truss construction (the original roof support system used in American airplane hangars). The Randolph Field Historic District in San Antonio, Texas, was listed in the National Register for its association with the development of the Army Air Corps. Established in 1928, Randolph Field was the first American flying field designed exclusively for training pilots. During the 1930s, Randolph earned its nickname as "West Point of the Air," as a pilot and instructor training base, graduating more than 6,800 cadets, hundreds of whom served in World War II. The district contains a notable collection of Spanish Colonial Revival and Art Moderne buildings, the majority of which were constructed between 1931 and 1935.

Military aviation facilities also include supply depots, ports of embarkation, and other defense installations that may be located away from air terminals. The military, for example, established radar stations for early warning as part of the air defense network. In Hawaii, on December 7, 1941, the Opana Radar, which consisted of two trucks and a trailer atop an Opana hill, detected Japanese airplanes on their way to attack on Pearl Harbor. The grassy site is now a National Historic Landmark. It is significant as the place where the then-new technology of radar was first used by the United States in a combat situation. The Army's Radar Station B-71, listed in the National Register, is located near the Klamath River in northern California. It consists of a power-supply building disguised as a farmhouse and an operations building disguised as a barn. Both are concrete-block constructions camouflaged with false exterior walls of wood. Built in late 1942 and early 1943, this radar station remained in operation until the end of the war. In the latter months it operated as an emergency-rescue radar service for air-sea rescues.

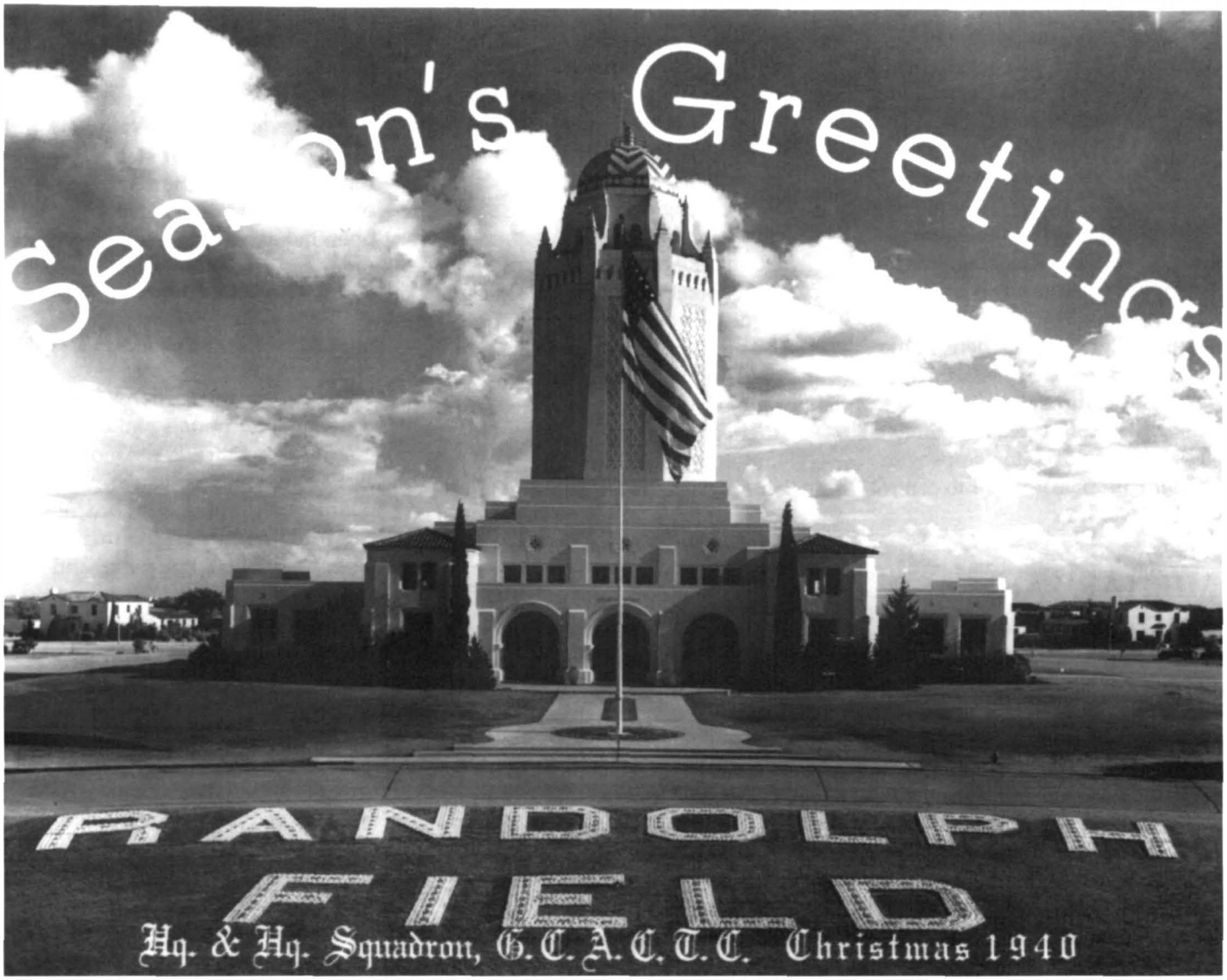
AIDS TO NAVIGATION

Aids to air navigation were installed at terminals and on the ground along airways. Among the aids were daymarks (such as roof paintings), flashing light beacons, course lights, airport lighting, radio beacons and stations, radar, and weather services, as well as emergency landing fields. The National Register lists several examples of aids to air navigation. A revolving aircraft beacon near Portland, Oregon, is representative of the dead-reckoning type of beacons once constructed as aids to aerial navigation. Built by the U.S. Bureau of Lighthouses in 1933, the beacon is still in operation. It is an engineering structure that contributes to the significance of the Rocky Butte Scenic Drive Historic District. The control tower at the Old Port Columbus Airport in Ohio is another example of an aid to air navigation listed in the National Register.

Refer to *National Register Bulletin: Guidelines for Evaluating and Nominating Historic Aids to Navigation* (marine navigation), for additional guidance on this topic.

ADMINISTRATIVE, EDUCATIONAL AND OTHER FACILITIES

A number of administrative and educational facilities significant in aviation history are listed in the National Register. Two educational examples are the National War College in Washington, D.C., and the original Naval War College in Newport, Rhode Island. The



Constructed from 1930–1931, the Base Administration Building at Randolph Air Force Base in Bexar County, Texas, is individually listed for its architectural significance and for its historic association with the development of the Army Air Corps. Affectionately know as the "Taj Mahal" by generations of military flyers, the Base Administration Building was designed in the locally popular Spanish Renaissance style of architecture. (Photograph used as a Christmas card, 1940, photographer unknown. Courtesy of Randolph Air Force Base)

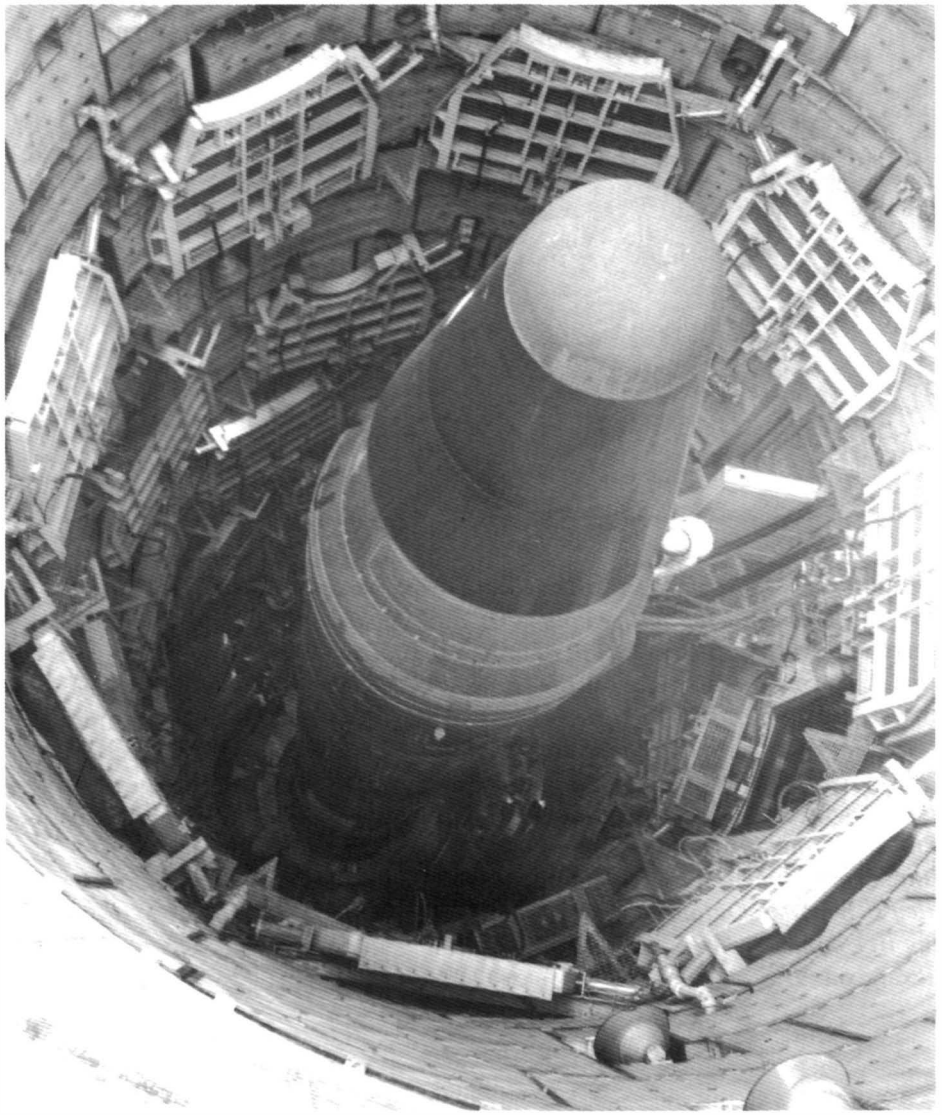
Pentagon in Arlington, Virginia, is a National Historic Landmark. So is the headquarters of the Commander in Chief of the Pacific Fleet (CINCPAC) at the Pearl Harbor Naval Base in Hawaii. Constructed in 1942, the CINCPAC headquarters building was used by Admiral Chester W. Nimitz from its completion in 1942 into late 1944. From there, Nimitz directed strategic and tactical operations of naval, including air, forces in the Pacific. Headquarters of the U.S. Army Forces, Pacific Ocean Areas (USAFPOA) is also a National Historic Landmark. Located in the Palm Circle Historic District at Fort Shafter in Hawaii, USAFPOA moved during World War II from one building there into the Pineapple Pentagon, built on the circle in 1944. In a final example, the Base Administration Building at Randolph AFB in Texas is a Spanish Colonial Revival style building of architectural significance; its nickname is the "Taj Mahal." Military properties dominate the administrative and educational properties listed in the National Register. Less well represented are properties associated with colleges and universities and the aviation industry.

MISSILE LAUNCH SITES AND COMPLEXES

The National Register includes several missile launch sites or complexes associated with America's space or defense programs. The Goddard Rocket Launching Site was designated a National Historic Landmark for its association with the early history of rocketry. On March 16, 1926, Dr. Robert H. Goddard launched the world's first liquid propellant rocket on a farm near Auburn, Massachusetts. This

event established the use of liquid fuel as a propellant for rockets and set the course for future developments in rocketry. The Cape Canaveral Air Force Station near Cocoa, Florida, has also been designated a National Historic Landmark. Since the launch of America's first earth satellite in 1958, the Cape Canaveral Air Force Station has been America's premier facility devoted to space exploration. The Landmark consists of discontiguous sites within the Air Force Station, encompassing Launch Pads 5, 6, 14, 19, 26, 34, the mobile service tower at Pad 13, and the original Mission Control Room. The Air Force Facility Missile Site 8 (571-7) Military Reservation, constructed in 1963 near Green Valley, Arizona, was listed in the National Register for its association with military defense during the Cold War. Missile Site 571-7 is the only surviving Titan II Intercontinental Ballistic Missile (ICBM) complex of the 54 that were "on alert" throughout the Cold War. Built in response to the "missile gap" panic of the 1960s, the ICBMs were designed to survive and retaliate against a first strike nuclear attack from the Soviet Union and possibly other nations. The Titan II missiles were retired when they were superseded by a new generation of land-based and submarine-based missiles.

