

# A BRIEF HISTORY OF AERONAUTICS

As pictured on the murals  
in the Rotunda of the  
Administration Building,  
Langley Memorial Aero-  
nautical Laboratory.

by  
J. J. Lankes  
Technical Illustrating Section



Langley Field, Virginia  
1946

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PREFACE

Like any early history of man's endeavors, the early history of aeronautics, the expressed hopes concepts and realizations if any, are tangled in the mists of time, and to pronounce any of these endeavors as unqualified "firsts" is generally open to dispute. The tooth of time has gnawed too deeply at the records to make certainties of many dates, places, and inventors.

In this booklet we can allude to only a few of the most persistent legends of flying and the most pertinent facts of later aeronautical history. As these panels were not designed with their elements in chronological sequence, these descriptions have, for the sake of readier reference, to follow the same irregularity of sequence. The design and the execution of these murals were done by the LMAL Illustrating Section during a period of over 3 years, in lulls of the less busy periods. The aim was illustrative rather than, in the finer sense, artistic since this Laboratory is dedicated to technical objectives.

The design and supervision were by J. J. Lankes and the execution by Lee Wade, Francis McVay, and Harry DeVoto.



PANEL I

EARLIEST CONCEPTS OF FLIGHT  
3500 B.C. TO 1499 A.D.

1. Hermes was the winged messenger of the Greek gods, and as such it was necessary for him to have quick means of transportation between Olympus and the regions of the earth under the gods' jurisdiction. The myth dates back to at least 900 B.C.

2. The oldest flight record, about 3500 B.C., engraved on a semiprecious stone, is of Etana, a Babylonian shepherd. He had saved an eagle's life, and as a reward the eagle carried Etana to the heavenly palace of the goddess Ishtar, to make a plea for his stricken city. Ishtar had him cast out, and he fell to his death.

3. In II Kings, 2:11 it is recorded that Elijah, having performed his mighty works, was parted from Elisha on the bank of the River Jordan and rewarded. "And behold, there appeared a chariot of fire and horses of fire, and parted them both asunder, and Elijah went up by a whirlwind into Heaven." 896 B.C.

4. Triptolemus (750 B.C.) spread knowledge of agriculture all over the world in the winged car of Demeter, the Greek goddess of growing vegetation.

5. Kai Kaoos, King of Persia, 1500 B.C., was a keen student of astronomy, which apparently gave him an edge on science that lesser scholars lacked. Having dominated the earth, he was persuaded to master the air. He had built a light throne of wood with javelins at the corners. Taking aboard an ample supply of food and rare wines, four trained but hungry eagles were harnessed to the four corners of the throne, and pieces of meat impaled on the javelins. The effort of the eagles to reach the meat furnished the power to carry the throne with Kai Kaoos comfortably seated on it through the air.

6. The first man to fly a self-powered flying machine was the Chinese Emperor Shun, as mentioned in Chinese official records. According to the "Annals of the Bamboo Books," he was also the first man to make a descent from a high tower with a parachute. Both "facts" are from contemporary records. He used two huge umbrella-shaped reed hats as the parachute. The Bamboo Books relate that Emperor Yao's gifted daughters instructed Shun in the mysteries of bird flight - the "mysteries" which helped him escape on an occasion when his life was in danger. Possibly because of his engineering skill, he was given the two daughters of Emperor Yao in lawful marriage and a share in ruling the empire. 2220 B.C.

7. One of the best known myths of the Greeks is that of Daedalus and his son Icarus (1100 B.C.). Daedalus learned to fly while imprisoned in a tower. He made two pairs of wings, using thread and wax to hold the feathers. Icarus was given a pair, and warned not to fly near the sun, but after the immemorial ways of young men, he paid no heed to the warning of his father with the result that the sun's heat melted the wax, the wings disintegrated, and Icarus fell into the sea and was drowned - a sad warning to disobedient youth.

8. Weiwoho was the Queen Mother of the East and symbolized the beauty of youth. She traveled on the back of a sacred peacock. Taoist legends abound in feats of flight, through elixirs, magic, or on the backs of large birds.

9. Lu Pan, a contemporary of Confucius, 550 B.C., was a mechanic who contrived a magpie from bamboo which is said to have flown. It could have been a gliding toy like some of the modern ones but fashioned like a bird.

