The AIRCRAFT YEAR BOOK

For 1935

ACCA

LEADING THE NATION INTO FLIGHT

AIRCRAFT YEAR BOOK FOR 1935

AMERICAN AIRCRAFT ABROAD

One of the new Douglas transports operated by Royal Dutch Air Lines, over Rotterdam.

The AIRCRAFT YEAR BOOK

(Registered U. S. Patent Office)

For 1935

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CHAPTER I

THE UNITED STATES IN THE AIR

Superiority of American Aircraft—Importance of Federal Aviation Commission's Report—Necessity for a Definite Development Program—Needs of the Air Forces—Investigations—Findings of the Baker Board—Report to the NRA—Production of Aircraft and Engines in 1934.

AT the beginning of 1935 the United States had the fastest and most efficient airplanes in the world, and had even more striking technical developments under way; but it still lacked a comprehensive national aviation program. Other nations were rapidly overtaking the United States because their governments had adopted vast programs for aeronautic development. Other governments were building up huge private manufacturing and operating industries, knowing these industries to be the heart and soul of air power. But the American Government had stated no national aviation program. There was much activity but it lacked coordination.

During 1934 the foreign aircraft industries received from their own governments and their own parliaments fresh inspiration and renewed vigor. Most official and legislative bodies outside the United States apparently recognized that national security and economic independence depend on development of front rank air power. They were making a great race for world leadership. American aviation was still reputed to be setting the pace: but actually it was groping blindly in the confusion of aims and methods brought about by the impact of a new political philosophy on the economic structure of the nation. It was beginning to falter. There were many signs that without a comprehensive and constructive program for rehabilitating the industry it might soon be forced to drop out of the international race entirely.

The situation was well known in Washington, of course. There the confusion was most noticeable. Congress recognized it in 1934 in authorizing the appointment of the Federal Aviation Commission to recommend a constructive program. The President knew that the lack of a program might ultimately prove disastrous, and he appointed to the Commission men on whose experience and judgment he could depend. His confidence was justified. The extensive labors of the Commission and its thorough investigation of the subject with all its manifold problems resulted in a report which should become the basis for a comprehensive national aviation program. It is so important in all its various phases that it cannot long be ignored.

The recommendations of the Federal Aviation Commission are published in full in Chapter III.

The Commission was the first group of the kind to study and report on all branches of aviation since the Morrow Board rendered its report in 1925. The Morrow Board, appointed by President Coolidge, had been confronted with a most depressing situation. There was very little existing aviation for the Morrow Board to consider in forming a definite planned program for the future. It developed such a program, however, confining the specific details within a period of five years in view of the experimental stage through which the art was passing and the inability to judge with accuracy what might be best for aviation at the end of that period.

As a result of the Morrow Board's recommendations, Congress adopted five-year programs for the development of the Army and the Navy air forces, a definite program for civil aeronautics under the jurisdiction of the Government and a national policy calculated to preserve and develop the industry as an essential reserve for national defense. The Morrow Board's recommendations would have been worthless had they not been translated into legislation. The Army and Navy five-year program acts and the Air Commerce Act of 1926 launched American aviation on its career of progress, and soon it was making full speed ahead.

From 1927 until the end of 1932 there was continuous development in all branches of aviation. The five-year program acts worked so well with the Army and Navy air forces that other nations commenced striving to duplicate the American organizations. A similar situation developed in commercial aviation. Air transport was encouraged to grow and render a service to the people. The aircraft plants began turning out improved equipment. The commercial and military development kept the pace together, as they must necessarily do in any country.

At the end of the five-year programs in 1932 all informed persons realized that new programs were essential if American aviation was to make continued progress. The science of flight had made such phenomenal progress that it demanded new conceptions for the future. Other nations were beginning to get into full stride in the air.

The fact that no new program was adopted after 1932 accounts for the confusion existing in 1934 and the more pressing need for a restatement of national policy and a definite program in 1935. The superiority of American aviation equipment and the efficiency of the air forces at the beginning of 1935 could not be traced to anything

THE MARINES IN THE AIR

U. S. Marine Corps pilots laying a smoke screen to protect their fighting squadrons from surface fire.

actually accomplished during the last two years. Technically the industry was still making progress, but it was the momentum of the past which carried it on. The enviable position of air transport lines of the United States, the envy of the world, was not traceable to any program developed since 1932. Their better service was being carried on at the expense of capital, their superior equipment had been planned and placed in development prior to 1933.

The statistics for the periods under discussion show that the five-year program acts and other programs legislated by Congress in 1926, as a result of the Morrow Board's recommendations, were responsible for the present technical development.

Commercial aviation had not really started prior to the adoption of the programs in 1926. There were 482 commercial and municipal airports, few if any in a fair state of development. At the end of 1932 there were 1,194 commercial and municipal airports, a majority adequately equipped for the flying service accommodated. At the end of 1934 the number had dropped back to 1,072. The miles of lighted airways jumped from 2,041 in 1926 to 19,500 in 1932 and fell back to 18,896 in 1934. The number of civil airplanes grew from approximately 1,000 in 1926 to 10,324 machines in 1932, and then dropped back to 8,322 in 1934. The number of licensed pilots took the same curve; 1,572 in 1927, 18,594 in 1932 and 13,949 in 1934. The average daily flying of air lines of the United States grew from 11,830 miles in 1926 to 139,542 in 1932 and then fell off to 133,446 miles in 1934.

The influence upon the public has been precisely what the above figures indicate, as evidenced by the traffic on the air lines. Under the stimulus of the national programs prior to 1933 the air lines developed traffic in the face of the depression and other obstacles. They cooperated with the manufacturers and by large capital expenditures developed the most efficient and fastest transport planes in the world.

In 1926 the lines carried 5,782 passengers. They carried 504,575 in 1932 and 546,235 in 1933. In 1934 the traffic dropped to 537,637 passengers. The Post Office Department, operating the air mail service from 1918 until it was turned over to private operators, carried 433,649 pounds of mail by air in 1926. The contract air mail lines starting from nothing at the beginning of 1927 developed the service until they carried 7,658,195 pounds in 1932 and 7,644,646 pounds in 1933, both depression years. The postage rate was excessively high. In 1934 the air lines carried 7,155,281 pounds of mail. Reduction of the postage rate to 6 cents is believed to have prevented a drastic drop in volume. During the hiatus in contract mail operations, caused by cancellation of contracts, the Army Air Corps carried 768,215 pounds of mail from February 19 to June 1, 1934. The volume of air mail should have been much greater in 1934.

At the end of 1926, the last year before the five-year programs became effective, the Army had 422 combat planes and the Navy had 703, a total of 1,125 for the combined forces, with few of the machines modern and a majority obsolescent. The fastest service craft, machines then in actual service, could make only 161 miles an hour.

At the end of the programs in 1931-32 the Army had 1,033 combat planes and the Navy 776, a total of 1,809; and the pursuit fighters with which the squadrons were equipped, or in process of being equipped, had speeds of 197 miles an hour.

At the beginning of 1935 American squadrons were equipped with the best planes, type for type, in the world. Their pursuit-fighters, actually in service and carrying full service loads could fly at 230 miles an hour and perform the most advanced aerial acrobatics, including power dives. Experimental military and naval planes had much higher speeds. The United States led all nations in the performance of its service planes and had under development machines designed to maintain that superiority, provided the development was not stifled. But the air forces did not have enough planes.

The Army Air Corps was short more than 300 of the 1,800 planes allotted to it under the Air Corps Act passed by Congress back in 1926. The Baker Board, the General Staff and experienced officers of the Air Corps admitted that the Army air forces should have at all times at least 2,320 planes, the greater number being combat types, including armed observation machines. Actually the Air Corps and reserves had on hand less than 1,500 serviceable planes of which approximately 1,200 might be termed combat machines not actually obsolete. In his annual report Secretary of War Dern recommended

SWEDEN USES AMERICAN PLANES

A Northrop Delta express plane powered with a Pratt & Whitney Hornet in service on A. G. Aerotransport.

purchase of 600 planes; and orders for some of that new equipment were being let at the end of the year. When filled, including replacements, they would give the Air Corps approximately 1,400 planes in the combat class, including armed observation types.

The Navy Bureau of Aeronautics, charged with maintaining land based naval aircraft as well as the squadrons on surface vessels with the Fleet, had on hand at the end of 1934 approximately 860 combat planes, some 260 of them obsolete, leaving about 600 combat types fit for active service, for serious training or an emergency. The Navy requirements were to be about 1,910 planes of all types at the end of five years, after making allowances for annual replacements.

From the above it may be seen that the combined air forces of the United States at the beginning of 1935 were equipped with approximately 2,060 combat planes, about 1,600 modern enough for an emergency. They represented less than half the combined strength necessary to place the United States on anything like an equal footing with other air powers, in view of American areas to be protected. President Roosevelt recognized the situation when he sent his budget message to Congress in January, 1935.

The budget for the fiscal year 1936, beginning July 1, 1935, provided $12,500,000 for airplanes to be used on naval ships under construction, $14,000,000 for replacement of naval planes in commission but obsolescent, and about $22,000,000 for Army aircraft equipment, of which about $13,000,000 was to be allotted to new planes and engines. It remained for Congress to act upon those recommendations. The acute need of the services and the recognition of that need among members of Congress formed the only bright spot in the aviation picture. There seemed to be too much diverse sentiment in Washington to permit the adoption of a comprehensive aeronautical development program.

The aircraft industry, through the Aeronautical Chamber of Commerce of America, repeatedly extended to Congress and the executive branches of the Government assistance in solving the complex problems which the aviation people and the officers of the Army and the Navy knew to be in urgent need of solution in view of world conditions, the activities of other governments and the nation's own requirements.

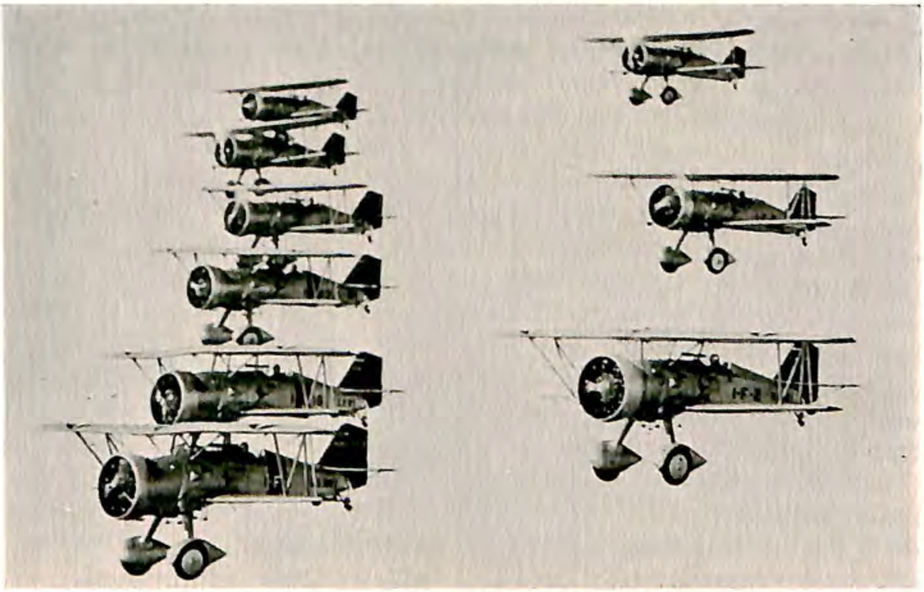
The industry was able to solve its own technical problems. It was quite capable of solving its operating problems, if left reasonably free from interference. But alone and unaided it could not solve the great problem of preserving to the United States its heritage of first place in the air. Foreign competition was becoming too keen, the pace too swift. It demanded of the Government intelligent cooperation.

The situation was ably summarized by the New York Times on February 3, 1935, when it published an article by Reginald M. Cleveland, its aviation editor and president of the National Association of Aviation Editors, as follows:

> "The most hectic period in American aviation entered a new and, it is hoped, a more cheerful phase last week when President Roosevelt sent to Congress the report of the Federal Aviation Commission and set forth a policy of coordinated control for aeronautics. By a coincidence, Thomas A. Morgan completed, during the same week, his second term as president of the Aeronautical Chamber of Commerce of America. His was the arduous job of guiding the industry through the many problems which have menaced its existence. The low point of the national depression in March, 1933, was not the bottom of the depression as far

as concerned aviation. Budget cuts slashed deep holes into Army and Navy expenditures for aircraft and then took a large part of the appropriations for air mail payments. This at a time when military procurement orders and air mail payments formed the only motive power by which aviation might hope to ride out of the economic storm.

"Then, within a few weeks, came the NRA insisting upon shorter hours, higher wages and more work for more persons. Late in 1933 the air transport industry got a code. The aircraft manufacturers code is not approved yet, though the manufac-



NAVY'S "HIGH HAT" SQUADRON

Cyclone-powered Curtiss Hawks on a formation flight from their roost aboard the carrier "Saratoga."

turers have drafted more codes than there are companies in the industry. Next, through the Black committee, the air lines not only lost mail revenues, they lost passenger and express traffic by disruption of service. The temporary air mail legislation knocked the holding companies into integral parts and gave all company executives anxious days and sleepless nights. It forced the pioneer air lines to operate at a loss and it curtailed orders with the manufacturing industry.

"The Senate and House Military and Naval Affairs Committees investigated the industry at about that time. There arose much controversy about aircraft contracts, methods of purchasing and other details which resulted in millions of dollars of Army contracts being delayed, causing further chaotic conditions and further unemployment. The agitation injured the industry also because the publicity cast aspersions on the contractors. Just then foreign propaganda started to show that United States aircraft was not as good as Europe's products. It took time to prove that American-built planes and engines were not surpassed by those of any other nation in the world. Next came the Nye committee with a munitions investigation. During 1934 the Baker Board made a complete investigation of the Army Air Corps and recommended some very drastic changes which are now in process of being made. The Federal Aviation Commission started its investigation in the summer of 1934. This body has just made its very comprehensive recommendations."

Prior to the report of the Federal Aviation Commission the trend of most of the official thought in Washington seemed to be discouraging to all private invention and initiative in aviation. There was considerable talk in some quarters about taking all profit or chance for profit out of air transport operations, of eliminating the industry's plants by placing embargoes on exports of aeronautical products and building military and naval aircraft in Government plants. Meanwhile a number of members of Congress were trying to save aviation by urging recognition of design rights, maintenance of a healthy industry and recognition of an essential principle of national security which demands that the best equipped plants, if not always the cheapest, be encouraged to develop and build the most advanced and efficient aircraft, for present training purposes and as a measure of preparedness for any emergency.

In a comprehensive and thoughtful memorandum presented to a Senate committee, which had been studying embargoes on exports and the possibility of the manufacture of military and naval equipment in Government factories, Don L. Brown, president of United Aircraft Corporation, pointed out that the American public has been well repaid for its Government aviation expenditures, not only in reduced costs of military equipment, resulting from mass volume, but in the prompt adaptation of all military progress in aeronautics to the betterment of facilities for rapid and safe transport of passengers, mail and express.

Mr. Brown added that the experience of all the great powers, including the United States, has shown that "governments themselves cannot design and produce the equipment of precision and performance which under private initiative has given this country a preeminent position in the aeronautical field."

It was significant that the report of the Federal Aviation Commission urged upon Congress the advisability of maintaining a private industry as essential to the national defense and economic welfare of the nation, and promoting the export market for aeronautical products as an aid thereto. Equally significant is the fact that experienced officers of the Army and the Navy have no desire to depend on Government arsenals for aeronautical equipment. The War Department Special Committee on Army Air Corps, appointed in April, 1934, and known as the Baker Board, conducted extensive hearings and found that an "aircraft industry is absolutely essential to national defense."

The members of the Baker Board included Newton D. Baker, chairman, Major General Hugh A. Drum, Major General George S. Simonds, Major General Benjamin D. Foulois, Chief of Army Air Corps Karl T. Compton, George W. Lewis, James H. Doolittle,

AMERICAN AIRPLANES IN GERMANY

One of the high speed Wasp-powered Boeing 247-D transports in the Deutsche Luft Hansa service.

Edgar S. Gorrell, Brigadier General J. W. Gulick, Clarence D. Chamberlin and Major Albert E. Brown. They heard 105 witnesses and received volumes of written observations from officers and civilians. Among their detailed findings the following paragraphs are quoted here because they should be of interest in any consideration of national aviation policy. The Baker Board found:

"The air line transportation and commercial aviation in the United States is far ahead of that of foreign nations. There is more transport flying in the United States, with more passengers carried annually, than in all the rest of the world combined.

"Our air line transport development has resulted in airplanes superior in design, characteristics and performance to those of any other nation. Our air line pilots are more highly trained than those of any other country. Our facilities and equipment, except as to certain types of engines, surpass all others. We lead in the development and use of avigation instruments and in our communications system."

Further on in the report:

"The Air Corps units of the Army's covering and overseas forces must be ready at all times for war service. Any great war is now likely to begin with engagements between opposing aircraft, either sea or land based, and early aerial supremacy will be an important factor. This involves many factors but primarily a superior supply of efficient airplanes and of all accessories.

"An aircraft industry, therefore, is absolutely essential to the national defense. The size of the air forces for a major emergency would be vastly greater than it would be prudent to maintain in time of peace. Improvements in airplanes are continuous and relatively rapid. Airplanes become obsolete in a few years and, in some cases, are already obsolescent at the time of quantity delivery. Military airplanes cannot in time of peace be stored in large quantities, as can guns for example. This is the premise that leads to the conclusion that there must be maintained in time of peace a satisfactory nucleus of a war-time aviation industry. By a 'satisfactory nucleus' is meant a number of aircraft manufacturers distributed over the country, operating on a sound financial basis and capable of rapid expansion to meet the Government's needs in an emergency.

"Military aviation in time of war must rely largely upon airplanes built in time of war, and consequently the general condition and productive capacity of the aircraft industry are of national concern.

"The preparedness of military aviation for combat may be considered in three stages. During the first, immediate reliance must be placed upon facilities and equipment existing at the outbreak of the war. The second is a longer period of expansion of the existing aircraft industry and delivery of airplanes at a steadily increasing rate. In a major emergency the third period would be the efforts of the Government to speed up the production of airplanes by temporarily drawing into the aircraft industry automobile engine and body manufacturers and other industries whose facilities could be effectively used in the construction of airplanes, parts or accessories.

"For the first few and vitally important months of a war, the permanent aircraft industry would carry the full burden of supplying equipment, and thereafter would also provide for the emergency industry the necessary engineering and supervisory talent.

"It is difficult to determine the maximum productive capacity of the American aircraft industry in time of war, and no reliable data are available as to the maximum productive capacities of other nations. It is believed, however, that no other power could exceed in productive capacity the highly industrialized United States.

"The development of commercial aviation in the United States has been more rapid than in any other country and has contributed to a great increase in the design and construction facilities of American aircraft manufacturers. The number of civil and commercial airplanes produced is, however, not sufficient to maintain to any appreciable extent a satisfactory nucleus of an aircraft industry.

THE FAIRCHILD CARGO CARRIER

Developed by the Kreider-Reisner Aircraft Company this Cyclone-powered utility transport was delivered to the Army in 1934.

"In the opinion of the committee the major measure to insure the existence of a satisfactory nucleus of an aircraft industry in the United States is the establishment, with the President's approval, of an annual program of procurement for the Army and Navy. If these programs are based on the normal annual replacement of the Army's airplane strength, as recommended herein, plus that of the Navy, the committee believes that the airplane industry of the United States can be maintained on a sound basis and adequate from a national defense viewpoint. The production orders covering this number of airplanes distributed to those firms essential to national defense will assure a continuity of production and stability in the aircraft industry.

"The Government should encourage the development of design and engineering staffs in the various airplane factories by a more liberal policy of placing experimental orders for prototypes on a basis on which the Government bears in full the proper cost of development. Such experimental contracts should also provide for changes and additions ordered by the Government, at proper increases in contract prices.

"In view of the importance of the aviation industry to the national defense the committee believes that the Government should not enter into competition with private industry by the manufacture of airplanes in Government factories. In the same connection the committee believes that it would be advisable for the Department of Commerce to encourage further the airplane export business.

"We recommend, as did the Morrow Board and the Lampert Committee, that proprietary design rights be fully recognized. It is further recommended that the Secretary of War give such instructions to his Department."

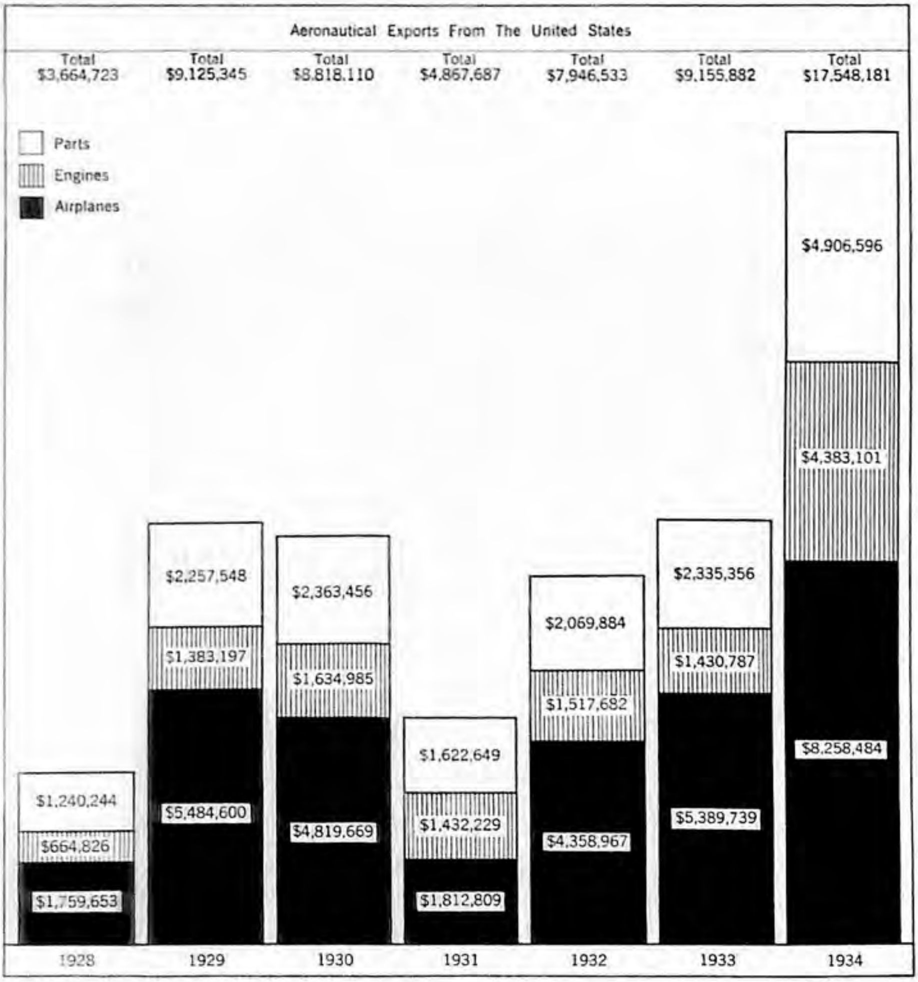
The Baker Board and the Federal Aviation Commission were only two of the numerous Government committees, commissions, bureaus or boards which investigated the aviation industry during 1934. Listed among the investigations were those of the following groups: the Black Committee, National Recovery Administration, National Labor Board, House Committee on Military Affairs, House Committee on Naval Affairs, Comptroller General of the United States, Senate Committee for Investigation of the Munitions Industry, the Post Office Department and the Interstate Commerce Commission.

The attention of the industry was so diverted from manufacturing and operations, because the heads of companies were compelled to pay so much attention to the Washington investigations, that the technical progress made during the year seems all the more remarkable. So acute was the situation at one time that a visiting Englishman remarked: "In Europe the Governments subsidize aviation; in the United States the Government investigates it."

After more than a year of effort to negotiate a code for the manufacturing branches of the aircraft industry the Aeronautical Chamber of Commerce of America, through its executive vice president, Leighton W. Rogers, on January 7, 1935, sent a new draft of the proposed code to the NRA. It was accompanied by a letter which set forth the condition of the industry in specific terms. The following abstracts of that letter are of interest:

"The industry, as one more last effort to obtain a code, therefore, presents this new draft as the best it can possibly agree to and survive, and hopes that the NRA will make it effective. In considering it, there are certain controlling factors in the industry which must be taken into account.

"Army and Navy contracts which were supposed to have been let last spring are only now beginning to go to the industry; the bids on these were made on the basis of time and one-third for overtime provided in the modified President's Reemployment Agreement under which the industry is working. There is no legal way of revising these bids to include higher overtime rates and



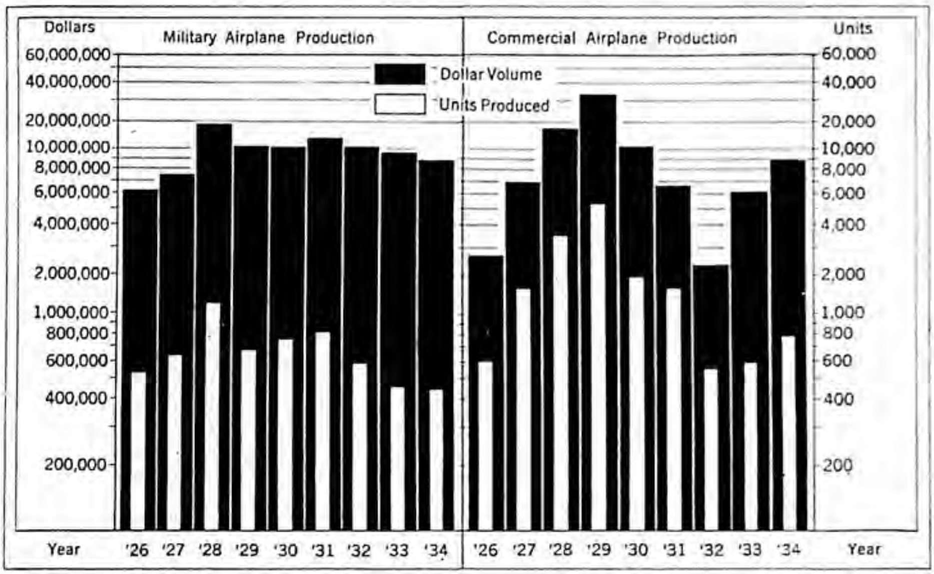
GROWTH OF FOREIGN TRADE

The superiority of American aeronautical products is evidenced by the amazing increase in exports during the last three years. It was almost doubled in 1934.

the industry is forced to carry out the terms of the bids. Some of these contracts will require a year and a half or two years to complete.

"The industry is in a very precarious condition. This should be obvious from the fact that a Presidential Federal Aviation Commission has been appointed to study its difficulties and to make recommendations to save it.