The National Register Criteria for Evaluation identify the specific criteria under which a property may qualify for listing in the National Register. There are four basic National Register Criteria. Seven "criteria considerations" provide additional guidance for evaluating the significance of historic properties. Also, seven aspects of integrity influence the evaluation of a historic property. A nomination should address all applicable criteria, considerations, and aspects of integrity. For guidance in applying the National Register criteria to historic properties and in evaluating the integrity of a property, refer to *National Register Bulletin: How to Apply the National Register Criteria for Evaluation.*



The Air Force Facility Missile Site 8(571–7) Military Reservation, also known as the Titan Missile Museum, in Green Valley, Arizona, is the sole surviving Titan II Intercontinental Ballistic Missile of the 54 that were "on alert" throughout the Cold War era. The Titan II missiles were constructed to survive a first strike from the Soviet Union and to retaliate. The Titan II missiles were retired when they were superseded by a new generation of land-based and submarine-based ballistic missiles. (Control room launch consoles and silo, David K. Stumpf, January 24, 1992)

IV. APPLYING THE NATIONAL REGISTER CRITERIA TO HISTORIC AVIATION PROPERTIES

THE NATIONAL REGISTER CRITERIA FOR EVALUATION

The four National Register Criteria represent different types of values embodied in districts, sites, buildings, structures, and objects.

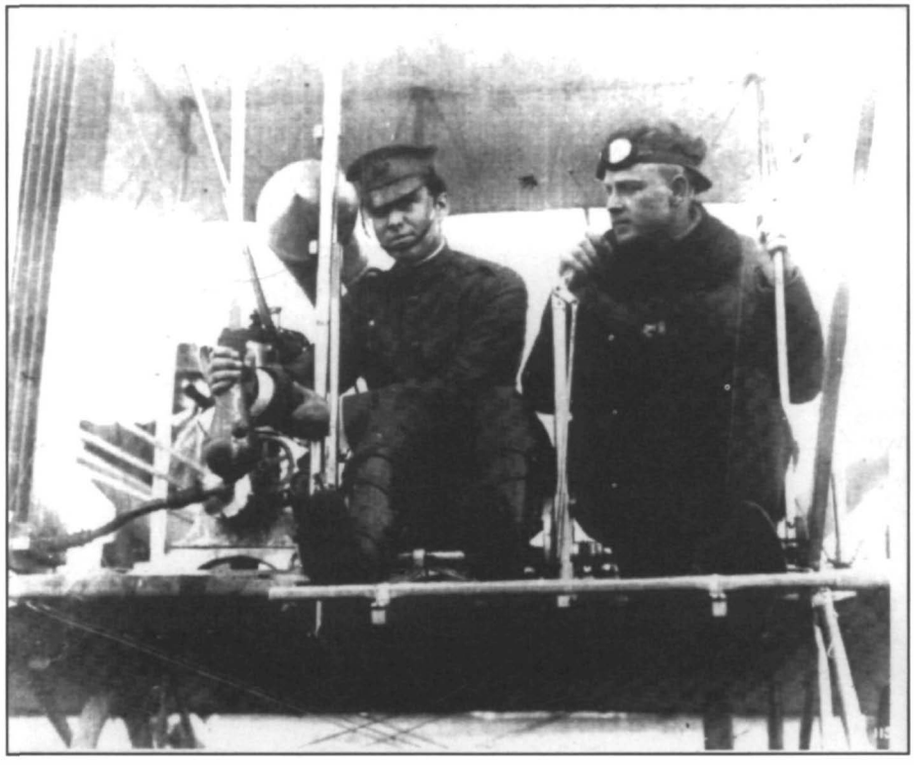
Associative value/Event—Criterion A: Properties that are associated with events that have made a significant contribution to the broad patterns of our history.

Associative value/Person—Criterion B: Properties that are associated with the lives of persons significant in our past.

Design or Construction value—Criterion C: Properties that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

Information value—Criterion D: Properties that have yielded, or may be likely to yield, information important in prehistory or history.

A property can qualify for listing in the National Register under one or more of the criteria. For a complete listing of the Criteria for Evaluation refer to the *National Register Bulletin: How to Apply the National Register Criteria for Evaluation.*



The College Park Airport, in College Park, Maryland, is historically significant for its association with many early and important developments in aerial technology and the evolution of military aviation. Beginning in 1909 this airport became the first site for the training of military fliers in the United States. Many aircraft were tested here, and numerous records for speed and distance were set. Among the many "firsts" accomplished at the College Park Airport were the first women in America to fly as a passenger, the use of aerial photography, night flight and landing, the testing of bombing and the use of machine guns from an airplane, controlled helicopter flight, and the first blind, or instrument, landing. Shown here are Lt. T. DeW. Milling and Cpl. Riley E. Scott on October 10, 1911, as they prepare for the first test of dropping live bombs from an airplane. (USAF Still Photograph Repository, Alexandria, VA)

CRITERION A—EVENT

Properties can be eligible for the National Register if they are associated with an event or events that have made a significant contribution to the broad patterns of our history. The property may be associated with a specific event marking an important moment in American prehistory or history, or it may represent a pattern of events or a historic trend that made a significant contribution to the development of a community, a State, or the nation. To meet this criterion, a historic property needs (1) to have existed at the time of the important event and (2) be associated in a significant way with the event.

Aviation properties may be associated with a wide variety of events. Some examples are the origins of manned flight, the development of air power for military purposes, the transportation of airmail, commercial airline development, exploration by air, aerial photography and mapping, aviation employment during the Great Depression, air power during war, scientific and engineering research activities, transoceanic flying, air races, and America's "romance" with aviation.

Several examples are already listed in the National Register. Hangar One at the Los Angeles International Airport was a stop on the courses of the National Air Races in 1933 and 1936. Isley Field, on Saipan Island in the North Mariana Islands, is listed in the National Register because the American conquest of Saipan in 1944 marked the breaking of the inner line of Japanese World War II defenses in the Pacific, and allowed Isley Field to become a base for U.S. B-29 bombers for long-range bombing of the Japanese homeland through the end of the war. The Secretary of the Interior designated the field as part of the National Historic Landmark on Saipan.

A historic property may be significant in State or local history. Felts Field in Spokane, Washington is a historic district locally significant for its association with the development of early aviation in eastern, inland Washington. The district contains six buildings contributing to the historic significance of the airfield—three hangars, a passenger terminal, a National Guard headquarters building, and a storage building; and two historic structures—a clock tower and a memorial.

Under this criterion, an aircraft might be eligible for listing in the National Register if it had a significant role in an important event (for example, a battle) or pattern of events (for example, early airmail carriers). The Pilgrim 100B Aircraft, manufactured in 1931, is listed in the National Register under Criterion A for its historic association with the development of air commerce and transportation in Alaska.

CRITERION B—SIGNIFICANT PERSON(S)

Under Criterion B, a property can be eligible for the National Register if it is associated with the lives of persons significant in our past. The person must be important as an individual and within a historic context, not simply representative of a group or class. The individual's association with the historic property should be compared with that person's association with other properties in order to determine relative importance of the property in question. Properties associated with living persons usually are not eligible for inclusion in the National Register. Architects, artisans, artists, and engineers are often represented in the National Register by their works, which are eligible under Criterion C. Their homes, workshops, or studios, however, can be eligible under Criterion B, because these usually are the properties with which they are most personally associated.

Individuals significant in the history of aviation may be pilots, technical representatives, engineers, industrialists, airline executives,

The Idaho Falls Airport Historic District, in Idaho Falls, Idaho, is historically significant as a rare surviving example of the pioneering era of aviation in the area. Built between 1930 and 1937, the airport in Idaho Falls served as an important link in connecting communities in the West. The historic district is also significant for its association with the Depression era Works Progress Administration program in Idaho. Pictured is the superbly crafted log airplane hanger built in 1936. (Renee Magee, July 22, 1997)

The Hughes Flying Boat* (Hercules), *shown during its successful test flight in 1947, is listed under Criterion B for its association with the life of noted aviator Howard Hughes. The aircraft is also significant for its engineering design and construction technique. It is located in Long Beach, California, the site of its successful air tests. (Photographer unknown, November 2, 1947. Photo courtesy of the Hughes Helicopter Division of the Suma Corporation)

military officers or the rank and file, airport managers, or government officials. After World War I, Maj. Gen. William "Billy" Mitchell advocated a strong air force, even in peacetime, for the defense of the United States. His house in Virginia is a National Historic Landmark. The Ford Airport Hangar in Lansing, Michigan, is listed in the National Register in part for its association with Henry Ford, who built it in 1926 as part of the airline system he was developing. The hangar is also significant under Criterion A for its association with the early development of commercial aviation.

The College Park Airport in Maryland similarly derives some of its historic significance from association with important people. There in 1909 aviation pioneer Wilbur Wright taught military personnel, including Frank P. Lahm and Benjamin Foulois, how to fly. The airport was the first training site for military fliers in this country and was listed in the National Register under Criteria A and B. Benjamin Foulois once commanded the U.S. Air Service station at Henry Post Air Field in Oklahoma. This fact provides that historic site with a strong association with an important person.

Aircraft can be listed under Criterion B if they are associated with a significant aspect of an important person's life. The Hughes Flying Boat *Hercules*, popularly known as the "Spruce Goose," is listed under Criterion B for it association with the life of noted aviator Howard Hughes. In addition, the Hercules is significant for its engineering design and construction technique. The aircraft is located in Long Beach, California, the site of its successful air tests in 1947.

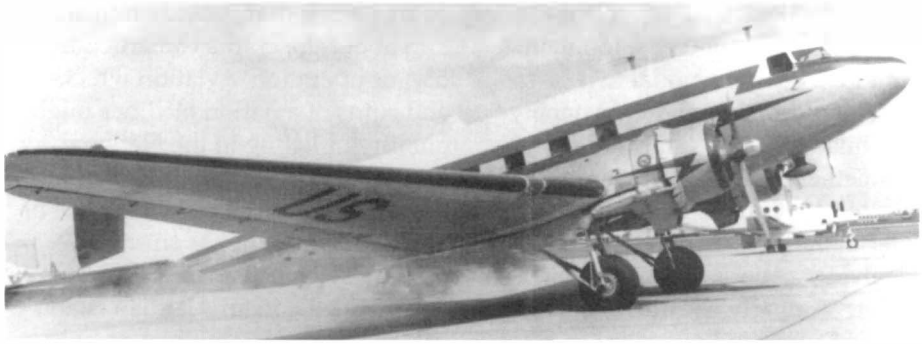
For additional guidance refer to *National Register Bulletin: Guidelines for Evaluating and Documenting Properties Associated with Significant Persons.*

