
# WRIGHT FIELD

MATERIEL DIVISION - U.S. ARMY AIR CORPS

DAYTON, OHIO.

# VISITORS' INFORMATION

VISITORS are welcome at Wright Field. Conducted tours of the Field and Laboratories with guide lecturer are made each working day.

**Visiting Hours**

Daily, except Saturdays, Sundays, and holidays—9:00 A. M. to 3:00 P. M.

Saturdays—9:00 A. M. to 11:30 A. M.

Visitors are not admitted to the Field on Sundays and holidays.

**Tours of Field**

Daily, except Saturdays, Sundays, and holidays—10:30 A. M.; 2:00 P. M.

Saturdays—10:30 A. M.

The work carried on at Wright Field is largely of a highly technical nature—to be clearly comprehended only by the trained engineer. Some of it is confidential. Much of it, however, is comprehensible and entertaining to the visitor without special aerodynamic knowledge, and it is believed a visitor can carry away with him many new bits of aircraft information, together with an added insight into the problems to be solved in flying an Air Army under all sorts of conditions. He will be convinced that the Air Corps is striving to give the United States the protection of the most efficacious air force of which modern science is capable.

Time permits only part of the work described in this booklet to be explained by the guide-lecturer. This booklet is planned to complement the information given by the guide in the visitor's journey through the field, explaining the scheme of the organization a little more fully. It is hoped the visitor will reread this little pamphlet at his leisure and perhaps find it worth keeping as a souvenir.

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A cafeteria is maintained in the basement of the Administration Building where guests may obtain lunch or refreshments.

# HISTORY IN BRIEF

*—OF—*

# MATERIEL DIVISION

The gateway

SOME quarter of a century ago, Dayton saw the beginning of a new engineering industry. The Wright brothers started it as a side line in their bicycle repair shop. To such vast proportions has that industry grown in this short span that today it is regarded as a major arm of national defense by all the civilized nations of the world. The development of this aviation industry was hastened through its early stages by the great war. During the war period Dayton again became a pivotal point in its growth.

A flying field for experimental purposes was established by the Army at McCook Field, Dayton, Ohio, on a tract of land partly within the city of Dayton. The field was named for General Anson McCook and his seven sons, the "fighting McCooks" of Civil War fame. At this field an energetic program of aviation research and experimentation was followed by the Air Corps. The results of this work were beginning to be effective when the World War was drawn to a close. This wartime organizaton was kept substantially intact and peacetime aviation has felt the force of its influence ever since.

Wright Field from the air.

McCook Field proved in time to be too small for larger and faster airplanes; its temporary wartime buildings were inadequate. In place of McCook Field the Government now has the organization known as the Materiel Division, Wright Field.

The new Field was named for the Wright brothers, Wilbur and Orville, who built the first airplane flown under its own power, and who on December 17, 1903, were the first to demonstrate to the world the possibility of such flight. Orville Wright is still an honored resident of Dayton. Wilbur Wright died of typhoid fever in 1912. Most of their lives they lived and worked in Dayton. Here they carried out their experiments, built their early models, and attempted their earliest flight demonstrations.

**Orville and Wilbur Wright, co-inventors of the airplane.**

When the Air Corps had to find new quarters for the continuation of its work started at McCook Field during the war, the citizens of Dayton, wishing to establish some fitting and permanent memorial in honor of the Wright brothers, purchased the tract of land which is now Wright Field. The field was presented to the United States Government to be used for the purpose of aeronautical development and was dedicated in 1927. Hence Wright Field as a flying field is devoted chiefly to the testing of new and experimental airplanes and equipment. Flying is not taught here, but at special Army training fields. At this field only the experienced pilot operates.

During the war, many of the foremost engineers in the country gathered at McCook Field to help build an Air Army. Many of them are still with the Materiel Division, richer in experience by many years. Expert Army pilots are among the engineering experts at work in the different sections.

**Actual photograph of first airplane flight in history. Orville Wright lies prone on the wing while Wilbur runs alongside watching. The airplane has just left the inclined starting rail.**

Because of the large volume of testing, carried on through the past twenty years at McCook and Wright Fields, the Materiel Division is now a vast reservoir of scientific aviation data. It has been able to discover the fundamentally sound and the fundamentally unsound in new aircraft construction methods and materials. As a result, new problems of flight are solved more quickly by technicians and engineers in charge of such work. Special apparatus has been built for the static and dynamic testing of airplane structures, for the dynamometer testing of engines, for the whirl testing of propellers, and for the strength testing of the raw materials used in connection with flight.

The work of the Materiel Division has contributed to more powerful and more reliable engines, to highly improved motor fuels, to propellers of much greater strength and efficiency. The lighting of commercial landing fields and airways followed work done by the Division. The parachute was carried to its present successful development here.

More recent problems have been the radio compass, automatic landing devices, supercharged cabin airplanes, and other items too numerous to mention. Data from experiments, with the exception of a few military secrets, have ever been open to the aviation public and have been freely drawn upon by the industry in every step of its forward progress.

**First completely automatic aircraft landing in history accomplished by this airplane and crew, August 23, 1937. Capt. Carl J. Crane** (left), **Capt. G. V. Holloman** (center), **and Raymond Stout** (right), **all of Wright Field.** (See page 22.)

**Two-seater pursuit airplane**

## MATERIEL DIVISION

"And what," you may ask, "is the Materiel Division?"

The word "Materiel" signifies every object, raw material and part, from a complete flying field to the smallest bolt or strip of fabric, from a complete airplane to a pair of flying goggles, connected in any way with the operation of Army aircraft.

In line with this definition it is the responsibility of the Materiel Division to *develop* advanced aircraft, equipment, and accessories to the point where they may be used by the Army Air Corps; to *procure* these aircraft, equipment, and accessories in quantity for issue to the Air Corps; and finally to *issue* these articles to the Air Corps Tactical Units and *maintain* them in good condition throughout their service life.

Other Air Corps organizations function to train pilots and technicians, to form them into flying squadrons and groups, such as Bombardment, Pursuit, Attack, Observation, which fulfill the tactical functions essential to the operation of an Army Air Corps under all conditions of peace and war. The Materiel Division, however, under the immediate direction of the Chief of the Air Corps, must produce the physical objects necessary for the effective operation of the human Air Corps elements.

Single-seater pursuit airplane

*The purpose of the Materiel Division is to have in readiness for immediate production and service the most advanced types of aircraft, engines, armament, and other equipment for the defense of the nation.*

In carrying out this purpose the Materiel Division is divided into various sections and laboratories, one of the most important of which is the Engineering Section.