10. The Roman poet Horace, 65-8 B.C., assumed that Archytas had not only invented a flying bird but had hitched a number to a chariot and had "penetrated into the broad heavens."

11. The Flying Rug was made popular in the "Thousand and One Nights." The folklore of the Arabians contains many allusions to flying. The motive power was magic.

12. Legend has it that in 843 B.C. King Bladud, father of King Lear and founder of the city of Bath, fabricated wings, and with necromantic arts attempted to fly from a tower in London. But alas! he broke his neck. This tragic tale was first written by Geoffrey of Monmouth in 1147 A.D.

13. Winged motifs were common with Egyptian royalty signifying their relationship to their gods. King Tutankhamen used a design like this as a breastplate. 1355 B.C.

14.-18. Leonardo da Vinci, the great genius of the Italian Renaissance and painter of one of the most famous paintings in the world, the Mona Lisa, drew the oldest known plans for a helicopter, flying machine and parachute, among other of the great many things he had engaged in. These devices he recorded in the manuscripts of his Codex Atlanticus 1490.

15. Ninhal was the consort of Ashur, chief of the Assyrian gods, patron deities of the city of Assur, ancient capitol of Assyria, which was in existence in 2376 B.C., and quite likely, so was the concept of these deities as flying beings.

16. The Saracen of Constantinople (circa 1100 A.D.) fashioned a robe stiffened with rods to make wings in an attempt to fly. He waited on a high tower for a favorable wind, and leaning against it, rose like a bird - for a moment. Reported in a history of Constantinople.

17. The Chinese claim to have had a balloon at the coronation of the Emperor Fo-Kien in 1306. They also

claim to have had a system of signalers on high hills to announce changes of wind and weather to navigators of dirigible balloons. Marco Polo, the great explorer (1234-1324) claimed to have seen flying machines in China. Three claims.

19. Archytas who antedated Euclid and Archimedes was a famous mathematician in his day (40 B.C.) as well as an intimate friend of Plato. The story of his wooden flying pigeon excited great interest for over a thousand years, but history is discreetly quiet as to its wonderful mechanism.

20. Rameses III who ruled Egypt, 1200 B.C., also had a winged motif in his insignia.

#### CONCEPTS OF FLIGHT BETWEEN 1500 TO 1799

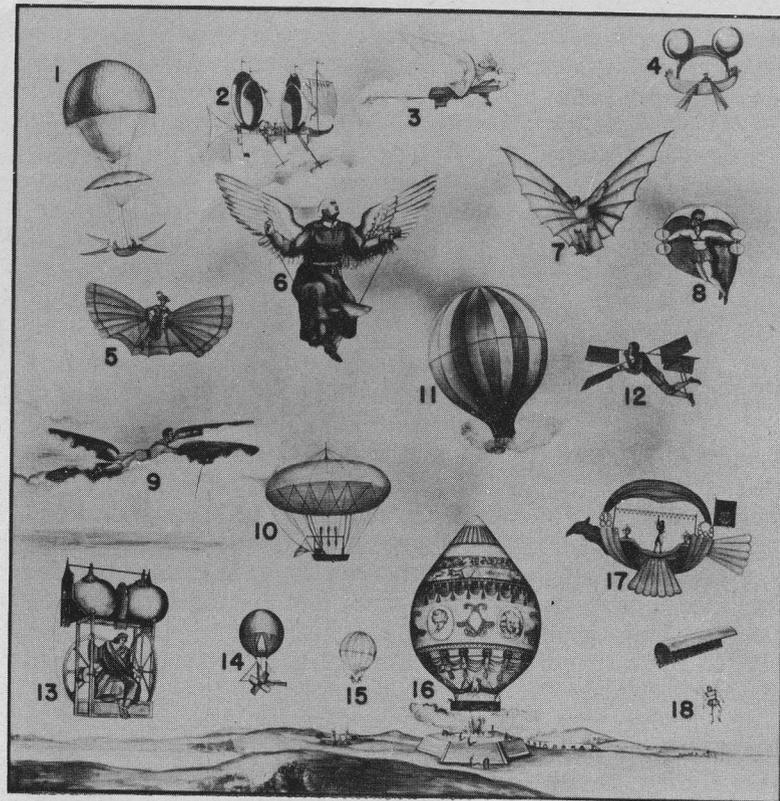
1. Blanchard made a flying machine in 1781 on which the huge wings were to be operated by arms and legs. A French scientist declared it would take wings 2,000 or 3,000 feet long and to be moved 3 feet a second to sustain a man in the air. In 1784 Blanchard built a balloon with a parachute as well as apparatus for steering.