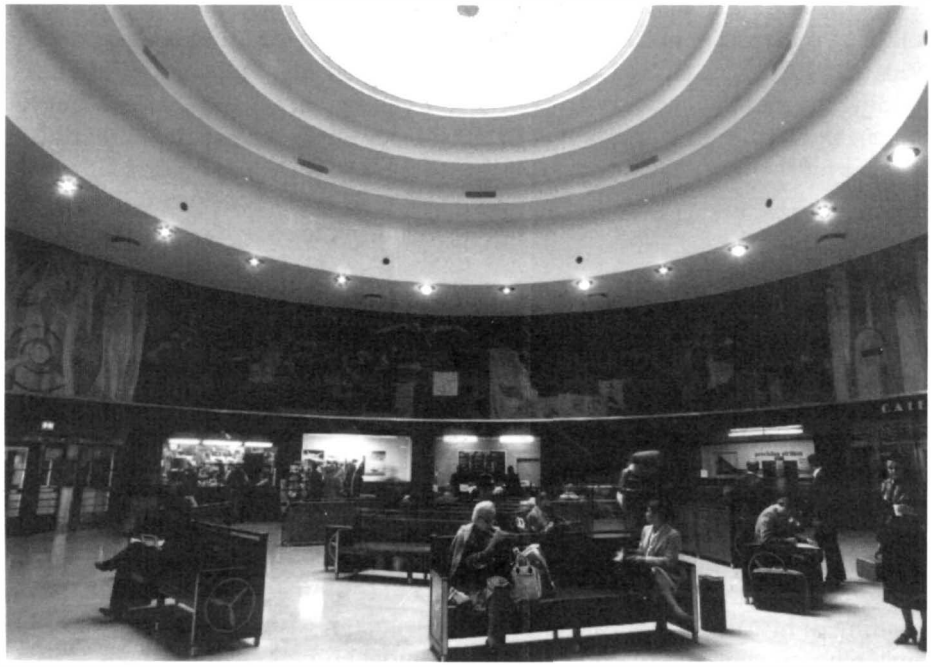
CRITERION C—DESIGN/CONSTRUCTION

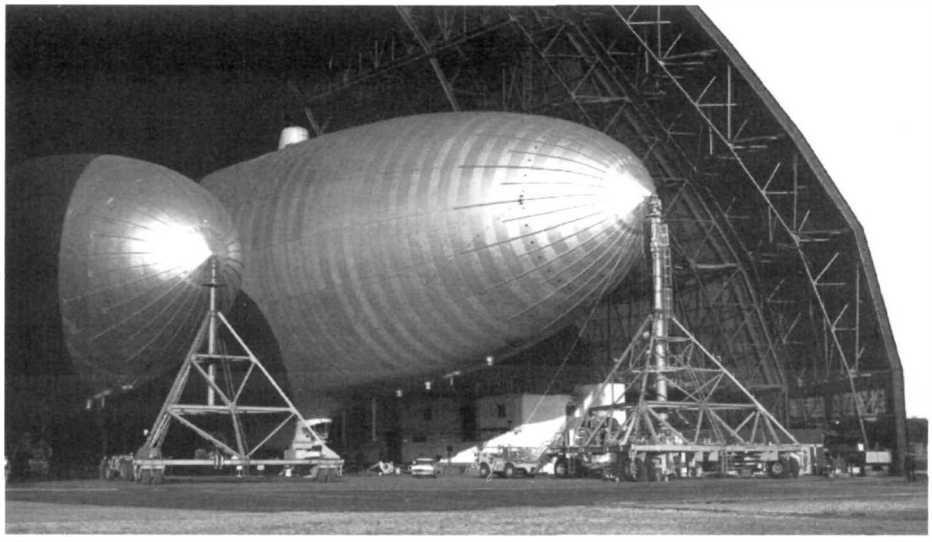
Properties can be eligible for the National Register if they embody the distinctive characteristics of type, period, or method of construction; or that represent the work of a master; or that possess high artistic value; or that represent a significant and distinguishable entity whose components may lack individual distinction.

Distinctive Characteristics. Aircraft and air-related facilities can be eligible if they embody the distinctive characteristics of a type, period, or method of construction important in aviation history. An aircraft can be eligible if it is a good representative of an important type (military, commercial, civilian), or if it represents a significant development in aircraft technology, or if it represents a significant doctrinal development, like an organization's response to changing technology or tactics. The 1905 Wright Flyer III, located in Dayton, Ohio, was designated a National Historic Landmark for its significance in engineering history as the first airplane capable of sustained and controlled flight and suitable for practical application. It was with this airplane that Orville and Wilbur Wright perfected the technique of flying and designed a powered airplane completely controlled by the pilot.

Air-related buildings, districts, structures, and objects may also be significant under this section of the criterion. Hangar One at Los Angeles International Airport represents an important style of architecture—Spanish Colonial Revival. In contrast, the Bryce Canyon Airport Hangar in Utah illustrates vernacular construction in the use of sawn-log and corrugated-tin features. The Marine Air Terminal at La Guardia







The Larsen Brothers Airport in Clayton, Winnebago County, Wisconsin, represents one of the earliest forms of airport design in the State. Builder Knute Johnson adapted barn-building technology to construct the hangar in 1924. (Peter J. Adams, November, 1983)

Aircraft can be listed under Criterion C if they are a good example of a significant type of aircraft. The Douglas DC-3, N-34, manufactured in 1945, was listed as a rare surviving example of the aircraft which revolutionized the air transport industry. The design and construction of the DC-3 was begun by the Douglas Aircraft Company in the mid-1930s. This remarkably reliable aircraft soon became the best-selling airliner in the world. Today the aircraft is the housed at Hangar 10, Federal Aviation Administration, Mike Monroney Aeronautical Center, Oklahoma City, Oklahoma. (Jerry Searcy, FAA, October, 1993)

Aviation properties can derive significance under Criterion C for high artistic value. In addition to its Art Deco style exterior, the Marine Air Terminal Building at La Guardia Airport in New York City contains the mural "Flight" by James Brooks. Both of these contribute significantly to the building's importance. (Carl Foster, New York City Landmarks Preservation Commission, 1981)

Significant examples of aviation-related engineering can qualify under Criterion C. With the construction of the Goodyear Airdock in 1929, Akron, Ohio, became one of the centers for development and construction of lighter-than-airships. The dirigibles* Akron *and* Macon *were built in the airdock. The building is constructed of sheet metal attached to eleven parabolic arches. With dimensions of 1,175 feet long, 325 feet wide, and 211 feet high, it was the largest building in the world without interior supports. (Goodyear Aircraft Corporation, Photographic Department, 1972)

Airport in New York is an example of Art Deco architecture of the late 1930s, as well as a tangible reminder of the era of clipper ships and early transoceanic air service. The decorative interior design is also Art Deco. All three buildings are listed in the National Register. Built in 1929, the Goodyear Airdock in Akron, Ohio, is where the Goodyear Zeppelin Corporation developed and constructed dirigibles, including the *Akron* and *Macon*. The airdock's shape (semi-paraboloid), size (1,175 feet long by 325 feet wide by 211 feet high), and structural system (no interior supports) are architecturally significant. In a final example, the Unitary Plan Wind Tunnel at Ames Research Center in California represents the continual development of superior technical aeronautical research facilities after the end of the Second World War and is a National Historic Landmark.

The Work of a Master refers to the technical or aesthetic achievements of an architect, engineer, or craftsman. African American architect Clarence Wesley Wigington designed the Holman Field Administration Building in St. Paul, Minnesota. Wigington's significance as an important architect gives that building an association with a local master, an association recognized through listing in the National Register. Internationally known architect Albert Kahn designed the Ford Airport Hangar at Lansing Municipal Airport in Lansing, Illinois. He applied his famous "factory-type" style to provide natural light and structural strength to the building. The work of a master may also apply to aircraft, particularly owner/designer-built models and small production runs of light planes built by craftsmen.

High Artistic Value concerns the expression of aesthetic ideals or preferences and applies to aesthetic achievement. Inside the Marine Air Terminal at La Guardia Airport in New York City is the mural "Flight," by James Brooks, which adds artistic value to the building.

A Significant and Distinguishable Entity Whose Components May Lack Individual Distinction refers to historic districts. Cheyenne, Wyoming, was once an air transportation center. Surviving properties include a Boeing/United Airlines building, a hangar, and a fountain, constructed between 1929 and 1934. The famous Boeing 247B airplane appears in the detail on the fountain, built in 1934 as a memorial to aviation. The properties might not qualify individually for the National Register, but together they signify the importance of Cheyenne as a transportation center in the days before high-altitude flying made such remote centers obsolete. Similarly, the Bowman Field Historic District in Louisville, Kentucky, consists of three adjacent buildings constructed in the late 1920s and 1930s. The administration building, Curtiss Flying Service hangar, and Army Air Corps hangar together reflect the early days of aviation in that locale.

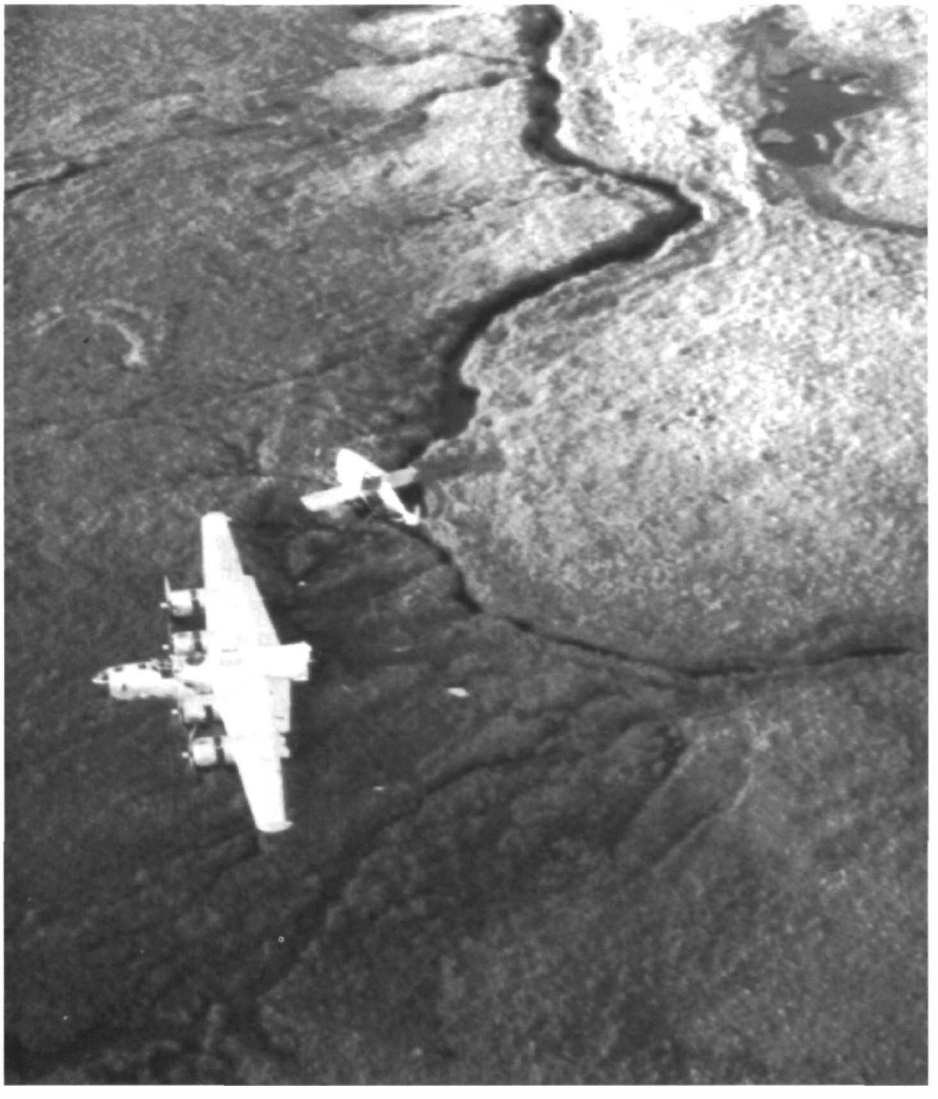
CRITERION D—INFORMATION POTENTIAL

Properties can be eligible for the National Register if they have yielded, or may be likely to yield, information important in prehistory or history. The property must be known to contain information that would be important to our understanding of history or prehistory. Archeological sites and districts can qualify under this criterion, including sites and districts studied by historical archeologists and industrial archeologists. Buildings, structures, and objects might also qualify under Criterion D. It is necessary to demonstrate (1) the importance of the information within an appropriate historic or archeological context, (2) the connection between the important information and the specific property, and (3) the presence of adequate data in the property. According to the National Register, a property with information potential is a geographic location having important historical or archeological information. The information may be literally buried under ground, submerged under water, or scattered across the surface.

An aviation property is significant under Criterion D if that property has yielded or is likely to yield information important to history, such as the physical characteristics of an aircraft that provide information about the craft's construction, use, or operation. Aviation wrecks and ruins of aviation facilities might qualify for listing in the National Register under Criterion D. Also, a rare aircraft for which inadequate or no documentation has survived might also be considered.