## ENGINEERING ACTIVITIES

Most of the extensive laboratory buildings are devoted to the work of the Engineering Section. This Section initiates all of the experimentation, designing, testing, and development of airplanes, engines, accessories, and ground equipment used in connection with aircraft. In these laboratories will be found the most extensive and modern aircraft test equipment in the world. This equipment represents the most expert engineering judgment obtainable and an investment of approximately ten million dollars. The Engineering Section is made up of five main engineering branches: Aircraft, Power Plant, Equipment, Materials, and Armament.

## AIRCRAFT BRANCH

This Branch is concerned primarily with the development of new types of aircraft and with the improvement of those already accepted as standard by the Air Corps. When an entirely new type is contemplated, the engineers of this branch after thorough study draw up in specification form the qualifications desired in the new airplane. This specification is furnished to the manufacturers throughout the country. These in turn submit to the Materiel Division tentative designs of the new airplane, fully explained by drawings and descriptions, including, in the case of procurement competitions, an actual airplane for approval.

When a new airplane is received the engineers of this branch study and evaluate it. They are constantly initiating new aircraft designs, the majority of their work being along extremely experimental lines.

### Wind Tunnels

Wind tunnels are used for the purpose of predicting performance of an airplane or part and for actually measuring the performance of an airplane in flight.

The wind tunnel laboratory contains two wind tunnels, one 14 inches, the other 5 feet in diameter. The former is used for the testing of small airfoils or propellers. The latter is used for complete airplane models. When these models or airfoils are suspended in the tunnel and the wind sent through at a definite rate of speed, the air passing the airplane has the same effect on the lifting surfaces as if the airplane were moving at that speed through the air. If the performance of the small airplane, as recorded by highly sensitive precision instruments, is unsatisfactory in the wind stream, the design is changed until satisfactory performance is obtained. The advantage of the wind tunnel test is that changes are made on the wind tunnel model at a cost of but one per cent of the cost of the same change made on a full-size airplane or airfoil. The 5-foot wind tunnel is 90 feet long with a maximum air speed of 275 m. p. h.

### Static and Dynamic Testing

Just as certain aerodynamic characteristics are determined in the wind tunnel, so the strength of airplane structures is determined by static (weight carrying) or dynamic (impact) testing.

In static testing, the structure tested is kept at rest while lead bars or bags filled with shot, all of known weight, are piled on. This is done in order to check the calculated strength of the structure, or, if carried through to destruction of the structure, to learn its ultimate or maximum strength. In dynamic or impact testing, the structure tested is supported by a jig and dropped. The height and angle of drop are mathematically computed to give the same shock or jar to the assembly that it would actually receive in landing under definite conditions.

The static test laboratory at Wright Field is one of the best equipped in existence. The weight of the jig and its auxiliary members used in dynamic testing is 52 tons. It is supported on a 228-ton base of reinforced concrete and steel. Two traveling cranes of 5 and 15-tons capacity make possible the picking up of a complete airplane or an entire static test setup, steel scaffolding and all, with ease.

To the work of the engineers of this laboratory, principally, the world owes the all-metal monocoque airplane.

**Structures Laboratory showing static and dynamic test equipment**

**Propellers**

The Propeller Unit which is concerned with the design and testing of Air Corps propellers, is an important part of the Aircraft Branch. The Materiel Division possesses the largest propeller test rig in the world. Propellers up to 45 feet in diameter may be whirl tested here for endurance up to speeds of 4300 r. p. m. Electric motors are used for operating the propeller rig, the largest being one of 6000 horsepower.

**Oppositely rotating propellers in close tandem mounted experimentally on a pursuit type airplane**

A new method of test recently developed at the Division makes it possible to predict the point of failure in a new or existing propeller design. This is done by subjecting the propeller to vibration of such frequency that a certain type of resonant vibration is excited. From the point of view of greater safety, this is one of the most valuable contributions to aeronautics of recent years, since it enables weaknesses of design to be corrected before the propeller is flown on an airplane.

The development of controllable and constant speed metal propellers has been fostered by the Materiel Division. Thousands of hours of study and testing have been devoted to making them practicable. The use of these propellers has materially increased the performance of airplanes.

This laboratory conducts all the propeller tests for the U. S. Navy and the Department of Commerce and is the prime source of propeller engineering data in the United States.

## PRESSURE CABIN DEVELOPMENT

The problem of carrying crews and passengers of aircraft to high altitudes and of maintaining conditions of respiration and atmospheric pressure suitable to the preservation of human faculties for extended periods of time has been under consideration ever since aircraft have first been capable of ascending to great

**Propeller test rig with propeller mounted and ready for testing**

heights. During the war, and for some time after, the only aircraft called upon to operate at altitudes above 15,000 feet were military aircraft of pursuit or similar types. For the limited time these airplanes were able to operate at high altitudes, the crew partook of oxygen by mouth and nose through a tube, directly from the container. Although frequently unsatisfactory and sometimes dangerous, this system of supplying oxygen appeared to be the most practical solution of the problem at that time.

Early experiments conducted at McCook Field between 1919 and 1923 attempted to provide a pressure compartment which could be maintained at constant low-level air pressure even while the airplane was at high altitude. The experiments were finally discontinued, however, as involving greater complications than the necessity for such equipment then warranted.

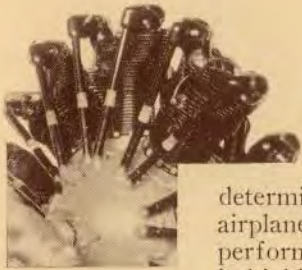
In February, 1935, a renewed attack of the problem was undertaken at Wright Field. Between 1924 and 1934 power plant development had progressed to the stage where efficient operation of aircraft could be counted on between 20,000 and 30,000 feet. The phrase "over-weather flights" had come into use. Both military and commercial interests would obviously be served if the pressure cabin airplane could be made a practical reality.

The result of the energetic research and experimentation program followed by Wright Field engineers was that in the summer of 1937 the world's first pressure cabin airplane was produced. Several hundred hours spent at altitudes where oxygen is usually required have proved its success. Already the pressure cabin is being made a feature of new aircraft of both military and commercial types. (Photo of Air Corps pressure cabin airplane shown on page 21, lower right.)

### Aircraft Accessories

The Aircraft Branch is responsible for the development of other vital aircraft parts: retractable landing gears which are drawn up during flight; nose-wheel landing gears; wheel brakes which enable the pilot to maneuver the airplane on the flying field and obviate the necessity of blocking the wheels when warming up for take-off; and airplane skis for operating the aircraft when ice and snow cover the ground.

## POWER PLANT BRANCH



Upon his arrival the visitor no doubt will have heard the roar of the engines under test on the torque stands or in the dynamometer laboratory. Since the engine, aside from the design of the aircraft itself, determines more than any other factor the airplane's performance, the quality of work performed by the Power Plant engineers is highly important to the development of aviation. Three main buildings house the power plant activities: the dynamometer laboratory, torque stands, and fuel test laboratory.