2. This project of Spanish origin appeared, as a picture, in 1783. Nothing is mentioned of its lifting force - otherwise it was supposed to sail as a ship on water.

3. Girard filed this sketch of an ornithopter with French authorities in 1784. No mention was made of motive power. The design was obviously based on bird structure.

4. Francisco Lana, a mathematician and priest of Ferrera, 1670, published a book of new inventions in which he advanced the belief of the vacuum as a lifting agent. He proposed four copper vacuum globes 25 feet in diameter attached to a light car, believing that the removal of the weight of air would lift the contrivance. Atmospheric pressure was discovered 7 years earlier but the exact pressure and specific gravity was not known until later. One hundred and seventy-three years later, a Frenchman built a machine on Lana's specifications.

5. In this machine, like Goya's, it was expected of aeronauts that their flight aspirations would be in harmony with their muscular development. A ball and socket joint



PANEL II

to attach the wings to the waist band was one of the features. It was a Swiss invention of 1788.

6. Kaspar Mohr was credited in Wurttemberg with the ability to fly, and was pictured (1770) on the walls of a cloister in that city as winging his way to Heaven - having earned that reward by benefactions, good works and physical strength.

7. Goya, one of the most famous of Spanish artists, conceived this idea of a flying man in 1775. All that was needed to fly with this machine was a pair of stout legs and an especially powerful set of chest muscles.

8. The French were particularly keen about human flight. This represents a conception of a French artist, Fessard. Pictures like this give artists the reputation of

being "screw-balls." It is the faculty of pictorializing their ideas that does it. A doctor's "screw-ball" idea gets buried. 1783.

9. The Marquis de Bracqueville in 1742 contributed this idea to science. As a nobleman his discoveries carried weight.

10. General Mensnier, said to be a great scientist, offered this design of an Ellipsoidal Airship - 260 feet long and screw propelled. The length was explicit, the power to turn the screws will have to be surmised. Most likely hand power was intended.

11. In 1783, the Montgolfier brothers discovered that a paper bag would hold hot air. They were first to send a balloon into the air - using paper of their own manufacture. It started a great vogue, and a great deal of the inventive genius of the period was directed towards aeronautics. Incidentally, the Montgolfiers are still making very good paper.

12. The French locksmith, Besnier, built a gliding and flying machine in 1697 that has kept his name in aeronautical history. He made sundry claims of having flown with it, but a traveling showman who bought it was killed in trying to fly.

13. The possibilities of electricity, the newly discovered force, was being considered in 1775 in connection with flying but with more modest aspirations than present day engineers are entertaining with regard to atomic power. All that the French inventors desired then was to overcome the force of gravity - not to fly off to Venus. It is likely that Benjamin Franklin's experiments with electricity prompted this device.

14. Sir Richard Crosbie built this flying boat. The bag was filled with hydrogen gas, the two masts carried silk sails, and a silk rudder was used. The windmill vanes appear to be more ornamental than useful. It never carried more than a small animal or a weight and was held captive by a long cord. Later he ascended in a larger balloon wearing the first aeronaut's uniform - of oiled silk lined with fur, a waistcoat and breeches of quilted satin, morocco boots and a Montero leopard skin cap.

15. The ascent of the Charles balloon in 1783 created a sensation, for it marked the first forward step in aeronautics; the Robert brothers and Professor Charles

introduced hydrogen gas and a valve to release it, the barometer, ballast and the suspension car. The balloon was in the air for 2 hours, and traveled 27 miles. In the next ascent, Charles ascended alone. The balloon rose 9,000 feet so rapidly that Charles never again attempted flight.