The B-24D on an Aleutian island in Alaska is an example of an aviation property that qualified for the National Register under Criterion D for its information potential. All the pieces are "in the area," according to the nomination form. The aircraft is the oldest known surviving D model. It participated in the Aleutian Campaign of the World War II, and it is the only B-24D in Alaska. A combat veteran, the plane crash-landed in bad weather upon return from a weather observation mission. The historical context of the plane includes the war and military aircraft in general, and more particularly the history of Alaska as a United States territory and the history of Alaskan aviation. The geographical context or setting is the area in which the plane saw combat and where it crashed. The information potential includes construction features of the early B-24Ds that differ from later planes due to modifications introduced after this plane, the nineteenth 24D, was produced. The crashed plane also illustrates skillful emergency landing.

For additional guidance refer to *National Register Bulletin: Guidelines for Evaluating and Registering Historical Archeological Sites and Districts.*



Aviation wrecks qualify under Criterion D if they can provide important information about aircraft design, or construction. Shown here are the well preserved remains of a B-24D Liberator which crashed in 1942 in Alaska. As the oldest known surviving D model, the remains of the aircraft have the potential to yield information on construction features of early B-24Ds that differ from later models of the bomber. (Ted Spencer, Alaska Historical Aircraft Society, 1978)

CRITERIA CONSIDERATIONS

Certain kinds of property are not usually considered for listing in the National Register:

A—Religious properties

B—Moved properties

C—Birthplaces and graves

D—Cemeteries

E—Reconstructed properties

F—Commemorative properties

G—Properties that have achieved significance within the past fifty years

A property thus might meet one or more of the National Register criteria and still **not** be eligible for listing **unless** special requirements are met. These special requirements are called Criteria Considerations and labeled A–G.

Of particular relevance to aviation properties are Criteria Considerations B, E, F, and G. Consideration B (moved properties) applies because airplanes are mobile. Consideration E (reconstructed properties) would apply if too much original materials have been replaced. Consideration F (commemorative properties) applies if the property commemorating some aspect of aviation history has its own exceptional significance. Consideration G (properties that have achieved significance within the past fifty years) is particularly relevant because half of aviation's history occurred within the past fifty years. Other Criteria Considerations may also be applicable to a particular property.

CRITERIA CONSIDERATION A—RELIGIOUS PROPERTIES

A historic aviation property owned by a religious institution or used for religious purposes will be eligible if it derives its primary significance from architectural, engineering, or artistic distinction (Criteria C) or historical importance (Criteria A or B). Religious properties must be judged solely in secular terms. Given the use of airplanes to support missionary and other religious work, Criteria Consideration A may apply to a variety of aviation properties owned by religious institutions yet significant in secular terms (for example, the economic or social impact of an air field upon a rural locale).

CRITERIA CONSIDERATION B—MOVED PROPERTIES

A moved property can be eligible if it is significant primarily for its architectural or engineering value or if it is the surviving property most importantly associated with a historic person or event. In general, the National Register discourages moving historic properties because a property derives historical significance from its location and setting.

Moving a historic building or other historic property is acceptable when there is no feasible alternative for preservation. But for the moved property to qualify for the National Register, the new location must be historically appropriate. Often moving a historic property lessens that property's integrity to such a degree that it no longer qualifies for listing in the National Register.

Building 105 of the Boeing Airplane Company has been accepted by the National Register despite having been moved from its original location. The Port of Seattle acquired and redeveloped the original site. That redevelopment threatened the building with destruction, so the building was moved nearby. The building remained in an industrial and aviation setting, but out of harm's way. The National Register approved the move when it accepted the building for listing. Similarly, the National Register recognized the need to move the 1938 Rogers-Post monument in Alaska because it was sinking at the original site. The Naval Arctic Research Laboratory moved the monument to higher ground 95 feet away.

Aircraft, like ships, are transportation vehicles designed to move during operation. Because aircraft are designed to be moved, **they do not need to meet Criteria Consideration B (and the consideration should not be checked on the National Register registration form).**

See pages 36–37 for the related issues of integrity of location and setting for aircraft, and artificial collections of aircraft.

CRITERIA CONSIDERATION C—BIRTHPLACES OR GRAVES

A birthplace or grave of a person associated with the history of aviation is eligible if that person is of outstanding importance **and** if there is no other appropriate site or building directly associated with the person's productive life.

CRITERIA CONSIDERATION D—CEMETERIES

To be eligible, a cemetery must derive its primary importance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events. Aviation-related graves, for example, may be

In 1917, William E. Boeing converted this 1909 boathouse for use as offices and production headquarters of the fledgling Boeing Airplane Company. Threatened with demolition, the building was moved in 1975 to the King County Airport, in Seattle, Washington, where it now anchors a complex of buildings housing a museum of flight. (David M. Hansen, Washington Office of Archaeology and Historic Preservation, 1977)

found in war cemeteries that might merit National Register listing.

CRITERIA CONSIDERATION E—RECONSTRUCTED PROPERTIES

A reconstructed property must meet three requirements to be eligible for the National Register. One, the property is reconstructed accurately in a suitable environment. Two, the property is presented in a dignified manner as part of a restoration master plan. Three, no other building or structure with the same associations has survived. Accurate reconstruction implies sound historical or archeological data, appropriate materials, and adequate documentation. A suitable environment refers to both the physical context and the interpretative scheme.

Individual reconstructed aircraft are not eligible for the National Register because they are not authentic historic resources. A reconstructed airplane is a modern aircraft which reproduces the exact form or detail of a vanished aircraft as it appeared at a specific period of time. After the passage of fifty years, a replica aircraft might attain significance in its own right as a product of one generation's perception of aviation history.

In rare instances, replica aircraft can be a contributing component of a National Register property if: 1) the reconstruction is based on scholarly analysis or graphic, written, and archeological sources; 2) the aircraft's construction is accurately executed, using appropriate period materials and construction techniques; 3) the reconstruction is presented in a historically appropriate manner as part of a restoration master plan; 4) no other aircraft with the same association has survived. Being part of a restoration master plan means that the reconstruction is an essential component in a group of historic properties which together constitute a historic district. The reconstruction must be part of an overall restoration master plan for the entire district. For example, a reconstructed aircraft may be eligible as part of a restoration master plan for an early 20th century airport historic district, which includes historic properties, such as hangars, terminal building, tower, etc. In this case, the reconstructed aircraft may be essential to convey the aviation significance of the district.

See pages 37–40 of the Integrity section for related issues of evaluating an aircraft's integrity of materials and the nature of aircraft maintenance.

CRITERIA CONSIDERATION F—COMMEMORATIVE PROPERTIES

A commemorative property can be eligible if design, age, tradition, or symbolic value has invested it with its own exceptional significance. The National Register has recognized the exceptional significance of commemorative properties related to aviation.

The Wright Brothers National Memorial shaft, for example, is a granite, triangular obelisk atop Kill Devil Hill in North Carolina. Completed in 1932, it commemorates "the conquest of the air by the brothers Wilbur and Orville Wright" on what were shifting sand dunes at the time of the first flights in 1903. The sandy soil is now stabilized, and building developments block the view to the beach, but a grass field and this memorial shaft commemorate the historic place where the Wrights flew. The shaft's design is also significant. On the sides of the obelisk are outspread wings in bas-relief to give the impression of flight.

For another example, two monuments near Barrow, Alaska, commemorate the humorist Will Rogers and pilot Wiley Post who died there in an airplane crash in August of 1935. The wreckage of the hybrid Lockheed Orion-Explorer, a low-wing plane equipped with pontoons for Alaskan flying, was removed. The first monument was built in 1938 with funds raised through public subscription. It consists of poured cement, local aggregate rock, and beach boulders. Its dedication attracted national attention. In 1953 a private individual built the second monument, a rectangular obelisk of poured concrete in four blocks of diminishing size. Both are listed in the National Register for their symbolic value in memorializing Rogers and Post.

CRITERIA CONSIDERATION G—PROPERTIES THAT HAVE ACHIEVED SIGNIFICANCE WITHIN THE PAST FIFTY YEARS

Such properties are eligible only if they are of exceptional importance. The fifty-year requirement allows sufficient time to elapse to develop historical perspective, guards against listing properties of passing interest, and ensures that the National Register is a list of historic places.

Given that airplanes and the infrastructure of aviation (like navigation aids and hangars) were not designed or constructed for fifty years of operation, Criteria Consideration G deserves special attention. Other aviation properties, like wartime training fields and temporary buildings, similarly were never intended to last fifty years. Without identification and preservation of some of these properties before they reach the age of fifty years, the properties will not survive to reach fifty years of age.

The National Park Service has recognized and addressed this fifty-year challenge in regard to the space program. In the early 1980s the National Park Service surveyed sites associated with the early space program. In 1984 the Park Service completed a study of the theme "man in space" and identified properties associated with the space program

for National Historic Landmark status and thus also listing in the National Register. President John F. Kennedy extended the man-in-space program to man-on-the-moon with his 1961 announcement "that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth." The young National Aeronautics and Space Administration (successor of the National Advisory Committee on Aeronautics) constructed and converted facilities for the space program. These facilities, which are significant to the nation's space program and its successful Project Apollo, are less than fifty years old.

Many space facilities of exceptional importance are National Historic Landmarks listed in the National Register of Historic Places. In Hampton City, Virginia, there are several landmarks of the space program—the Lunar Landing Research Facility, the rendezvous docking simulator, the Saturn V dynamic test stand, and the Saturn V launch vehicle. Other space-age landmarks listed in the National Register include the Space Environment Simulation Laboratory in Houston, Texas; a twenty-five-foot space simulator in Pasadena, California; and the neutral buoyancy space simulator in Huntsville, Alabama.

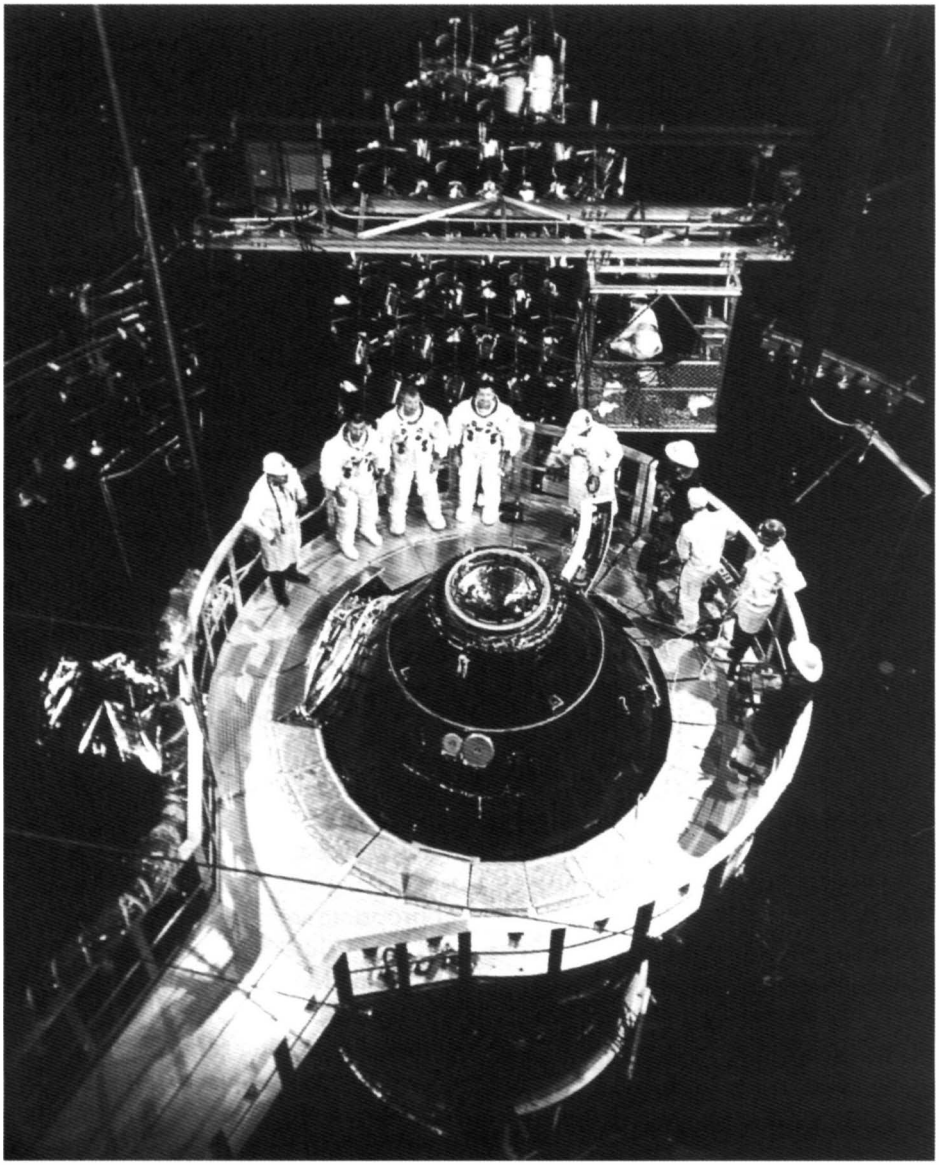
The National Park Service has determined that the main terminal building at the Dulles Airport outside of Washington, a building designed by architect Eero Saarinen, is eligible for listing in the National Register because of the building's exceptional architectural importance and despite the fact that the building was not yet fifty years old at the time it was evaluated.