**Testing a radial air-cooled engine in the dynamometer laboratory**

Cargo type airplane for transporting personnel

### Dynamometer Laboratory

Forces developed in high-powered aircraft engines are computed and measured in the Dynamometer Laboratory. Complete equipment is installed there for the performance testing of aircraft engines and the units of which they are composed. Included in this equipment are high-speed dynamometers, water brakes, gauges for determining fuel consumption, scales for measuring oil consumption, revolution counters, and tachometers for computing engine speed. There are three test stands for testing large air-cooled and liquid-cooled engines; three, for testing large liquid-cooled engines; one, for testing smaller air-cooled engines; and four, for testing small single-cylinder engines, either liquid or air-cooled.

There is also a "cold room" in which liquid or air-cooled engines may be tested for starting and operation characteristics at temperatures as low as 50 degrees below zero Fahrenheit. Liquid-cooled engines may be tested under conditions simulating those met when flying at extremely high altitudes. Here the effect of great cold and high altitudes on fuels, lubricants, oil coolers, fuel systems, and all materials and parts used in the operation of an engine may be studied. Engineers working in the cold room wear electrically heated clothing. A telephone and signal system make outside communication possible. In case inflammable vapor or carbon monoxide should seep into the air of

Airplane designed for ground attack. Develops high speed at low altitudes

the interior, detectors would cause the ringing of alarm bells to attract the attention of engineers both within and without the cold room. Approximately 20 tons of cooling coils, not to mention cork and other insulating materials, are required for this room.

### Torque Stands

From the exterior, the torque stands present a series of square concrete stacks, 40 feet high, joined by enclosed passages. These stacks which are open to the sky are for the purpose of reducing the deafening noise caused by high-powered engines being run at full throttle in endurance tests. So great is this noise that pilots flying over the stacks at altitudes up to 600 feet catch it above the racket of their own engines and propellers. Centered between these stacks are seven torque stands, six for the endurance testing of engines, and one for the testing of propellers installed on engines. Each engine support pier is a huge block of concrete sunk 20 feet into the ground and completely encased in cork to absorb vibration. Here, engines are endurance tested for periods as long as 150 hours. Observation rooms, fully equipped with necessary test registering instruments, enable engineers to study the performance of the engine under test.

### Fuel Test Laboratory

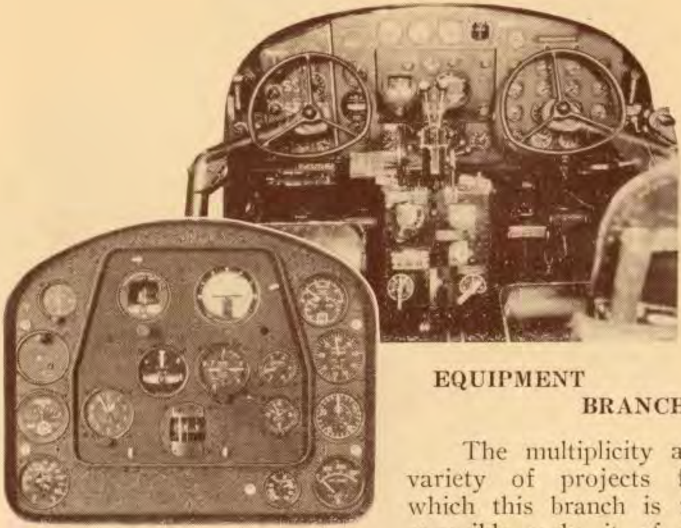
Of great influence upon the performance of the aircraft engine is the type and quality of fuel and lubricant used in its operation. A laboratory was built containing six single-cylinder engines, especially designed and constructed for testing fuels and lubricants. It was determined that if the standard of these materials could be improved, engine performance would be greatly benefited. Several years were spent in research and testing. As a result, the fuels and lubricants used by the Air Corps today are of higher quality than any ever before obtainable and are not surpassed by those in use by any other military organization in existence.

### Various Engine Developments

Engine development in the Air Corps encompasses types designed to deliver from 300 to 1200 hp. The high-powered air-cooled engine, largely due to results of experimentation in the Materiel Division laboratories, has achieved enormous success in the United States. The engine is but a unit, however, composed of many parts, each forming an individual installation of the complete engine. Hence there are engineers specializing in carburetion, ignition systems, cooling systems, fuel systems, and supercharging systems.

The substitution of Prestone for water as a coolant in liquid-cooled engines made possible the reduction of the size of the radiator by 60 per cent. This development was responsible for a new lease on life for the liquid-cooled engines which at that time were being largely replaced by air-cooled types. With Prestone cooling, supercharging, and propeller gearing, the liquid-cooled engine promises to take a prominent place in the aviation field once more. Its better visibility and streamlining possibilities offer distinct advantages over air-cooled types.

The general trend in engine improvement is to take as much responsibility as possible from the pilot's already crowded attention, by replacing the great mass of manual controls by automatic controls. The increased complications of modern aircraft have made this requirement an engineering "must."



## EQUIPMENT BRANCH

The multiplicity and variety of projects for which this branch is responsible make it of especial interest to the layman. But a few of these can be mentioned here. Flight indicators, turn indicators, artificial horizons, directional gyroscopes, sensitive altimeters, air-speed indicators, compasses, drift sights, and engine instruments are items of equipment in use on all modern aircraft. They are under constant improvement and development.

### Aerial Photography

In the development of aerial photography, the Materiel Division has outstanding achievements to its credit. In addition to the improvement of night photographic and spotting cameras, great progress has been made in the construction of cameras and apparatus for the production of accurate maps from aerial photographs. In this work Air Corps officers and engineers have been assisted by officers of the Corps of Engineers stationed at Wright Field. For mapping purposes the United States is di-