"The industry has declined in size from 133 companies employing 22,082 men in 1929, to 92 companies employing 12,328 men in 1933. There has been a further decline in employment during the last few months of at least 2,000 men. The great problem



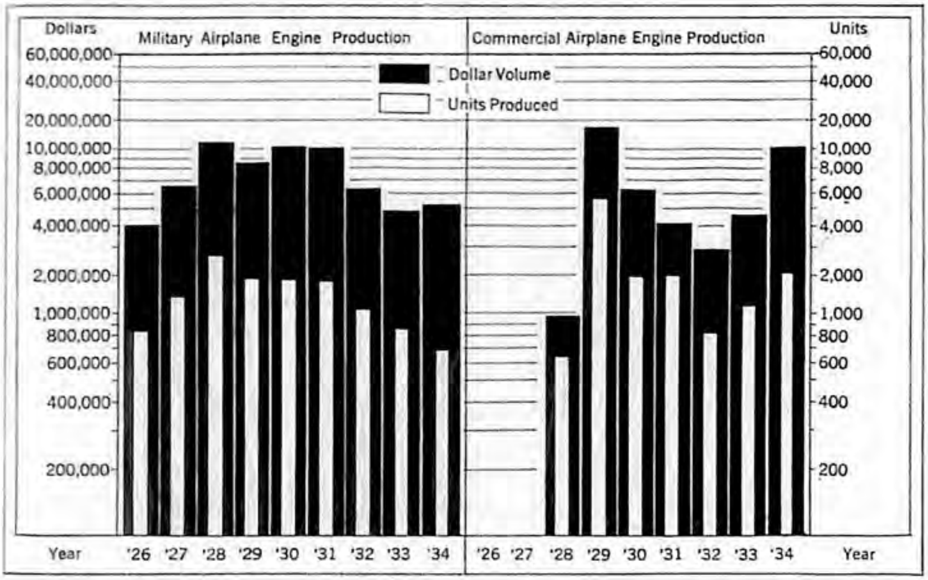
TOTAL AIRPLANE PRODUCTION IN THE UNITED STATES

in the industry is to keep employed the men it has rather than to spread employment. The companies are striving desperately to hold the men they have.

"About 60 per cent of the industry's sales are to the United States Government. From 1927 to 1932, appropriations for aircraft purchases by the Army and the Navy ran from $20,000,000 to $35,000,000 each annually. In 1932-33 and 1933-34 the appropriations were $11,500,000 and $8,250,000, respectively, for the Army, and $7,200,000 and $21,950,000, respectively, for the Navy. It is true that the sums available for purchases in 1934-35 are $28,400,000 and $27,600,000 for the Army and the Navy, respectively, but these funds do not get to the industry for a year or a year and a half.

"Generally speaking, for the past few years, about 60 per cent of the production of the industry has gone to the United States Government; about 25 per cent to export; and the remaining 15 per cent to domestic sales.

"The domestic sales are slowly improving, but the industry considers that the important export sales are gone for many years, due to factors completely beyond its control. One of these is European competition based on lower wage rates. In airplane construction the average wages are: England 32.4 cents; France



AIRCRAFT ENGINE PRODUCTION IN THE UNITED STATES

40.4 cents; United States 66.4 cents. In engine construction the average wages are: England 34.4 cents; France 43.4 cents; United States 70.4 cents.

"The industry is very widely bracketed as regards size of company and geographical location. It comprises large companies with a majority of their business done with the Army or the Navy, and small companies which do no Government business. There are centers of manufacturing on the West Coast, in the central States and in the east, with their varying cost-of-living scales. The interests of all types of companies must be observed in the writing of the code.

"Wages in the industry are high: the averages of all wages in the industry being 62½ to 68 cents per hour, depending upon the inclusion of certain parts and accessories.

"Government appropriations are, of course, fixed sums. It is only natural that the services try to obtain for them all the aircraft possible. The competition in the industry is keen. Industry has no way of effectively passing on increased costs to the customer, because the result of increased cost is only fewer aircraft purchased.

"In addition to this absolute ceiling of funds available, there is another restriction applying to the purchases for the United States Navy. The Vinson Act limits to ten per cent the profit which a manufacturer may make on any contract. If he makes more than ten per cent, he must turn the excess back to the Treasury, whereas if it is found that he has made less than that, or shows a loss, there is no redress. Owing to the experimental, pioneering character of the industry and the competition and the excess productive capacity, it is seldom that a manufacturer has Navy business every year. He makes some profit one year or perhaps two in succession, and very likely thereafter has no such business at all, and must bear a loss until he can develop a new superior product and get another Navy contract. The ten per cent permissible profit is not an average, but applies to each contract.

"Payments under Government contracts are often long delayed, due to technicalities and the involved Governmental procedure. The manufacturer has to carry the burden.

"Another provision of the Vinson Act puts the United States Government itself in direct competition with the industry in Government operated plants. The cost figures of these plants have never been made available to the public or the industry, so no comparison is possible."

If further evidence were needed to show the precarious state of the industry, which must always represent the heart and soul of air power in any country, no better picture can be obtained than by comparing the production records of 1934 with those of the previous year.

The following statistics are based on reports made direct to the Aeronautical Chamber of Commerce of America, and checked with Government figures wherever possible.

The industry produced 1,209 airplanes — both commercial and military—in 1934 as compared to 1,057 in 1933. It produced 2,736 engines in 1934 as compared to 1,980 in 1933. That increased production was the result of export orders placed in the United States prior to hearings of the Senate munitions investigating committee, and also orders from air transport lines placed with the manufacturers before the cancellation of the air mail contracts.

Total airplane sales abroad in 1934 had a money value of $8,258,484 as against $5,389,739 in 1933. That alone would absorb the difference between the $18,794,111 worth of airplanes produced in 1934 as compared to $15,965,543 in 1933. The $15,433,210 worth of engines in 1934 as against $9,710,622 in 1933 was partly accounted for by the $4,383,101 worth of engines exported in 1934 as compared to $1,430,787 in 1933.

A MARINE AIR TERMINAL

A Wasp-powered Douglas Dolphin amphibion on the ramp at island end of Wilmington-Catalina Airline.

The increased production, of course, did not come from Government orders. At a time when all other air powers were receiving new air force machines in steadily increasing numbers the American air forces were receiving fewer planes than during the previous year.

A total of 437 air force planes and 688 engines—for both the Army and the Navy—were produced in 1934 as compared to 466 planes and 860 engines in 1933. Their dollar value, however, was approximately the same because they were new types, faster and more powerful, therefore representing a slightly higher material and labor

A CONDOR ALL-SLEEPER PLANE

One of the Curtiss-Wright Cyclone-powered night planes in American Airlines service between Los Angeles and Fort Worth and between New York and Chicago.

cost per unit. Air force airplane production value in 1934 was $8,836,509 and engines $5,162,710 as compared to $9,784,643 for planes and $4,986,181 for engines in 1933.

The most casual study of the above figures would show that the increased commercial plane and motor production in 1934 was a result of export deliveries and delivery of multi-engine transports to American lines. The 1934 production of 772 commercial planes valued at $9,957,602 and 2,048 commercial engines valued at $10,270,500 represented the total increase of all types over 1933, because the 1933 production was 591 commercial planes valued at $6,180,900 and 1,120 commercial engines valued at $4,724,441.

NAVY VOUGHT CORSAIRS
Wasp-powered scouting planes in formation flight at sea.

Not only American airplanes and engines were delivered abroad in greater numbers during 1934, but parachutes, parts, instruments and other accessories as well. The value of those auxiliaries exported in 1934 was $4,906,596 as compared to $2,335,356 in 1933. Thus planes, engines and parts exported in 1934 totalled $17,548,181 as compared to $9,155,882 in 1933. Those figures proved the superiority of American aircraft products and the technical reliability of the American industry. Otherwise the industrial nations of Europe would have captured that trade. They were trying hard enough.

In that connection it should be borne in mind that approximately 70 per cent of the cost of aircraft and engines goes to labor and that in past years, for the American export trade alone, has amounted to at least 18,000,000 man hours annually. Naturally American manufacturers are eager to save this for the benefit of American labor as against European labor.

Development of the export market was part of the air force programs of all the larger nations because with foreign sales they could maintain larger aircraft industries at less expense to serve as vast reservoirs for equipment, not only for their growing peace time air forces but for any emergency demanding supplies of equipment on a gigantic scale.

For that reason the next chapter on what other powers are doing in the air should be of interest to Americans at this time.

NEW YORK FROM THE AIR

A Fairchild Aerial Surveys photographer catches the metropolis through the clouds.

CHAPTER II

AIR POWERS OF THE WORLD

Combat Airplane Strength—British Air Power—The French Position—Germany's Program—Italy's New Plans—The Russian Development—Japan's Status in Aviation.

THE beginning of 1935 brought every indication that the world was due for some tremendous surprises in aviation before the end of the year. No less than six of the seven air powers were making rapid strides in an international race for supremacy in commercial aviation and aerial armaments. Germany and Russia for the first time in post war history emerged as serious contenders for front rank position, and they were giving Great Britain, France and Italy cause for considerable worry. Japan was augmenting her air force strength with almost frantic haste. Among the seven air powers of the world, the United States ranked first in commercial aviation, first in military aircraft performance and first in naval aviation; but it was fifth in numbers of combat airplanes. From the point of view of having a comprehensive national aviation development program, the United States, as pointed out in Chapter I, had not set forth its plans.

In theory there are three ways of comparing the air strength of nations; but no way is accurate or entirely adequate. The best that can be done is to obtain an idea of what each nation would have if it went to war today. One way would be to study the known facts and rumors about development programs, count the airplane factories, estimate their production capacity, which would be only guesswork, consider their training programs, national resources in raw materials and national aviation policy, and then make deductions. But national policies change, and advanced programs are invariably secret, so one can only say that a nation has factories, trained men and the ability to produce aircraft. Another method of comparison would be necessary.

A nation's actual air strength would depend wholly on the kind of war it was fighting—whether with a neighboring country and a well-armed people with comparable forces, or a distant land across the seas, and whether the war was to be one of defense or aggression, a fight between great powers with allies or a colonial war. There, too, one can only surmise.

The only reasonable way of comparing air strength is to determine, if possible, what a nation has in numbers and quality of combat planes and what it is doing to increase that number. An attempt in that direction has been made here. The figures and notes about development plans have been culled from every available source and checked, where possible, with official statistics, which, however official, are not always reliable. The degree of obsolescence, of course, could never be determined, because a plane is useful as long as it will fly. For example, an old plane flying at 60 miles an hour at 1,000 feet could bomb a town having no air forces or anti-aircraft defense. The problem of adequate defense, however, grows more complex every year because the flying machine becomes faster, more reliable, and more capable of flying non-stop over vast distances, at great heights, and with increasing loads of bombs, machine guns or troops.

During a discussion on world disarmament in Geneva in February, 1935, Lord Stanhope, for the British, urbanely injected commercial aviation into the question of arms limitation, adding, according to the New York Times, "some new American commercial planes were better than the best European war planes."

The year 1935 is to see much faster war planes in Europe.

Huge multi-motored machines carrying 50 soldiers with full fighting equipment or their equivalent in bombs, and flying three miles high at 300 miles an hour, are what the air powers are trying to develop within the next few years.

The following should be looked upon then as an approximation of relative strength, each nation treated in the same manner, with consideration given to what it has produced in the past and is known to be capable of producing today, tomorrow and next year, with allowances made for obsolete and obsolescent machines understood to be in active service. They are counted in these totals if they are armed machines, including pursuit fighters, armed scouts and observation types, light bombardment, attack, patrol flying boats and heavy bombers.

Relative Numerical Strength

This table has been compiled for the Aircraft Year Book for 1935 to show the relative positions of the seven air powers in approximate numbers of combat airplanes since 1932.

	January 1932	January 1934	January 1935
France	4,000	4,000	3,600
Russia	1,500	2,200	3,000
British Empire	2,000	2,500	2,800
Italy	1,800	2,300	2,300
United States	1,800	1,700	2,060
Japan	1,300	1,500	1,850
Germany	....	200	600

British Air Power

As may be seen from the above, the relative position of the powers in numerical air force strength, excepting Russia, remains about the same as a year ago. France still has more combat planes than any other nation. She has approximately 3,200 fighters, bombers and observation machines at home, with some 400 others in the colonies—in all 3,600. But actually the British Empire is the strongest power in the air. The British have 2,800 combat planes, of which 1,300 are kept in the British Isles, 400 are assigned to the Navy, 600 are with Royal Air Force contingents on duty abroad and 500 are maintained by other air forces in the dominions and other possessions of the empire. Regardless of what others have in numerical strength Great Britain is

VOUGHT CORSAIR V-90

A two-place tactical plane with Pratt & Whitney Hornet engine equipped for machine guns and bombs.

rapidly realizing her ambition, an objective determined upon in 1915, to be mistress of the air as well as mistress of the seas.

Great Britain can transport aircraft on her large merchant fleet and establish an air force in any corner of the world. She has 50 merchant ships which she might convert into aircraft carriers in time of war. The dominions, colonies and possessions, with all their varied terrain, and meteorological conditions ranging from sub-Arctic to tropic climate, are available for experimentation, training and commercial operations in the British program for aircraft development.

The British Imperial Airways is being extended from Singapore to Brisbane, Australia; so that these British routes aggregating 20,500 miles now criss-cross Europe, and at Cairo, Egypt, branch off in two directions, one to Capetown, South Africa, and the other eastward through Arabia, India, Straits Settlements and thence to Australia. The objective is a seven-day service between London and Brisbane.

Imperial Airways is developing plans for a transatlantic service by way of the Azores, with branches radiating to North, Central and South America. In cooperation with the four great railway systems in England a very comprehensive system of fast mail, passenger and express services is being created throughout the British Isles, a program to which the Government is giving the utmost support. Great Britain has several reasons for expanding her air transport systems to the utmost.

Repeated surveys have proven the theory that international trade flows fastest over the routes where deliveries are quickest; therefore Great Britain, having a position to maintain as the greatest carrier of ocean commerce, intends to see that it is not lost to her in the air. Her program demands the earliest possible development of air transport routes linking industrial England with all her own colonies and also all the non-industrial nations of the earth, peoples which are in the market for goods manufactured abroad.

By selling air transport service to other countries, Great Britain also can sell them air transport equipment and military aircraft whenever they need it. The British learned years ago that any people using British products in time of peace will turn to British products in war or preparedness for war. Accordingly, Great Britain has been a pioneer in cultivating foreign markets to provide extra sales outlets for her aircraft plants, the plants which her industry set up during the World War and which the British people will never permit to pass out of existence. They learned their lesson when the Germans hopped over England's surface defense and repeatedly destroyed her docks, arsenals and other war production facilities, at the same time forcing large contingents of troops to remain at home to fight off the aerial invaders. The British insist that the air warfare of the last conflict was child's play compared to what it must be in any war of the future; and they are irrevocably committed to a program of aerial preparedness.

A thousand planes were available for the defense of London at the beginning of 1935. They included fighters and bombers. Squadrons equipped with an aggregate of 156 fighters, and as many more in nearby warehouses ready for immediate service, were on constant duty in the metropolitan area. The bombing squadrons were ready to strike at any foe on land or sea, in British waters or at enemy bases anywhere in Europe. It was with that in mind that Mr. Baldwin during 1934 remarked in the House of Commons that the battle front in future would be on the Rhine. At the beginning of 1935 many experts were of the opinion that the British front might conceivably move eastward as far as north Russia or India.

Great Britain's policy since the World War has been to develop the greatest possible number of privately owned aircraft and aircraft engine plants. Shortly after the war the Air Ministry attempted to build planes in Government owned and operated plants, but these machines were not very successful; and the practice was discontinued. Since that time private manufacturers have been given every advantage. Only those manufacturers maintaining design staffs and other facilities for development are permitted to receive orders from

A HAWK FROM THE CARRIER "RANGER"

One of the Curtiss Hawks, with retractable landing gear, powered by a Wright Cyclone, attached to the Navy's newest aircraft carrier.

the Government. There are 14 airplane manufacturers and four engine manufacturers on the approved list; and it is significant that during the last 12 months those British manufacturers have produced 14 new types of planes for the Government air forces or the subsidized Imperial Airways. As is the case with all other European governments, the British do not force their manufacturers into competitive bidding for aircraft orders. The Government negotiates contracts with the companies maintaining competent design staffs and adequate manufacturing facilities. On the rare occasions when manufacturers are given contracts to manufacture from another's designs the originator of the design is reimbursed. This knowledge that they will be reimbursed for the outlay has inspired the British manufacturers to carry on expensive development work.

To promote the sales of British aircraft products abroad the foreign sales are financed in London, with the active cooperation of the Government whenever necessary, and in accord with the policy of building up a manufacturing reservoir always available for British needs.

In 1934, when the United States was taking the lead in discouraging American firms from disposing of aircraft products abroad, spokesmen for the British Government hastened to reassure nationals that they had nothing to fear; they would not be discouraged. Sir John Simon, Foreign Secretary, said: "Our diplomatic help is given when a foreign State has announced its intention to purchase abroad. In that case we do our best to see that British firms get a proper opportunity."

When a United States Senate munitions investigating committee held hearings in Washington in the fall of 1934, statements in the press made it appear that the committee was about to divulge facts which would cast aspersions on certain South American governments, and further, led the world to believe that the Senate committee might soon bring about an embargo on exports of all aircraft products. Fear that their honesty might be questioned if they purchased further supplies from the United States, and moreover, that, having purchased, an embargo at some future time might prevent their procuring replacements and parts, led the South American customers to look elsewhere for equipment. As usual they were able to purchase it in England; and Sir John Simon explained: "We are convinced that the practical way to deal with this matter is not by national legislation that seeks to abolish private manufacturers, but by regulation and control which can be in accordance with an international treaty negotiated in Geneva and signed and obsolved by all signatory States."

Great Britain plans to spend about $55,000,000 for new aircraft equipment during 1935. Her fighter squadrons charged with the defense of London, or any other mission to which they might be assigned abroad, are to be equipped with Gloster Gauntlet interceptor planes having a top speed of 228 miles an hour at fighting heights. At the same time the Hawker Super-Fury fighter, of which much was heard in 1933 when it was brought out in experimental form, is to be further developed in an effort to create a fighter capable of speeds as high as 250 miles an hour, which would be only a few miles slower than certain pursuit types developed by American manufacturers for the U. S. Army Air Corps. All Britain is enthusiastic at the prospects for stratosphere development within the next two years; and experiments are under way seeking to produce machines capable of long flights six miles high. One experiment contemplates a stratosphere flight from London to India within a day.

Creation of more private flying clubs with machines supplied by the Government, transportation of all first class mail by air in the British Isles, except where better schedules could be maintained on the surface, and the development of long range ocean flying boats for a British transatlantic service were among other projects for 1935.

French Air Power

France and England carried on a running controversy in the press during 1934 as to which was more vulnerable to air attack. The British

THE GREAT LAKES AMPHIBION

Navy XSG-1 observation amphibion, with Pratt & Whitney Wasp Junior engine, developed by Great Lakes Aircraft Corporation.

could not see the French point of view until they were told candidly that, according to General Lauré's calculations, neighboring air forces could drop 865 tons of explosives on Paris in a single day, as compared to the total of 11 tons falling on the city throughout 1918.

The French air forces have within the Paris defense area 240 bombers, 240 pursuit and 620 armed observation planes, ready for action, with about 100 per cent reserves available for service within a few days, and, further, a secondary reserve of approximately 640 obsolescent planes in warehouses. The French also have approximately

760 combat planes elsewhere in France and in the colonies—a total of about 3,600 combat planes.

Inspired by the policy of the Hitler Government in rearming Germany the French Government has decided that its air force equipment by and large is too obsolete for safety. It plans to junk hundreds of planes in 1935, replacing them with new machines.

A part of the program provides for production of 270 new bombardment planes to be developed from American twin-engine low-wing cabin monoplane types operated on the air lines of the United States, the American commercial ships having proved faster and capable of longer non-stop flights at higher altitudes than similar types in the French air forces. No less than 300 of the Navy's aircraft are to be scrapped and replaced by 360 new machines.

The 25 French aircraft factories which have grown up around Paris are to be decentralized under the new plan. The Government has allocated $16,500,000 to defray the cost of moving these private factories, to be assured that they are relocated at strategic points where a series of raids cannot blow all the production facilities out of existence. The French Government plans to spend $65,000,000 for new aircraft equipment in 1935, and each private airplane manufacturer is to be encouraged to develop his plant into an independent unit, that he may continue to turn out planes or motors without waiting for fabrication of parts elsewhere. The program includes continuous production schedules in all factories, the number of planes to be gauged by the extent of airplane construction in Germany. French officials insist that they should maintain at all times 50 per cent more combat planes than those known to be available to the German air forces.

In order to build up their aircraft industry to what they believe to be a strength consistent with safety the French have embarked upon an intensive campaign to increase production facilities. Contracts for new equipment are negotiated with the manufacturers. They are paid liberally for their experimental work. The creator of a design is paid a royalty when his design is turned over to another manufacturer. As a rule, however, the creator of a design receives the production contracts. He is not forced into cutthroat bidding. The French Government encourages all manufacturers to maintain adequate plant facilities, including experienced design staffs. France long ago discontinued the practice of attempting to build aircraft in plants owned or operated by the Government. The personnel on the public payrolls could not work together over the long period of years very often necessary to devise new design and construction methods. Then too, France recognizes the fact that if she intends to maintain adequate manufacturing facilities available in an emergency, she must either rely on a number of manufacturing plants partly supported by commercial sales in the home market and abroad, or otherwise set up a gigantic nationalized military aircraft industry.

France is only one of the European nations to have learned years ago that the design, construction, test and development of all types of aircraft and engines involve not only the manufacture of the machine itself but rather the conception and constant development of about 1,000 different kinds of fabricated parts, materials and accessories which must be carried on outside the aircraft plant proper by other manufacturers. To nationalize one branch would be impossible without nationalizing hundreds of other accessories branches in the industry.

To provide another outlet for her private factories and keep them

FOR FIRST LINE DEFENSE

One of the fast Boeing P-26A, Pratt & Whitney Wasp-powered pursuit planes in Air Corps service.

operating with fully trained staffs of designers, engineers and trained workmen, France encourages export sales to the fullest possible extent. The Air Ministry releases a military type for export almost as quickly as the experimental model is completed, particularly if the country of destination is on friendly terms with France.

The air transport lines of France were merged into one combine, Air France, in 1933. Its division operating in South America between Argentina and Chile received a subsidy of $3.40 for every mile flown in 1934. The other divisions to European capitals, North Africa and

French Indo-China were similarly subsidized. The South American division received a total of about $8,000,000 in subsidies in 1934. Officials of Air France planned to follow the Germans across the South Atlantic with a regular flying boat service in 1935. The first of the proposed fleet, the Lieutenant de Vaisseau Paris, was flying on test hops early in 1935, and it appeared that France would establish her service ahead of the British, and also the Royal Dutch Airlines which was planning a transatlantic service to Dutch Guiana.

German Air Power

At the beginning of 1935 Germany presented an example of the fact that treaties do not of themselves prevent a nation's arming in the air.

The Treaty of Versailles, which the United States did not ratify, prohibited Germany from producing military planes and engines or maintaining an air force. The Reich obeyed treaty injunctions until the Hitler Government came into power at the end of 1932. True, a number of airplane factories, such as Junkers, turned out transport planes for the Luft Hansa system. German engineers went abroad and opened factories, devoting their talents to all kinds of aircraft. German technicians helped Soviet Russia launch her aircraft development program. Under liberal subsidies German factories produced large flying boats, huge multi-motored land planes and remarkably efficient gliders. Soaring societies were established throughout Germany. The technical schools taught aviation engineering, and the Government, State, municipal and industrial laboratories explored the science of flight in all its varied and wonderful phases. For many years after the armistice the German aeronautical effort was largely academic, with the exception of its pioneering efforts in all-metal transport design and the operations of the "Graf Zeppelin."

When the Hitler Government first assumed power, with General Hermann Goering in charge of aviation, all Europe was curious as to what it would do with air armament. The Germans had a reputation for thoroughness. Goering during the war had succeeded the famous Richthofen as commander of his squadron when the leader was shot down. Goering was a staunch believer in air power. What would Germany do? The answer was partly written at the beginning of 1935.

Germany has the nucleus of an air force. Within the space of two years of the most intensive effort Germany, with 17 airplane factories and nine engine plants, has succeeded in turning out some 600 military airplanes. With the exception of several experimental types, including three light bombardment and one heavy bomber, none of the German planes has been developed to a state of speed and performance which would warrant matching strength with either the French or Polish equipment. The experimental types, including the Heinkel two-place light bombardment machine, have top speeds of about 190 miles an hour. Auxiliary equipment still is in an experimental state. The reason lies in the fact that when a nation falls behind its neighbors in the performance of its aircraft, at least two years are required before it can get back into full stride and maintain technical standards on a parity with others.

General Goering, at the beginning of 1935, stated that the German program was barely started, that Germany needs combat planes in number at least equal to 40 per cent of the combined air force strength of France, Poland, Czechoslovakia and other neighbors. He said that Germany is surrounded by nations possessing 6,500 war planes cap-

BELLANCA ARMY BOMBER

With two Wright Cyclone engines and Curtiss controllable pitch propellers, it was developed for the Army by the Bellanca Aircraft Corporation.

able of reaching Berlin within two hours of flight. His program for 1935 is what he termed an answer to the challenge of unsettled conditions throughout the world.

The German program contemplates an expenditure of $83,000,000 for air defense in 1935. That is nearly four times the 1934 expenditure. Every responsible manufacturer in Germany has been selected for special production contracts on planes, motors and accessories. Some companies are turning out gigantic multi-engine planes, fit for either transport or bombing.

The German Air Defense League has been reorganized into 1,600 local groups responsible to a headquarters in Berlin, under the personal direction of General Goering. The country is divided into 16 air centers, each having its own program for training pilots and organizing squadrons. To facilitate training and provide the necessary number of planes and engines for all training centers, some equipment is purchased abroad, notably in England which has sold hundreds of engines to Germany, and which is scheduled to receive orders for 300 high-powered engines in 1935.

The aircraft factories were placed on a war production basis at the beginning of 1935. At least two factories had production schedules for two complete light bombardment planes a day each. The workmen were paid bonuses, and cautioned to observe the strictest rules regarding secrecy. The drafting rooms, engineering laboratories and testing stations were placed under armed guards day and night. German shipyards were given orders for flying boat hulls of huge dimensions; and there too the details were being jealously guarded.