The end of the Cold War, and the subsequent closing of many Cold War facilities, means that Cold War properties present challenges to preservationists and other cultural resource managers. Through the Legacy Resource Management Program, the Department of Defense sponsored many studies of Cold War cultural resources. Cold War properties—including aviation properties—**may be** candidates for the National Register under this "exceptional importance" rule; the

Above: A monument erected in 1938 and a second in 1953 mark the site of the airplane crash near Barrow, Alaska, that claimed the lives of world-renowned aviator Wiley Post and actor, author, and humorist Will Rogers. Although the wreckage of the 1935 crash has been removed, the property is listed in the National Register for its symbolic value as a memorial to the men's lives. (Naval Arctic Research Laboratory, 1973)

Left: The Wright Brothers National Memorial Shaft, completed in 1932 at Kill Devil Hills, North Carolina, commemorates the conquest of the air by the brothers Orville and Wilbur Wright. (Kenneth A. John, National Park Service, June, 1975)

A F-117A Stealth aircraft undergoing icing tests in the main chamber of the McKinley Climatic Laboratory at Elgin Air Force Base, Fort Walton Beach, FL. The laboratory, whose period of significance extends to within the past fifty years, was listed based on exceptional importance for its contribution to the development of military aviation during the World War II and Cold War eras, and for its advanced engineering design. (Official U.S.A.F. photograph, 1991)



Since its construction in 1965, NASA's Space Environment Simulation Laboratory in Houston, Texas, has been the primary location for testing of flight hardware for the manned space program, space shuttle systems, and satellite systems. This 1968 photograph shows three astronauts entering Apollo Spacecraft 2TV-1 for an eight-day manned thermal-vacuum testing. (Official NASA photograph, June 11, 1968)

exceptional importance is in addition to meeting National Register Criteria in general. The phrase "exceptional importance" may be applied to the extraordinary importance of an event or to an entire category of resources so fragile that survivors of any age are unusual. Exceptional importance does not require that the property be of national significance. It is a measure of the property's importance within the appropriate historic context, whether the scale of the context is local, state, or national.

The retirement and replacement of aircraft by airlines raise preservation issues concerning obsolete jet liners that are less than fifty years old. Similarly, the replacement of private and sport aircraft with newer, higher-technology models poses questions now about the preservation of aircraft less than fifty years old. Some of these aircraft may qualify for National Register listing.

Refer to *National Register Bulletin: Guidelines for Evaluating and*

Nominating Properties That Have Achieved Significance Within the Last Fifty Years for further guidance on this topic.

EVALUATING THE INTEGRITY OF HISTORIC AVIATION PROPERTIES

In addition to being significant under the National Register Criteria, properties must retain integrity to be listed. Integrity is the ability of a property to convey its significance. The National Register recognizes seven aspects or qualities that, in various combinations, define integrity. To retain historic integrity a property will always possess several, and usually most, of the aspects. The retention of specific aspects of integrity is paramount for a property to convey its significance. Determining which of the aspects are most important to a particular property requires knowing why, where, and when the property is significant.

The basic guidance for evaluating the integrity of historic properties if found in *National Register Bulletin: How to Apply the National Register Criteria for Evaluation.* The following sections supplement that bulletin with an emphasis on evaluating the integrity of historic aircraft.

SEVEN ASPECTS OF INTEGRITY:

- Location
- Setting
- Materials
- Design
- Workmanship
- Feeling
- Association

Location is the place where the historic property was constructed or the place where the historic event occurred.

Setting is the physical environment of a historic property. Whereas location refers to the specific place where a property was built or an event occurred, setting refers to the character of the place where the property is found. It involves how, not just where, the property is situated and its relationship to its surroundings.

The relationship between a property and its location is often important to understanding why the property was created or why something happened. The actual location of a historic property, complemented by its setting, is particularly important in recapturing the sense of historic events and persons. Except in rare cases, the relationship between a property and its historic associations is destroyed if the property is moved. (See Criteria Consideration B, pages 31–32, for the conditions under which a historic aviation property which has been moved is eligible.)

The National Register recognizes, however, that **some types of resources were designed to be moved**. Ships, railroad cars, trolleys, and airplanes are property types that were constructed to be mobile; their significance is inherent in their ability to move. In many instances, they are today not located in the place where they were constructed or where the historic event(s) with which they are associated occurred. These properties may still be able to convey their importance despite not being at their original location. **Thus it is not required that movable objects be at their original location in order to retain integrity.**

What is required of these movable properties, in order to be eligible, is that the structure (as the National Register categorizes ships, railroad cars, trolleys, and aircraft) must have an appropriate setting. This requirement applies both to historic aircraft which are still being flown and those which are not.

Aircraft located in museums directly raise the issue of appropriateness of location and setting. The National Register generally excludes museum objects from being listed. It would not be practical or useful to list in the National Register the many millions of museum objects which might be found significant under the criteria. Museum objects do not have integrity of location or setting under the National Register criteria because museums are not the location or setting in which aircraft achieved significance.

How does this policy relate to aircraft? In short, aircraft which have been removed from an aviation setting and are now museum objects, in the traditional sense, generally will not qualify for the National Register. National Register status for museum objects is redundant since the objectives of recognition and preservation are inherent in the museum mission. For example, the airplanes maintained and displayed at the Smithsonian Institution's National Air and Space Museum on the Mall in Washington, D.C., while historically significant, would not meet the National Register criteria because they do not meet the requirement for setting. This in no way detracts from the extraordinary importance of the Wright brothers' or Charles Lindbergh's aircraft, or the many others, maintained in this facility.

This general policy would not, however, disqualify an aircraft simply because it is part of a collection. The deciding factor will be appropriateness of setting. If an aircraft is part of a collection and: (a) is important under the National Register criteria, (b) retains integrity of materials, design, workmanship, feeling and association; and (c) is in a setting which is appropriate to an aircraft and allows it to convey its significance as an aircraft, then it will be eligible. An example of an appropriate setting would be an air-related facility where the aircraft is maintained. A historic SBD Dauntless dive bomber parked on an aircraft parking ramp, or inside of a hanger, at a naval aviation station would meet the requirement of integrity of setting, as would a his-

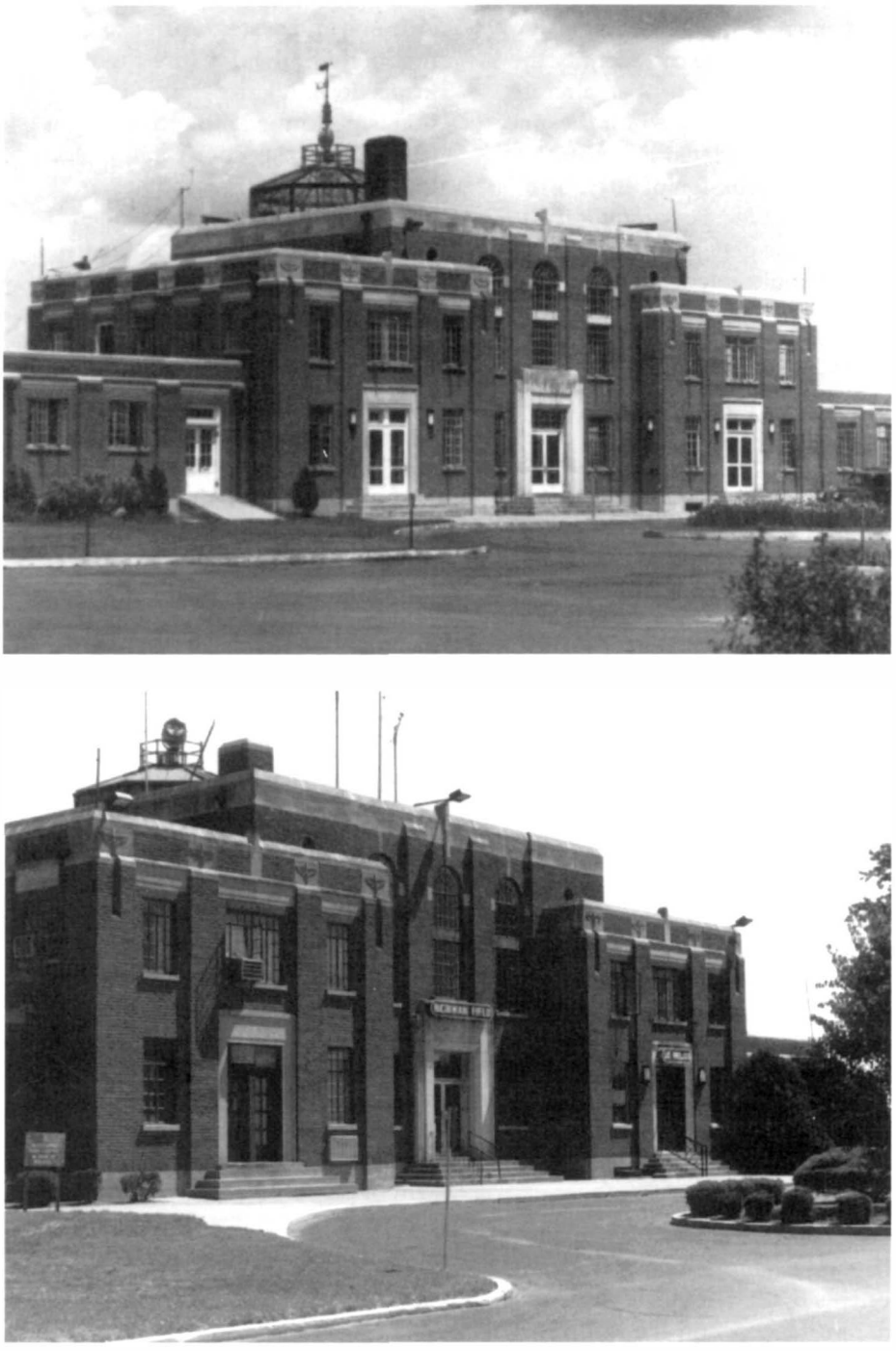
toric DC-3 maintained in a hanger at a municipal airport. Aircraft kept within modern buildings constructed to house a collection could qualify if the building itself were in an appropriate setting. For example, if a period aircraft is situated within a modern building designed to store and display the aircraft, and the building is located near the runways at an airport, it might qualify. As with all other National Register property types, the aircraft must be judged on an individual basis to determine if it is significant and retains integrity.

A question to consider is does the aircraft have to be located at a facility where it was historically associated to qualify? The short answer is NO. It is not required that period aircraft be located at an airfield where historically they were based. Nor would we expect, for example, to find a WWII carrier based airplane still located on a ship floating off of an island in the Pacific. The general requirement, then, is that historic aircraft must be located in an appropriate setting, such as an air-related facility.

Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.

A property must retain the key materials dating from its period of its significance. If the property has been rehabilitated, the historic materials and significant features must have been preserved. The property must also be an actual historic resource, not a recreation; a recent structure fabricated to look historic is not eligible. Likewise, a property whose historic features and materials have been lost and then reconstructed is usually not eligible. (See Criteria Consideration E on page 33 for the conditions under which a reconstructed property can be eligible.)