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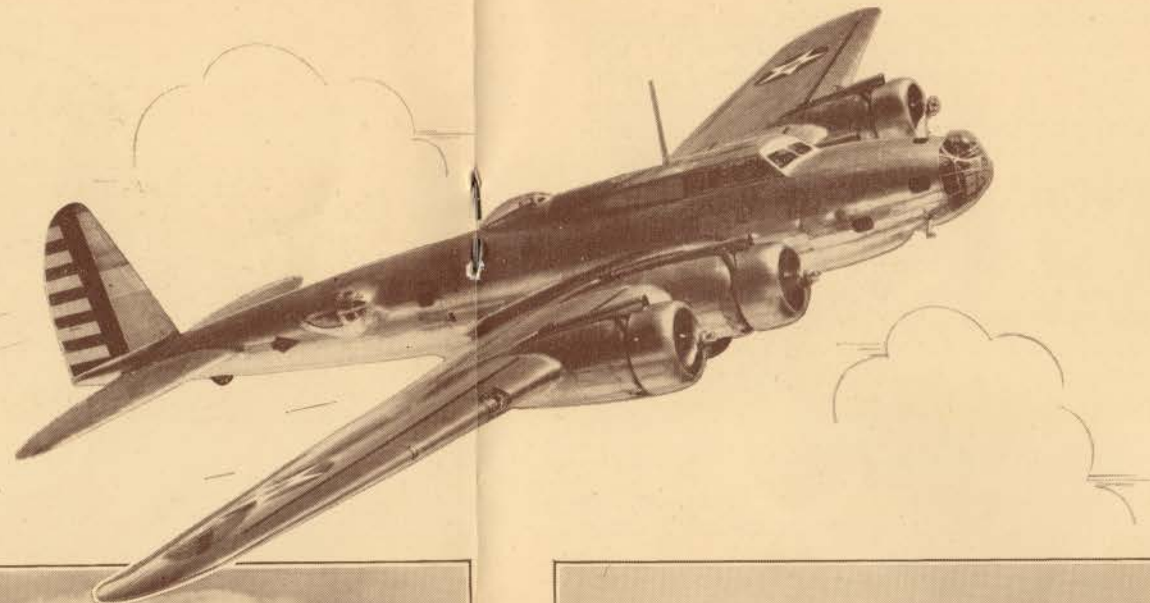
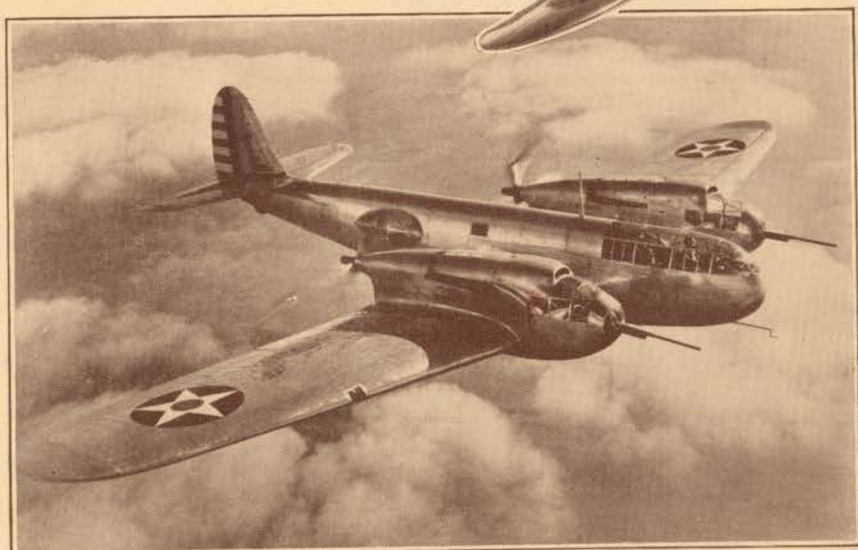
**Above illustration shows instrument boards as installed in multi- and single-engined airplanes**





(See page 39)

vided by the Geological Survey into quadrangles, each quadrangle covering an average area of 225 square miles. Formerly it took several seasons to map one quadrangle. By airplane this territory can now be covered with overlapping aerial photographs in a few hours with great accuracy and reduced cost. Highly sensitized films that photograph through haze details that are invisible to the naked eye have been made at the instigation of the Air Corps. A series of highly perfected mechanisms makes possible the development, in the air before landing, of negatives exposed during the flight. Air Corps photographers have made with equipment developed by the Army Air Corps, the highest-altitude and longest-distance photographs ever obtained. Electrical heating of cameras for high altitude work and electrical heating of clothing to be worn by aviators on such flights have also been developed here.

**Other Equipment**

Improved lighting installations for flying fields, landing lights for use on airplanes, and engine starters are among other items of electrical equipment under improvement. Parachute development has been an important project. For over-water use the aviator must have life rafts that can be automatically inflated and set afloat in case of emergency, and life preserver cushions. The group of engineers responsible for this equipment is also responsible for the design of aviators' clothing and kit bags. Other groups are responsible for transportation equipment, oxygen apparatus for use at high altitudes, and the volume of complex instruments used in flight and ground testing of aircraft.

**Flying by Instrument**

The development of a system for instrument flying, including blind approach to an airdrome, and blind landing upon it has long been acknowledged one of aviation's great needs.

The first practical method toward accomplishing these results was developed at the Materiel Division and demonstrated by Capt. A. F. Hegenberger in 1932. Although many others have been proposed and tried out by various agencies, this Air Corps system forms the basis of all those actually used.

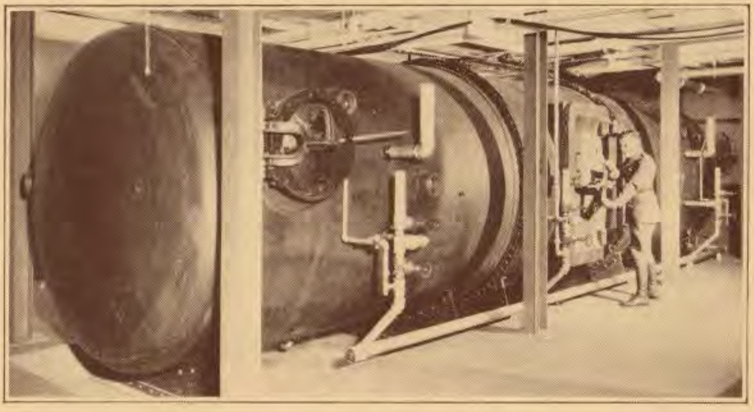
**Blind flying is taught on the ground as well as in flight with the aid of these devices**

In 1935 a program of intensive research was engaged in for the purpose of simplifying the instrument flight and landing problems. This was in keeping with the policy of developing as far as possible automatic control for all aircraft operations. For some years the Air Corps had been using the Sperry Gyro Pilot. This equipment automatically relieved the human pilot of making rudder and aileron corrections and held the airplane to a straight flight path. A great forward step was taken when a directional relay was designed which linked the gyro pilot with the radio compass. By this device the airplane could be steered automatically not only in a straight flight path, but regardless of cross winds to any selected radio station in the vicinity of the airport where the pilot desired to land. A long period of thorough testing proved the reliability of this device. Many flights were made to various parts of the United States in which, except for take-off and landing, the pilot did not touch the controls.

The next step was a completely automatic landing. This was achieved for the first time in history on August 23, 1937, without any human direction whatever in the airplane or remote control from the ground. Capt. C. J. Crane, in charge of the development, and Capt. G. V. Holloman and Raymond Stout, his assistants, were in the airplane at the time. Further test flights proved the system reliable and feasible.