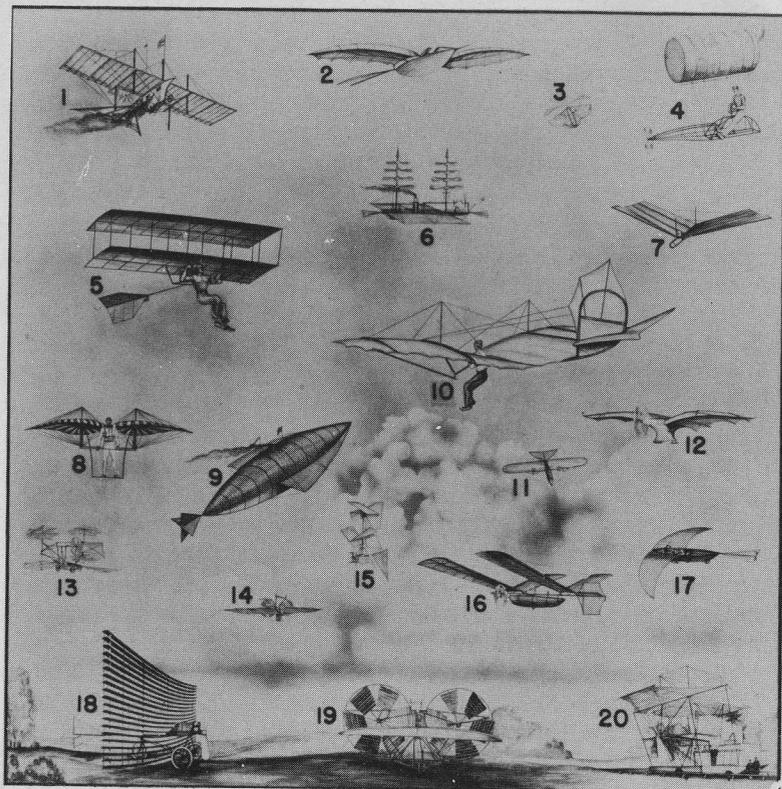
16. Discounting Chinese claims of balloon flights, the first human beings to ascend in the air were Pilatre de Rozier and Marquis d'Arlandes in 1783. They rose 300 feet and were carried by a gentle south wind 5 miles in 20 minutes.

17. Bartolemeo de Gusmao, a Brazilian priest in Lisbon, invented this aerial machine in 1709. It was as elegant an engraving as skill in Portugal permitted. The lifting force was powerful magnets enclosed in spheres and a large bellows furnished the wind in unfavorable conditions. King John V was so impressed by its possibilities that he granted Gusmao patent rights, and threatened with death any experimenters with them. Gusmao was also promised a professorship in mathematics with an annual pension of 600,000 reis for life. It was a marvelous period for aeronautical engineers.

18. In the book "Machinea Novas," published in 1595 and written by Fausto Veranzio, is a picture of a man descending in a parachute. There is no record of its use, except as an illustration in this book. Veranzio studied da Vinci's plans of a parachute and improved on it, he thought.

#### CONCEPTS AND REALIZATIONS OF FLIGHT 1800 TO 1899

1. William S. Henson, in 1842, was the first man on record to propose a monoplane. One of his models flew 60 to 80 feet but crashed. All his models crashed. He proposed an Aerial Carriage, 150 feet over all, with two six-bladed propellers 20 feet long. A steam engine of about 30 horsepower was to furnish the power. It was intended "to convey passengers, troops and the government dispatches to China and India." It aroused a great deal of interest and received much publicity. A 40-foot model was built. Derisive comments prompted Henson and his co-



PANEL III

worker, Stringfellow, to make a test flight at night. Dew on the grass and dampness of the night air caused the silk-covered wings to shrink and warp. Otherwise it might have flown.

2. J. M. Le Bris, a sea captain, in 1857 built an "artificial albatross" with 23-foot wings of wood and cotton flannel on a canoe body. This was hitched by a rope to a cart and was carried up in the air like a kite as the horse trotted forward.

3. The Dandrieaux flying toy was operated by a twisted rubber band that revolved a two-bladed propeller shaped somewhat like a butterfly's antenna. Dr. Samuel P. Langley had several. 1891.