An aircraft's integrity of materials cannot be evaluated without an understanding of the nature of aircraft maintenance, and the periodic



To qualify for the National Register, a property must retain the essential physical characteristics it possessed during its defined period of significance. These two photographs, taken ca. 1938 and in 1988, demonstrate that the Administration Building at Bowman Field in Louisville, Kentucky, retains the majority of its original building materials and features and is able to recall its role in the history of aviation in the State. (Photographer unknown, ca. 1938, and Margaret Warminski, August, 1988, both courtesy of the Kentucky Heritage Council)

replacement of parts. With this understanding one can identify the essential components of an aircraft which must be retained for the aircraft to be considered historic. The following discussion of aircraft maintenance focuses on military aircraft, but the general principles are broadly applicable to all aircraft.

THE NATURE OF AIRCRAFT MAINTENANCE

An aircraft is a complex, relatively fragile machine, intended to operate in an environment inherently unforgiving of failures of judgment or material. The design of aircraft has evolved with a tendency to incorporate redundant critical components and rigid schedules of inspections. These designed inspection requirements include the periodic, programmed, replacement of system components. For instance, a "time change item" is a part that is to be changed after the accumulation of a specified number of operational hours or cycles. An example of a time change item is an oil filter. Regardless of the apparent condition of the item, at the end of its specified operational time the item is removed and replaced. Depending on the type of item, it might be refurbished and installed in another aircraft. Aircraft engines are good examples of system components that are removed, inspected, refurbished, and reinstalled on an operational time basis. After a number of operating hours specified by the manufacturer, an aircraft engine is removed and thoroughly inspected and refurbished. The U.S. Army's aircraft that circled the globe in 1924, the "World Cruisers," used Liberty engines, which were replaced after every fifty hours of operation. In the case of a modern F-15, some items are changed based on the number of times the pilot cycles the throttle.

The modern military fighter aircraft undergoes an inspection of its airframe and systems prior to the first flight of the day (pre-flight inspection). A less detailed inspection is performed after every flight (thru-flight inspection), and after the last flight of the day, another detailed inspection is performed, (post-flight inspection), and is usually even more thorough than the pre-flight. If the aircraft operated in an unusual altitude or high-g condition special inspections are performed. In addition to these daily inspections the aircraft is subject to "periodic, phase inspections." The periodic inspection, like time change item replacement, is based on the number of hours the aircraft has flown. Most modern aircraft operate under a periodic cycle of in-depth inspections that vary in degree, depending on where they are in the cycle. For instance, after two hundred hours an aircraft might enter its Number 1 phase inspection; after another two hundred hours it enters a slightly more in-depth Number 2 phase. After a further two hundred hours it enters the most detailed Number 3 phase inspection, after which it starts the cycle all over again. Each of these periodic or phase inspections removes panels and parts to thoroughly inspect the aircraft for wear or damage. These inspections can take from two to six weeks to complete. This entire system of preventive maintenance is aimed at preventing or fixing problems before they ground the aircraft or endanger the aircrew.

The Bureau of Aeronautics Manual for 1945 states that periodic inspections will be performed as specified in the specific aircraft's technical manual and:

> The following factors shall determine when an aircraft is to be overhauled:
>
> (1) The current condition of the aircraft and its component parts;
>
> (2) The number of months that the aircraft has been in an operating status since its last overhaul or since commissioning;
>
> (3) The number of operating hours since its last overhaul or since commissioning; and
>
> (4) The service to which the aircraft has been subject.

In addition, the manual provides that the aircraft will undergo daily inspections, 30-hour inspections, and 6-week inspections.

These systems of inspection contribute to the relatively frequent replacement of parts. When F-111A, number 67–087, goes into the phase dock for inspection and has both engines changed, a refurbished wing sweep mechanism installed, repacked main gear struts installed, and its primary hydraulic reservoir replaced, it leaves the phase dock as F-111A number 67–087. In fact, even if the wings are removed and replaced along with numerous skin panels and the radar nose cone, it is still aircraft 67–087.

As is the case with most artifacts, frequent hard use over a long period of time equates to frequent repair or replacement of component parts. Aircraft are designed for the frequent removal and replacement of parts. Close examination of the skin of modern and historic aircraft will reveal that many skin panels have quick release latches or easily removed fasteners to allow access to the interior of the fuselage. Many aircraft have quick access panels, whose sole reason for existence is to allow quick inspection of some interior section or component. Even the terminology of hardware indicates the replaceable nature of components; modern "black boxes" are often "LRUs" (Line Replaceable Units). Electrical instruments in historic and modern aircraft are connected to the power system through "Quick Disconnects" or "Cannon Plugs." To remove the engine of a P-80 or T-33 jet aircraft, the after portion of the fuselage (the empennage) is removed. The P-80/T-33 empennage is attached to the rest of the fuselage with only three bolts. The J-33 engine of the T-33 is mounted inside the fuselage with three bolts. An F-111A main gear tire

is held to the strut axle with one nut. These examples indicate the "Remove and Replace" nature of many aircraft components.

Aircraft are also subject to continual modification in their service lives. As operational experience is gained, changes are made to the original design. If these changes become substantial the design may be identified with a new model designation thus the existence of both F6F-3 Hellcat and F6F-5 Hellcat aircraft designations. Throughout their service life aircraft are continually being updated. A F4-E Phantom that participated in action over Vietnam and continued its career for ten or twenty years afterwards will have features incorporated that did not exist during its time of war service. How does this impact integrity of design and materials?

Although the above aircraft may have been updated, it is still the same aircraft that flew in Vietnam. If possible, changes that were incorporated over time should be identified in documenting an aircraft for National Register nomination. This does not mean that every minor detail, such as an "O-ring" seal change or every wire bundle support bracket modification, needs to be documented. What it does mean is that if the landing gear struts were significantly modified, that change should be documented, since it may reflect important developments in the use of the aircraft. If all of the wire bundle support brackets were modified because of a vibration problem, that too might warrant discussion. It should be kept in mind that an aircraft is a piece of complex technology. No matter what criterion for nomination is used, the technical aspects of the aircraft's history will remain important. For military aircraft this is relatively easy to discern; when significant modification has occurred the military usually redesignates the aircraft. For instance, when F-111A 67–041 was modified to test the F-111's potential for electronic jamming it was redesignated EF-111 A, number 67–041.

So, when does an aircraft stop being the "original?" As long as an aircraft retains the majority of its original structural members, it should be considered the authentic aircraft. Spars, stringers, longerons and other structural parts are not usually changed in an aircraft's existence. Some repair work may be done that replaces ribs or stringer sections but never comprehensively. Most commercial and military operators will not invest the money required to comprehensively replace major structural members to re-establish an air-worthy aircraft. Private flying enthusiasts may be willing to make that investment. Thus, the aircraft records should be examined to identify the depth of any restoration work accomplished outside of the aircraft's military operational life.

As discussed above, aircraft by their nature undergo constant changes of system parts throughout their service lives. Engines, pumps, actuators, radios, etc., are all periodically replaced based on time in operation and condition. For an aircraft at an underwater crash site, the site is a physical record of the time of the crash. An aircraft that continued to fly beyond its historic period must be examined to establish that it is still indeed the historic aircraft. Research into the design history of a given aircraft type is essential to verification of design integrity and identification of features that must be present to qualify as a specific aircraft type. Those features and system parts, so identified, should be authentic to the historic operational period. Refurbished contemporary parts were historically used in the aircraft maintenance cycle, and are, therefore, appropriate, as is replacement in kind as part of routine maintenance.

THE ESSENTIAL TEST FOR INTEGRITY OF MATERIALS

Aircraft structures such as ribs, frames, longerons, stringers, spars, skin panels, etc., are not readily removed and replaced in the life of an aircraft, and these must be considered the key materials of an aircraft. Although it is possible that a given aircraft may have seen some of these things replaced, it is likely only a small percentage. If an aircraft is depaneled, and all of the structural members (ribs, spars, stringers, etc.) are replaced, and the skin panels or fabric is replaced, it is no longer the original aircraft but a replica. If the structural members are replaced and the original skin and components are reinstalled, the aircraft retains a minimal integrity of materials and would not normally be considered a candidate for the National Register. Aircraft that are reconstructed from parts in a crash site debris field do not have integrity of materials. However, an aircraft crash site that does not contain all of the aircraft parts (a debris field) may still have integrity as an archeological site.

Other components, such as systems parts (fuel system, hydraulic system, power plant, flight control system, etc.) are more readily changed. Engines, pumps, actuators, reservoirs, cables, etc., are all likely to have been repeatedly changed if an aircraft had a long operational life. Integrity of materials therefore should be interpreted in this light, i.e., contemporary replacement parts would be acceptable versus original parts; if possible verify the historical replacement of the part versus a modern reconstruction.

Some materials are obviously inappropriate for a given aircraft. It would be inappropriate to use aluminum ailerons on an aircraft that historically had fabric-covered ailerons. In the same light, a World War II aircraft with an engine that was not available during the 1940s would not be a candidate for the National Register if it is being submitted for association with World War II. An SBD Dauntless dive bomber has been recovered from Lake Michigan by the National Museum of Naval Aviation. This SBD-2, Bureau Number 2106, a U.S. Navy Dauntless dive bomber, saw action with the U.S. Marine Corps,

Scout-Bomber Squadron VMSB-241 at the Battle of Midway in World War II. The aircraft was damaged and returned to the U.S. for training use. On June 11, 1943, this SBD-2 crashed into Lake Michigan (the pilot survived). SBD-2, number 2106 most likely does not have the Wright R-1820-32 engine in it that it had at Midway, but it should have an R-1820-32 engine and it should be the R-1820-32 engine that was installed in it when recovered from Lake Michigan. In other words, in the course of normal flight and maintenance, the engine on 2106 may have been changed numerous times, but its design required a Wright R-1820-32 engine and that is the engine type that should be on the aircraft.

Aircraft recovered from underwater, especially from salt water, require conservation treatment to stabilize and preserve them for the future. If this conservation process repairs or replaces portions of the aircraft, the treatment may affect the aircraft's eligibility for the National Register. The question is one of degree. Those conservation methods and treatments required to preserve an aircraft are not likely to jeopardize an aircraft's eligibility. Cosmetic changes or additions to the recovered property are inappropriate unless the intent is to return the aircraft to its configuration immediately before the crash. In other words, if a historic aircraft is recovered and is found to be missing its canopy and wing flaps as a result of its underwater environment, replacement of those parts with contemporary or clearly identified modern replicas is appropriate and should not jeopardize the historic integrity of the aircraft. However, the ideal is to conserve the aircraft as an archeological artifact, and therefore, minimum cosmetic actions should be employed.

Design is the combination of elements that create the form, plan, space, structure, and style of a property. In evaluating integrity of design you might ask, does a building still retain the design qualities of its architect? Does an airplane reflect the design of its type; or the design of a special purpose of historic importance? Does a radio range beacon contain the features characteristic of its design? Have changes over time altered the design associated with the historical significance of the particular property?

Aircraft by their nature undergo constant changes of system parts throughout their service lives; engines, pumps, actuators, radios, etc., are all periodically changed. Research into the history of a given aircraft design series is essential to verification of design integrity and identification of features which must be present to qualify as a specific aircraft type.

Determination of integrity of design, therefore, requires a knowledge of designation attributes. An F4F Wildcat can be distinguished from an F6F Hellcat fairly easily even though both have a similar silhouette. If the main landing gear resembles a trapeze extending from the underside of the fuselage, just forward and below of the windscreen, then it is an F4F. If the main landing gear is comprised of two individual gears, each a single strut extending from under each wing, then the aircraft is an F6F.

However, an F4F-3 is not as easily distinguished from an F4F-4. The F4F-3 Wildcat had four .50 caliber machine guns, two in each wing, and lacked a folding wing feature. An F4F-4 had folding wings and six, .50 caliber machine guns. An F4F billed as a F4F-4 model that has non-folding wings should be suspect. Within any given design series there may be numerous modifications and models. The changes that distinguish one model from another may or may not be readily discernible, thus sound research is required.