## PHYSIOLOGICAL RESEARCH LABORATORY

In the early days of flight, man flew neither sufficiently high, fast, nor far to take him beyond the elements of normal physical reactions. Now, however, speeds, altitudes, durations, and aerial maneuvers have been stepped up beyond previous human experience with results that must be studied to be understood. Equipment of a laboratory for the study of the effect of flight under all conditions upon the aviator has recently been completed. The laboratory operates under the direction of an Army medical officer. Besides standard medical equipment, the laboratory contains three pressure chambers, the largest of which is 31 feet long and 8 feet in diameter. Altitudes up to



Altitude pressure chamber, 31 feet long and 8 feet in diameter

80,000 feet above sea level and temperatures down to $-65°$ F. can be simulated. Flying personnel willingly act as human "guinea pigs" for these tests. The physical reactions to such cold and high altitudes can be studied with a view to designing equipment capable of obviating all ill effects, while the subject remains safely on the ground.

Another interesting test item is a centrifuge for studying the effects upon the aviator of centrifugal force, which is experienced in high speed maneuvers, such as making sharp turns or pulling out of a dive.

## ARMAMENT BRANCH

Machine guns, bombs, and ammunition—these must be properly mounted in the airplane and properly operated. It is this feature of aviation which concerns the Armament Branch. Instruments for the accurate dropping of bombs upon definite objectives have been developed. These take into consideration the speed of the plane, its pitching and yawing movements, the speed of the wind, and the trajectory of the fall of the bomb. Gun sights, for fixed and flexible guns, machine gun synchronizers—a timing device which makes it possible for the pilot to fire dead ahead through the plane of rotation of high speed propellers—are under constant improvement. Pyrotechnics, including signal and lighting flares are handled by this branch.

The visitor may receive some idea of the weight carrying requirements of a modern bomber by viewing the bombs displayed in the Museum. He may also gain an idea of the need for safe carrying and accurate sighting devices which the Air Corps has developed, for successfully dropping the bombs upon a target.

## RADIO

An Aircraft Radio Laboratory under the direction of Signal Corps officers working in cooperation with Air Corps officers is charged with development of radio used in conjunction with Army aircraft. Interphone systems for two-place and multi-place airplanes, radio compasses, airplane antennas, radio guiding station trucks for landing fields are but a few of the radio needs handled there.

High-speed pursuit airplane

## MATERIALS LABORATORY

The Materials Laboratory is devoted to the testing and development of all materials used in connection with flight. Fuels, oils, paints, varnishes, fabrics, rubber, steel, etc., all must come up to a necessarily high aircraft standard. Experimental work is constantly in progress here for the improvement of certain products. Where a material which would be necessary in time of war, such as parachute silk, is not available in quantity in this country, effort is made to obtain a substitute which may be domestically produced. The development of welded steel structures and the application of chrome-molybdenum alloy steel to this type of construction were initiated and fostered by the Materials Laboratory and are now used extensively throughout the industry. Similar activity is now being carried on in connection with aluminum, magnesium, and beryllium base alloys. The Materials Branch, working closely with the engineers, has been responsible in no small measure for the development of aluminum alloy used in cylinder heads of modern air-cooled engines. In the foundry hundreds of different castings of these new alloys have been made for the determination of the proper design, not only from the cooling standpoint but for ease of production. Material for innumerable small parts such as tires, wing ribs, metal wing spars, cables, and propeller blades are the subjects of ceaseless experiment.

Basic training airplane used by advanced Air Corps flight students

Nonshatterable glass that will not be subject to deterioration in the tropics has been a recent item of experimentation. Spot welding is being studied from the standpoint both of stainless steel and aluminum alloy structures. An extensive program for the development of a solder with a higher melting point is under way. Years of research finally produced a substitute material for rubber, which has proved more durable and generally applicable than genuine rubber.

## FIELD SERVICE SECTION

This Section is responsible for the adequate flow of supplies to the Air Corps services both at home and abroad and the proper maintenance of these supplies. Storage, salvage, and disposal of property when it is no longer useful to the Air Corps are also its functions. In performance of its duties the Field Service Section has jurisdiction over five main supply depots, situated at Fairfield, Ohio; Middletown, Pa.; San Antonio, Texas; Belleville, Ill.; and Coronado, California.

## PROCUREMENT SECTION

This Section is responsible for the purchase of practically all the equipment and supplies used by the Air Corps, which for the fiscal year 1937 involved approximately $60,000,000. It maintains district inspection offices throughout the United States and has jurisdiction over officers who serve as Air Corps representatives at aircraft manufacturing plants.

## INDUSTRIAL PLANNING SECTION

This Section is charged with the organization of industrial establishments with a view to procurement in time of necessity of adequate supplies for the Air Corps. It controls six district offices located in New York City, Buffalo, Cleveland, Detroit, Chicago, and Los Angeles.

## AIR CORPS ENGINEERING SCHOOL

The Air Corps Engineering School instructs officers in the fundamental principles and practices of aeronautical engineering especially as applied to the needs of the Materiel Division. Air Corps officers only are eligible for instruction and the school is usually limited to from 12 to 15 students.

**A highly successful type of twin-engine bombardment airplane**

## THE LIBRARY

A technical library is maintained for the convenience and aid of engineers. It contains approximately 10,000 volumes, 120 current American, British, French, German, and Italian magazines, and an invaluable collection of technical reports of American, British, French, German, Italian, and Japanese origin. The collection of documents is invaluable, especially the Materiel Division Technical Reports. These, through detailed accounts of tests and the various aeronautical developments fostered by the Air Corps, form a rather intensive history of the advancement made in the science of aeronautics since 1917.


The old idea of a museum was a place where dust accumulated upon a display of old and odd specimens of construction and invention. In the Air Corps a new need for a museum was recognized, especially at Wright Field where engineers are working in a science still young in development. Here it was realized that many hours of needless work might be saved if access could be had to examples of what had already been accomplished. In studying the article itself, reasons could be learned why it had been successful or unsuccessful. With this idea in view, war and prewar aeronautical specimens and inventions have been preserved and catalogued. In addition, the collection has been kept up to date by including the later developments along the same lines. Thus a living display is attempted. The history of engineering is full of instances where modern technique has reverted to an old and formerly unsuccessful mode of construction and through modern development in material and design has registered a significant advance. It is not surprising then, that the Army Aeronautical Museum has already proved of value not only at Wright Field but also to outside investigators and educational institutions.

The engine display includes many foreign types famous during the great war together with various designs of the American Liberty engines. In several cases these engines are disassembled and the cylinders sectionalized for study.

Aerial cameras, with lenses, films, plates, and emulsions are featured in the photographic section. A section is devoted also to the raw materials used in aircraft construction.

## THE HANGARS

Here the airplanes equipped and ready to be rolled to the flying line are kept. Virtually every type of military airplane is represented; training, observation, attack, pursuit, bombardment. Besides these are airplanes equipped for special missions; photographic, radio, instrument flying, and parachute testing. Many of these planes represent the very latest in Army design, many are still in the experimental stages of development and undergoing testing. Wright Field, it will be remembered, is the testing ground of new planes for the Army Air Corps, the only Army field of its kind in the United States.