Piecing together information from sources that should be reliable, and taking General Goering at his word, that he intends to have in

NEW NORTHROP BOMBER

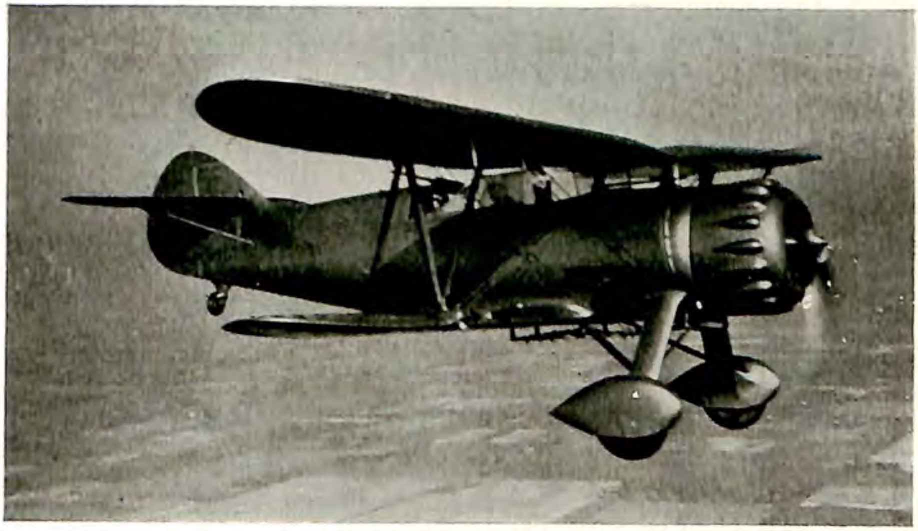
All-metal monoplane carrying six heavy bombs.

1936 at least 40 per cent of the 6,500 planes of neighboring States which he says could fly to Berlin in two hours, one concludes that the German program contemplates at least 2,600 combat airplanes within the next two years. Close observers believe that Germany can produce nearly that number in two years, and have them as efficient in performance qualities as the products of the established military aircraft industries of other nations. At the same time the German air transport program calls for German flag lines operating over the principal international trade routes of the world.

Italy's Air Power

Despite her rather modest civil aviation, with relatively few private planes and her air transport lines limited to her own cities, Italy in many ways ranks as the fourth air power of the world. The Italian air forces possess approximately 2,300 combat planes, including fighters, light bombardment, armed observation and heavy bombers. That places Italy numerically behind Great Britain, France and Russia. In technical performance, however, Italy is ahead of Russia, but is surpassed by the United States in the speed and performance of military and commercial aircraft and in efficiency of naval air forces. Italy's air power has been developed from the viewpoint of her own possible strategic needs, however; and it is ample and efficient for whatever purpose she may need it within the near future.

The Italian program is extensive. After several years of development work on high horsepower engines, during which Italy has re-



WACO D FIGHTER-BOMBER

Without its machine guns in lower wings and rear cockpit and bomb racks underneath, this Whirlwind-powered Waco was convertible as an ambulance plane.

tained the world speed record, breaking her own record for speed in 1934 and taking from France the world altitude record, her 1935 program contemplates newly designed aircraft to meet the motor development.

The Government plans to spend about $100,000,000 on the air forces in 1935. New equipment is to be built in Italy by its 14 private aircraft and six engine manufacturers. Production orders will be let without competitive bidding. A total of 420 high speed and high altitude fighters, 330 multi-engine bombers and some 400 armed observation planes are to be built before the end of 1936.

It is significant that Premier Mussolini, with his many cabinet posts and manifold duties as head of the Government, also retains the portfolio of aviation. Under Government patronage Italian aircraft manufacturers are encouraged to market their products abroad. Sales to foreign nations are financed by Government credits. The Government finances foreign aircraft sales up to 70 per cent.

In that connection the following Associated Press dispatch from Rome on November 22, 1934, is of interest: "Italy is getting ready to drive the United States out of the Chinese airplane market, it was learned today. A consortium has been formed by the three largest Italian aircraft manufacturers, under Government jurisdiction and with Government support, to sell Italian planes to China at cost. The Government will appoint Lieut. Furio Drago to head the Italian aviation school in China, which hitherto has specialized in bombing instruction, but now will branch out into all lines of aviation instruction in competition with the American school. This nation (Italy) has already sent 20 bombers to China and is manufacturing more at Turin and Milan."

The Italian Government is making a survey as to possible expansion of air transport service through Europe as far north as London. Observing that the British, French, German and Dutch air transport systems have steadily built up mail, passenger and express traffic, at the same time reducing rates, the Italians believe that the public soon will create a very great demand for scheduled flying service: and they are looking into the possibilities for extension of Italian lines in 1935.

The Russian Development

Nowhere in the world has aviation developed so rapidly and with such intensity of effort as that which has grown up in Soviet Russia during recent years. The Russians had an aviation program in their first five-year plan. The world knew it would not work, because of the technical difficulties involved at that time, lack of materials and the relatively few persons trained in aviation technique. Surprising then were the achievements which could be seen by visitors in Russia during 1934. One observer counted 535 combat planes in a massed demonstration over Moscow, and 165 of them were heavy bombers. Another visitor saw a new multi-engine bomber turned out of a factory every day over an extended period.

The Red Fleet maintains a number of air bases close to the frontier in Europe. Each base is equipped with hundreds of combat planes.

The largest land plane in the world, the "Maxim Gorky," was built in a Russian factory and successfully flown in 1934, without too much significance, however, because experts know that over-sized land planes are unfitted for practical operations unless there are sufficient numbers of large fields for them to get into during a forced landing. Russia was the scene of many serious accidents in 1934; but this did not deter the officials or the masses which are more air-minded than any other nationality in the world.

Conservative estimates credit Russia with at least 3,000 combat airplanes. Several great collectivized aircraft factories are turning out planes at a rapid rate of production. The factories are said to be the largest of their kind in the world, claiming the services of thousands of workmen, including both men and women. The Soviet air transport lines operating over 31,000 miles of routes in Russia are carrying full loads of passengers and express, nearly all of the passenger traffic, with the exception of foreign visitors, being Soviet officials traveling on Soviet business.

DOUGLAS ARMY OBSERVATION Y1O-43

A high-wing two-seat high altitude plane with Curtiss Conqueror engine.

Workers flying clubs are being organized and the Government is providing planes for flight instruction. The flight bases of the Red Air Fleet are kept closely guarded so that only trusted officials know the exact number of planes and pilots regularly stationed at a certain base. The movement of Red Air Fleet planes toward the Vladivostok area has been more pronounced in recent months than during any previous period. At isolated posts north of Manchukuo large detachments of planes are concentrated. Russian officials in responsible positions admit that the Soviet air force in the far eastern section of Siberia has available more than 600 bombing planes capable of carrying a half ton of bombs and flying non-stop for more than 1,500 miles.

The factories in the Soviet Aviation Trust include plants for planes, engines and accessories. Most significant is the fact that the majority of plants are equipped with laboratories which carry on a certain degree of research and experimental work. Three engineering research institutes are operating on a huge scale. The Engine Institute, for example, covers 30 acres, and is equipped with modern machinery and facilities. It has the services of 250 engineers. Russia is beginning to produce its own aircraft metals. The Central Institute of Aero Hydrodynamics, with 300 engineers and scientists, is possibly the largest of its kind. The Metallurgical Institute is expanding rapidly, and soon will include all modern facilities.

Contrary to outside opinion about Russian communism in industry, the Soviet aircraft plants follow the practice of capitalism in providing an incentive for the people who do the work. Each factory is given contracts directly from the military, transport and various bureaucratic services. For the most part each factory is built from the ground up, both in facilities and personnel. Thus it invariably is a self-contained social and industrial unit, with all activities revolving about the factory.

Planes and parts are produced on a compensation basis. The workers are paid for their labor, as they are in other countries. Production costs also include an additional 16 to 25 per cent of the payroll which is used for recreation, clubs, summer camps and other social activities. As producers of equipment for the national defense the Soviet aircraft factories are operated under the most liberal political conditions, the workers being treated as high-class specialists and technicians, which they are, on which rest the defense of the country. Each factory maintains its own educational programs ranging from trade schools, through technical preparatory school and an aviation academy comparable to the average technical institute in the United States.

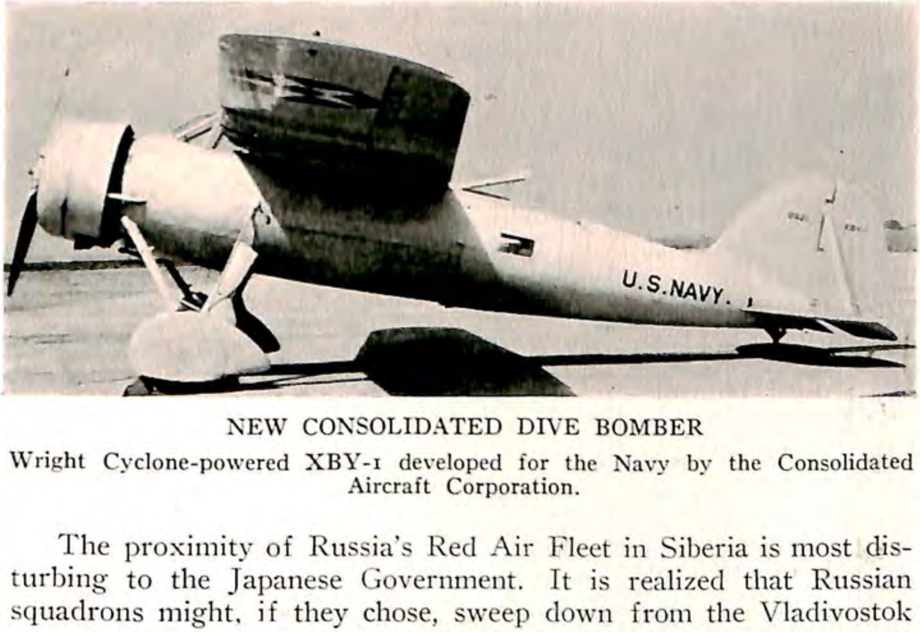
At the beginning of 1935, 36,000 students were enrolled in the schools of the aviation industry.

Japan's Air Power

At the beginning of 1935 the Japanese Government was working on an aviation development program calculated to strengthen the nation's position on international trade routes in the Pacific and at the same time build up the Army and Navy air forces to a strength which would assure a certain degree of protection from Russia's Red Air Fleet in case of war.

Japan's Army and Navy air forces have available for immediate service approximately 1,850 combat planes, including reserves. That number represents an increase of 350 modern fighting planes, besides replacements, in 1934. The 20 Army squadrons have been equipped with new fighters, bombers and armed observation types. The Navy aviation forces have more long range bombers and fast scout planes.

Plans for 1935 include larger procurement orders for the seven private airplane and two principal aircraft engine factories. The naval air forces are being reorganized and equipped to comprise 39 full squadrons with reserves by the end of 1936. The Army is to receive 500 more combat planes before the end of 1935, if possible. The 1935 aircraft building program for both services contemplates an expenditure of $10,000,000 for the Navy and $20,000,000 for the Army. Army air squadrons with all auxiliaries for field service, including transport aircraft to keep them in touch with the supply bases in the rear, are stationed at permanent posts throughout Manchukuo.



NEW CONSOLIDATED DIVE BOMBER

Wright Cyclone-powered XBY-1 developed for the Navy by the Consolidated Aircraft Corporation.

The proximity of Russia's Red Air Fleet in Siberia is most disturbing to the Japanese Government. It is realized that Russian squadrons might, if they chose, sweep down from the Vladivostok area and bomb the Japanese industrial centers by flying only 700 or 800 miles.

Japan is building a huge air base at Nemuro on Hokkaido Island, 600 miles northeast of Vladivostok. Another air defense center is being set up at the naval base on the Sea of Japan, and it will maintain squadrons with hundreds of fighter planes to intercept the Russians if they ever come down toward the Japanese industrial districts. Another gigantic air base is being completed at Ominato on the northern end of Honshu Island, 500 miles east of Vladivostok; and here are stationed a number of squadrons, with bombers, scouts and fighters, for the purpose of raiding Russia's bases in the event of war.

The Japanese commercial program is no less extensive. It includes eight separate projects. The Government is helping to start an air mail, express and passenger air line service from Taihoku, Formosa, to Singapore, by way of the Philippine Islands. Another commercial service, if present plans materialize, will be operated between Sappora and Saghalien, and another between Sappora and Kamchatka. The Government also planned to set up a commercial service between Tokio and the Bonin Islands.

The intensity with which the other air powers were striving to win first place in both commercial and military aviation made the report of the Federal Aviation Commission most opportune, because it provided for a comprehensive national aviation policy and a definite program, which, if adopted by the Government, would assure the United States a strong position in the air.

INTER-ISLAND AIRWAYS NEAR HONOLULU

One of the Sikorsky Wasp-powered S-38 transports in regular passenger service between the Hawaiian Islands, over Makapuu Point, Oahu.

CHAPTER III

REPORT OF FEDERAL AVIATION COMMISSION

Thoroughness of the Commission's Work—Congress Offered an Admirable Foundation for a National Program—Recommendations.

INSPIRED by the overwhelming popular demand for a more clearly defined national aviation policy to remedy both the confusion concerning the state of the national defense and the chaotic conditions which had disrupted air transport service after the cancellation of the air mail contracts, Congress took preliminary action. It incorporated in the Air Mail Act of June 12, 1934, (see appendix for full text) a provision for appointment by the President of a Federal Aviation Commission of five members "to be appointed by him, not more than three members to be appointed from any one political party, for the purpose of making an immediate study and survey, and to report to Congress not later than February 1, 1935, its recommendations of a broad policy covering all phases of aviation and the relation of the United States thereto."

President Franklin D. Roosevelt appointed the following: Clark Howell, chairman; Edward P. Warner, vice chairman; Albert J. Berres, Dr. Jerome C. Hunsaker and Franklin K. Lane, jr., with J. Carroll Cone executive secretary. The Commission immediately organized a statistical and research department in charge of Joseph T. Hartson and J. Howard Yeomans.

The sincerity and ability of all members of the Commission were demonstrated from the very beginning of their labors. They worked day and night. Their comprehensive program to cover the field thoroughly, their apparent eagerness to give everybody a hearing and their early demonstration of a broad knowledge of the complex problems involved, those factors quickly won for them the whole-hearted cooperation of all persons interested in the development of aviation for both the national defense and economic welfare of the United States.

The Commission's work was summarized in a report of 254 pages, its 102 specific recommendations being set forth and the reasons explained with exemplary thoroughness and a clarity which anybody might understand. It offered Congress an admirable foundation on which to build a great national aviation program.

On January 31, 1935, President Roosevelt sent the Commission's report to Congress.

How the Commission Worked

The manner by which the Commission arrived at its facts, conclusions and recommendations are set forth in the introduction to its report as follows:

General Introduction

"In accordance with the provisions of the Air Mail Act enacted into law on June 12, 1934, the President of the United States designated us to serve as members of a Federal Aviation Commission to make an 'immediate study and survey, and to report to Congress not later than February 1, 1935, its recommendations of a broad policy covering all phases of aviation and the relation of the United States thereto,' as directed by the Act. We proceeded immediately to organize, and to collect material and initiate studies bearing upon the accomplishment of our assigned purpose. In the course of August, the Chairman of the Commission visited Europe and made an intensive personal study of the aeronautical status and of the governmental administration of aeronautical matters in four of the major European countries. At the same time a majority of the other members of the Commission embarked upon an aerial tour of the United States and the countries of the Caribbean which took them over a total distance of 13,000 miles in four weeks of elapsed time, with stops in more than half of the states of the Union and in ten foreign countries, and gave them an opportuntiy of personally inspecting a majority of the important Air Corps and Naval air stations of the United States; most of the principal bases of air-transport operation; most of the leading aircraft and engine factories; and a miscellany of airports, flying schools, research laboratories, and other aeronautical undertakings; and of conferring informally with personnel at all those establishments.

"On September 24th we opened public hearings, which continued over the next six weeks and in the course of which we heard 102 witnesses and compiled 3,519 pages of typed record. Executive hearings on matters important to the national defense succeeded the public ones, and during that section of our work 89 further witnesses were heard and another 1,009 pages of record were secured. In addition, certain matters of a particularly confidential nature were heard at full sessions of the Commission but without the making of any stenographic transcript. Testimony has been received from members of the Cabinet, from members of Congress, from each branch of the government service actively interested in aviation, from every substantial aeronautical interest and branch of activity, from representatives of organizations patriotically devoting themselves to the promotion of America's aeronautical welfare, and from a large number of individual witnesses who presented recommendations based on individual experience and long consideration of the subject.

"Many of the witnesses have preceded their verbal testimony by the submission of more or less elaborate briefs, and briefs and thoughtful letters of suggestion have been received from a great many others who did not appear as witnesses. Many of our communications have come from writers who have had no interest in the subject except as American citizens anxious that the nation should receive the greatest benefit, on the fairest terms, from this great new instrumentality, limitless in its potentialities of peaceful commerce, of war, and of

THE FEDERAL AVIATION COMMISSION

Left to right—J. Carroll Cone, executive secretary; Dr. Jerome C. Hunsaker, Franklin K. Lane, jr., Clark Howell, chairman; Edward P. Warner, vice chairman; and Albert J. Berres.

further expansion of the life of the average individual and of his further emancipation from barriers of time and space.

"The matters laid before us have been the subject of constant investigation by departmental boards, by Congressional committees, and by commissions of special Presidential appointment, from 1919 down to the present time. There have been almost a score of such inquiries, from that made by the Crowell Commission, which went to France immediately after the war to study the bearings of the war experience upon the future development of American air policy, down to the Baker Board, which submitted its report some two weeks after the date of our own appointment. We have had the work of our predecessors upon which to build, and we have given careful attention to their record and their conclusions, as well as to the material that has been laid directly before us in the course of our own hearings and investigations. We have tried to give due weight to all of the views that have been represented, whether by individuals or by boards, commissions, and committees preceding our own. The recommendations that follow this introduction, and the reasoning that has led up to them, are the integrated result of all that we have been able to learn from any source of the present aeronautical situation and of the processes through which it has been developed.

"How much does the aeronautical activity of the United States amount to? How large an industry devotes itself to the making of aeronautical products and the operation of aircraft? We asked ourselves the questions at an early stage of our study, and though we have made no attempt to secure exact figures we have at least approximated to an answer. The total of original privately financed investment in the aeronautical industries, almost all of it put in between 1927 and 1929, appears to have been some $550,000,000. To that, we have added another $90,000,000 for the investment in municipal airports. Much of the investment was disastrously reckless. Much of it has disappeared by the attrition of depression. There remains some $180,000,000 of current value in commercial activities.

"Some 15,000 men and women are directly employed in the manufacture of aircraft and engines and parts and accessories; 12,000 in the operation of air lines and airports and flying services. Thirty-four thousand more are in the government's aviation services, 93 percent of them in the Army and Navy. A total of about 61,000 gainfully employed Americans find aviation their chief vocational interest.

"In the course of our study, by personal inspection and interview and by formal hearings, certain facts have become apparent. It has become apparent that there exist in the United States today air transport organizations at least the equal, and in certain respects very definitely the superior, of any others in the world; that American air transport equipment as developed in the last three years is generally recognized as occupying a position of world leadership, and that European constructors, once prone to scorn American aeronautical activities, have been visiting our shores in steadily increasing numbers as earnest seekers after information on the methods whereby such remarkable characteristics are obtained; that American transport lines handle a larger volume of traffic than the lines of all the rest of the world combined, and with a safety record unexcelled by the lines of any nation and quite unapproached by most. It appears from all that we can discover of the record at home and abroad that nowhere else are passengers, mail, and goods carried with such regularity and speed, by day and by night, with such comfort and convenience to the user of the service on anything like so broad a network as that provided by our major air lines. It appears, on the other hand, that a considerable part of the nation's air transport system is running at a steady loss, and that operations cannot continue indefinitely under present conditions.

"On the side of national defense it has been agreed in the first place by all witnesses and all authorities, and it seems to be widely recognized by expert opinion in other parts of the world, that American naval aviation represents the finest adaptation of aircraft to the role of service as units of a fleet that the record of world experience can offer. Even the severest critics of American naval policy in respect of the handling and distribution of air forces are united in praise of the success of the present personnel in working out the operating problem that has been given them, and of the high quality of their seagoing equipment.

"The situation of the Army Air Corps cannot be disposed of so

THE SPERRY SOUNDPROOFING SYSTEM

First step in soundproofing a Douglas transport. Note the acoustical filter connected to the exhaust ventilator in the ceiling.

categorically. It has had its serious internal problems, and its problems of inter-relationship with other branches of the Army and with other departments of the government. We have commented upon its status and the way in which it appears to be developing in much greater detail in another section of our report (pages 119-122). Certain changes in the organization of the Air Corps and in the manner of its training have appeared to be desirable to increase its flexibility of employment and to increase its readiness for the infinitely varied strains of war. For the professional ability of its personnel, however, and for the qualities of most of its aircraft and engines, we have only praise. We do not believe that there is a finer military flying man in the world than the typical graduate of the Air Corps Training Center, and his capacities increase with increased Service experience. Where the Air Corps personnel have appeared to fail in giving a good account of themselves, it has been the result either of inadequately varied experience after graduation from the training center, of an organization lacking in the flexibility necessary to adjust itself immediately to the efficient meeting of emergency conditions, or of the inefficiency or lack of certain special items of equipment. Upon some of these matters we offer specific recommendations in the succeeding pages.

"We have more to say in another connection, also (page 127), of the general qualities of American aeronautical material. A general introductory summary might declare that in respect of those types of equipment upon which we have concentrated special attention there have been developed products unexcelled, and in many cases unequalled, elsewhere; that where we have given a low priority to a particular line of development which other nations have treated as of major importance, we have taken an inferior position; and that in some cases the judgment of military and naval authorities in relegating certain lines of development to an inferior status in their plans or in discarding them entirely has been shown by the outcome to have been sound, while in other instances the decisions taken appear to have been questionable or definitely unwise and should be reversed without delay in order that accelerated progress may be sought in fields once taken as unimportant but now seeming to have a major significance.

"In general terms, we have seen no evidence that American industrial organizations or American engineering talent applied to the development of aircraft are in any way inferior in capacity or in alertness to those of the rest of the world. The evidence seems in general to point the other way, and to indicate that whatever line of development is made the subject of concentrated attention here and given suitable governmental support will progress at least as briskly as under any other flag. The evidence certainly points to the high quality of

American research and to the existence of a close and sympathetic relationship between those engaged in doing research work and those, either in the manufacturing industry or among aircraft operators or in the aircraft-using government departments, for whose ultimate benefit the research is carried on.

"Upon practically all of these matters, and many others not mentioned in this introduction as well, we have reached conclusions and have definite recommendations to submit. They follow. In the interest of simplicity and of easy discovery of the line of reasoning upon which we based each recommendation, we have first printed the recommendations as a body (pages 7-39), grouped by general subdivisions of the field within which our inquiry was pursued, and subsequently re-

THE MARINE CORPS AND THE "MACON"

Boeing F4B-4 Wasp-powered pursuit ships of the U. S. Marines frame the Navy airship during a pause at Miami, Fla.

printed them one by one, with appropriate discussion directly attached to each (pages 41-247)."

Recommendations

The Commission made the following comment at the end of its report:

"In making the studies upon which our recommendations are based and in preparing the statistical and other material that appears in our discussions we have had the assistance of a small but loyal and highly efficient staff of aeronautical experts, statisticians, and clerical workers. We have also had the help of Colonel John H. Wigmore, Dean Emeritus of the Northwestern University School of Law, and of Professor Fred D. Fagg, Director of the Air Law Institute. We wish to express our acknowledgment to them, as to the witnesses that have appeared before us and to those who have conferred with us or furnished us with statistical and historical material pertinent to our task."