Workmanship is the physical evidence of the crafts of a particular culture or people during any given period of history or prehistory. It is the evidence of artisans' labor and skill in constructing or altering a building, structure, object, or site. Workmanship can apply to the property as a whole or to its individual components. Workmanship is important, because it can furnish evidence of the technology of a craft, illustrate the aesthetic principles of a historic or prehistoric period, and reveal individual, local, regional, or national applications of both technological practices and aesthetic principles.

Aircraft can exhibit examples of distinguished workmanship. Production methods can reflect workmanship as evidenced in the transition from shop to line production during the wars and how prewar and wartime aircraft differ, even for the same model. Distinctive aircraft markings such as nose art should be considered examples of workmanship. Other field modifications should fall under this category. An F4F squadron stationed on aircraft carrier CV-6 in 1942, installed steel boiler plate to protect its pilots in a time prior to factory installation of aircraft armor plate on F4Fs. This modification is an example of field response to an immediate need. As such, it is also an example of workmanship. Whether the boiler plates were bolted in or welded, and the workmanship of the machinist's holes or the cut edges of the plate and weld seam are indications of the quality of the welder's workmanship.

Another example is the engine bolts on SBD-2 bureau number 2106, the aircraft discussed earlier. Critical attachment bolts in various parts of an aircraft have holes drilled in the bolt-head faces through which pass steel safety, or locking wire. The wire is intended to keep the bolts from backing out, much like cotter keys are used to keep nuts from loosening. The appropriate way to attach safety wire is to loop it through a series of bolts, with the tension pulling on the bolt head in a clockwise, tightening direction. The safety wire on the engine case bolts of SBD-2, 2106, is pulling in a counter-clockwise direction. Either the case bolts are a non-standard

type or the safety wire is installed incorrectly. If incorrectly installed, this poor workmanship is an indication of aircraft maintenance ability both at the Naval Air Station that the aircraft was assigned to and where the engine was assembled.

Workmanship may be particularly evident in airplanes built before WW II. During that period, light airplanes had numerous hand-crafted parts. Many aspects of the airplanes' construction, such as ribstitching, propeller carving, the placement of reinforcing tape, or the doped finish, can be evidence of high-quality or poor workmanship. These features should be noted and evaluated.

Feeling is a property's expression of the aesthetic or historic sense of a particular period of time. It results from the presence of physical features that, taken together, convey the property's historic character.

Association is the direct link between an important historic event or person and a historic property. A property retains association if it is the place where the event or activity occurred and is sufficiently intact to convey that relationship to an observer. Like feeling, association requires the presence of physical features that convey a property's historic character. This is a self-explanatory requirement; the aircraft either is directly associated with an historic event or person or it is not.

In conclusion, old airplanes often require restoration. As noted by the Paul E. Garber Preservation, Restoration, and Storage Facility of the National Air and Space Museum: "Many [aircraft] have been left to the ravages of weather, and airplanes are not built to last in adverse conditions. Their materials—light metal alloys, wood, fabric, rubber, and plastic—are not selected for durability but for maximum strength and minimum weight. Wood rots, cloth decomposes and tears, rubber hardens and crumbles, and metals succumb to corrosion." In addition to weather, aircraft suffer accidents, salvage and souvenir hunters, parts cannibalization, wear and tear of normal operation, the replacement and modification of components as routine maintenance of operational aircraft, as well as damage from moisture, light, fungus, and rodents. These factors affect an aircraft's integrity, and each aircraft must be evaluated individually to determine if it retains the essential features necessary to retain historic integrity.

V. NOMINATING HISTORIC AVIATION PROPERTIES

DOCUMENTING THE PROPERTY

Physical inspection **and** records search are necessary for the documentation of the individual characteristics of the property. National Register forms will provide a general outline of the data required. Search for information about the historic context of the property, the property's association with important events and people, and the period during which the property was significant.

Among the published sources about historic airplanes are several valuable reference series. From 1927 to 1939, the Department of Commerce issued an "Approved Type Certificate" or A.T.C. to manufacturers for each type of aircraft certified as airworthy. Joseph P. Juptner compiled information about each A.T.C. aircraft, arranged by A.T.C. number, in a nine-volume series entitled *U.S. Civil Aircraft Series.* The "Putnam" series, published by Putnam in Great Britain and reprinted in the United States by the Naval Institute Press, presents information about aircraft manufacturers and their aircraft, one manufacturer per title; see, for example, René J. Francillon's *Lockheed Aircraft since 1913.* The books in the Putnam series also explain the respective manufacturers' model designations and constructor's numbers (CNs) or serial numbers (SNs), as well as the military designations for military equipment.

The historian R.E.G. Davies has extensively recorded the development of commercial aviation in *Airlines of the United States* and other books. Henry Ladd Smith also investigated commercial aviation for his books *Airways* and *Airways Abroad.* Such publications contain information about airlines and the airplanes flown. Similarly, books on military aviation provide data not only on the military organizations, but also about military aircraft; for example, see Peter B. Mersky's *U.S. Marine Corps Aviation,* William T. Larkins' *U.S. Marine Corps Aircraft, 1914–1959,* Gordon Swanborough and Peter M. Bowers' *United States Navy Aircraft since 1911,* or Maurer Maurer, *Aviation in the U.S. Army, 1919–1930.*

Archival collections also contain documentary sources. If the military serial number of an aircraft is known, there might be a corresponding serial number card on file in the Archives of the National Air and Space Museum of the Smithsonian Institution. If the civil registration number is known for aircraft Federally registered between 1926 and 1946, two sources can be checked—the U.S. Registered Aircraft Project at the National Air and Space Museum's Archives and records at the Federal Aviation Administration's Monroney Aeronautical Center in Oklahoma City. The Federal Aviation Administration maintains records of airplanes by the civil registration or "N-number" and by the manufacturer's serial number, also known as the "C/N" or constructor's number. Information on production, construction, and materials also may be found among the records of the Aircraft Production Board of World War I and other records in the Army Air Forces record group at the National Archives. Industrial archives, like that of the Boeing Company in Seattle, preserve engineering drawings, technical publications, and other industrial records of products and processes.

The various military services and the many manufacturers adopted different systems, and changed systems, of designating aircraft and aircraft equipment. An explanation of the U.S. Naval aircraft designations—type or class designations, manufacturers' identification letters, Navy suffix letters and prefix letters, mission symbols, and what each designation means—appears in the front of *United States Navy Aircraft since 1911,* by Gordon Swanborough and Peter M. Bowers. For the U.S. Army aircraft designation systems, see the appendix of *U.S. Army Aircraft since 1947,* by Stephen Harding. The Coast Guard designations are explained by Arthur Pearcy in *U.S. Coast Guard Aircraft since 1916.*

Different systems were also employed to designate models of engines and other aircraft equipment. For samples of designations of engine models, see *Model Designations of USAF Aircraft Engines,* issued by the Air Force Air Materiel Command, and *Pratt & Whitney Aircraft Engine Model Designations and Characteristics,* regularly updated by the Pratt & Whitney Aircraft Division of United

Aircraft Corporation after 1945, including jet engines in later years.

The military services maintain history centers and museums that can provide guidance to a researcher or access to records. The Naval Historical Center, with its Naval Aviation History Branch, is located at the Washington Navy Yard in Washington, D.C. The National Museum of Naval Aviation is at the Naval Air Station in Pensacola, Florida. The History and Museums Division of Headquarters, U.S. Marine Corps, is located at the Marine Corps Historical Center, also at the Washington Navy Yard. The Marine Corps Air-Ground Museum is located at the Marine Corps Base, Quantico, Virginia. The Air Force Historical Research Agency is at Maxwell Air Force Base in Alabama, and the United States Air Force Museum is at Wright Patterson Air Force Base in Ohio. The Historian's Office of the Coast Guard is at Coast Guard Headquarters, Washington, D.C. The Army Corps of Engineers, which constructed many aviation-related facilities, maintains a Historian's Office in Washington, D.C.

Information may be found in sources not clearly identified as aviation. As one example, the Stone & Webster collection, located in the Historical Collections at the Baker Library, Harvard University, includes completion cost reports for construction projects done for the Curtiss Airports Corporation. Before 1931, Stone & Webster completed 22 Curtiss airport construction projects at the Miami Airport and Sea Plane Base, the Oklahoma City Airport, the Valley Stream Airport on Long Island, the Los Angeles Airport, and other airports around the country.

Field documentation of an aviation property is also important. The Historic American Buildings Survey and the Historic American Engineering Record, known jointly as HABS/HAER, maintains professional standards for the documentation of architectural and engineering properties. HABS, founded in 1933, focuses on architectural heritage, and HAER, established in 1969, on engineering heritage. The HABS/HAER collections include photographs, measured drawings, and written histories of buildings and engineering sites recorded by HABS/HAER over the years. These records are at the HABS/HAER Office, within the National Park Service, and at the Library of Congress. HABS/HAER surveys cover properties listed in the National Register, like the Pensacola Naval Air Station in Florida, and properties not listed on the National Register, like the Wright-Patterson Air Force Base in Ohio. HABS/HAER creates benchmark documentation that can serve as the basis for cultural resource management decisions, and that can support a nomination to the National Register. Also, HABS/HAER develops techniques and technologies, like photogrammetry and computer-aided-drafting, for documenting the historic built environment. HABS/HAER is thus a resource for information about aviation properties as well as a resource for methods of documenting properties.

Aviation archeology is a specialty within both historical archeology and industrial archeology; thus, guidelines can also be found in literature not specifically related to aviation, like the textbook *Industrial Archaeology: Techniques*, edited by Emory L. Kemp. In general, archeological techniques for surveying and documenting a site can be applied to aviation sites. The technical data recorded needs to be appropriate to the technology being recorded; a wind tunnel, for example, requires different terms and measurements than an airplane or a factory site, but the tools and techniques remain the same. Techniques for the study of submerged shipwrecks can be applied to ditched aircraft now resting under water; see, for example, *National Register Bulletin: Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places.*

IDENTIFYING THE HISTORIC CONTEXT

A historic property can only be understood when it is evaluated with its historic context. *National Register Bulletin: How to Complete the National Register Multiple Property Documentation Form* provides guidance on how to develop a historic context. Discuss the different themes, geographic parameters, and periods of the property's significant development, and the different levels of significance—local, State, or National. For trends in aviation history, see the standard surveys, such as Roger E. Bilstein's *Flight in America.*

Primary literature, as well as the secondary literature, can illuminate different aspects and contexts of aviation. For the development of Federal airways in the 1930s, for example, see the *Air Commerce Bulletin,* published by the U.S. Department of Commerce from 1929 into 1939, and historian Nick A. Komons' book *Bonfires to Beacons.* In the same series as Komons' book are *Turbulence Aloft* about the Civil Aeronautics Authority, 1938–1940, and the Civil Aeronautics Administration from 1940 to 1953; *Takeoff at Mid-Century* about the Civil Aeronautics Administration and the Federal Aviation Agency, 1953–1961; *Safe, Separated and Soaring* about the Federal Aviation Agency and Federal Aviation Administration, 1961–1972; and *Troubled Passage, 1973–1977.* These books address issues of civil aviation, including commercial and private flying, as well as civil-military relations, and each volume is extensively documented with references to original source material. Refer to the bibliography at the end of this bulletin for a more complete listing of source of information on aviation history and properties.

DETERMINING IMPORTANT CHARACTERISTICS

Determination of the characteristics that make the property a good representative of a type is necessary to judge the significance of a property. Physical inspection of the property is essential. Date each important characteristic, and describe its condition. Relate each characteristic to the historical theme or period that gives it significance.

For an airport, for example, list the dates of construction, the principal engineers, the length of the runways, the surface materials, the control tower, hangars, terminals, and other buildings, the communication system, historic aircraft at the airport, and alterations to the property. Place the airport in the context of airport development in general as well as the history of flying at that location. Check historical, architectural, engineering, archeological, and cultural features for both significance and integrity. Using such information, determine what characteristics of the property are important.