4. Professor Ritchell flew this foot-power dirigible

for an hour over Hartford, Connecticut in 1878. It rose 200 feet in the air on its trial trip.

5. Octave Chanute, a Paris-born American engineer with much experience in large bridge engineering and truss work, which knowledge he applied in making gliders, was first to sponsor gliding in America. He was concerned in developing inherent stability in gliders instead of the operator shifting his weight to maintain equilibrium. His early involved models became biplanes, and eventually, the model for the early American airplanes. This was an 1897 model. None of the 2,000 glides in Chanute's gliders had an accident.

6. This design by Gabriel de la Landelle startled the world (quite naturally) in 1863. It was primarily a helicopter with parachutes attached atop the masts - just in case. Landelle originated the word "aviation," otherwise not a great deal can be said of his engineering ability.

7. Lawrence Hargrave of Australia developed the first ornithopter (wing-flapping) model that actually flew, in 1892. He used compressed air, and this model flew 368 feet. Lacking a light engine of sufficient power, Hargrave turned to gliding and developed the box kite which later became the model, with gas engine attached, of Santos-Dumont's airplane. Another case of deferred realization for lack of power.

8. Jacob Degen, a clock-maker from Vienna, built in 1807 this flying machine with the claim that "any man can fly." He kept half of Europe in a state of excitement until 1812 when Paris gave him a chance to fly. He used a small balloon to assist. After three futile attempts his disappointed spectators beat him up.

9. Marriott, a former associate of Stringfellow, built this balloon - airplane in 1869, which he called "Avitor" using steam for power. It made 5 miles per hour on its trial trip in California.

10. Otto Lilienthal was first to establish the principles of bird flight in human gliding. His glider was constructed of waxed cotton cloth stretched over a framework of peeled willow wands. The glider weighed 40 pounds. Lilienthal made 2,000 flights. After 30 years of research and preparation, and after 5 years of gliding he was fatally injured through an air mishap.

11. Victor Tatin's "Airplane Flying Machine" model,

activated by compressed air, acquired a speed of 18 miles per hour and flew 50 feet. He convinced his associates of the practicability of human flight in a heavier than air machine. 1879.

12. It is claimed for Clement F. Aders, French engineer, that he was the first man to fly an airplane. He built three between 1890 and 1897. All of them flew but none could be controlled in the air and all of them crashed. The 1890 model had a wing spread of 46 feet, was 21 feet long, weighed 1,100 pounds, was screw propelled, and powered by a 40-horsepower steam engine. Ader claimed it flew 150 feet. The second model flew 300 feet. The "Avion" tested in 1897 left the ground several times the first day; the second day it got into the air in a violent wind and was wrecked. French army officers present did not consider it a flight but a series of hops.

13. Sir George Cayley, the Father of British Aeronautics, devised this helicopter. Two pairs of vanes provided the lift and a pair of propellers the forward thrust. Two separate rudders were provided - one for vertical guidance and the other for lateral. A steam engine furnished the power for by then steam power was common. This aerial carriage was built in 1842. The Cayley theories of gliding were right as proven by the Smithsonian Institution with a model built on his plans.

14. In 1848 John Stringfellow made a model aeroplane that flew 120 feet. He had demonstrated the practicability of a flying machine. Finding nothing but pecuniary loss and no honor attached to the work he dropped the matter for the time being, although 20 years later he designed a triplane.

15. Vittorio Sarti depended on manpower to operate this combined helicopter and ornithopter. The vanes, it was hoped, would rotate as well as flap. No inventor has, to date, been able to extract much power out of a hope. This contribution was offered from Bologna in 1825.

16. Dr. Samuel Pierpont Langley, after whom Langley Field and the Laboratory were named, built this model in 1894 after years of research and many small experimental models. It was 16 feet long with a 13-foot wing spread and with twin propellers powered by a 1-1/2 horsepower steam engine. In 1896, with an improved engine, he catapulted it from a houseboat on the Potomac River. It flew 3,200 feet until its fuel and water supply was exhausted.

17. The Germans never forgot the first rocket plane advocated, it is believed, by Werner Siemens, a German Army officer, in 1847. It was to be propelled by the explosive force of gunpowder.