The full text of the report was printed and bound as Senate Document No. 15, 74th Congress, First Session, and was available to the public. Space permits only publication of the recommendations in The Aircraft Year Book. They are printed with the page references in the official document, as follows:

Air Transport

"(1) It should be the policy of the United States to maintain a position of world leadership in air transport, and to lend such aid as may be necessary to insure that the most modern and efficient equipment and methods shall be applied on American domestic and foreign air lines. (43)

"(2) There should be no legal limitation upon the growth of air transport. (48)

"(3) The carriage of mail should be put on a commercial basis, with payments to lines within the amount received by the Post Office. Whatever additional sums are for the time being necessary to maintain and develop adequate transport services should be allocated specifically to that purpose by the government. (49)

"(4) There should be a close and continuous governmental control of the financial aid having to be given to air lines. Certificates of convenience and necessity should be issued under proper safeguards and specifications. Provision should be made to specify a minimum quality of service and a minimum frequency of schedule on air lines. Rates of fare should be subject to governmental approval, and the financial structure of air lines should be supervised and their general conformity with the letter and spirit of the law watched over by appropriate governmental agencies. For these purposes we suggest the creation of a nonpartisan commission, described in detail in another section of our report. (52)

"(5) All regular domestic scheduled transport operations should require a certificate of convenience and necessity, to be issued by the commission hereinafter proposed. Such certificates should not be cancelled except for good cause without equitable compensation to the holder. (54)

"(6) Direct Federal aid should not as a matter of course be extended to all air lines having certificates of convenience and necessity, but only to such air lines as are deserving of such aid in the public interest. (57)

"(7) Every air line operating on December 1, 1934, should be considered to have a presumptive right to the receipt of a certificate of convenience and necessity. (58)

"(8) The development of new airways and the provision of navigation facilities thereon should be a responsibility of the Department of Commerce, subject to commission approval. (59)

"(9) It should be the general policy to preserve competition in the interest of improved service and technological development, while avoiding uneconomical parallelling of routes or duplication of facilities. (61)

"(10) The Post Office Department should be free to use any service that exists, without being limited by specific contracts. (63)

"(11) The rates to be paid by the Post Office Department to air lines

AMERICAN AIRLINES VULTEE

The high speed 10-place, Cyclone-powered transport produced by Airplane Development Corporation.

carrying mail should be fixed by the commission hereinafter proposed. (64)

"(12) The direct financial aid given to air lines should be under the constant control of the commission, and subject at all times to revision as technical improvement, changes in operating conditions, or the needs of the particular territory served may require. The formulas under which aid is extended should be such as to encourage good management and technical progress, and to stimulate rapid evolution towards complete self-support and independence of direct governmental aid. (67)

"(13) The control of a multiplicity of air lines through holding companies should be prohibited. The ownership of stock in air lines by corporations engaged in other activities, or the interlocking of diverse aeronautical interests, should be strictly controlled by the commission hereinafter proposed. Nothing should be permitted which would in any way reduce the effectiveness of any competition, the preservation of which could serve the public interest, or which would interfere with the exercise of the government's regulatory functions. Subject to these paramount considerations, the door should be left open as far as possible for a free flow of investment capital into air transportation in the interest of a strengthening of its structure and an improvement of its facilities. (69)

"(14) Air lines should be made eligible, as railroads now are, for loans from the Reconstruction Finance Corporation upon suitable security. (72)

"(15) In connection with the placing of the carriage of air mail upon a strictly commercial basis, involving no net financial burden upon the Post Office Department, there should be authorization for experiments with special classes if light-weight air mail matter carried at a low rate, in the interest of an increase of the total volume of air mail and the gross receipts of the service. (73)

"(16) It should be a duty of the commission hereinafter proposed to require periodic financial and operating reports from all air lines, to examine into their status at suitable intervals, and to make public record of such reports. (75)

"(17) It should be the policy of the commission herein proposed to subscribe to the principles contained in Section 7 (a) of the National Industrial Recovery Act, and to foster adherence thereto, in all branches and activities of air transport; and to use its influence to bring together employers and the duly chosen representatives of their own choosing of the several crafts and callings with a view to agreeing upon a method of procedure to be followed in the handling and adjustment of all questions involving wages, hours, and conditions of employment. (76)

"(18) The control, in the interest of public safety, of the minimum standards of equipment and the operating methods and organizations and ground facilities of civil aeronautics should continue approximately as at present, but under the jurisdiction of the commission hereinafter proposed. (77)

"(19) There should be no attempt to require the inclusion of military features in the design or equipment of transport airplanes. (79)

"(20) Air transport in American territories and possessions should be developed, and in particular there should be an increase of air transport service and ground facilities available for air navigation in Alaska. (80)

"(21) The national policy of stimulating air transport should extend to the promotion of American-flag air lines connecting the United States with our territories overseas and serving our major trade routes

AMOS 'N ANDY

and, not Madame Queen, but Stewardess Hazel Cochran of United Air Lines, arriving in Chicago from New York.

to foreign countries. The time has now come when air transport can be regarded on a world-wide basis, and in particular when the early inauguration of regular trans-oceanic services by aircraft can be foreseen. (82)

"(22) The Secretary of Commerce should study ways and means to foster American air lines to foreign countries and recommend to the Congress, from time to time, legislation governing the extension of financial aid. Consideration should be given to the nature of similar aid given the merchant marine, with a view to developing a co-ordinated policy. (84)

"(23) The policy of making available for the carriage of mail all American air lines rendering regular service, and of payment by the Post Office Department to the air lines only for service rendered, should be extended to future arrangements for foreign air lines. The rates of payment to the air lines for the carriage of mail should be fixed by the commission hereinafter proposed, and such additional aid as may be necessary to build up and maintain a proper service under the American flag outside of the boundaries of the United States should be allocated by the commission. (85)

"(24) No changes should henceforth be made in the existing foreign air-mail contracts except with the approval of the commission hereinafter proposed. (87)

"(25) The governmental administration of foreign air transport should as far as possible be kept similar to that of the domestic air line system, but with such modifications as may be clearly necessitated by a fundamentally different political, legal, and operating status. The status of American air transport in foreign fields competing with foreign-owned air lines should in general not be one of competition between American lines, but of carefully-controlled regional monopoly. The general powers of the commission hereinafter proposed in connection with foreign air transport should be essentially similar to those which it enjoys in the domestic field, and the commission should have the additional power of stipulating for fixed periods certain minimum and maximum conditions of service and of governmental aid in the interest of stability of the undertaking and of encouragement of large investment in ground facilities. (88)

"(26) The policy of the United States should be to support and assist American air lines in their relations with foreign governments and with foreign competitors. It should be considered as in the public interest to regulate and control foreign air lines entering the United States with the purpose of securing for American air lines equality of opportunity in foreign countries. (91)

"(27) It should be provided by legislation that American air lines outside the continental United States should have the same opportunity now given by the Shipping Act to American steamship lines to enter into trade and traffic agreements with their competitors. Such agreements should be subject to approval by the commission hereinafter proposed. (92)

"(28) The existing regulations for customs clearance, immigration,

PENNSYLVANIA AIRLINES

One of the Wasp-powered Boeing 247-D transports operated by the pioneer line between Washington, D. C., and Detroit.

and public health clearance should undergo early revision and the greatest possible measure of simplification to meet the special problems of aircraft operation in international service. (93)

"(29) As a measure of immediate emergency, the present Air Mail Act (Public 308, 73rd Congress) should be amended so as to empower the Interstate Commerce Commission to revise existing air mail rates either upward or downward as the facts may warrant, and subject to such revision existing contracts should continue in force until such date as the commission hereinafter proposed, in the exercise of its full powers and duties, may prescribe. (95)

"(30) As a measure of immediate emergency, the provisions of the present Air Mail Act (Public 308, 73rd Congress) regarding the designation of primary and secondary routes, and the prohibition of an air line from holding more than one primary and two secondary route contracts, should be amended so as to postpone their effective date to January 1, 1936. (97)"

Miscellaneous Civil Aviation

"(31) It should be the policy of the government to impose a minimum of regulation upon private flying, and to determine that minimum with reference to public safety alone. The technical regulation of aircraft and personnel engaged in commercial activities should remain substantially as at present. (99)

"(32) In the interest of improved utility and increased safety of aircraft suitable for private use, and to extend the scope of the ownership and operation of aircraft by private individuals, the Department of Commerce should be authorized to make experimental purchases by negotiation of aircraft or other aeronautical equipment seeming to promise special advantages to civil aviation and not likely to be promptly developed otherwise, and to pay substantially the full development cost therefor. Such purchases should have the prior approval of the National Advisory Committee for Aeronautics. (104)

"(33) The National Advisory Committee for Aeronautics should give the development of those qualities in aircraft which render them particularly suitable for private operation an enlarged place on its program of research, and should cooperate with the Department of Commerce in determining the qualities and performance of aircraft of new types which may be offered for consideration. (106)

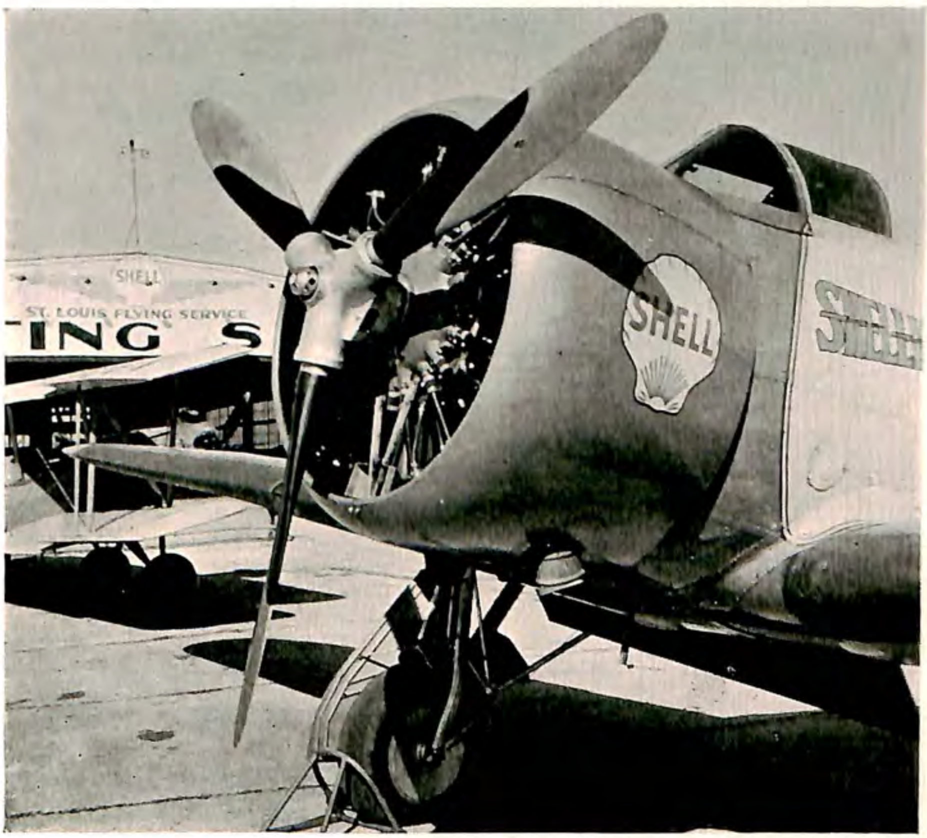
"(34) There should be a general survey of governmental mapping projects and other undertakings requiring the observation of wide areas to determine the extent to which aerial survey or observation can profitably be used. Where such work is economically advantageous it should be done by contract by commercial aircraft operators wherever reasonable bids can be obtained. (107)

"(35) Fixed-base aircraft operators, maintaining schools, service stations, and charter services, should be made eligible for Reconstruction Finance Corporation loans upon proper security, in the same way as manufacturing industries and railroads are already eligible. (108)

"(36) The usefulness of gliding and soaring flights in the promotion of aeronautics, and in the aeronautical activities of the various departments of government, should be carefully studied. In particular, the authorities charged with the technical regulation of aircraft should give special consideration to glider problems and to means of simplifying the formalities connected with glider control and licensing. (109)"

Airports

"(37) The installation of lights and other navigational aids should be undertaken by the Department of Commerce at airports designated by the commission hereinafter proposed as forming effective elements in a national airport system. The cost of maintenance of such lighting equipment, or of that already installed by local enterprise when desig-



SHELL OIL LOCKHEED ORION

An Orion with Wright Cyclone engine and Lycoming-Smith controllable pitch propeller equipped with de-icers.

nated by the commission, should be shared between the Federal Government and the appropriate local agency. (111)
"(38) It should be the policy of the Federal agencies concerned to provide airports and glider sites in or adjacent to recreational areas under Federal control, such as national parks and monuments. (115)
"(39) Action should be taken without further delay for the early determination of the site of a permanent airport for the national capital, and for the provision there of a model airport installation. (117)"

National Defense Organization

"(40) The modification in air force organization now being put in effect should be continued until their merits or otherwise shall have been proven by experience. The employment of air force as an independent striking unit should continue under constant study, both in the Army and in the Navy, and should be developed to its limit by tactical maneuvers and through the procurement of material best suited to such independent operations. (119)
"(41) The personnel and equipment of the air forces should be further developed, and where necessary expanded, in accordance with fixed programs of regular growth based upon the current plans of the Army and Navy. The effectiveness of the forces should be kept at the highest pitch by constant attention to superior quality of equipment and of personnel, and by the conduct of training exercises under widely diversified climatic and geographical conditions offering the greatest possible variety of operating problems. (121)
"(42) Intense study and prompt remedy should be given to the inter-relationship of the national defense Services. (123)
"(43) The budgetary practices of the Army and Navy in respect of aeronautical matters should be standardized for easy comparison. In both Services the funds for equipment to be used on aircraft should be directly allocated to the authorities in charge of aeronautical development, and subsequently transferred to other branches or offices if necessary. (124)
"(44) A number of officer pilots of the regular Army and Navy should be assigned annually to the other Service, and given duty with other active air units. (126)
"(45) The experimental and developmental work of the Army and Navy should be carried on on an increased scale. The funds provided for such work should be materially increased, as the necessary consequence of the increasing complexity of aircraft and engine construction. Special allocations should be made by both Services for a

particularly vigorous developmental campaign on high-powered and highly supercharged engines, and on power-plants of diesel type. (127)

"(46) Funds appropriated for experimental purposes, and not paid out when expected because of a failure of an article to meet the contractor's guarantees or a failure of any contractor to come forward with an article meeting a Service specification under which funds had been set aside, should remain available until used. (132)

"(47) There should be a closer coordination of Army and Navy experimental and developmental work, and the National Advisory Committee for Aeronautics should be more largely used as an agency for

NAVY TRANSPORT

A Cyclone-powered Curtiss-Wright Condor with wheels up.

such coordination. A much higher degree of uniformity than now exists should be attained in auxiliary material and the methods for its development, and also in the practices of the Army and Navy in such technical matters as the analyzing of aircraft for strength, testing for performance, and so on. (133)

"(48) Arrangements should be made for the temporary attachment of a few officers of the Army and of the Navy to civil activities, and especially to air transport, for study in order that the armed Services may secure the greatest benefit from civil aeronautical experience. (135)

"(49) The War and Navy Departments should adopt the practice, where possible without increase of cost to the government, of making reasonable use of the facilities of approved civil aircraft repair stations for repair and service work on military and naval aircraft. (137)

"(50) There should be immediate and positive action to improve the promotion situation in the Army, with special reference to the Air Corps. The authority to provide temporary rank in the Air Corps, to make the rank commensurate with the responsibilities held, should be broadened and then used. (138)

"(51) The authority to select a Chief of Air Corps from among all the officers of long service in that arm, which has now expired, should be renewed. (141)

"(52) The maximum term of active service with regular forces on the part of Reserve pilots graduated from the Army and Navy training schools should be increased, at least to three years and perhaps further. A cash payment should be given upon termination of this duty to ease the shock of transference to civilian life. (142)

"(53) Cadets accepted for training in either the Army or Navy flying schools should be required to take a definite obligation to perform a definite period of active duty after graduation, except as their resignations may be accepted in the discretion of the War or Navy Departments. (145)

"(54) The aviation Reserves both of the Army and Navy should be materially strengthened, and should receive a higher priority than they at present enjoy in the allotment of funds. Consideration should be given to the establishment of Assistant Secretaries of War and of the Navy for Reserve or personnel matters. Their duties would include the encouragement and maintenance of a more effective Reserve force in both Services, particularly with regard to the fields requiring a specialized combination of technical ability and military training. (146)

"(55) The Army and Navy should organize special classifications in the Reserve for essential personnel of air line organizations, and every effort should be made to secure the enrollment of such personnel in one or the other of the Reserve forces. (149)

"(56) The War and Navy Departments should give serious study to measures of securing a general enrollment in some category of the Reserve of private pilots and commercial pilots other than those employed in air transport, to the maintenance of an appropriate check on the individual qualifications of civil pilots, and to the establishment of special training courses to supply highly trained civil pilots with such specifically military training as might be necessary to make them immediately effective members of a reserve. (150)

"(57) There should be created a new type of government insurance for Reserve officers, covering the aviation hazard exclusively, available in amounts substantially beyond the present $10,000 limitation, and with premiums arbitrarily maintained on a very moderate scale. The personnel of the aviation Reserves should receive the same protection in case of injury or death in line of duty as would be given to Regular officers under the same circumstances. (152)

"(58) The provision for officer personnel of special engineering ability and industrial experience in the aviation field should be reconsidered both by the Army and by the Navy. An adequate number of such officers should be developed and given assurance by legislation of attractive careers in the Service. In the case of the Navy at least, we

27TH PURSUIT SQUADRON, AIR CORPS

In formation flight with Wasp-powered Boeing P-12E planes over Selfridge Field, Mich.

recommend the commission of such officers in a staff corps to insure continuous employment on duties connected with their specialty. (154)"

Procurement of Materiel

"(59) The paramount importance of quality in military aircraft should be recognized, and procurement policies should be fixed with primary reference to the securing at all times of the best material. Price should not be the primary consideration. (157)

"(60) The general purpose in the relations of the government to the industry engaged in manufacturing Service aircraft should be to maintain units sufficiently stable and sufficiently well organized so that they would be available for expansion in the event of war. The strength and efficiency both in design and in production of the individual manufacturing units, rather than the number of independent units existing, should be regarded as the test of the nation's industrial preparedness. (159)

"(61) Procurement policies should be planned to encourage the development of integrated manufacturing units carrying on their own research, development, design, and production work. (161)

"(62) The practices of the government departments procuring aircraft should, as far as practicable, be the same. The Federal Director of Procurement should promulgate the necessary directions to this end. (163)

"(63) Every effort should be made to organize procurement policy so that the supply of each general type of aircraft for replacement and for modernization should proceed at a substantially regular rate, and so that there may be a substantially regular flow of productive work in the plants of the aircraft industry. (164)

"(64) The War and Navy Departments should so organize their technical forces as to obviate the simultaneous functioning of any personnel in the roles of competitor and of judge. (166)

"(65) The development of new types of aircraft should continue to be provided for either by design competition or by experimental contracts for a specific article, but the rules now governing formal design competitions should be modified to allow administrative flexibility, and in particular to provide for the holding of competitions in which design development is allied with experimental construction of the article designed. (167)

"(66) The Army and Navy should adopt a policy in holding design competitions by which details of the military characteristics of the aircraft and equipment desired to be created shall be disclosed only to fully responsible competitors, of American nationality, and qualified for the work contemplated in the opinion of the Secretary of War or of the Navy. (169)

"(67) The announcements of design competitions should include the statement of the fixed price at which, subject to bonuses and penalties for performance, machines from the best designs will be purchased from the originators of the types. (171)

"(68) Where the interests of the government clearly require that the construction of equipment from a particular design be thrown open to general competition or that orders for such construction be allocated to others than the originator of the design, royalties should be paid to the originator in reimbursement for the right to use his drawings, calculations, and production information. (173)

"(69) The attempt to introduce a standard catch-all patent-license clause into all developmental contracts for aircraft and aeronautical material should be abandoned. Reproduction rights on patentable inventions should accrue to the government, in connection with a developmental contract for purchase of an article embodying the inventions, only in case the contractor is engaged to conduct a specific experimental development under governmental direction. (176)

"(70) Existing provisions of law should be amended as necessary to allow direct suit (but not injunctive procedure) against a manufacturer alleged to be infringing a patent in connection with work done by him for the Federal government. (180)

CLOSE-UP OF AN ARMY BOMBER

One of the 48 Martin-139 models delivered in 1934, the YB-10 powered by Wright Cyclones and the YB-12 with Pratt & Whitney Hornets.

"(71) Explicit authority should be granted to the Secretary of War and to the Secretary of the Navy to negotiate contracts for quantity purchases of aircraft and other aeronautical material, subject to the requirement of a full report to Congress in each case where the authority is used. (181)

"(72) In order that there may be no incentive for an uneconomic expansion of plants that could not be kept regularly running at anywhere near their capacity, it should be procurement policy to avoid any concentration in any one plant of an abnormally large proportion of the total military and naval work then outstanding. (184)

"(73) When purchases are to be made as the result of a process of competitive bidding, the Secretary of War or Secretary of the Navy should be authorized either to award a contract for the whole quantity sought to the bidder who can best perform the work, or to divide the work among two or more bidders if that be in the best interest of the government. (186)

"(74) Where definite profit limitation is to be employed, as in the present Naval Construction act, it should not be applied to the individual contract, but, in the interest of equity, of simplicity of accounting, and of stimulation of technical development, should be extended over all the work done for the government Service over a considerable length of time. (187)

"(75) Industrial mobilization plans in the field of aeronautics should be pressed by the joint effort of the Army and Navy. (190)"

Coast Guard

"(76) The Coast Guard should give to its aviation personnel essen-

VOUGHT CORSAIR V-80

A high performance single-seat fighter with Pratt & Whitney Hornet engine.

tially the same opportunity to specialize on aviation duty over long periods as does the Navy. (193)

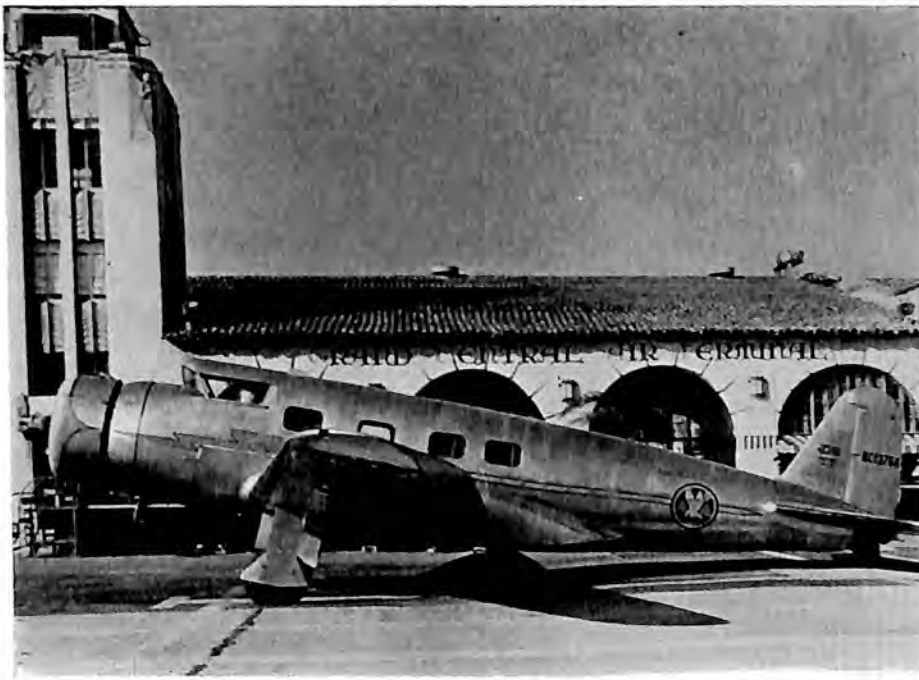
"(77) A limited number of aviation specialists should be allowed to enter the Coast Guard directly upon completion of their terms of active duty as reservists with Naval aviation. (195)

"(78) The Coast Guard should procure its aircraft through the Navy Department, which should assume the responsibility of necessary experimental and developmental work to produce equipment especially suited to Coast Guard needs. Both experimental work and quantity procurement for the special purposes of the Coast Guard should be covered by Coast Guard funds to be transferred to the Navy Department for the purpose. (196)"

Lighter-Than-Air Craft

"(79) It should be the policy of the United States to undertake further construction and operation of rigid airships in naval and commercial service. (197)

"(80) The Navy should determine by actual experience the scouting value of airships and the need for their further construction for naval purposes. (199)



AT LOS ANGELES DEPOT

An American Airlines Cyclone-powered Vultee transport at Grand Central Air Terminal, Glendale, Calif.

"(81) The prompt construction for the Navy of a training airship to replace the 'Los Angeles,' as recommended by the Navy General Board, should be undertaken. (200)

"(82) The early inauguration of an experimental trans-Atlantic airship service should be undertaken to meet the competition of the newest foreign ocean liners and of a projected foreign airship line. The initial step should be the construction by the government, for charter or lease to a commercial operator, of a commercial airship and a commercial terminal, with necessary docking and handling facilities. (201)

"(83) The production of helium by the Bureau of Mines should be continued, with authority to sell helium to commercial users and to foreign purchasers for export when it is available in excess of naval and military needs. Such domestic sales and export sales should be subject to the approval of the commission hereinafter proposed and should involve no net cost to the government. Export of helium from production by others than the Bureau of Mines should also be subject to approval of the commission. (207)

THEY FLY ON BUSINESS

Aviation personnel of the Standard Oil Company of New Jersey and their Lockheed plane. Left to right—R. C. Oertel, R. E. Ellis, E. E. Aldrin, manager, and Shepard Dudley, secretary of the Stanavo Specifications Board.

"(84) The helium tank cars now owned by the Army and Navy should be transferred to the Bureau of Mines. (209)"

Relations of Government and Industry

"(85) The degree of control by the government of the design and construction of civil aircraft should remain for the time being approximately as at present. The ultimate purpose should be a minimizing, in the degree consistent with public safety, of detailed control over the work of responsible manufacturers maintaining an adequate inspection and engineering organization of their own. (211)

"(86) The examination of a new type of aircraft by the government should include a numerical determination of all the essential elements of performance, and the figures so obtained should be recorded in the approved type certificate. (213)

"(87) Every assistance should be given by the appropriate agencies of government to manufacturers of commercial aircraft, engines, and accessories seeking an export market for their product. In those cases where possible military and commercial applications exist for the same

WACO WHD CONVERTIBLE

A land plane or seaplane for military, commercial or private use, with 420 h.p. Wright Whirlwind engine.

article, there should be no presumption of prospective military use in the absence of any specific evidence pointing in that direction. (215)

"(88) The State Department and Department of Commerce should make every effort to obtain an increased number of international agreements for the mutual recognition of airworthiness certificates, with the object of permitting a free trade in aircraft and the free travel of private owners in their own machines. (217)

"(89) The principle of cross-licensing of patents in the aircraft industry should be recognized as beneficial to the government and as promoting a rapid development, and should be encouraged. The government should take an active interest in the operations of a cross-license association, membership in which is open to all on reasonable terms, to insure fair treatment for all participants in its affairs and to protect the government's interest. The commission hereinafter proposed should be authorized to act as an adjudicator, either between private parties or between a private party and a government department, in such cases arising under such an agreement as the commission may elect to hear. (219)"

Research and Education

"(90) The National Advisory Committee for Aeronautics should remain the central agency of governmental research in aeronautics, and also the recognized body for coordinating experimental and developmental work of the various government departments and the results obtained from the researches of various institutions. It should extend its mechanism of unpaid subcommittees to include frequent conferences upon particular questions with technically qualified representatives of the commercial industry, and to draw the industry's personnel engaged in the development of aeronautical products more directly into the planning of its research work. (225)

"(91) The best qualities of present-day aircraft are preeminently due to organized research work, and the work done by the government in that field has paid for itself repeatedly in the improved service that aircraft have been able to render as a result. The extent of such governmental research work should be increased to substantially above its present level as rapidly as the personnel can be trained and special laboratories equipped. (227)

"(92) The National Advisory Committee for Aeronautics should have a moderate appropriation specifically ear-marked for the support of approved research projects at universities and other semi-public institutions which have competent staff and proper equipment to perform the work, and should be authorized to contract for the conduct of such researches and to publish the results. (229)"

General Government Organization

"(93) There should be created an additional Assistant Secretaryship of Commerce especially qualified to supervise the responsibilities of the Department under the Air Commerce Act. Ultimately the duties of this office might well include the supervision of the Department's functions with regard to other forms of transportation. (231)

"(94) The Bureau of Air Commerce should be definitely recognized as a purely professional and technical organization, and its personnel, including division heads, should have a high degree of security of tenure. (232)

"(95) The Weather Bureau should be transferred to the Department of Commerce. (233)

"(96) Authority should be given to detail certain members of the Weather Bureau's organization for training at government expense in new methods of weather forecasting. (235)"

Aeronautical Law

"(97) If the several states do not adopt substantially uniform aeronautical regulatory laws within a reasonably early time, a Federal constitutional amendment should be adopted which will give to the

THE STEARMAN PRIMARY TRAINER
Model 70, with Lycoming 680 or Wright Whirlwind R-760 engine.

Federal government exclusive control of all phases of civil aeronautics within the United States. (237)

"(98) The United States should participate actively in the codification of international private air law, with annual appropriations therefor as necessary. (239)

"(99) The commission hereinafter proposed should undertake a careful study of the subject of international public air navigation agreements to determine the desirable extent, if any, of American participation therein. (240)

"(100) One or more specialists on aeronautical matters should be attached to all American delegations to international conferences having aeronautical topics on the agenda. (241)

"(101) The application of general legal principles to matters specifically aeronautical should be modified as experience has shown to be wise, and in particular there should be provisions for Federal recording of title to aircraft, and of mortgages and other liens. (242)"

Air Commerce Commission

"(102) There should be created an air commerce commission, its members appointed by the President by and with the consent of the Senate for long terms. The commission so created should have broad supervisory and regulatory powers over civil aeronautics, and particularly over domestic and foreign air transport. It should have all powers necessary to the attainment of its general supervisory and regulatory purposes, including the power to hold hearings and conduct investigations upon any subject pertaining to civil aeronautics. It should be subject to merger by executive order at any time with any other body of a similar nature having similar functions. (243)"

THE 17TH FLIES HIGH

Army Air Corps pursuit squadron with Curtiss P-6E fighters, powered with prestone-cooled Curtiss Conqueror engines, in formation near Selfridge Field, Mich.