For aircraft, list the aircraft's type, name, and builder. Include the vernacular name if there is one. Provide the aircraft's construction date and date of modifications other than those that are part of routine maintenance. Define the aircraft's historic characteristics (those design features associated with the designation). In addition to the physical features, performance specifications should also be listed (weight, speed, range, etc.). Historic characteristics also include field modifications and paint schemes from the aircraft's service life. What were the historical influences (such as design, materials, style, or function) on the aircraft's appearance? For example, an explanation should be given for the adoption of the "gull" wing design of the F4U Corsair. Describe what changes have been made over time and when. Explain how these changes have affected the important characteristics of the aircraft.

EVALUATING SIGNIFICANCE

Evaluation of the significance of the property should be based on the National Register Criteria; see *National Register Bulletin: How to Apply the National Register Criteria for Evaluation.* The evaluation should consider the context of aviation history. In civil aviation, important topics or contexts might be general aviation and private flying, commercial transportation, airmail, crop dusting and other agricultural uses, fire fighting, sports flying, aerial surveys and exploration, aerial photography, and research. In the field of military aviation significance might be derived from the military mission, whether combat (attack, bomber, fighter, etc.), observation and reconnaissance, training, utility (including cargo and transport), or research. Aviation research and development and production themes may appear significantly in both civil and military aviation. The evaluation of significance must also address the question of level of significance. Is the property significant to the history of the locale, State, or Nation?

EVALUATING INTEGRITY

Evaluation of the property's integrity is essential to understanding the importance of the property. What features are important to the property's significance historically, archeologically, architecturally, culturally, or in terms of engineering importance? The evaluation should assess the features that need to be retained to preserve the integrity of the property. Review all seven aspects of integrity. Refer to pages 36–41 for guidance on evaluating integrity.

VI. PREPARING THE NATIONAL REGISTER NOMINATION

To prepare a National Register nomination, follow basic instructions in *National Register Bulletin: How to Complete the National Register Registration Form.*

The following guidance supplements that *Bulletin* and is organized according to the section name of the National Register registration form.

NAME OF PROPERTY

The historic name of aviation properties will be used to identify it in the National Register files, the computerized National Register Information System (NRIS), and any publications. If there is more than one historic name for a facility, enter the name that best reflects the significance of the property; enter other historic or different names under "other names."

CLASSIFICATION

Intact aircraft are classified as "structures"; aviation wrecks are either structures or "sites." Other examples of structures are navigation beacons and seaplane ramps. A single air-related facility (such as a hangar, a terminal building, or a control tower) is a "building." An air-related facility with a combination of buildings, sites, structures, or objects is a "district." Refer to *National Register Bulletin: How to Complete the National Register Registration Form* for definitions and additional examples.

GUIDELINES FOR COUNTING AVIATION RESOURCES

Contributing and non-contributing resources are counted according to guidelines in *National Register Bulletin: How to Complete the National Register Registration Form.* An aircraft counts as one structure. For air-related facilities count only buildings, objects, structures, or sites which are substantial in size and scale, or that are specifically discussed in the text.

FUNCTION

National Register Bulletin: How to Complete the National Register Registration Form includes a list of historic functions that should be consulted to define both the historic and present uses of the historic aviation property. Only the most predominant functions of the property should be listed. Functions that may apply to historic aviation properties could include: "domestic" (for institutional housing on an air base); "commerce/trade" (for an air-related facility associated with commercial endeavors); "social" (for an air-related facility containing an important recreation hall); "education" (for air-related educational institutions); "industry" (for aircraft manufacturing plants); "defense" (for aircraft, air base, missile launching sites); and "transportation" (for aircraft, hangars, airports, launching sites).

DESCRIPTION

In this section provide a narrative describing the current and historic appearance and condition of the historic aviation property. The narrative should begin with a summary paragraph that briefly describes the property, noting its major physical characteristics and assessing its overall integrity. Additional paragraphs describing the aviation property should support the summary paragraph.

In describing aircraft, use official designations:

- Manufacturer's designation
- Constructor's number
- Civil or military registration number
- Civil or military designation of type or class
- Aircraft's configuration sequence
- Type model number
- Status prefix letters
- Special purpose suffix letters
- Mission designation
- Serial number for the specific aircraft
- Appropriate designations for major components,like engines,propellers, and landing gear, and the manufacturers of the major components

For aircraft, the Description Section should address the following:

- When was the aircraft constructed?
- What are the aircraft's historic characteristics?
- What were the historical influences (such as design, materials, style or function) on the aircraft's appearance?
- What modifications, major repairs, alterations, and other changes have been made over time and when? How have these changes (other than routine maintenance that replaces existing parts in kind) affected the aircraft's integrity?
- What is the current condition of the aircraft, including exterior and interior features?

STATEMENT OF SIGNIFICANCE

The Statement of Significance is a narrative that describes why the historic aviation property was important by explaining how the property relates to its historic context, National Register criteria, and areas and periods of significance. The important events and persons, design qualities, or information potential associated with the property are discussed. The Statement of Significance should begin with a summary paragraph describing the overall importance of the aviation property and should be followed with additional paragraphs supporting the significance of the property and its associated important events and people.

The Statement of Significance should address:

- How the property meets one or more of the National Register criteria
- Do any of the National Register criteria considerations apply to the property?
- What are the areas of significance with which the property is associated?
- What is the property's period of significance?
- Who are the leading individuals associated with the property and what was their role in the property's history?

AREAS OF SIGNIFICANCE

From National Register Bulletin: How to Complete the National Register Registration Form, select the "areas of significance" which reflect the importance of the nominated property. Common areas of significance to consider for historic aviation properties are:

- **Agriculture:** aircraft engaged in agricultural production, such as crop dusters.
- **Architecture:** air-related facilities which are good representatives of a type, period, or method of construction; or that represent the work of a master; or that possess high artistic value; or that represent a significant and distinguishable entity whose components may lack individual distinction.
- **Archeology:** aircraft (or aviation wrecks) and air-related facilities that have yielded or may be likely to yield information important in the history of aircraft design, production, maintenance or operation.
- **Art:** air-related facilities embodying significant artistic design features, or an aircraft exhibiting significant example of artistic markings or decoration.
- **Commerce:** aircraft, airways, airfields, and air-related buildings associated with the growth or development of the business of trading goods, services, and commodities.
- **Communications:** aircraft or aids to navigation associated with the technology and process of transmitting information.
- **Education:** air-related facilities associated with conveying or acquiring knowledge of aviation design, doctrine, or training.
- **Engineering:** aircraft, manufacturing plants, or research facilities important for aviation technological developments, or aircraft significant for their engineering characteristics.
- **Entertainment/Recreation:** aircraft used for leisure activities, diversion, amusement, or sport, and aircraft plants associated with the production of civilian recreational aircraft, as well as properties used in recreational aviation activities.
- **Industry:** manufacturing plants associated with the production of aircraft and aircraft components.
- **Invention:** aircraft or air-related facilities associated with the invention or refinement of aircraft design.
- **Landscape Architecture:** air-related facilities exhibiting significant landscape design features.
- **Military:** aircraft, airfields, manufacturing plants, or research facilities associated with the development of military aviation.
- **Politics/Government:** an aircraft or air-related facility associated with significant political events.
- **Science:** aircraft or air-related facilities associated with scientific experiments or other research.
- **Social History:** aircraft associated with humanitarian missions (for example, saving of life or delivery of relief in times of emergency).
- **Transportation:** aircraft or air-related facilities associated with the development of air transport of passengers, express or cargo, and mail.

BOUNDARY

General guidelines for preparing a boundary description and justification are found in *National Register Bulletin: How to Complete the National Register Registration Form.* For historic aircraft, the verbal boundary description may refer to the extent or dimensions of the aircraft and give its location.

PHOTOGRAPHS AND MAPS

Refer to *National Register Bulletin: How to Complete the National Register Registration Form* for requirements.

VII. RECOMMENDED SOURCES

NATIONAL PARK SERVICE PUBLICATIONS

CRM, (formerly *CRM Bulletin*, Cultural Resource Management), 1978–present. (Pertaining to airplanes as historic "places," see the recent comments by Carl Spath, Letter to the Editor, in Volume 18, No. 2, 1995; Michael S. Binder, Letter to the Editor, in Volume 17, No. 9, 1994; Richard E. Gillespie, Letter to the Editor, and Paul C. Diebold, Response, in Volume 17, No. 4, 1994; and the article that inspired the discussion, Paul C. Diebold, "Aircraft As Cultural Resources, the Indiana Approach," in Volume 16, No. 10, 1993. See also the article by David B. Whipple, "Aircraft as Cultural Resources: the Navy Approach," in Volume 18, No. 2, 1995, and Amy Slaton's article, "The Engineering of Flight, Wright-Patterson Air Force Base," in Volume 16, No. 3, 1993.)

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The Historic Sites Survey and National Historic Landmarks Program, a History, by Barry Mackintosh (1985)

Man in Space, Study of Alternatives (1987)

National Register of Historic Places, 1966–1994 (1995)

Protecting Archeological Sites on Private Lands, by Susan L. Henry (1993)

Recommendations of the Large Industrial Artifact Advisory Panel, America's Industrial Heritage Project, Pennsylvania (1991)

The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (1983)

The Secretary of the Interior's Standards and Guidelines for Architectural and Engineering Documentation: HABS/HAER Standards (1990)

The Secretary of the Interior's Standards for Historic Vessel Preservation Projects with Guidelines for Applying the Standards (1990)

The Secretary of the Interior's Standards for Rehabilitation with Illustrated Guidelines for Rehabilitating Historic Buildings, revised edition (1992)

The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, & Reconstructing Historic Buildings (1995)

AVIATION-RELATED NATIONAL REGISTER BULLETINS

How to Apply the National Register Criteria for Evaluation

How to Complete the National Register Registration Form

How to Complete the National Register Multiple Property Documentation Form

Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places

Defining Boundaries for National Register Properties

Guidelines for Evaluating and Nominating Properties That Have Achieved Significance within the Last Fifty Years

How to Improve the Quality of Photographs for National Register Nominations

Guidelines for Evaluating and Documenting Properties Associated with Significant Persons

Guidelines for Evaluating and Documenting Historic Aids to Navigation

Guidelines for Evaluating and Registering Historical Archeological Sites and Districts

Researching a Historic Property

Guidelines for Identifying, Evaluating, and Registering America's Historic Battlefields

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VIII. NATIONAL REGISTER BULLETINS

THE BASICS

*How to Apply National Register Criteria for Evaluation**

Guidelines for Completing National Register of Historic Places Form

*Part A: How to Complete the National Register Form**

*Part B: How to Complete the National Register Multiple Property Documentation Form**

*Researching a Historic Property**

PROPERTY TYPES

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Guidelines for Identifying, Evaluating and Registering ***America's Historic Battlefields***

Guidelines for Evaluating and Registering Historical ***Archeological Sites***

Guidelines for Evaluating and Documenting ***Historic Aviation Properties***

Guidelines for Evaluating and Registering ***Cemeteries and Burial Places***

How to Evaluate and Nominate ***Designed Historic Landscapes****

Guidelines for Identifying, Evaluating and Registering ***Historic Mining Sites***

How to Apply National Register Criteria to ***Post Offices****

Guidelines for Evaluating and Documenting ***Properties Associated with Significant Persons***

Guidelines for Evaluating and Documenting ***Properties That Have Achieved Significance Within the Last Fifty Years***

Guidelines for Evaluating and Documenting ***Rural Historic Landscapes****

Guidelines for Evaluating and Documenting ***Traditional Cultural Properties****

Nominating ***Historic Vessels and Shipwrecks*** *to the National Register of Historic Places*

TECHNICAL ASSISTANCE

Contribution of Moved Buildings to Historic Districts; Tax Treatments for Moved Buildings; and Use of Nomination Documentation in the Part I Certification Process

*Defining Boundaries for National Register Properties**

*Guidelines for Local Surveys: A Basis for Preservation Planning**

How to Improve the Quality of Photographs for National Register Nominations

*National Register Casebook: Examples of Documentation**

Using the UTM Grid System to Record Historic Sites

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Publications marked with an asterisk (*) are also available in electronic form on the World Wide Web at www.cr.nps.gov/nr or send your request by e-mail to nr_reference@nps.gov.

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