18. Horatio Phillips spent 25 years collecting, making and studying data on the infant science of aerodynamics. He built a wind tunnel - possibly the first - to test air pressures and resistances on plane surfaces. His model, mounted on a tricycle, was driven by a steam engine and was tethered to a central pole around which the model ran on a track until it rose in the air a few feet for several circuits. He developed the curved surface, or airfoil, instead of using the flat plane surface of his fellow experimenters. 1893.

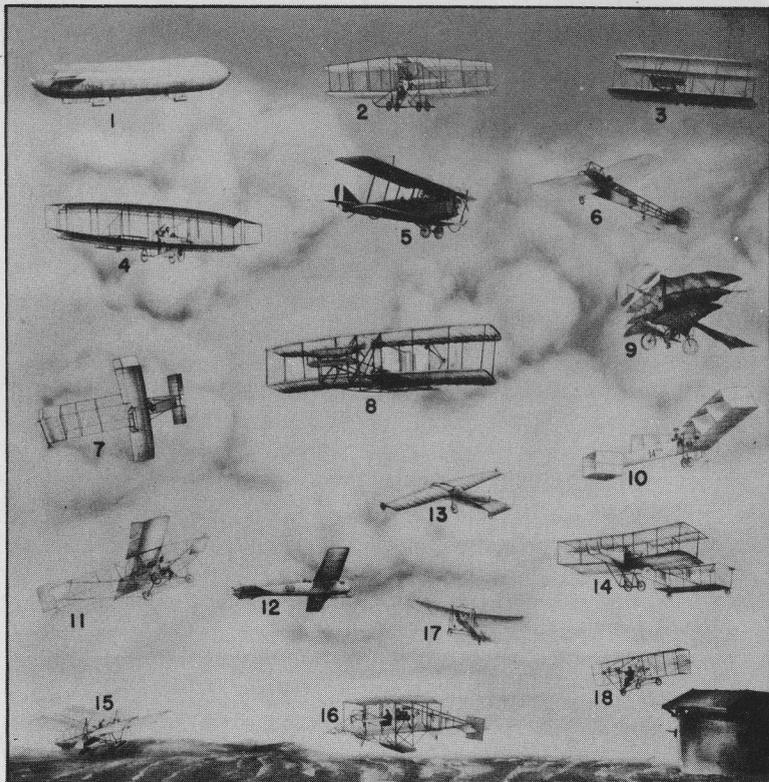
19. In 1875 Thomas Moy, of the Royal Aeronautical Society of England, claimed to be "first to demonstrate the possibility of flying by steam power." His machine weighing 120 pounds was lifted a few inches by a 3 horsepower steam engine. He urged a flying speed of 150 miles per hour. His own work in developing a light weight steam engine convinced him that Henson and Stringfellow might have succeeded in flying had a more powerful engine been available.

20. Sir Hiram Maxim, the expatriated American and inventor of the Maxim gun, built this record size model in 1893. It was 110 feet long and weighed 3-1/2 tons. It had twin propellers over 17 feet long and was operated by a 350-horsepower steam engine, using benzine for fuel. It ran on a restraining track and actually lifted itself with Maxim aboard. Maxim knew it could not be controlled once it got up from its track, nor could it be landed without serious consequences.

#### FLIGHT IS ACHIEVED AND DEVELOPED 1900 TO 1919

1. In 1900 Count Zeppelin launched the first rigid airship. It was 420 feet long and 38 feet wide. It rose to an altitude of 1300 feet and sailed for 20 minutes at 8 miles per hour.

2. Dr. W. W. Christmas was granted a patent as the inventor of the interconnected ailerons. He is recorded as



PANEL IV

the third man to make a public flight in America. His plane of his own design and construction was equipped with ailerons for lateral control; it had no front elevator common with the Wright and Curtiss planes.

3. Wilbur and Orville Wright took their first Dayton, Ohio built glider to Kitty Hawk, North Carolina for experimental flights in 1900. The following year they tested their second glider of somewhat larger dimensions. This one had a tail which the first lacked. The glides were very successful. That winter they built the "world's first wind tunnel" - if we can overlook Horatio Phillips' contrivance. A third glider was built for further tests.

4. In 1908 Glen Curtiss won the first American trophy

for publicly flying a straightaway kilometer, or five-eighths of a mile.