CHAPTER IV

ARMY AVIATION

Heroism of Air Corps Pilots—Decorations and Awards—The Headquarters Air Force—Training Activities—Development of Equipment—Personnel Strength.

WITH courage unexcelled and far beyond that demanded by any routine call of duty, pilots of the Army Air Corps repeatedly went up in their high-speed combat planes during 1934 and in one extraordinary feat after another placed their branch of the service securely on the very apex of the high pedestal of popular esteem.

Not since the World War have the pilots of any service the world over been confronted with such consistently hazardous flying missions as those which were dumped into the lap of the Air Corps, under the command of Major General Benjamin D. Foulois, when it received orders to fly the mail in February, 1934. The army machines had just begun to get into the air with loaded pouches when one of the most severe winters in history fell upon the country. There were blizzards of Arctic ferocity and winds of gale force which swept across the paths of the fighting planes as their pilots struggled over the erstwhile civil air routes in a kind of flying duty even more dangerous than the most arduous effort at military acrobatics in time of war. The prosaic record of day to day mail service maintained by the Army pilots is discussed at length in the chapter on air transportation. The record of steadfast heroism in the face of many casualties, which at one time threatened to decimate the contingent flying the mail, will remain forever among the fine traditions of our military service.

During the year several officers and men of the service received official awards for daring or unusual ability. Capt. Russell L. Meredith, retired, received the Distinguished Flying Cross for taking a doctor through blinding snow to an ice-bound island in Lake Michigan in 1923. Lieut. Cornelius W. Cousland received the Distinguished Flying Cross for safely landing a wrecked plane full of passengers in Gatun Lake, Panama Canal, on May 31, 1934, after broken parts of an engine had crashed through his windshield, killing a co-pilot and seriously injuring the officer.

Capt. Albert F. Hegenberger received the Distinguished Flying Cross Oak Leaf Cluster for his scientific work in developing blind flying and perfecting the Air Corps instrument landing system, which in 1934 was adopted as standard for civil flying under the supervision of the Bureau of Air Commerce, Department of Commerce. Distinguished Flying Crosses were awarded to Major William E. Kepner and Captains Albert W. Stevens and Orvil A. Anderson for courage displayed when their stratosphere balloon collapsed during the flight of July 28, 1934, further details of which will be found in the chapter on lighter-than-air.

The annual Cheney Award, for the oustanding act of valor in the

FAST AIR CORPS FIGHTER

The Consolidated P-30 two-place pursuit, powered by a Curtiss geared Conqueror engine, one of the American types with performance unequaled abroad.

Air Corps each year, was presented for 1933 to Lieut. William L. Bogen and Sergeants Doy D. Dodd and Thomas J. Rogers, for heroism in saving all hands when their Army transport plane crashed and burned at Fort Clark, Tex., in May, 1933. The Soldier's Medal for the year was also awarded to the three airmen. The Mackay Trophy, for the year's most outstanding flight, was awarded to Capt. Westside T. Larson, for 1933, in recognition of his pioneering flights, including blind landings and take-offs, while developing the frontier aerial defense system of the Air Corps. Cited for the most outstanding achievement during 1934 were the officers and men of the Air Corps round trip flight to Alaska in July, 1934, the details of which will be found in the chapter on notable flights.

When a group from the American Legation in Panama were injured in an automobile accident near Rio Hato early in 1934, an army plane flew out from Albrook Field, picked up the injured, including three men, three women and a baby, and carried them to Gorgas hospital. In June Army pilots flew 11 bombers loaded with tents and other supplies to Ocotepeque in Honduras where a flood had rendered the population homeless. In July an Army plane carried a half ton of clothing to San Salvador, Costa Rica, for the victims of a tornado.

THE AIR CORPS FLIES HIGH AND FAST

The 34th Pursuit Squadron with Wasp-powered Boeing P-26A planes in tactical maneuvers above the mountains and clouds of Southern California.

On October 2, 1934, the War Department announced a change in the Air Corps organization, when combatant units were organized into a General Headquarters Air Force directly under the command of the Chief of Staff of the Army. At the end of the year this G. H. Q. Air Force was made up of the First Pursuit Wing on the West Coast, including three pursuit, five bombardment and three service squadrons; the Second Bombardment Wing, stationed at Langley Field, Va., including three bombardment, four pursuit and two service squadrons; the Third Attack Wing, with three attack and one service squadron at Fort Crockett, Tex., and three pursuit and one service squadron at Shreveport, La.; the First Pursuit Group, including four pursuit and one service squadron at Selfridge Field, Mich.; and the 21st Airship Group with one airship and one service squadron at Scott Field, Ill., and one airship squadron at Langley Field, Va. On December 26, 1934, Lieut. Col. Frank M. Andrews was appointed commander of the G. H. Q. Air Force, with the rank of Brigadier General.

When the advanced class graduated from Kelly Field, Tex., in February, 1934, the cadets were kept on a flying cadet status for additional training with tactical units another year, marking the War Department's new plan of providing further training after the advanced flying school course. Cadet graduates, however, continued to receive the rating of "airplane pilot", but they were not commissioned in the Air Reserve until they had completed their post-graduate year of training. Upon being commissioned they were given another year on active duty with tactical units, if funds permitted.

Commissioned officers, enlisted men and candidates from civil life were selected every four months to attend the Primary Flying School at Randolph Field, San Antonio, Tex. There were three entering classes each year. During 1934, a total of 60 officers of the regular Army and 371 flying cadets, or a grand total of 431 students, started training at the Air Corps Training Center; 145 flying cadets entering the March class at Randolph Field, 150 flying cadets the July class, and 60 officers and 76 flying cadets the October class. There were graduated from the Air Corps Advanced Flying School at Kelly Field, Tex., during the year a total of 206 flying students, comprising 56 officers of the regular Army, 10 graduates of the U. S. Naval Academy who were not commissioned in the Navy because of lack of vacancies and who received flying cadet appointments, and 140 flying cadets. The March class graduated seven officers and 63 flying cadets; the July class five officers and 57 flying cadets, and the October class 44 officers and 30 flying cadets.

New Air Corps units organized during the year included the 29th, 58th and 74th Pursuit Squadrons. Ten new Air Corps detachments were established, making eleven in all. They are assigned one to each of the nine Corps Areas, one at Fort Lewis, Wash., and one for the U. S. Military Academy at West Point.

The Air Corps system of instrument (fog) landing was successfully applied to high speed tactical airplanes, especially the Martin bombers. In service tests at Wright Field more than 800 instrument landings were made in which 26 pilots received instruction and training in fog landing procedure. Upon completion of these tests, the Air Corps landing equipment was turned over to the Department of Commerce where it received, after extensive tests by that Department, the unqualified endorsement of the Director of Air Commerce, and was adopted for the commercial airways of the country.

The officers who qualified in instrument landings were sent to Air Corps posts, as soon as instrument landing stations could be completed and furnished at those posts. A total of 48 trucks for instrument landing and guiding stations were being purchased out of Public Works Funds for the various tactical units in the Air Corps.

NEW ARMY ATTACK PLANE

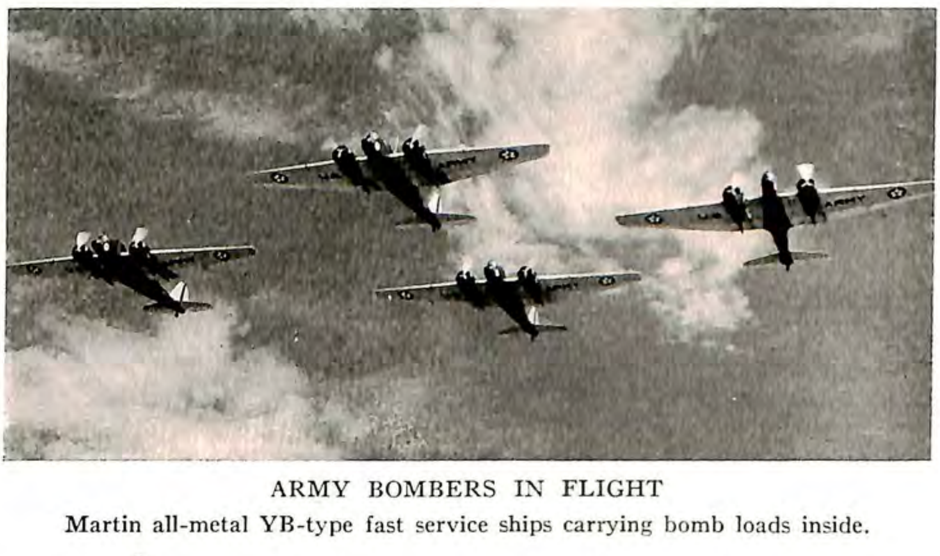
One of 46 Curtiss all-metal low-wing fighting machines, powered with Wright Cyclone engines, delivered in 1934.

During the fiscal year ending June 30, 1934, 30 Air Corps Regular Army Officers, 535 Air Corps enlisted men and four National Guard enlisted men graduated from the Air Corps Technical School at Chanute Field, Rantoul, Ill. At that school various courses were taught students in the trades allied to aviation, such as airplane or engine mechanics, aircraft armorers, radio mechanics and operators, aircraft machinists, aircraft welders, parachute riggers and aerial photographers. Student officers usually pursued the courses in aerial photography, aircraft maintenance, aircraft armament or radio communications.

During the year new airplanes for the Army air forces included both single-seat and two-place pursuit planes with supercharged engines, among them low-wing monoplanes of all metal construction with enclosed cockpit and retractable landing gear. A single-motored, low-wing monoplane was developed for attack purposes. Two different bombardment types were placed in service and development work continued through improved design and engine performance. An amphibion observation plane was under development at the end of the year.

In his annual report Secretary of War Dern recommended purchase of 600 additional planes to give the Air Corps 2,320 serviceable machines as urged by the Baker Board, the report of which is discussed at length in the chapter on air power. At the end of the year the Air Corps had fewer than 1,500 serviceable planes, more than 300 short of the 1,800 provided by the Air Corps Act of 1926. The 19 observation squadrons of the National Guard possessed only 50 per cent of the number of planes believed necessary. Production orders placed at the end of the year were calculated to provide an increasing number of new machines to replace obsolescent equipment.

As of October 31, 1934, Air Corps personnel included 1,279 regular officers on active duty, 119 regular officers assigned principally as flying students, 198 reserve officers on active duty, 14,339 enlisted men and 316 flying cadets.



ARMY BOMBERS IN FLIGHT

Martin all-metal YB-type fast service ships carrying bomb loads inside.

CHAPTER V

NAVAL AVIATION

Secretary Swanson's Statement—Admiral King's Report—Aircraft in Service—Building Program—Operations with the Fleet—The "Ranger" Enters Service—Activities of the Marine Corps—Plans for the Future.

BRILLIANT achievements of the U. S. Navy air forces during 1934 enhanced the fame of our aviators, impressed upon the world the excellence of American aircraft and won for the flying arm of the Navy official recognition as an indispensable branch of the national defense.

In his annual report to the President, made on December 1, 1934, Secretary of the Navy Swanson stated:

"Experience in the Fleet during the past year has again demonstrated conclusively that aviation is an important integral part of the Fleet. The Navy is thoroughly air-minded, and the Fleet devotes a large part of its operation to the development of naval aviation."

Ample justification for Secretary Swanson's statement will be found in even the most casual study of the record of the Bureau of Aeronautics of the Navy under the active command of Rear Admiral Ernest J. King. As Chief of the Bureau Admiral King won the cooperation of the entire personnel to an exceptionally high degree, and continued the notable progress in efficiency of equipment and operations which marked the work of his predecessor, Admiral Moffett. Official announcement of any project or mission planned by the Bureau of Aeronautics is tantamount to its complete success.

In his report for the fiscal year 1934, Admiral King characterized the Vinson-Trammell Naval Bill, signed by President Roosevelt on March 27, 1934, as "the greatest step forward in the development of naval aviation taken by the Government during the year." That legislation authorized the construction of the Navy to treaty strength in surface ships along with the necessary number of aircraft to equip them properly. It was the first law authorizing an increase in aircraft since the passage of the Navy 5-Year Aircraft Program Act of 1926, which limited the Navy, Marine Corps and Naval Reserve to 1,000 useful planes.

Thus the operating plans of the Navy had been limited to relatively small numbers of planes in these classes:

Combat Planes	
Dive bombers	125
Horizontal bombers or torpedo planes	32
Fighters	179
Carrier scouts and dive bombers	173
Patrol-bombers	147
Observation-scouts	208
Total	864
Utility and Training	
Utility planes	42
Transports	19
Training planes	75
Total	136
Total (both classes)	1,000

That limit of 1,000 machines was calculated to provide only for the Navy strength which existed in 1926. It did not provide for flying equipment on board surface ships which might be acquired after that date. From 1926 to 1934 fifteen cruisers and the aircraft carrier "Ranger" were commissioned; and as no legislation was passed for additional aircraft, planes for these new ships were supplied only by curtailing other authorized activities.

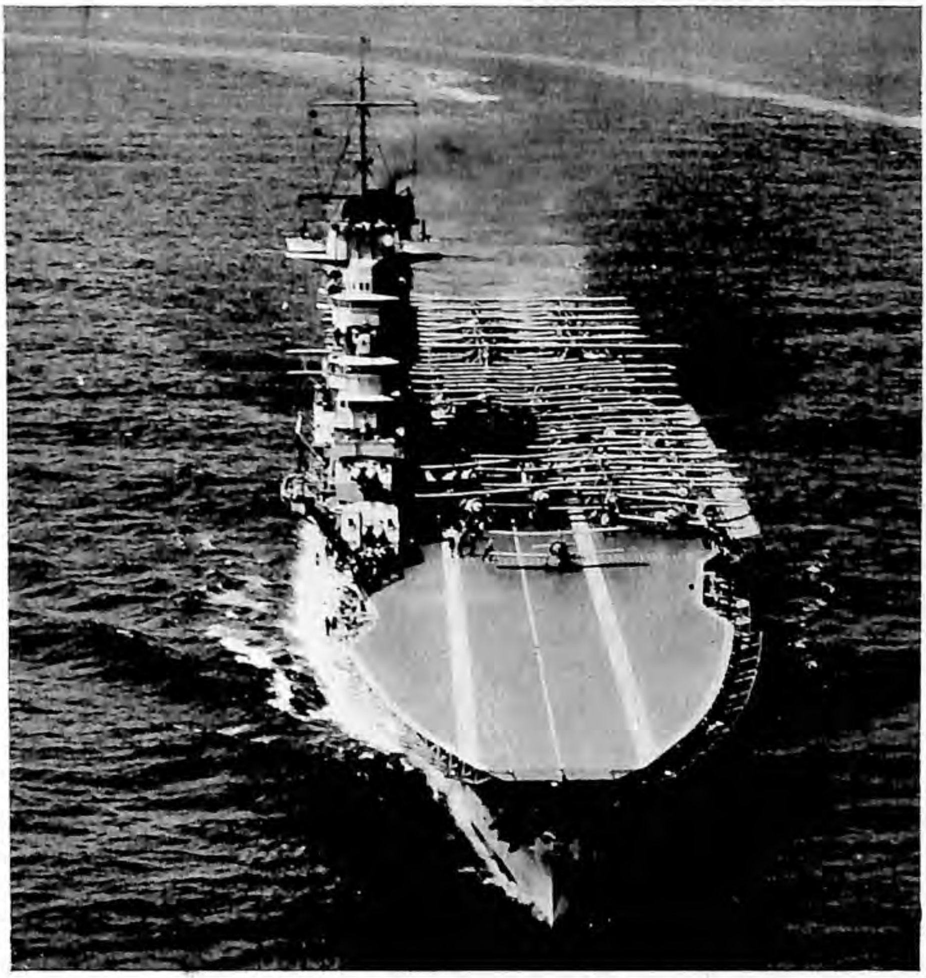
In his annual report Admiral King said: "In order to provide an adequate and commensurate aviation arm of the Navy, a five-to-seven-year aircraft building program has been laid down which will provide approximately 1,910 airplanes by 1940-1942.

"Funds to carry out the first year of this new program are now available. Upon completion of the first year's program the Navy will have 1,193 airplanes. Funds for the second year's program, 273 airplanes to provide aircraft complements for the two new carriers and the six new cruisers will be requested in the 1936 budget.

"In the matter of service aircraft the Bureau has provided, in so far as available funds permitted, airplanes of approved types, and in accordance with approved type complements which embody in their characteristics the latest and most important developments in the state of the art. Of particular importance has been the increase in speed range of our latest types. By means of the use of the controllable pitch propeller and the various devices for decreasing landing speeds it has been possible to raise considerably the high speed of new service types and at the same time to keep landing speeds down to the required limits."

For the first time two squadrons of patrol planes early in 1934 accompanied the Fleet from the West Coast to Panama and to Caribbean ports, and took part in all Fleet exercises. Those two squadrons were joined by three additional patrol squadrons from Coco Solo, C. Z., taking part in all exercises. After that demonstration of value as a patrol and striking force, the patrol squadrons were recognized as an essential part of the U. S. Fleet.

During the transfer of the Fleet from the West to the East Coast, the airplanes of the three carriers "Saratoga," "Lexington," and "Langley" alone flew approximately 1,341,500 miles, while engaging



THE AIRCRAFT CARRIER "SARATOGA"
Squadrons leaving the deck on tactical missions.

in maneuvers and Fleet exercises, without a single actual casualty.

After the airship "Macon's" arrival at the Naval Air Station at Sunnyvale, Calif., it participated in Fleet problems, and in April, 1934, made a flight to the Atlantic Coast to participate in Fleet Problem XV in the Caribbean area, after which it again returned to Sunnyvale, and continued flights for training personnel and testing experimental projects related to lighter-than-air ships. Particularly noteworthy in this field was the progress made in operating airplanes from airships of the "Macon" type.

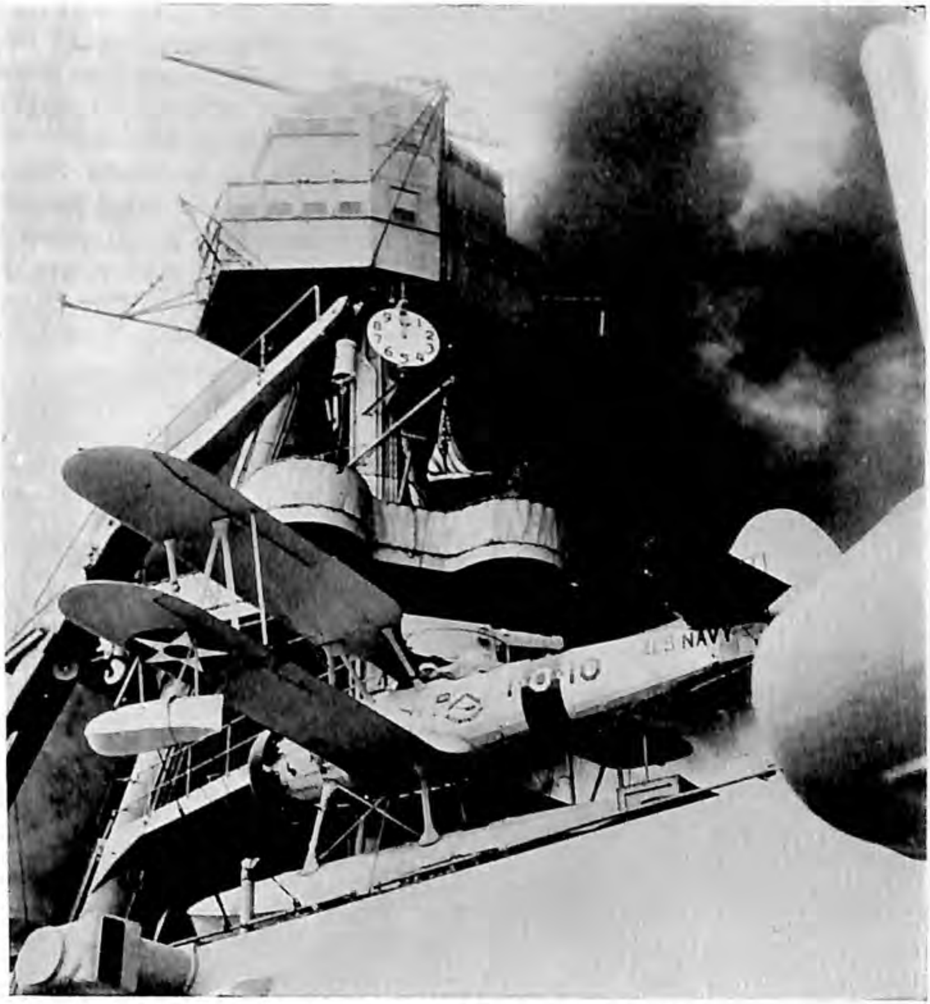
The carriers "Saratoga," "Lexington" and "Langley" accompanied the Fleet to New York, and during the review on May 31, 1934, launched twelve full squadrons from their decks. The total of 174

DOUGLAS OBSERVATION SEAPLANE

Air Corps O-38 on Edo floats.

planes of various types flew past the President's ship "Indianapolis" in formation and then carried out their various tactical operations, including laying smoke screens, and both diving and horizontal bombing attacks. Foreign official observers who witnessed the demonstration said they had never seen such an impressive display of efficiency in Fleet aviation tactics. The Navy's massed flight to Alaska and return, July 17-September 4, is described in the chapter on notable flights.

The new carrier "Ranger" was commissioned on June 4, 1934, the first vessel in the Navy to be originally designed and constructed as an aircraft carrier, the "Langley" being a converted collier, and



PREPARING FOR A MODERN BATTLE

The "Pennsylvania" lays a smoke screen as it goes into battle formation, while mechanics prepare to warm up the Hornet engine in the Vought Corsair.

the "Lexington" and "Saratoga" having been originally laid down as battle cruisers. The "Ranger's" dimensions were: displacement 13,800 tons; length at waterline 727 feet; beam 80 feet 2 inches; mean draft 19 feet. It carried a total load of 72 planes of various types.

During the year the policy of ferrying new and overhauled aircraft was extended to include practically all deliveries of aircraft to operating units. The 269 transcontinental flights made during the fiscal year 1934 saved the Government $100,000 in transportation charges, while permitting personnel to gain valuable experience in extended flight training. The ferrying program included delivery overseas. A squadron of new patrol planes flew non-stop from Norfolk to Coco Solo, a distance of more than 2,059 statute miles—the longest formation flight on record at that time. A squadron of patrol planes flew from Norfolk, Va., to Coco Solo, Acapulco, Mex., San Diego, Calif., San Francisco, Calif., and thence to Pearl Harbor, Hawaii. The last leg of the flight, 2,399 statute miles, was flown non-stop and in formation, setting a new world record, as explained in the chapter on notable flights.

CATAPULTED INTO THE AIR

The Vought Corsair leaves the catapult on the "Pennsylvania" to make a scout flight before the sham battle.

The Naval Air Station at Lakehurst, N. J., was placed on a reduced status, but was maintained for the training of personnel and for limited operations, using the metal-clad airship ZMC-2 and the non-rigid airship K-1.

The U. S. Marine Corps in 1934 maintained for operations with the Fleet three observation squadrons, one fighting squadron, two utility squadrons and the requisite number of headquarters and service squadrons, with an aggregate authorized strength of 95 planes. Observation squadron 7-M was awarded the Herbert Schiff Memorial Trophy for 1933 for having the greatest number of flying hours without serious accident.

Six separate operations of Marine Corps squadrons featured the Fleet exercises early in the year. On one occasion the Marines flew 22 planes from Quantico, Va., to San Juan, Puerto Rico, and return.

Plans for the future in naval aviation involved the service tests of larger seaplanes of the long range patrol bombing type with an increase of range, bomb loads and speed; also increase of the striking power of the carrier-based scouting class airplanes by including arrangements for dropping heavy bombs in diving attack.

Admiral King in 1934 recommended to the Secretary of the Navy:

Continued improvement of types through a balanced airplane, engine, accessories and materiel program.

Modernization of existing aircraft carriers, and improvement of airplane handling facilities on all classes of ships carrying aircraft.

Provision of an adequate number of suitable tenders for patrol class airplanes.

Provision for the necessary increases and additions at shore sta-

NAVY FIGHTERS

Wasp-powered Boeing F4B-4 pursuit-fighters of the Navy's air force equipped with Hamilton Standard controllable pitch propellers.

tions as required by the increase in numbers of operating aircraft, and in line with the Departmental shore development program.

Provision for required increase in personnel.

Continued development of rigid airships, and development of tactical and strategic employment of rigid airships as units of the Fleet.

Construction of one rigid airship (ZRS) to replace the "Akron" and one rigid airship (ZRN) to replace the "Los Angeles."

Mooring facilities for airships at Panama and improved mooring facilities in northwestern United States.

Consideration of employment and procurement of non-rigid airships for naval purposes.

In 1934 the Navy awarded the Distinguished Flying Cross to Aviation Machinist's Mate Doyle Joseph Cavin, with the following citation:

"For extraordinary achievement while participating in an aerial flight, as plane captain of the RS-3 Airplane Number A-9055, on 14 December, 1933, during an extended flight from Coco Solo, Canal Zone, to David, Republic of Panama. At an altitude of 5,000 feet, the weather conditions were unfavorable, the pilot descended in a glide through heavy clouds when ground was sighted close beneath with altitude of 3,000 feet. He then applied full power and started climbing at about 65 knots; still not clearing the mountain, he pulled further back on his controls, reducing speed to 40 knots and stalling the plane. It then fell into a right spin. In spite of the fact that he had been authorized by the pilot to abandon the plane in his parachute and fully realizing that the plane would most probably crash, resulting in death for himself and the other passengers, Cavin remained at his post of duty, working calmly and intelligently manipulating the engine throttles and gasoline valves. His efforts were successful; control of the plane was regained and the pilot was enabled to clear the mountain and veer away to safety. Without the assistance of Cavin in this grave emergency, it is highly doubtful if control of the plane could have been successfully regained, thereby preventing a crash costing the lives of all its occupants."

THE NEW CARRIER "RANGER"

U. S. Navy's first ship to be originally designed and built throughout as an aircraft carrier.

CHAPTER VI

COAST GUARD AVIATION

Daring Rescues—Operations Over Water—Flying Equipment—Coast Guard Flight Training—Plans for the Future.

HEROIC flights by day and by night on innumerable errands of mercy and rescue and the unceasing task of chasing outlaws and smugglers added brilliant pages of achievement to the magnificent record of the United States Coast Guard in 1934. There were long breathless flights over the watery waste far out at sea to save human beings or help vessels in distress, flights in storm and fog and the pitch-black darkness of starless nights over the treacherous swamps along the eastern coasts and emergency landings in those same swamps to rescue the injured or sick, flights over the wooded wilds that dot our northern borders and over the lonely, sand-swept areas of the southern boundary line. Wherever help was needed in out-of-the-way places there went the flying guardsmen responding to emergency's call.