A glance about will reveal to the eye of the initiated just how modern are the airplanes featured here. Monoplanes of metal construction and with metal monocoque fuselages prevail over the biplanes. A great number of the landing gears are retractable; that is, fold into the wings or fuselage during flight.

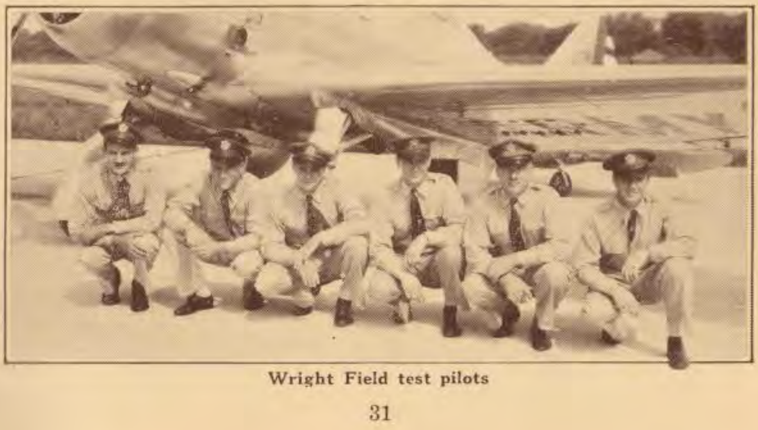
Also, the general aspect of many of the tail and landing gear wheels has changed. They are wearing streamlined tires and cowlings, which add greatly to the speed through the air by cutting down air resistance, and smooth contour types are beginning to appear.

The engines furnishing power to these planes range from 200 to 1000 horsepower. There are air and liquid-cooled types. Propellers are metal and many are three-bladed. The whole plane has acquired a cleaner, more knife-like appearance.

About the hangars are various offices for the flight test pilots and their assistants. There is a room where special test instruments such as barographs, air-speed indicators, and thermometers are calibrated before and after flight tests. A storeroom holds equipment temporarily removed from an airplane while special equipment put on in its place is being tested. Airplane flares are also kept here for night flying. Sandbags, dummy guns, and dummy flares, used in weight carrying tests, are stowed in a ballast room ready for loading and installing on airplanes.

# Test Pilots

The majority of Wright Field flights are test flights flown by Materiel Division test pilots for ascertaining the performance of experimental airplanes or equipment. These pilots must be experts. They are a small group chosen because of their flying experience, reliability, and efficiency. To take into the air a new type of plane for the purpose of learning its speeds, its rate of climb, its "ceiling"—in short, to "performance" test it—is pioneering of the most venturesome kind. Thousands of test flights are made each year without accident or even incident. Test pilots have, however, on test flights lost a propeller or part of a landing gear, landed airplanes that caught fire in the air, made hasty forced landings where they could, taken to parachutes to save their lives, or given their lives in the performance of their duty. The Army test pilots' Roll of Honor is fortunately brief; the names appearing on it are alive with the highest courage.



**Wright Field test pilots**

## BITS OF McCOOK AND WRIGHT FIELD FLYING HISTORY

The following incidents taken from the files of McCook and Wright Fields give a glimpse of the part played by the Army pilots of these fields in flying history.

### 1920

Feb. 27—Major R. W. Schroeder flies to 33,113 ft., through a temperature of 67 degrees below zero, setting a new world altitude record.

May 4—Capt. L. L. Snow brought his Liberty-powered Fokker into the shallow Miami River when his engine failed. He climbed up the tail, lighted a cigarette, and waited for a row boat to rescue him.

May 6—Lt. Louis Meister, testing a Nieuport, landed it in a tree to break the fall, when his engine failed. The plane burned and the pilot's life was despaired of until those who rushed to the scene found Meister on the ground calmly looking for his goggles which he'd thrown overboard before the crash.

### 1921

Sept. 28—Lt. J. A. Macready in a LePere biplane with supercharged Liberty engine flew at McCook Field to 34,508 ft. gaining the world's altitude record.

### 1922

April 6—Lt. J. A. Macready flies to 34,563 ft., a world record.

June 12—Lt. A. W. Stevens established record high altitude parachute jump, going over the side of the plane at 24,200 ft. The plane was piloted by Lt. Leigh Wade of Flight Test Branch, who established on this flight an altitude record with load. Roy Langham served as observer.

July—Extensive night flying and landing tests carried on by Lt. Donald L. Bruner at McCook Field in the development of landing lights and night flying equipment, leading to the establishment of the first scheduled night airways system in the United States.

Oct. 20—Lt. Harold R. Harris jumped from an airplane which failed at 2500 ft., this being the first instance in this country in which a flier saved his life in an emergency by means of an airplane parachute.

Nov. 4—Lts. Macready and Kelly flew from San Diego, Calif., to Indianapolis in the T-2 monoplane, the greatest distance ever traveled nonstop at that date.

### 1923

Barling Bomber, world's largest airplane, flown by Lt. H. R. Harris. This plane was later flown by Capt. Muir Fairchild and Lt. John A. Macready.

Mar. 31—Lt. Alexander Pearson in a Verville-Sperry racer, R-3, made world speed record for 500 kilometers at Dayton over a triangular course.

Mar. 31—Lt. H. R. Harris and Ralph Lockwood flying a DH-4L made a world speed record for 1000 kilometers over a triangular course at Dayton.

Apr. 16-17—Lts. Macready and Kelly in Fokker monoplane established world's endurance and distance records over a triangular course, remaining aloft 36 hr., 4 min., and 32 sec.

Apr. 16-17—Lts. Macready and Kelly established world speed records for 2500 km., 3000 km., 3500 km., and 4000 km. in Fokker transport, T-2, over a triangular course at Dayton, Ohio.

Apr. 17—Lt. H. R. Harris broke world speed record for 1500 and 2000 km. flying a DH-4L over a triangular course at Dayton, O.

May 2-3—First transcontinental nonstop flight made by Lts. Kelly and Macready from Roosevelt Field, New York to Rockwell Field, San Diego, Calif., in 26 hr., 50 min., and 3 sec. in T-2 monoplane transport.

May 8—Aerial Circus in honor of return of Lts. Kelly and Macready from California where they landed on the first transcontinental nonstop flight in history.

Sept. 6—One of the earliest cross-country instrument flying experiments made when Lt. A. F. Hegenberger and Bradley Jones, navigator, fly above the clouds from the Ohio River to the Hudson River in testing new sextant.

Dec. 17—McCook Field celebrates 20th anniversary of flight.

### 1924

Flying Branch pilots fly nightly over the new night airways laid between McCook Field and Columbus, Ohio, first to be established in this country.

Engineering requirements for Round-the-World Flight airplanes drawn up by McCook Field engineers.

March—Lt. James H. Doolittle performs daring acceleration tests, gaining information which proved that pursuit airplanes must be constructed with a higher factor of safety.