5. The NACA was organized in 1915. The first plane worked on at the Langley Memorial Aeronautical Laboratory was the Curtiss JN4H in 1919.

6. In July 1909, Louis Bleriot made the first great flight across the English channel. He made the distance - 25 miles - in 37 minutes. It was sensational.

7. Louis Paulhan of France won the \$50,000 prize in the first International Race and the greatest race to date - between London and Manchester, a distance of 183 miles in 1910. Both contestants were compelled to land before completing the distance.

8. In 1903 the Wright brothers built a new plane with a 40-foot wing spread, 6-1/2 feet wide, with twin propellers powered by a 12-horsepower gas engine. Orville Wright flew it for 12 seconds, flying over 120 feet, making it unmistakably the first controlled human flight.

9. The Ellehammer machine was a triplane with wings shaped like a bird's. It was tractor propelled, a novelty in Europe and unknown in America. In 1908 he flew about a mile over Danish waters with it.

10. Santos-Dumont, a Brazilian, made the first airplane flight in Europe in 1906. We were leading by 3 years. His plane construction was based on Hargrave's experiments with box kites. This plane was powered with an 8-cylinder 50-horsepower motor. Incidentally, this plane flew tail forward. In his first flight the plane was lifted in the air on the envelope of his airship. In his second flight, without the aid of the airship, he flew nearly 200 feet at 25 miles per hour, thereby winning 3,000 francs as a prize to the first person to fly 25 meters.

11. Dr. Henry W. Walden flew the first successful all-American monoplane, his own creation, and the first American monoplane to pass the license tests of the Federation Aeronautique Internationale.

12. It was believed in 1910 to be dangerous to fly over large cities because of heated air currents. Hubert Latham won the first over-city prize in his streamlined "Antoinette" monoplane with its long narrow fuselage.

13. Robert Esnault-Pelterie was years in advance with his streamlined fuselage and metal wings. The use of landing wheels is a French contribution.

14. Henri Farman, in 1907, was the first aeronaut to achieve a speed greater than 50 miles per hour, flying 770 meters.

15. In 1914 friends of Dr. Langley formed a group called the Langley Laboratory with the intention of launching his Aerodrome that had met with disaster before it left its catapult in 1903. It was repaired and furnished with pontoons and a successful flight was made.

16. The first successful hydroplane was Glenn Curtiss' "Flying Fish," in 1911. He put pontoons on an airplane. He was first to take off successfully from the water and first to land safely on water.

17. John B. Moisant, a Chicago architect, was the first to cross the English Channel with a passenger. 1910. His monoplane wings showed a more definite trend towards the form of the later planes.

18. The first aviator to land on a ship and to take off from a ship was Eugene Ely, in January 1911. He landed on a platform built on the battleship "Pennsylvania," at 40 miles per hour. Later he took off to land in San Francisco.

## THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

On March 3, 1915, President Woodrow Wilson signed the bill authorizing the National Advisory Committee for Aeronautics "to direct the study of the problems of flight with a view to their practical solution." Twelve of the nation's upper bracket scientists were appointed to membership on the Committee. This number has since been augmented to fifteen. They include the head and principle technical officer of the Army and the Navy, heads of other government agencies who are aware of the needs and direction of aviation, and six outstanding scientists and engineers from private life, all of whom serve without compensation. Eight technical committees and twenty-two subcommittees supplement the main Committee. Nearly 300 top-ranking engineers, scientists, and operating specialists comprise the group.

Research is conducted in three of the best equipped laboratories in the world, and is directed by Dr. George W. Lewis aided by a staff of about five thousand highly trained engineers, scientists, and technicians.

The original laboratory at Langley Field, Virginia was started in 1917 and named the Langley Memorial Aeronautical Laboratory in honor of Dr. Samuel Pierpont Langley, a pioneer of aviation in America. The first wind tunnel was dedicated and placed in operation in 1920.

The second laboratory was started in 1940 at Moffett Field, California. It was named in honor of Dr. Joseph Sweetman Ames, who for 24 years was a member of the Committee, and for 12 years its Chairman.

The third laboratory is the Aircraft Engine Research Laboratory at Cleveland, Ohio, where the first research project was started in May 1942.