At the end of the year the Coast Guard was operating 30 airplanes, including three Douglas amphibions, a Douglas flying boat, five General Aviation flying boats, eight Vought land planes and seaplanes, a Consolidated trainer, a Stinson land plane for radio testing, two New Standard land planes for training and nine Grumman amphibions. That fleet was distributed among the flying stations at Miami and St. Petersburg, Fla., Biloxi, Miss., Cape May, N. J., Salem, Mass., San Antonio, Tex. and San Diego, Calif. Another station soon was to be opened at Port Angeles, Wash., and recommendations had been made for another flying station on the Great Lakes.

In his annual report, Rear Admiral H. G. Hamlet, Commandant of the Coast Guard, pointed out that during the fiscal year 1934 Coast Guard planes and crews had flown a total of 219,572 miles and had patrolled or searched a vast area aggregating 1,975,014 square miles. Coast Guard pilots had spent 2,752 hours in the air during the twelve months. They had flown over and identified 5,494 vessels and aircraft.

With repeal of the Eighteenth Amendment, the Coast Guard, having worked arduously at its unpopular task of thwarting rum-runners along the coasts, was confronted with still greater problems.

Smuggling activities increased, not only on the coasts but along the international borders. Not only liquor but narcotics and aliens and considerable miscellaneous merchandise began flowing into the country on a greater scale than ever before. The U. S. Customs Bureau had been seizing smuggling planes for some time, and using them in a border patrol service. Secretary of the Treasury Morgenthau was convinced that aircraft might be employed even more effectively were the aerial branches of the two services to be merged into a single branch in the Coast Guard; and this was accomplished in March, 1934. Nearly all the planes confiscated by the former Customs Border Patrol were condemned as obsolete, and a new program was adopted for an increasing number of service machines to be acquired every year.

A COAST GUARD STINSON

Radio test and research plane powered by a Lycoming engine, with Lycoming-Smith controllable pitch propeller.

A number of new planes and flying stations were being acquired at the end of the year with funds allocated by the Public Works Administration. The Public Works allotments provided for some 27 aircraft and also seven new Coast Guard cutters, each of which was to carry an airplane for scouting purposes.

Study of the records reveals that the flying contingents of the Coast Guard during 1934 were instrumental in saving an average of four lives a month by means of aircraft alone; besides locating numerous illicit stills; harassing outlaws and gangs of criminals evading officers on the surface inland; flying on long trips with

A COAST GUARD RESCUE PLANE

One of the Douglas Dolphin amphibions, powered with two Pratt & Whitney Wasp engines, with which Coast Guard aviators made many rescues.

medicines, serum and emergency apparatus; locating missing or overdue vessels and small boats; picking up sick, injured, or distressed persons at sea; flying out and spotting boats suspected of smuggling aliens and narcotics, and reporting their positions to Coast Guard surface craft; training crews in patrol, aircraft radio, and flood-relief duties; and generally serving as the eye in the sky for all Coast Guard and Customs Bureau activities along the coasts and international boundary lines. Some of the more outstanding episodes in this work are narrated in the chapter on adventures in the air.

THE COAST GUARD ON MERCY DUTY

Its General Aviation flying boat takes off a stretcher case from the steamer Samuel Q. Brown far out at sea.

Twenty commissioned Coast Guard officers and 30 enlisted men took flight training at the Naval Air Station, Pensacola, Fla., during the year. A school for training enlisted men for aviation ratings was established at the Coast Guard Air Station at Cape May, N. J.

Plans for the future included the further development of the aerial border patrol, an aerial patrol in Alaska, preparations for serving in emergencies caused by floods in the Mississippi Valley and participation in the flood control work, progressive development of long range flying service over open water, and participation with surface craft in the International Ice Patrol which protects all shipping from the menace of icebergs drifting southward in the North Atlantic.

A GRUMMAN UTILITY AMPHIBION

The Coast Guard acquired these Cyclone-powered planes for patrol over land and coastline.

CHAPTER VII

GOVERNMENTAL ACTIVITIES

Bureau of Air Commerce—Bureau of Entomology and Plant Quarantine—Bureau of Fisheries—Bureau of Reclamation—Federal Communications Commission—Hydrographic Office—National Advisory Committee for Aeronautics—National Bureau of Standards—National Recovery Administration—Public Health Service—Soil Erosion Service—Subsistence Homesteads—Tennessee Valley Authority—U. S. Coast & Geodetic Survey—U. S. Forest Service—U. S. Geological Survey — U. S. Weather Bureau.

THE Government of the United States uses aircraft much more extensively than do other governments. Routine transportation by air has become a matter of course. and transport of men and supplies in an emergency has been turned over to airplanes on every possible occasion. Many of the bureaus are using planes for highly specialized work that can be accomplished by no other means. The superior speed of the flying machine and the facility with which it traverses vast areas and hurdles all obstacles that retard or stop surface transport are only two of its mighty attributes. The fact that one can have a birdseye view from an airplane, be it over a national park, a forest fire, a crop survey, a flooded district in need of control, or a district that is to be flooded behind a great dam, makes flying of unique value. No matter what kind of a project it is, the point of vantage is in the sky, and there the work of the various Government bureaus is becoming more extensive every year.

Bureau of Air Commerce

The Bureau of Air Commerce, of the U. S. Department of Commerce, was established in 1926 as the Aeronautics Branch, and its name was changed July 1, 1934. Under Eugene L. Vidal, Director of Air Commerce, the Bureau licenses pilots and aircraft, including engines and propellers, draws up air traffic rules for all flying crossing State boundaries and administers these regulations along with other rules to promote the safety of the public both in the air and on the ground. The Bureau maintains the Federal Airways System which is equipped with beacon lights, intermediate landing fields, radio range beacons which guide planes on their courses at night and in bad weather, radio communications stations which broadcast weather reports, and a communication system on the ground, including teletypewriter circuits and point-to-point radio for collecting weather information and transmitting all kinds of messages.

During 1934 the Bureau, under Mr. Vidal's direction, continued its efforts to develop a new design of airplane for private flying. A development section was created for that purpose; and it was assigned the further duties of engine and instrument designing and establishment of new airways and airports. The Bureau's activities in 1934 were carried out on a reduced budget, the funds available during the fiscal year ending June 30, 1934, being $2,400,000 less than originally appropriated by Congress. The total funds for 1934 were $5,200,000. For the fiscal year 1935 $5,205,250 was appropriated, as against average expenditures of $8,500,000 during the four years prior to 1934. The Bureau's new development section, under authority of the President, was allotted $100,000 from a special fund.

During the year a contract was awarded the Hammond Aircraft Corporation for 15 pusher-type monoplanes with a three-wheeled undercarriage, the machines to be used by the Bureau's force of inspectors with the further purpose of representing an experiment in the Bureau's plan to develop light airplanes for private flying. Further details of the Bureau's activities will be found in the chapters on airways and regulations.

Entomology and Plant Quarantine

The Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture in 1934 continued its work of fighting destructive insects by attacking them from the air. At many places in the country people became accustomed to seeing "bug-chasers" wearing high altitude helmets climb into planes equipped with numerous queer devices for catching the minutest members of the pest tribe, in adventurous efforts to determine how they migrate and why they are able to bring destruction on crops over vast sections.

When Col. and Mrs. Charles A. Lindbergh made their North Atlantic flight by way of Labrador, Greenland and Iceland in 1933 they carried in their plane a "sky hook" holding glass plates on which a sticky substance known as petrolatum held anything coming against it. Notes of the time and place were kept as the "sky hook" was used in the air at 26 points during the trip between Maine and Copenhagen, Denmark, at altitudes of 2,500 to 12,500 feet. Each plate was carefully identified. Scientists of the Bureau worked several months analyzing the plates after they arrived in Washington. It was found that microscopic bacteria, fungus spores and pollens, including some diseases, are carried across the North Atlantic by winds in the upper air.

During 1934 the Bureau employed planes to scatter calcium arsenate dust and other insecticidal materials over the bean fields in the

HIGH FLYING "BUG CHASERS"

A scientist of the U. S. Department of Agriculture ready for a flight four miles above the earth to collect migratory spores of plant disease in the upper air.

Northwest as an aid in killing off the bruchid, one of the weevil tribe that detroys the seeds. An airplane survey of Japanese beetle damage to fruit and ornamental trees in New Jersey resulted in a photographic record of the affected area. Tests were made with planes in the control of the pine tip moth in the East and the hemlock looper in the Pacific Northwest. At the same time State officials in California were using planes to dust sulphur on citrus groves menaced by a variety of insects. One of the promising tasks for airplane dusting concerned grasshopper extermination in the Middle West. At the end of the year the Bureau's scientists were using airplanes to obtain more definite information in four different fields:

1. The dissemination by air currents of fungi and bacteria which cause diseases of important agricultural crop plants.
2. Possible application of detailed knowledge of atmospheric content of micro-organisms to air mass analysis methods.
3. The distribution of pollens of types known to cause "hay fever" and other respiratory troubles.
4. Factors affecting cross pollination of crop plants.

Bureau of Fisheries

The Bureau of Fisheries, of the U. S. Department of Commerce, in 1934 used airplanes in supervising and patrolling the fisheries of Alaska. More than 260,000 miles were flown on patrol during the year. The Bureau secured the flying service from the Alaska Southern Airways; and planes were based at Ketchikan, Juneau and Cordova. The airplane patrols were out during 56 days of the season, and other trips were made for inspection purposes. The value of aircraft in this work was demonstrated by several long trips from Juneau to remote Bristol Bay which is difficult to reach by surface transport. Frank T. Bell, Commissioner of the Bureau, commenting on the accomplishments of 1934, said: "The value of planes in this branch of the Bureau's service has been well established by the results of the effective patrol maintained this year."

Bureau of Reclamation

The Bureau of Reclamation, of the U. S. Department of the Interior, in 1934 made contracts with various aerial service companies for photographic survey work on some of its projects. The Wallace Aerial Surveys, of Spokane, Wash., surveyed the lands for 50 miles between Grand Coulee Dam site and Hunters, in the Columbia River reclamation project. The work was done for approximately $20 a square mile, a tremendous saving when compared to surface methods, aside from the fraction of the usual time required to place the information in the hands of the project engineers.

Federal Communications Commission

The Federal Communications Commission in 1934 drafted a set of regulations for aircraft radio operations, among which the following are of general interest:

"Only one airport station will be permitted to an airport. The use of the station shall be open to any and all aircraft operators. In case one or more aircraft licensees operate regularly from such airport, control lines to the station shall be permitted upon request in order that each operator may, if he desires, use the station under the supervision of the licensee for the handling of his own aircraft. If airport stations are installed at adjacent airports, arrangements must be made between the licensees for a system to prevent interference being caused by simultaneous operation. In case of disagreement between the various interests as to the operation of airport stations the Commission will specify the arrangements.

NAVY'S EXPERIMENTAL FLYING BOAT

The Hall-Aluminum XP2H-1, with four Curtiss Conqueror engines, designed for long range patrol.

"At all times the licensee of an aeronautical point-to-point service shall be required to transmit, without charge or discrimination, all necessary messages in times of public emergency which involve the safety of life or property."

Hydrographic Office

The Hydrographic Office, U. S. Navy, in charge of Rear Admiral W. R. Gherardi, during 1934 published 62 aviation charts, a majority of them covering areas outside the United States. Late in the year rights were acquired to issue maps and charts prepared by a method known as the "Boyer Bookfold" permitting in aircraft the more convenient and efficient use of large sectional maps of the United States because of the manner in which they are folded.

National Advisory Committee for Aeronautics

The National Advisory Committee for Aeronautics, charged with fundamental scientific research and experiment in aeronautics, during the last 19 years has developed at Langley Field, Va., the largest and best equipped aeronautical research laboratory in the world, known as the Langley Memorial Aeronautical Laboratory. The results of research in this one central Government laboratory, under Dr. George W. Lewis, director, serve the needs of all branches of aviation, civil and military, and exert a profound influence on the progress of aeronautics by improving the performance, efficiency and safety of aircraft.

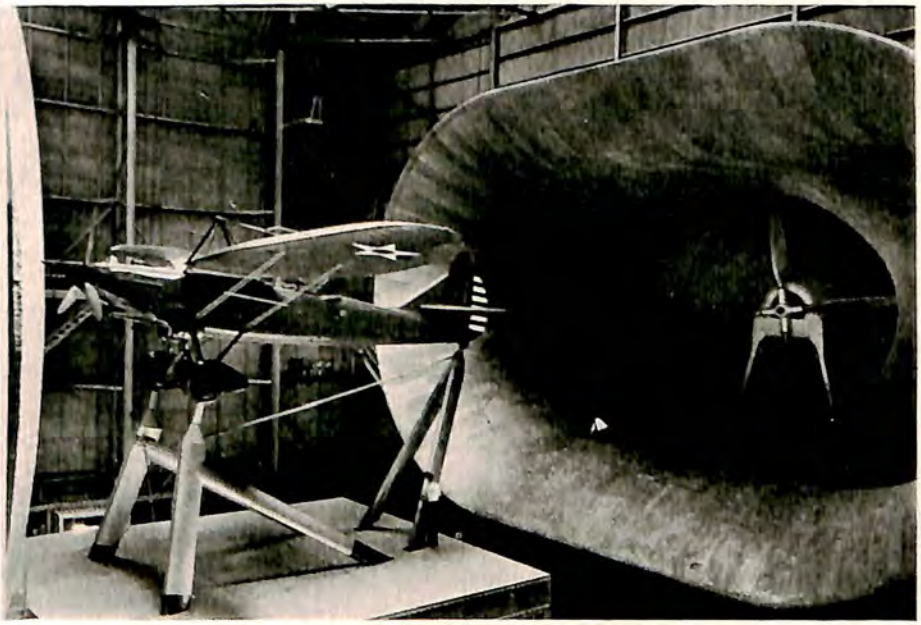
Much of the work at the Langley Laboratories is secret. It involves the national defense. Some of it, by remaining secret, might conceivably save this country in a future emergency. Much of it today would be important to other nations if they could discover it. It shows how American aircraft are being developed through successive stages and why American airplanes have greater speed, performance and safety than those produced abroad.

Two laboratory units were completed in 1934, and another, a high speed wind tunnel authorized by the Public Works Administration, was under construction at the end of the year.

The general wind tunnel building contained a seven by ten-foot wind tunnel in which model tests were made of the various parts of an airplane, so that the characteristics of a design might be judged with fair accuracy before the machine was built. In this tunnel devices for increasing the lift of the wing and problems of airplane control were investigated. In the same building a refrigerated wind tunnel created conditions the same as those which cause ice to form on airplanes in flight. By this method the N. A. C. A. scientists have been able to tell the Government and the industry how to meet the problem of ice formation in flight. A five-foot vertical wind tunnel was used in studying the spinning characteristics of airplanes. With this knowledge made available to him before he sets out to design a new type machine, the constructor of aircraft is able to produce a machine without bad spinning characteristics.

In another wind tunnel models were tested in compressed air up to 300 pounds to the square inch, 20 times the normal density of air at sea level. In determining the lift and drag characteristics, i.e., performance qualities of various kinds of wings, the results obtained in this wind tunnel were accepted as standard.

The Committee in 1934 completed a tunnel operating at speeds equal to the velocity of sound, for use in studying the air flow past propeller tips, and it should increase the efficiency of propellers used on commercial and military aircraft. The Committee also had a propeller-research tunnel for testing full-size propellers and other airplane parts. This tunnel had an air stream 20 feet in diameter, one of the largest in the world. Here was developed the famous



SCIENTISTS TEST NEW PLANE

Here in the National Advisory Committee for Aeronautics laboratories at Langley Field, Va., is the world's largest wind tunnel. It creates an air stream 60 feet wide and 30 feet high, by which the performance of full-size planes can be measured accurately with delicate instruments.

N. A. C. A. engine cowling (the metal hood which encircles radial aircooled engines on airplanes). The use of the N. A. C. A. cowling increased airplane speed from 15 to 20 per cent and also reduced the cost of operation. The research tunnel was also used in testing airship models. In it was developed also the N. A. C. A. engine-nacelle location, or the place for locating engine nacelles in relation to the wings in multi-engine airplanes to produce maximum efficiency. That work of the Committee was recognized as one of the greatest single contributions to the art.

The full-scale wind tunnel at the Langley Laboratories was the largest in the world, and was used for testing full-size airplanes in an air stream 60 by 30 feet. In this tunnel many problems of drag or resistance were studied, and special investigations of airplane performance were made for the Army and the Navy.

Of equal interest was the N. A. C. A. tank, a water channel 2,040 feet long, or two-fifths of a mile, covered to give protection from the weather. An electrically-driven carriage ran on rails along the side of the tank. It could pick up speed to 60 miles an hour, maintain it for 800 feet, and stop, all within 2,000 feet. It pulled through or on the water channel large models of the various kinds of boat hulls, floats and pontoons used on over-water flying craft. They could be tested with scientific precision so that the characteristics of each design might be thoroughly analyzed and its merits known before production. Thus the flying boat or seaplane designer could know, when he sat down at his drafting board, just what kind of boat hull, pontoon or float would answer his purpose. It permitted the design of floats having less drag and better rising characteristics for the amount of engine power used in a specific machine. In the past such knowledge was empirical at best, and the finished results never matched the guesswork which took the place of exact prior knowledge. The amazing speed, load capacity, long distance flying range and economy of operations which featured American flying boats at the beginning of 1935 were credited in no small degree to the work done in this water channel.

The engine research laboratory at Langley was of vast importance because it carried on advanced research of the kind that commercial companies cannot afford to do. The principal work involved research on a two-stroke cycle fuel injection principle for aircraft engines, which should eventually increase the horsepower of engines about 60 per cent, without increasing their weight. The very definite progress made in 1934 indicated that aircraft engines soon would possess an average weight of less than 1.4 pounds per horsepower as compared with the present average of two pounds per horsepower. Such development would save fuel, permit heavier loads and increase the flying range without landing. Here also an important part of the supercharger development was carried on. The supercharger is really a pump for maintaining sea level pressure at the carburetor. Creating air conditions for engines at great heights similar to conditions at sea level, it permits higher and more efficient flying. American military, naval and air transport planes were beginning to demonstrate the practical use of this knowledge in 1934.

In the Committee's flight research laboratory the pressure or loads on airplane wings and tail surfaces in high-speed military maneuvers were measured precisely. In certain maneuvers they may be 12 times the weight of the airplane itself. This change occurs almost instantly. The instruments developed by the N. A. C. A. and used in this research gave information on the change in pressure and location of shock stresses. This information had taken the uncertainty out of airplane design, and enabled the designer to build airplanes light enough to give good flying characteristics, and yet remain strong enough for safety. That development was one of the

Courtesy Fairchild Aerial Surveys, N. Y. C.

A WINGED BOAT FLIES AWAY

One of the new Sikorsky S-42 flying boats, powered by four Pratt & Whitney Hornet engines, leaves the Sikorsky factory at Bridgeport, Conn., to take its place among the clipper ships of Pan American Airways.

reasons why so many foreign missions visited Langley Field in 1934.

The free-spinning wind tunnel completed during the year permitted an airplane model to spin freely in an ascending current of air, with the controls and weights adjustable to control the character of spin. At the same time slow motion pictures were taken of exactly what was happening. Models of new types of airplanes were tested here before construction.

The high-speed tunnel authorized by the Public Works Administration was to cost about $500,000; and it was to make possible the acquisition of new knowledge bringing closer to reality and practicability an airplane capable of flying 500 miles an hour with safety.

From 1929 to 1935 the work of the Committee was carried on at an average expense to the Government of about $670,000 a year. Six of its accomplishments, only six out of innumerable developments, made possible a saving of some ten millions a year on the military and commercial planes in the United States.

National Bureau of Standards

The National Bureau of Standards, of the Department of Commerce, conducts investigations of materials, fabricated parts, apparatus and instruments for aeronautic use in cooperation with the Army, Navy, Bureau of Air Commerce, National Advisory Committee for Aeronautics and other aeronautic organizations. In 1934 fundamental research in the above fields was coordinated with the work of other Government organizations. Tests were made on aircraft structural members, engine fuels, radio shielding, ignition apparatus, lubricants, storage batteries, airplane lights, aerial camera lenses and aircraft instruments, principally at the request of other Government departments. The Bureau was the official agency of the National Aeronautic Association for the calibration of barographs and timepieces used in record flights. The standardization and test of materials, apparatus and instruments used in the construction, maintenance and test of aircraft such as length measuring devices, fire extinguishers, insulating materials and meters was a primary function of the Bureau, under Dr. Lyman J. Briggs, director. Investigations, research problems and developments in progress during 1934 included investigation of the cause of propeller failures, measurements of the stress distribution of vibrating propellers and development of a vibration indicator for measuring the amplitude of torsional vibrations in the shaft of a rotating propeller. Long time weathering tests of magnesium alloys and sheet aluminum alloys were in progress at the end of the year; also study of the protection of duralumin by anodic oxidation.

Work was continued on the development of a satisfactory material for the gas cells of airships. The Tuckerman optical strain gage was reduced in weight to make it suitable for measuring strains in vibrating airplane propellers. A vibrometer was developed for measuring the amplitude of vibration of airplane instrument-boards. The possibility of using either a portable hot-wire apparatus or pressure drop measurements on a sphere for measuring wind tunnel turbulence was being determined. Experiments to improve airplane signal lights and airway beacon lights were in progress.

Other investigations completed or in progress early in 1935 were improvement of airplane batteries; the relation between corrosion and thickness of chromium-nickel-copper electroplating on steel; the castability of aluminum or the flowing properties of the molten metal into a sand mold; the phenomena of gaseous explosives and the progress of combustion within the engine cylinder; the effect of atmospheric temperature on the volumetric efficiency of a gasoline engine; the performance of aviation spark plugs and aircraft engine ignition systems under various conditions; the detonation characteristics of aviation gasolines in full scale engines; the conditions under which ice forms in the induction systems of aircraft engines; investigation of lubricants suitable for aircraft instrument mechanisms; strength of welded joints in tubular members for aircraft; the torsional strength of duralumin tubing; the inelastic behavior of duralumin and alloy steels in tension and compression; the strength

THE TVA BELLANCA TRANSPORT

One of the six planes operated by the U. S. Tennessee Valley Authority.

of streamlined tubing; and metallurgical tests of structural parts of airships.

National Recovery Administration

The NRA, concerned with the vast number of complex problems incident to the promotion of business recovery in the United States, took to the air during 1934. Administrative executives and assistants found that they could save valuable time by using aircraft. Very often important conferences were attended by the same officials in cities a thousand miles apart in the course of a single day. Night flying in order to attend meetings halfway across the country became a commonplace. At the end of the year the NRA had charge of the Air Transport Code, the miscellaneous aircraft operators code and the proposed code for the aircraft manufacturing industry.

Public Health Service

The Public Health Service, of the U. S. Treasury Department, used aircraft extensively during 1934, under the direction of Dr. John McMullen, Acting Surgeon General. For example, a medical officer made inspection trips in Alaska. Another officer flew from Washington to Los Angeles to investigate a serious outbreak of poliomyelitis on the West Coast.

The Public Health Service inspects airplanes and their passengers and crews arriving at airports of entry from foreign countries. During the fiscal year 1934, 3,668 airplanes, carrying 26,951 persons requiring quarantine inspection, arrived at airports from other countries. Of these, 2,456 airplanes carrying 23,899 persons, including 4,364 aliens, were examined by medical officers of the Service. The others, comprising 1,212 airplanes carrying 3,052 persons, entered the United States without undergoing the medical examination required under the quarantine and immigration laws, because they arrived at airports of entry at which medical officers of the Public Health Service were not available for duty.

The reservations subject to which the United States had indicated its willingness to sign the International Sanitary Convention for Aerial Navigation were accepted by all prior signatory governments, and the Convention was signed on behalf of the United States by the American Minister at the Hague on April 6, 1934. On the latest date at which the Convention was open for original signatures, April 12, 1934, 23 countries had signed; namely, the United States, Germany, Australia, Austria, Belgium, Egypt, Spain, France, Great Britain and Northern Ireland, Greece, Irish Free State, Italy, Morocco, Monaco, New Zealand, Holland, Poland, Rumania, Sweden, Syria, Lebanon, Tunis, and the Union of South Africa. The Convention became effective 120 days after the ratifications of 10 countries were deposited with the Government of the Netherlands. The Convention represents a sanitary code which reconciles the interests of international air traffic with reasonable requirements for the protection of the public health.

Soil Erosion Service

The Soil Erosion Service, of the U. S. Department of the Interior, during 1934 employed Fairchild Aerial Surveys to map about 24,000 square miles of lands in northeastern Arizona, northwestern New Mexico, southeastern Utah and southwestern Colorado, embracing the Navajo Indian Reservation. The Service also contracted with Fairchild Aerial Surveys to make an aerial photographic map of 24,000 additional square miles in New Mexico and Arizona, and the work was in progress at the end of 1934. On this work the photographers used a camera taking four negatives simultaneously, all obliquely, the resulting four negatives being transformed rotationally to produce a single photograph in a true horizontal plane covering all the ground embraced in the four original photos. The value of these photographs in soil erosion prevention was demonstrated by the speed with which the complete maps were made and the minute

BACK HOME IN A SUNSET

A Hornet-powered Vought Corsair is hoisted back to its catapult nest on a battleship.

details made available for studies by the engineers working in their offices, instead of spending long periods in the field, which surface surveying formerly compelled them to do.

Subsistence Homesteads

The Subsistence Homesteads division of the U. S. Department of the Interior employed Fairchild Aerial Surveys to make photographic maps of the areas in which projects were laid down during 1934. The planning engineers were able to complete their surveys of topography, highways, drainage and other conditions from studies of the single maps made up from the aerial photographs. This preliminary work of the service was thereby speeded up to keep pace with the development plans.

Tennessee Valley Authority

The Tennessee Valley Authority, of the Emergency Relief Administration, acquired its own planes and used them extensively for transportation during 1934. Fairchild Aerial Surveys received contracts for aerial photographic mapping of 50,000 square miles in the areas under development. This work was done with the Fairchild five-lens camera. It was to be completed early in 1935.

U. S. Coast & Geodetic Survey

The U. S. Coast & Geodetic Survey, of the Department of Commerce, charged with maintaining accurate surveys of the coast and publishing navigational charts of the coastal waters, in 1934 let contracts for some 2,000 square miles of aerial mapping of the shore areas along the Gulf and Atlantic Coast States. By means of the photographic maps the engineers of this service were able to check the changes which tides and currents bring about at the mouths of the rivers and in the more shallow waters along the coasts, thus keeping up to date the charts which are indispensable to navigators.