March—Apparatus designed for scattering insecticide from airplane at request of Department of Entomology for checking spread of gypsy moth in New England.

March-April—First test flights of induction compass made.

May 2—Unofficial two-man altitude record by Lts. John A. Macready and A. W. Stevens to 31,540 ft. Also record high altitude photograph taken and greatest area ever included in one photograph obtained in same flight.

June—First radio interview held between airplane pilot flying at 6000 ft. and a reporter on the ground, with equipment developed at McCook Field.

Three-seater observation and reconnaissance airplane

June 18—Lt. John A. Macready makes first night emergency parachute jump while flying the new night airways.

Oct. 2, 3, and 4—International Air Races at Wilbur Wright Field.

## 1925

Jan. 24—Lt. Macready flies to 37,569 ft.; an American altitude record.

Mar. 20—Lt. F. O. D. Hunter makes parachute leap from PW-8B airplane which he was testing over McCook Field. Landed uninjured.

July—First radio beacon equipment installed in Air Mail plane sent in by the Department of Commerce for use in connection with the radio beacon developed by the Air Corps.

July—Visitors astonished by seeing small car moving about grounds without visible means of control. Control was by radio from airplane flying at 2000 feet.

Oct. 24—Lt. James H. Doolittle of Flight Test Branch wins Schneider Cup Race for seaplanes.

November—First tri-motor transport airplane brought to McCook Field for comment of engineers (Fokker F-VII).

Nov. 20—First air flashlight night photograph made by Lt. George W. Goddard with equipment developed at McCook Field.

## 1926

Mar. 24—Lt. E. H. Barksdale saves his life by jumping with parachute from airplane which failed in test.

June 17—Lt. J. L. Hutchinson and Paul Stanley saved their lives by parachute when their airplane took fire in the air.

July 21—Lt. Victor Bertrandias saved life by parachute from airplane which failed in the air.

Single-engine ground attack airplane

## 1927

Materiel Division moved from McCook to Wright Field.

June 29—Lt. A. F. Hegenberger and Lt. Lester Maitland accomplish first California-Hawaii flight across the Pacific. Awarded Distinguished Flying Cross.

Oct. 12—New Wright Field dedicated with impressive ceremonies and flying program.

## 1928

Jan. 21—Gene Althoff leaped by parachute from XB-1 when it caught fire. Airplane landed safely by Lt. Eubanks.

July 27—Lt. J. A. Macready awarded Distinguished Flying Cross for world's altitude record (1921) and first transcontinental nonstop flight (1923).

Aug. 28—Lt. Erik Nelson awarded Distinguished Flying Cross for participation in first Alaskan flight (1920).

Aug. 28—Capt. St. Clair Streett, chief of the test pilots, awarded Distinguished Flying Cross for participation in first Alaskan flight (1920).

## 1929

Aug. 1—Lt. J. H. Doolittle awarded Distinguished Flying Cross for:
Acceleration tests at McCook Field (1924).
Transcontinental one-stop flight (1922).
Instrument landing (1929).

Aug. 28—Lt. J. P. Richter awarded Distinguished Flying Cross for pioneer work in refueling airplanes in flight.

Aug. 28—Lt. H. A. Sutton awarded Distinguished Flying Cross for scientific data acquired through experimental spinning tests at McCook Field.

October—Record long distance photograph taken of Mount Rainier by Capt. A. W. Stevens from a distance of 227 miles. Distance later increased to 331 miles.

Nov. 4—Capt. Lowell Smith receives Distinguished Flying Cross for pioneer work in refueling airplanes in flight.

## 1930

Oct. 1—Lt. J. E. Parker leaped from Thomas-Morse XP-13 when it caught fire in the air and saved life by parachute.

Oct. 1—Master Sgt. Bottriell awarded Distinguished Flying Cross for parachute testing at McCook Field in 1919-1920. Made first jump with manually operated free type parachute.

## 1931

Mar. 18—Lt. H. G. Crocker lands burning plane which caught fire in the air while being tested. Both motors were saved.

August—Fluid Segregator for automatically separating water from gasoline in aircraft developed by Sgt. Samiran at Wright Field is adopted as standard Air Corps equipment.

## 1932

May 9—First solo instrument-landing flight in history accomplished by Capt. A. F. Hegenberger.

## 1933

May—First class of instrument flying and landing pilots in history graduated at Wright Field under instrument flying and landing system developed by Materiel Division engineers.

June 28—Capt. Donald L. Bruner awarded Distinguished Flying Cross for his work in the development of night flying and night flying equipment.

## 1934

May 18—Oak leaf cluster of Distinguished Flying Cross awarded Capt. A. F. Hegenberger for his work in development of instrument (blind) landing system.

July 13 (Friday)—Capt. Frank G. Irvin jumped with parachute at 6,000 feet near Medway, Ohio, from a pursuit airplane diving at the rate of 325 m. p. h. when the ski installation which he was testing failed. He landed safely.

December 6—Maj. W. E. Kepner and Capt. A. W. Stevens awarded Distinguished Flying Cross for Stratosphere Flight in balloon, Explorer I, to an altitude of 60,613 feet on July 28, 1934.

## 1935

July 22—Collier Trophy presented to Capt. A. F. Hegenberger for accomplishment and demonstration of successful instrument (blind) landing system for airplanes.

August 29—Successful "automatic navigation" demonstrated by hookup between automatic pilot and radio compass developed at the Materiel Division.

October 30—Lt. R. K. Giovannoli awarded the Cheney Award for heroism in rescue work in connection with crash and burning of Boeing Bomber.

October 30—Lt. R. K. Giovannoli and Lt. L. F. Harman awarded Soldier's Medal for heroism in rescue work in connection with crash and burning of Boeing Bomber.

November 11—Capt. O. A. Anderson and Capt. A. W. Stevens fly into stratosphere to an altitude of 72,395 feet (world record) in an especially constructed balloon, Explorer II. Valuable scientific data secured.

December 11—Capt. A. W. Stevens awarded Hubbard Medal for "distinguished achievement in scientific research in the stratosphere" on November 11.

## 1936

Test flights of automatic navigation and celestial navigation equipment flown from New Orleans, La., to Brownsville, Texas (500 miles over Gulf of Mexico), and other locations.

February 17—New Army Aeronautical Museum building opened to public.

June 23—Maj. A. W. Stevens presented with Mackay Trophy.

July 22—Capt. F. G. Irvin and Capt. J. S. Griffith, pilots, in conducting carbon monoxide tests in large transport airplane, ordered crew of five men to jump with parachutes when engine caught fire. By heroic work with fire extinguishers, they extinguished flames and landed airplane safely.

October 26—Maj. Hez McClellan, Chief of the Flying Branch, posthumously awarded the Distinguished Flying Cross for his part in flight of ten Army Bombers from Washington to Alaska and return.