U. S. Forest Service

The U. S. Forest Service, of the Department of Agriculture, made record use of aircraft in 1934. More than 1,400 men were flown to fire lines, and a quarter of a million pounds of supplies and equipment were carried by airplanes to points of pressing need. New records were set carrying passengers and freight and in air-mapping of forest lands for the Service. More than 1,600 flying hours were employed in transportation and about 1,000 hours in mapping. Fifteen planes were used in fire patrol work, with additional planes for transportation and mapping purposes, all flying under contract.

By employing planes and pilots the Forest Service put more speed into fire-fighting and map-making. In a number of instances it saved timber stands and watersheds from advancing flames by gaining time in scouting and bringing up fire-fighting forces. It was able to do these things at less cost by carrying men and materials by airplane instead of forwarding them by rail, truck and pack mule. Both time and distance were shortened. As planes making deliveries by air line routes usually had to traverse only about half the distance required for shipments by rail, road, and trail, or a combination of them, transportation charges frequently were cheaper by air.

Speed is a factor vital to efficient forest protection. The airplane often can deliver in an hour or two, as against the two or three days sometimes required to reach the same destination by other kinds of travel. In a number of emergency cases, qualified officers needed to direct crews were quickly mobilized and sent or delivered to the jobs. Sometimes whole squads of trained emergency men were moved by air.

More than half the total flying hours used for air patrol or transport to aid in fire suppression were spent in the Northern Rocky

FIGHTING A FOREST FIRE

A pack train meets a supply plane in Flathead National Forest, Montana, and sets out with provisions for fire fighters of the U. S. Forest Service.

Mountain region, where the country is more inaccessible and the fire hazard greater than in most other regions. Airplane use in Montana, northern Idaho, and eastern Washington totaled 915 flying hours. The Intermountain region required 360 hours, and the California region 222 hours. Four-fifths of the freight and two-thirds of the men transported by air were also in the Rocky Mountain area.

In California planes were employed mainly for scouting large fires and for detection purposes where heavy smoke impaired the visibility from the lookouts. Portions of large burned-over areas were sown from airplanes with mustard and grass seed to revegetate the denuded slopes and save them from disastrous erosion.

In the Lake States a plane was employed to haul freight on a timber survey and acquisition job in the Superior National Forest, where transportation by the usual water routes would have taken much valuable time. Experimental dumping of water to aid in checking the progress of forest fires was tried in the Montana section. Another plane was used in making a survey of big game. The Forest Service, with Civilian Conservation Corps and PWA assistance, during 1934 installed and improved 30 additional landing fields in the national forests.

Aerial mapping of national forest land advanced greatly in 1934 with more than 24,000 square miles photographed and mapped, compared to a few hundred square miles in 1933. Some of the surveys were made in cooperation with other Government bureaus.

CAPT. AL WILLIAMS AND HIS GULF HAWK

The Wright Cyclone-powered Curtiss plane flown by the noted speed pilot on executive business for the Gulf Refining Company.

Large areas were mapped on national forests and purchase units in Arkansas, Texas, Vermont and other States of the East and South. The entire Superior National Forest was included in the aerial mapping of 3,000 square miles under way in Minnesota at the end of 1934. Air mapping was done in most of the Rocky Mountain States, and a new survey to cover approximately 2,000 square miles, was initiated in the national forests of New Mexico and Arizona. In the East and South a few planes were employed in boundary surveys for acquisition purposes.

Much of the photography was done at elevations exceeding 20,000 feet, making photographs on a scale of 2,600 feet to the inch for completing service maps on a scale of two inches to the mile. An average of about 100 square miles to the hour of flight was covered in mapping. The maps made by the Forest Service were of the "drainage" type, showing the streams, ridges, peaks, density of cover and other physical features. Forest officers found the maps adequate for most administrative purposes. The cost of the maps ranged from $2.04 to $5.09 a square mile or about one-third to one cent an acre.

U. S. Geological Survey

The U. S. Geological Survey, of the Department of the Interior, in classifying the public lands for mineral and other resources, employed aerial mapping throughout the United States.

THE KINNER PLAYBOY

One of the two-place cabin planes with Kinner R-5 160 h.p. engine, operated by the Bureau of Air Commerce.

U. S. Weather Bureau

The U. S. Weather Bureau, of the Department of Agriculture, is charged with providing meteorological service along the Federal Airways System. During 1934 it was necessary to continue the drastic economies effected in 1933. Service, under W. R. Gregg, chief of the Bureau, was maintained with reduced personnel on approximately 26,000 miles of airways. A number of intermediate airway weather reporting stations and several of the stations at larger terminal airports were closed because of lack of funds. However, during the latter half of the year there were 62 first-order stations at terminal airports and approximately 490 intermediate stations with 50 off-airway stations in the airway weather network. Weather reports from these stations were charted every four hours at 10 general supervising stations from which four-hourly and trip weather forecasts were issued, covering all airways in the United States.

Weather service was established on 3,960 miles of new airways following increased air mail service at the beginning of the summer. This new weather service was limited in character and based largely on the cooperation of air line operators. More adequate service was planned for the new airways if funds became available.

On July 1, 1934, the Bureau in cooperation with the War and Navy Departments started a program of airplane weather observations, in which flights were made daily at 5:00 a.m. to 8:00 a.m., E. S. T., to heights of 17,000 feet at some 20 widely scattered stations. The airplanes carried self-registering instruments (aerometeorographs) recording barometric pressure, temperature and humidity. The data thus secured were distributed by airway teletype and radio circuits to five district forecast centers and 10 airway forecast centers for use in weather forecasting. That was the beginning of a comprehensive program dealing with air mass analysis, a new method of synoptic meteorology, recommended by the President's Advisory Board and adopted by the Weather Bureau.

FOR AERIAL TRAVELERS AT NEW ORLEANS
Main lobby of the terminal at Shushan Airport.

CHAPTER VIII

AIR LINES OF THE UNITED STATES

Increase of Speed—Across the Country in a Single Night—The Army Flies the Mail—Operations of All Lines in the United States—Pan American Airways.

SLEEK and trim as the most graceful birds, though faster, and gliding through space at heights above the surface which even the mightiest birds dare not emulate, the new transport planes on the air lines of the United States at the beginning of 1935 were carrying more passengers, mail and express than ever before in a service which the rest of the world was trying its best to copy because of sheer excellence and growing popularity.

Three miles a minute speed all the way, from one city to another, was becoming common throughout the United States. Men, women and children were flying by night as well as by day. They were having luncheon or dinner in one city today and tomorrow sitting down to breakfast on the opposite side of the country. Excellent meals served in flight, upholstered chairs, sleeping berths longer than those of a Pullman, steam-heated compartments with individual ventilating systems to satisfy the desire of every passenger, luxurious, comfortable and reliable, so noiseless that one might sleep half way across the country and wake up to pass the time of day with his neighbor in whispered tones—those were only a few of the remarkable characteristics of American planes with which the air transport industry set out in 1935.

With more than a hundred different professions, trades and occupations represented in the expanding field of air line operations those familiar with the subject believed that this most modern and surely the most romantic form of transportation offers attractive careers to young men of the nation. The job of being a pilot on an air line is only one of many jobs. For every pilot who takes out his plane for a dash over his division there are, as an average, ten other highly trained and equally as skilled persons on the ground working at one job or another to help bring the plane through safely, on time, with full loads and at reasonable expense to the company. The business of managing departments—executive, traffic promotion, purchase of supplies, maintenance, overhaul and repair—the servicing of aircraft, engines, propellers and scores of instruments, weather reporting, radio operations, the specialty of lighting at airports and on the airways, airport maintenance, traffic office and waiting room services and countless other different kinds of occupations appeared to be available to those with special training.

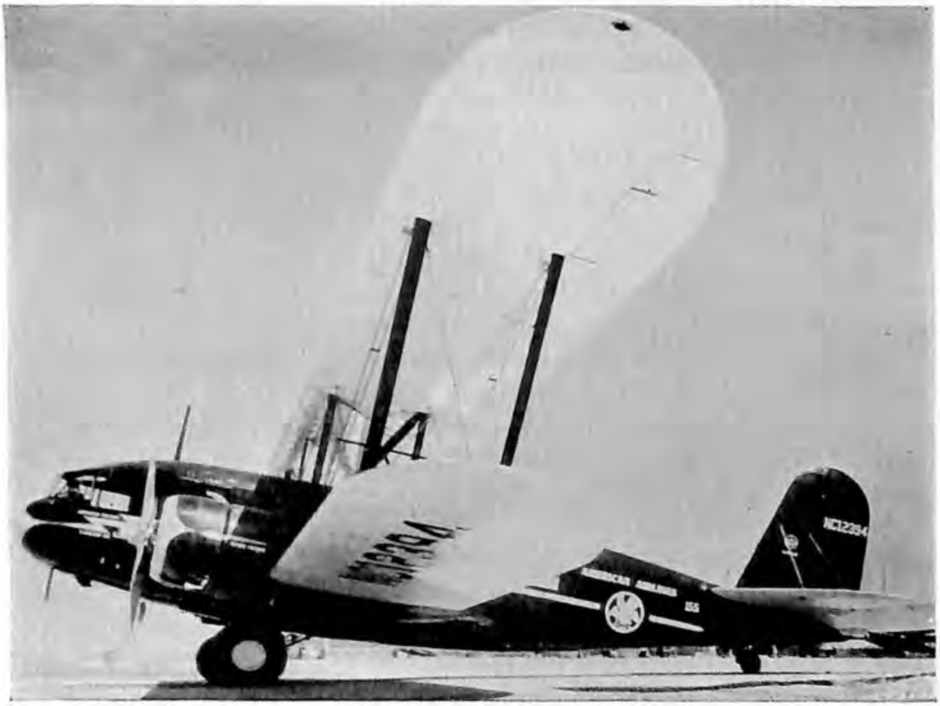
Traffic reports show that 537,637 passengers, 7,155,281 pounds of mail and 2,946,460 pounds of express were flown over the air lines of the United States in 1934.

INTERIOR OF THE VULTEE TRANSPORT
Comfortable chairs in a soundproofed cabin were features of this eight-passenger plane, one of the American Airlines fleet.

Air express proved its popularity whenever goods could be transported by air line at a saving in time and money to the shipper or the recipient. Introduction of high speed transports encouraged air shipments of perishable goods. The air line operators believed that air express eventually should become their largest source of revenue. At the beginning of 1935 they estimated that it was adding to earnings from one-half to two cents a mile, varying with different routes. The Railway Express Agency and the General Air Express handled the pick-up and delivery of shipments.

During 1934 many lines of industry and business changed their policy of using air express service only in emergency. Time saved meant money saved, so numbers of shippers became regular daily patrons of air express.

Cut flowers and other horticultural products were steady air express cargoes. Gardenias and other blooms from California and southern States were shipped to eastern markets. Orchids were shipped by boat and plane from Honolulu to Boston within eight days. Prizes for blooms sent in by air express were awarded at major flower shows.



AMERICAN AIRLINES CONDOR

One of the 18 Curtiss-Wright Condors, Cyclone-powered, in American Airlines service, some of them sleepers.

Pacific Coast fashion stores were using air express to obtain last minute styles and accessories. A Seattle store regularly received several dozen dresses weekly by air from New York couturiers, and was able to sell dresses of the last-minute design on the same day they were offered in New York shops. Sample goods, fabrics, decorations and trimmings for apparel were being flown from manufacturer to retailer in increasing quantities.

Air express of all kinds of emergency tools and heavy machine repair parts saved manufacturers, construction companies and industrial concerns heavy losses which delays or shut-downs otherwise would have caused. Motors, generators, castings and other equipment often weighing hundreds of pounds were flown, effecting spectacular savings to shippers. Assembly line production factories, by this speedy delivery of parts, avoided shut-downs.

The nation-wide system giving overnight service to all parts of the country was used continually by advertising agencies in the distribution of electrotypes for advertising campaigns. They also shipped art work, layouts, matrices, type and other printing and publicity materials. Radio transcription records were flown between broadcasting stations and advertisers. Twenty per cent of air express shipments at one period were news photographs of important events such as the "Morro Castle" disaster and the Hauptmann arrest.

In the banking field shipment of cancelled checks provided more traffic in 1934, and was saving hundreds of thousands of dollars in interest charges every year. One of the best customers of the air lines was the Federal Reserve System which expressed bundles of cancelled checks to New York banks on every plane from the South and West. Stock and bond houses were shipping securities by air.

Approximately 500 different things were identified in air express shipments, and the list was growing at the beginning of 1935. Sausage casings were flown from San Francisco to Chicago; ten pounds of liquid air were whisked by plane and rail from Midland, Mich., to Los Angeles; several shipments of feathers were flown from New York to the Pacific Coast; 50 pounds of ice cream, for one reason or another, demanded air shipment from Hollywood to New York; and 22 pounds of milk were flown from Omaha to New York for testing purposes. Silk ribbons, cigars, cheese, crabs, lobsters, paper bags, empty cartons, a 26-pound sample of limestone, tin cans, a bell, wheels, vegetable seeds, and all kinds of meat were air express cargoes in the "samples" class, shipped by manufacturers and producers to assist salesmen in bringing in orders.

Special surgical instruments were rushed to operating tables hundreds of miles away where life hung in the balance. Serums were flown overnight on regular schedules from New York to the West Coast to stem the ravages of a typhoid epidemic. Radium-emanating materials daily took to the air from laboratories to ease the sufferings of patients in all parts of the country. Special anesthetics, vaccines, and biological cultures were continually raced through the skyways to aid science in the cause of humanity. Daily, even hourly, air express was called upon to assist science, alleviate suffering, and save lives.

Exhibits were introduced into the courts from great distances at the last minute, frequently preventing miscarriage of justice. Indisputable evidence of guilt—photographs, fingerprints, personal effects with tell-tale stains or marks—found their way into the express compartments of fast transport planes to aid in the apprehension and conviction of criminals. Automatic firearms and other paraphernalia needed by the police were flown to quell disorder and prevent loss of life and property destruction.

Personal use of the air express was rapidly increasing with more widespread knowledge of the service. A typical month's traffic revealed that an actress received a wig; a net champion a case of tennis balls; a movie producer a suit of clothes; a left-handed golf star secured a needed left-hand club from a distant sporting goods manufacturer—all at the last minute by three-mile-a-minute air express. Famous authors flew their manuscripts back and forth to publishers. Personal gifts of cut flowers, candy, clothing, engagement rings and other jewelry were delivered with all the magic speed of flight.

BIRMINGHAM'S SPACIOUS TERMINAL

The Alabama city rightly claims one of the outstanding airport stations of the world.

General Air Express

General Air Express was organized in August, 1928, as an association of air lines, with a coordinator, a central office in New York, and agreements for interchange shipments under a standard waybill.

The companies which combined their shipping facilities under the banner of General Air Express were Transcontinental and Western Air (TWA), American Airlines, Eastern Air Lines, Northwest Airlines, Pennsylvania Airlines and Varney Speed Lines.

The ground delivery service was handled under a contract with Postal Telegraph & Cable Company. Its 3,000 uniformed messenger boys picked up and delivered shipments. General Air Express tariffs read "Call your nearest Postal Telegraph office which will dispatch a messenger quickly, provide you with a receipted waybill for your goods and rush the shipment to the first outgoing plane. At destination a messenger will meet the plane and deliver the shipment without delay to your customer (consignee)." There were no extra charges for this special delivery service. They were included in the rates. If shipments weighed more than about 30 pounds, the shipper could notify Postal and a truck would call. No individual package weighing over 200 pounds could be shipped by air without special arrangements.

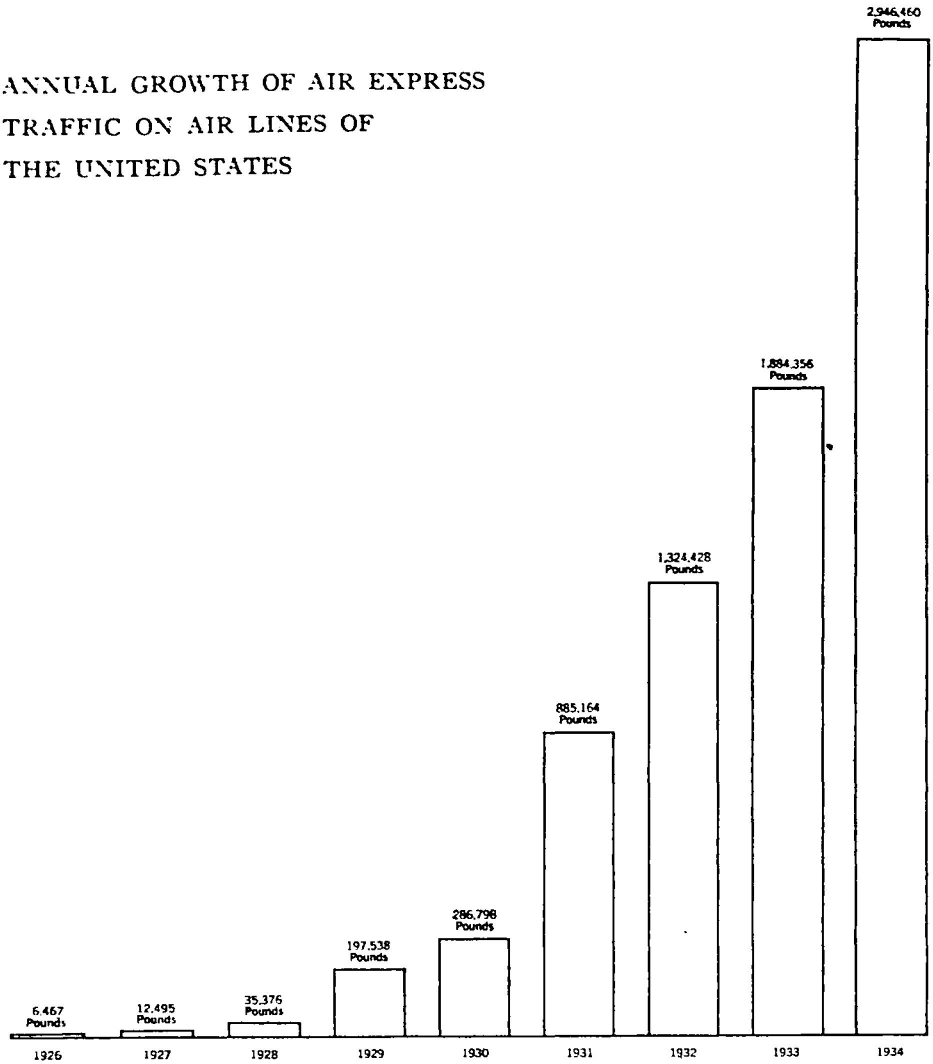
Rates over nearly all lines in the General Air Express group were based on four cents a mile a hundred pounds. For example, a 10-pound shipment, including pick-up and delivery, between New York and Chicago, 740 miles, would cost $3.12, between Los Angeles and New York $9.60, New York and New Orleans, $5.28. The insurance rate was 15 cents for $100, the lines assuming liability for negligence up to $50.

Railway Express Agency

The amazing extent to which air express traffic developed in 1934 was reflected in a report showing that air tonnage handled by the Railway Express Agency increased more than 115 per cent over 1933, the number of shipments increased 102 per cent and revenues 90 per cent.

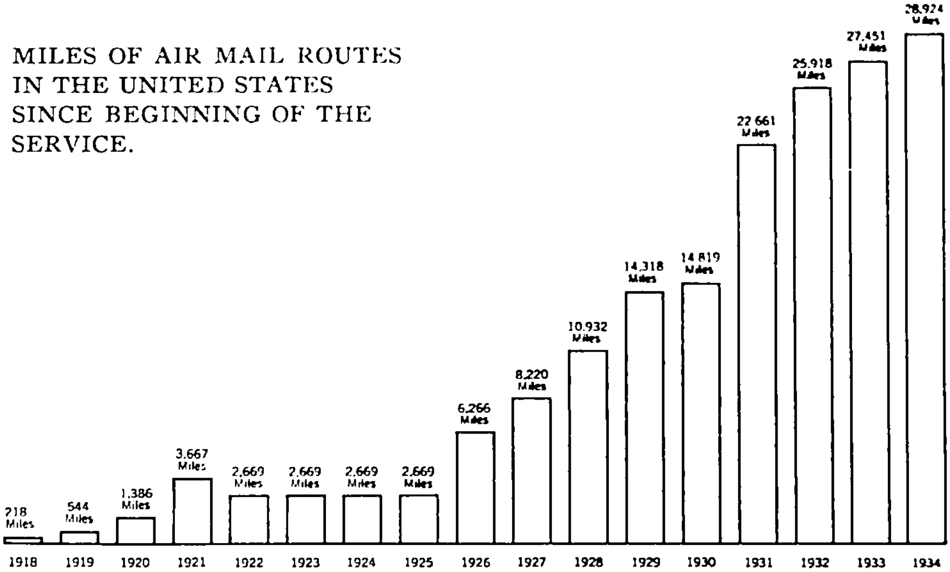
The standard contract agreement called for pick-up and delivery by the Agency vehicles and employees. The expressman, being in daily contact with shippers, handled the soliciting for the air service. Full responsibility for the shipment was assumed by the express company from the time receipt was given shipper until consignee signed the receipt for the package. Advertising, preparation of tariffs, insurance and settlement of claims were handled by the express agency. The actual out-of-pocket expense under this method of handling was low. At the beginning of 1935 the system of the Railway Express Agency included United Air Lines, National Parks Airways, Hanford Airlines, Rapid Air Lines, Bowen Air Lines, Central Airlines, General Air Lines, Wyoming Air Service, Braniff Airways, Chicago and Southern Airlines, Wedell-Williams Air Lines, Delta Air Lines, Boston-Maine Airways, Central Vermont Airways, and Gulf Airways. The Pan American Airways System had a contract with the Railway

ANNUAL GROWTH OF AIR EXPRESS TRAFFIC ON AIR LINES OF THE UNITED STATES



Express Agency to handle its express shipments in the United States.

Where a short train connection would expedite the shipment, the transfer was easily accomplished by the coordinated air and rail facilities offered by the Railway Express Agency. The speed of such service was guaranteed to the shipper. Unless faster time was made than by air service transportation, refund was made to the extent of the difference in the air and rail express rates. It was distinctly a special service for collection and immediate delivery. All-night delivery service was provided to night-working industries in the larger cities. Shipments arriving during the evening for homes, hotels or clubs were



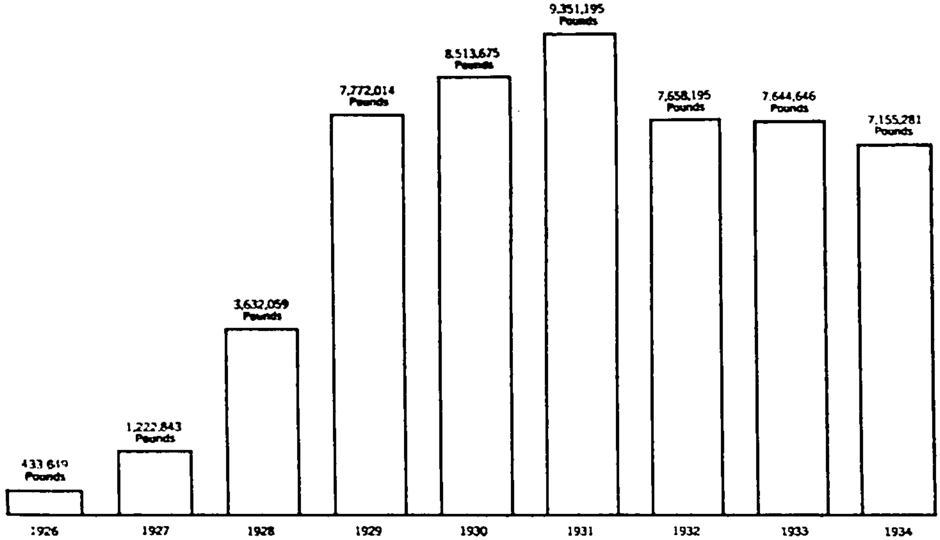
MILES OF AIR MAIL ROUTES IN THE UNITED STATES SINCE BEGINNING OF THE SERVICE.

delivered promptly after telephoning the consignee. As a further convenience to the public the Railway Express Agency arranged with Western Union for pick-up and acceptance of shipments of not over 20 pounds or $250 valuation, when messenger service would save time. The fleet of 9,500 trucks and three-wheeled motorcycle trucks, in use in the larger airport cities, speeded delivery.

The latest rate reduction was made August 15, 1934. and provided rates so low that air express could be used economically by all industries and private shippers. Minimum charges permitted shipment of packages weighing 12 ounces between any two airport cities on the company's system for 85 cents, while 25 pounds could be sent between cities 149 air miles apart for one dollar. Those charges included, of course, special pick-up and delivery, insurance up to $50 for shipments weighing 100 pounds, or less, and 50 cents a pound on heavier shipments, with signed receipts for the shipper and from the consignee.

Cancellation of Mail Contracts

On February 9, 1934, the Post Office Department cancelled all contracts of operators flying mail on routes within the United States, the order to become effective on February 19. The reason given by the Department was that the contracts had been obtained through "collusion" during the previous Administration. Hundreds of thousands of words were written and printed in the form of statements, interviews



POUNDS OF MAIL FLOWN BY AIR LINES

The air lines of the United States carried 7,155,281 pounds of mail in 1934. That service was interrupted, however, by cancellation of the domestic contracts. The Army Air Corps flew the air mail over some domestic routes from February 19 to June 1, 1934, flying 768,215 pounds, according to War Department reports. That should be added to the air line total, making 7,923,496 pounds of mail flown over United States routes in 1934.

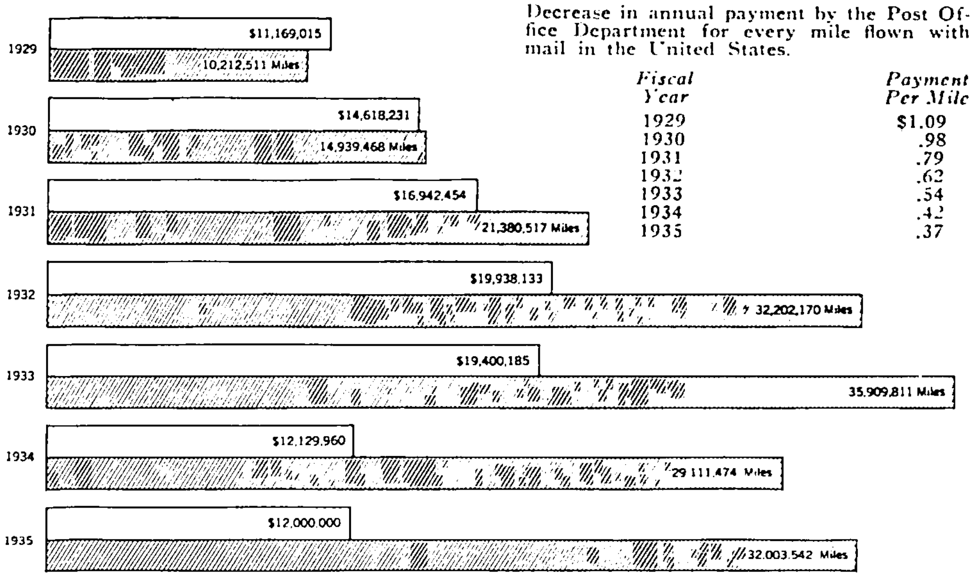
and speeches during the bitter controversy which followed. It flowered on the floors of the Senate and House of Congress, and developed into a series of unceasing partisan debates. The Post Office Department maintained its original position that the contractors had met in "collusion" in the office of the former Postmaster General. The operators denied "collusion" and asked for trial or hearings.