October 27—Capt. C. W. O'Connor jumped to safety from 5,500 feet when his motor failed while making the regular early morning weather flight. He was the 855th person to owe his life in emergency to the Army Air Corps parachute.

December 10—Capt. F. G. Irvin and Capt. J. S. Griffith awarded Distinguished Flying Cross for heroism displayed in saving crew and Army aircraft from fire in flight on July 22.

## 1937

January—Wright Field pilots and aircraft were on constant call for flood relief work. The Aerial Photographic Laboratory was used as a base for aerial photographic surveys during all flood stages. Serums, food, and messages were carried to inundated sections.

June 8—Maj. A. W. Stevens makes astrophysical history by photographing from an airplane, at 25,000 feet over Trujillo, Peru, for the first time the "globular corona" of the sun, during a total eclipse.

June 15—Bronze busts of Orville and Wilbur Wright placed in rotunda of Army Aeronautical Museum.

July 28—First experimental pressure cabin substratosphere airplane arrived at Wright Field for test and research purposes.

August 23—First automatic landing of airplane accomplished with Capt. Carl J. Crane, Capt. G. V. Holloman, and Raymond Stout, in the cockpit.

December 11—The Army's largest bombardment airplane arrives at Wright Field.

**1938**

March 9—Lt. B. S. Kelsey presented with the Distinguished Flying Cross for safe landing of airplane which caught fire in the air.

## WRIGHT FIELD FLIGHT TEST ROLL OF HONOR

Lieutenant Frank Banks ........ January 22, 1919

Captain W. F. Jones, pilot, and George Buzane, test observer ........ July 14, 1919

Sergeant Strong B. Madan ........ October 4, 1920

W. W. Stryker, Thomas H. Harriman, Allan B. MacFarland, Robert H. Hanson, Charles N. Schulenberg, William O'Laughlin ..February 21, 1922, Airship crash "Roma"

Lieutenant F. W. Niedermeyer ........ March 13, 1922

Lieutenant L. P. Moriarty, pilot, and William P. Stonebraker ........ August 14, 1922

Lieutenant Theodore S. VanVechten ........ April 8, 1924

Robert Anderson ........ May 13, 1924

Lieutenant Alexander Pearson, Jr. ........ September 2, 1924

Lieutenant Eugene H. Barksdale ........ August 11, 1926

Captain Hugh M. Elmendorf ........ January 13, 1933

Lieutenant Irvin A. Woodring ........ January 20, 1933

Major Ployer P. Hill ........ October 30, 1935

Lieutenant R. K. Giovannoli ........ March 8, 1936

Major Hez McClellan ........ May 25, 1936

## A FEW FACTS ABOUT WRIGHT FIELD

Area—746.78 acres: Flying field—520 acres. Whole Government reservation—4549.54 acres. Cost of ground—$450,000. (Gift of citizens of Dayton.)

### FLYING FIELD

Shape, generally triangular. Drainage system, corrugated pipe, concrete tile, French drains.

Landing area, approximately one mile each way.

Concrete aprons around hangars.

Lighting system—Beacon, 1000-watt, rotating; floodlights, three: two 10-kw., 180°, and one 12-kw., 90°. Obstacle, boundary, and best approach lights. Marker light circle indicating center of field. Illuminated wind indicator.

### HANGARS

Three—steel and concrete construction.

Total floor area, 86,300 sq. ft.

Total plane capacity, 75.

### BUILDINGS

Fifty buildings house the Materiel Division activities, including administration building (87,480 sq. ft. floor space), main laboratory (148,920 sq. ft. floor space), radio, power plant, wind tunnel, torque stands, propeller laboratories, and Army Aeronautical Museum.

Total floor space of buildings, approximately 900,000 sq. ft.

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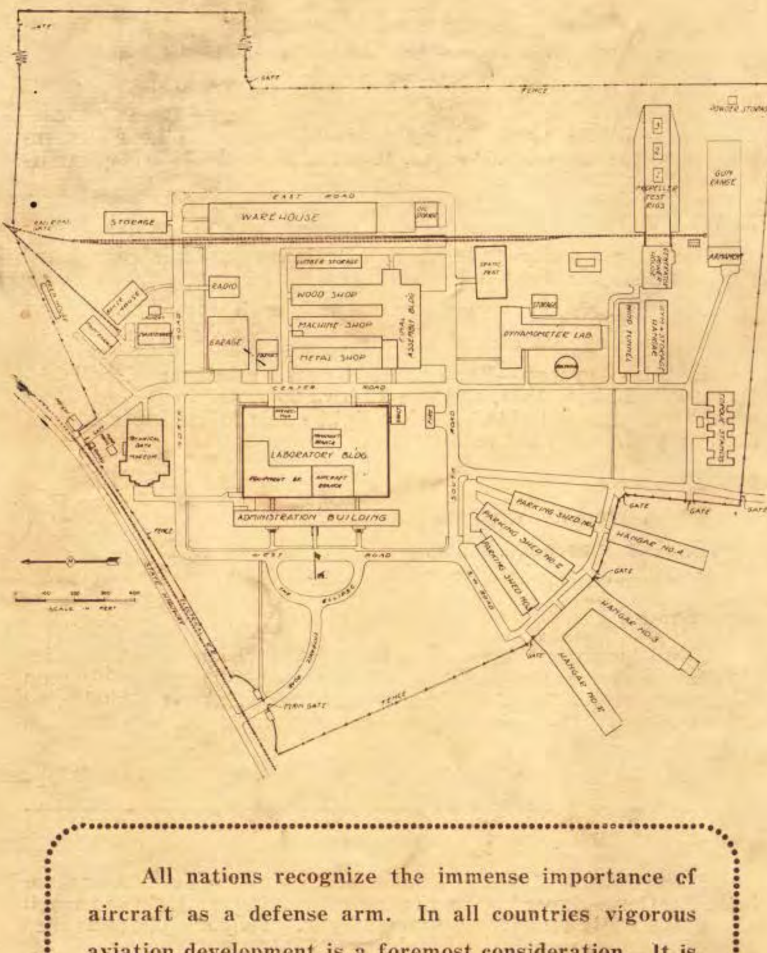
## ILLUSTRATIONS

**Front Cover**—The giant bomber soaring aloft on the front cover is the Air Corps Super Fortress (wing spread, 150 feet). The pursuit plane beneath is completely dwarfed by it. They are photographed above the clouds near Wright Field.

**Pages 20 and 21.**—Top: The Flying Fortress (wing spread, 100 feet), smaller sister of the Super Fortress, is shown. It was this type which flew out 750 miles over the Atlantic to greet the Italian steamship Rex, a 1500-mile flight. Lower left: A new type of multiplace fighter with pusher propellers, and gun emplacements in the engine nacelles. Lower right: The experimental pressure cabin airplane (see page 13).



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