The Army Flies the Mail

Cancellation of the air mail contracts held by the established pioneer companies operating inside the United States was accompanied by an executive order from the White House that the Army Air Corps should fly the mail. Air Corps operations started on February 19, and terminated on June 1, 1934. There was a hiatus when army mail flights were suspended between March 10 and 19, to afford time for a reorganization of this emergency service as a result of public criticism developing out of a number of fatal accidents to Air Corps personnel. Officials blamed expectionally bad weather conditions. A majority of the critics asserted that the pilots were not accustomed to scheduled cross-country flight operations day and night, and their equipment, being military in character, was not fitted for cargo transport. It was agreed, however, that the Air Corps made an exceptionally fine showing under the circumstances.

On the last transcontinental mail trip by the Air Corps on May 8, 1934, six pilots flying Cyclone-powered Martin bombers and Curtiss attack planes in relays, sped eastward from Oakland, Calif., and the sixth plane landed the mail at Newark in 14 hours and eight minutes from the time it left the Pacific Coast.

THE GOVERNMENT CUTS AIR MAIL PAYMENTS



Decrease in annual payment by the Post Office Department for every mile flown with mail in the United States.

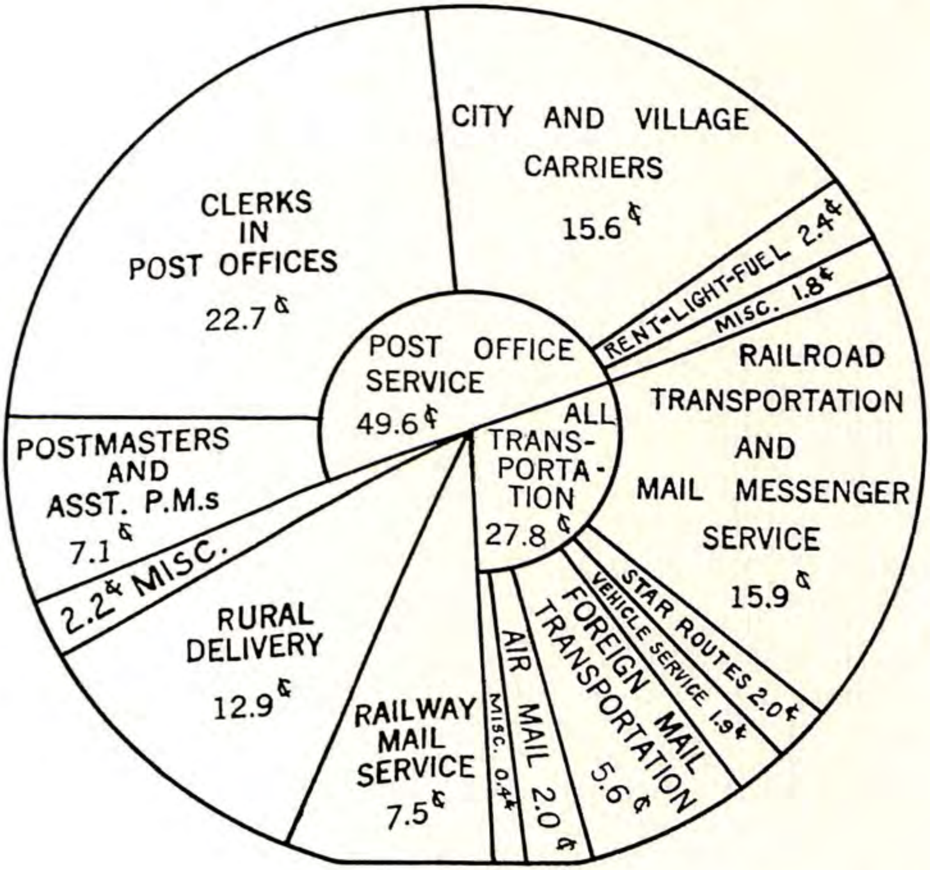
Fiscal Year	*Payment Per Mile*
1929	$1.09
1930	.98
1931	.79
1932	.62
1933	.54
1934	.42
1935	.37

The shaded parts of the graph show the number of miles of flying with mail by the domestic lines of the United States during fiscal years, compared to the amounts, in white, which the Post Office Department pays them for this service.

During those operations the Army Air Corps carried 768,215 pounds of mail, spent 14,745 hours in the air and flew an aggregate of 1,707,559 miles. In addition to the hours of actual flying with mail, more than double that many, or 32,641 hours, were flown on such missions as mail administration, mail engineering and mail training.

Postmaster General Farley's Report

On January 26, 1935, the New York Herald Tribune carried a dispatch signed by Theodore C. Wallen, head of its Washington Bureau. It is quoted in part as follows:

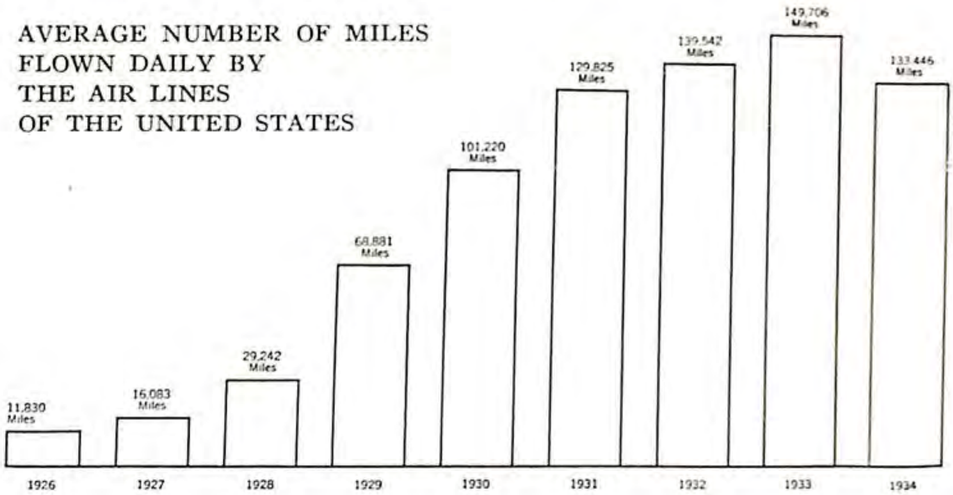


WHERE THE POSTAL DOLLAR GOES

Out of every dollar of expenditures by the U. S. Post Office Department during the fiscal year 1934 only two cents were spent on air mail service.

"Jan. 25—The cost of the disastrous experiment in the use of the Army Air Corps to carry the mails last winter and spring, it was officially reported today, has been finally recorded as $3,767,355.22, in addition to the loss of 12 lives in 66 accidents.

"The figures are set forth in matter-of-fact charts and tables, with an appendix of the brief accident records from the War Department files submitted to Congress by Postmaster General James A. Farley. The report, which has not been made generally available, was an accounting required in the Act which authorized the Postmaster General to utilize War Department equipment, airplanes and personnel for flying the mails, after his abrupt cancellation of the civilian air mail contracts.



"A routine type of document, the report placed the emphasis on the cost of the experiment in dollars, that being the information required.

" 'The only payments made by the Post Office Department under this Act,' Mr. Farley said in a brief statement accompanying the charts and figures, 'were those made to the War Department in the amount of $2,249,004.31, and I am transmitting herewith a copy of a letter with supporting charts from the Acting Secretary of War, dated October 31, 1934, which sets forth in detail the cost of this service.'

"The cost in dollars sustained by the War Department, it was shown, amounted to $1,518,350.91.

"Damage to all planes and engines resulting from the accidents was placed at $517,559.

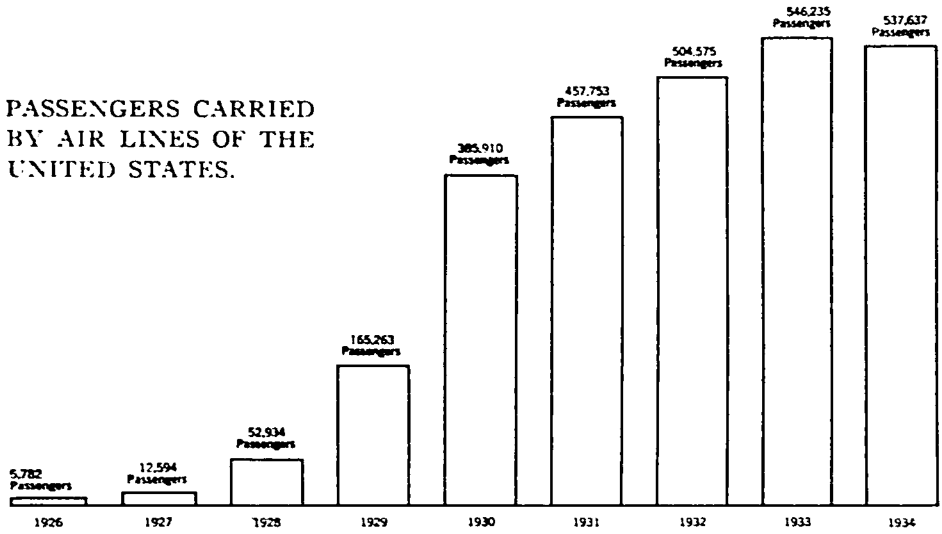
"The following cost table appeared in the accounting:

Per mile of mail-carrying (1,707,558 miles)	$ 2.21
Per pound mile (441,056,934 pound miles)	.0085
Per hours of mail-carrying (14,745.2 hours)	255.50
Per mile, all flying (5,402,004 miles)	.70
Per hour, all flying, (47,386 hours)	79.50

"The Postmaster General's accounting, with its War Department supplement, has been turned over to the Post Office committees of the Senate and House. It was indicated tonight that they would remain in the committee files, closing the incident, unless needed for reference for some unforeseen purpose."

An Editor's Comment

On February 10, 1935, a year after the cancellation of the con-

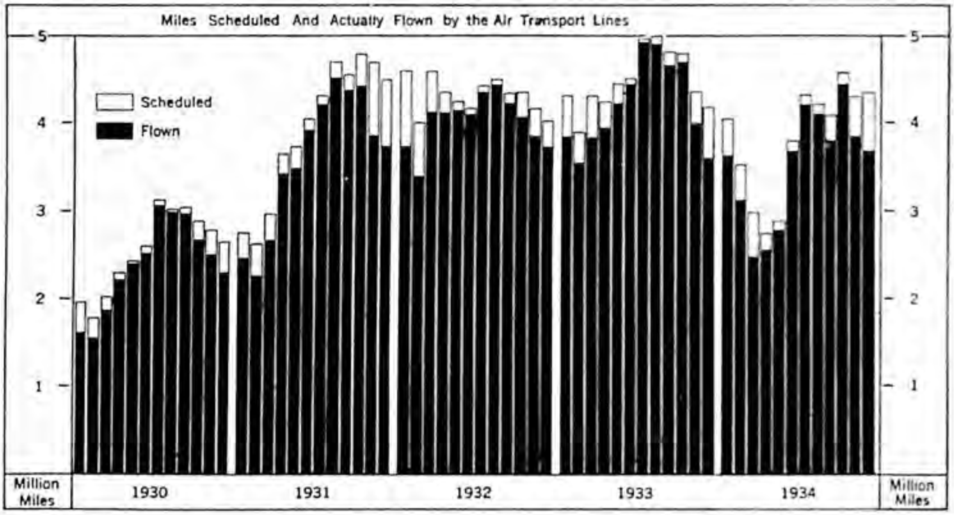


tracts, C. B. Allen, aviation editor of the New York Herald Tribune, in an article based on Mr. Wallen's dispatch, made this comment:

"Their most significant revelations, ignoring for the moment the sacrifice of human life involved in the fiasco, are that the total cost of the experiment is set at $3,767,355.22 and that the average cost a mile of flying the mail under Army auspices was $2.21. The latter figure compares with the $0.54 a mile average paid the former air mail operators during the fiscal year 1933.

"It might be added that, immediately prior to his wholesale cancellation of contracts, the average rate had been reduced to $0.426 a mile and that the Postmaster General possessed almost unlimited power to enforce further reductions under the then existing Watres Act.

"Other interesting figures from the cost table appended to the Postmaster General's accounting of disbursements due to the air mail's military interlude show that the average pound-mile payment during this period was 8½ mills—the major air lines having clamored for years for the opportunity to fly the mail at two mills a pound mile. The average hourly cost of operating the various types of military planes used in the mail service is given as $255.50, whereas the Post Office Department on numerous occasions has become indignant over commercial operators' insistance that it cost them anywhere from $125 down to $75 an hour to fly their modern multi-motored air liners carrying passengers, mail and express."



AIR LINES OF THE UNITED STATES FLY MOST OF THEIR SCHEDULED MILEAGE

The black lines show the proportion of miles flown in regular operations.

Two Administration measures followed cancellation of the contracts. An air mail law (S.3170) was passed and approved June 12, 1934, providing for temporary mail contracts, to be awarded under competitive bidding, for the duration of one year, the rate-fixing to be by the Interstate Commerce Commission. It also provided for the appointment of a Federal Aviation Commission to make a report to Congress recommending an aviation policy.

Three territorial zones were established for Army Air Corps mail operations, at Newark, Chicago and Salt Lake City. Four routes were established with Newark as a base and extending to Boston, Chicago, Miami and St. Louis. Five others in the eastern zone were from Washington to Cleveland, Cleveland to Memphis, Atlanta to St. Louis, Detroit to Toledo and Chicago to Jacksonville. Four routes in the central zone were from Chicago to Cheyenne, Memphis to Fort Worth, Chicago to Dallas and St. Louis to Kansas City. Four routes in the western zone were from Salt Lake City to San Diego, Salt Lake City to Seattle, Cheyenne to Pueblo and Cheyenne to San Francisco.

The routes in all three zones totalled 13,294 miles. The Army Air Corps had a schedule of 40,830 miles of daily flying over those routes. After temporary suspension of operations on March 10, the routes were reduced in the eastern and central zones, so that when the Air Corps resumed operations on March 19, route miles totalled 7,249 and scheduled daily flying 25,622 miles.

American Airlines

Fried chicken, southern style, as part of luncheon during a trip over scenic wonders, passengers tucked away in comfortable berths at night, and a faster, increasingly popular service between the Pacific Coast and Washington, D. C., thence to New York and New England cities were among the new features of American Airlines early in 1935. The new line connected with the established transcontinental route at Dallas, Tex., and extended to Memphis and Nashville, Tenn., thence to Washington, Philadelphia and New York.

AMERICAN AIRLINES PASSENGERS

Aboard a Cyclone-powered Douglas transport between New York and Fort Worth, Texas.

It was the first direct line between the Pacific and the nation's capital. Passengers leaving Los Angeles on American Airlines early in the evening went to bed in one of the Curtiss Wright Cyclone-powered Condor sleepers, arose at Dallas for a hot breakfast, received a southern meal somewhere over Tennessee and landed in Washington in the afternoon. They could fly into New York and even as far as Boston in time for dinner.

American Airlines in 1934 bought 10 Curtiss-Wright Condors, 10 Cyclone-powered Vultee monoplanes, 10 Cyclone-powered Douglas transports and two Lycoming-powered Stinsons. These machines were placed on routes where each separate type was especially adapted to render the greatest service to the public. Six of the Condor planes were sleepers, with six upper and six lower berths. When they were installed in regular service between Los Angeles and Dallas in March, 1934, they marked another milestone in the progress of American air transportation. Representatives of foreign lines at once came to the United States to study this latest development.

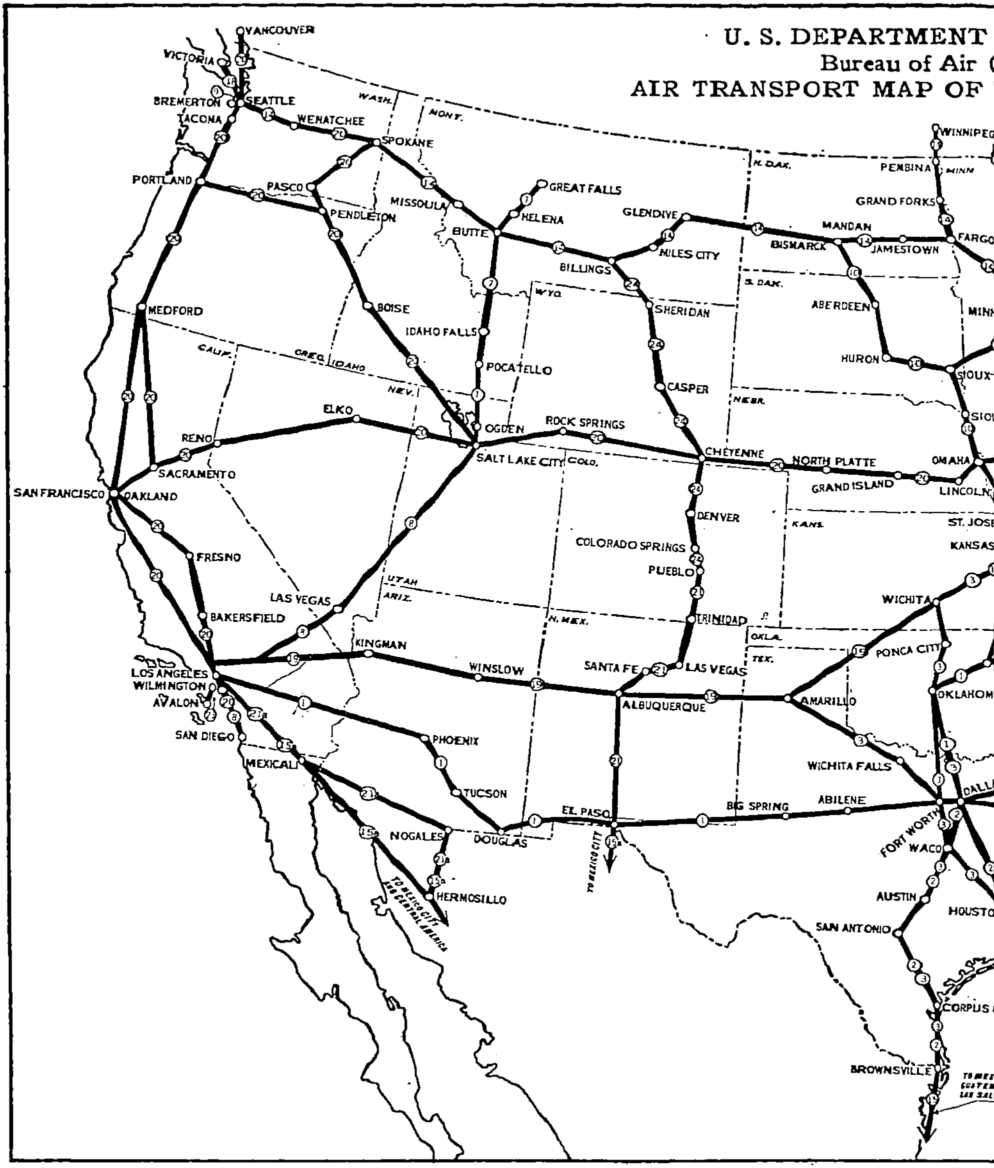
Three months of flying over the Los Angeles - Dallas division proved the Condor sleeping planes so acceptable to the traveling public that they were installed in a similar service between New York and Chicago. More than 4,000 passengers went to sleep in the berths during the last nine months of 1934. The berths were slightly longer than the standard Pullman railway berth, and followed the general details of railway sleepers. They had blankets, sheets and pillows. Each berth was individually ventilated. Each had its own reading lights, a call button for the stewardess, clothing nets, hangars and a baggage rack making hand luggage easily accessible. The berths were made up in three minutes, transforming the Condor plane into a 12-passenger transport for day flying.

The Vultee transports carried eight passengers and had a cruising speed of more than three miles a minute. They were single-motored, powered with the Curtiss-Wright Cyclone, and were operated over the level stretches of the Middle West, Southwest and between Montreal and Albany.

The first of the Douglas transport planes for American Airlines entered service between Chicago and New York late in 1934. With one stop, Detroit, Mich., the schedule between the two terminals was four hours and 30 minutes. American Airlines planned to add Douglas planes to several other routes early in 1935.

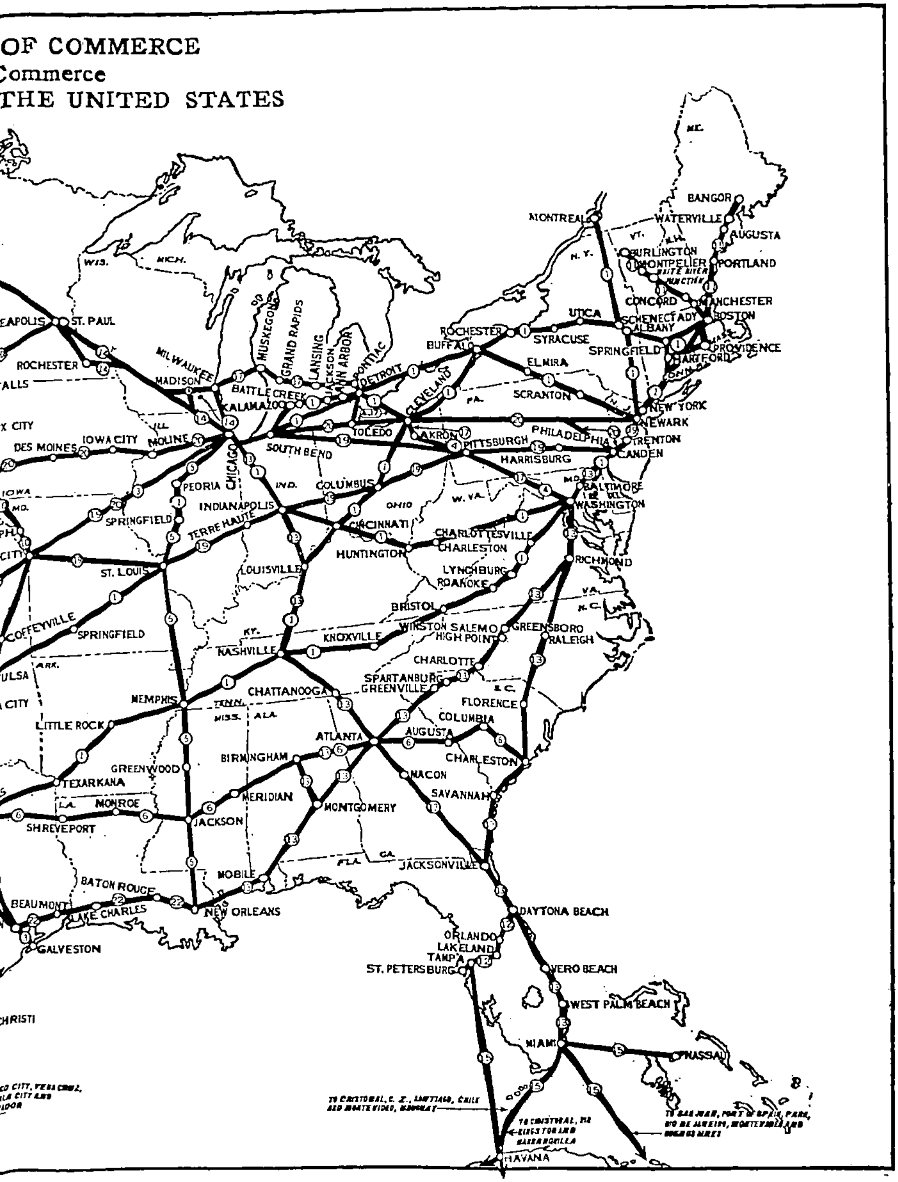
Despite the fact that it had been compelled to reorganize its system because of cancellation of the air mail contracts in February, 1934, and resultant loss of several contracts when the routes were again opened for contract bidding, American Airlines had the distinction of being the largest domestic operator of route miles at the end of the year. It was operating 6,792 miles of routes. Prior to cancellation of the mail contracts the former American Airways had more than 9,200 miles of routes; and this company became American Airlines on May 13, 1934. The loss of mail contracts caused a drastic curtailment in operations. From an average of 35,213 miles of flying daily in 1933 the system dropped to 27,951 miles average daily during 1934.

Cancellation of the mail contracts meant more than a loss in mail pay to the American system which had been serving a vast territory, parts of which would not produce passenger and express traffic in



Record Flights Across the Continent

1912	Fowler	Jacksonville to San Francisco	in 151 days
1923	Macready-Kelly	New York to San Diego	in 26 hours
1924	Maughan	New York to San Francisco	in 21 hours
1928	Goebel	Los Angeles to New York	in 18 hours
1930	The Lindberghs	Los Angeles to New York	in 14 hours
1930	Hawks	Los Angeles to New York	in 12 hours
1931	Doolittle	Los Angeles to New York	in 11 hours, 16 min.
1932	Haizlip	Los Angeles to New York	in 10 hours, 19 min.
1933	Turner	Los Angeles to New York	in 10 hours, 5 min.
1934	Turner	Los Angeles to New York	in 10 hours, 2 min.



Growth of Coast-to-Coast Speed by Scheduled Air Transport

1921	60 hours	Air Mail time
1924	31 hours, 35 minutes	Air Mail time
1926	30 hours, 45 minutes	Air Mail time
1930	29 hours, 30 minutes	Air Mail, Passengers, Express
1932	24 hours, 42 minutes	Air Mail, Passengers, Express
1933	19 hours, 30 minutes	Air Mail, Passengers, Express
1934	18 hours	Air Mail, Passengers, Express
1935	15 hours, 15 minutes	Air Mail, Passengers, Express

SCHEDULED AIR TRANSPORT OPERATIONS

January 1, 1935

Route No.	Operator	Routes Operated	Route Mileage	Class of Service
1	American Airlines, Inc.	Dallas to Los Angeles	1323	MPE
		Chicago to New York (via Buffalo)	774	MPE
		Boston to New York	192	MPE
		Boston to Cleveland (via Buffalo)	591	MPE
		New York to Nashville	808	MPE
		Washington to Chicago (via Charleston, W. Va.)	679	MPE
		Cleveland to Detroit	93	PE
		Chicago to Fort Worth (via St. Louis)	950	MPE
		Cleveland to Fort Worth	1127	MPE
		New York to Montreal	332	MPE
		Chicago to Detroit	261	MPE
2	Bowen Air Lines, Inc.	Fort Worth to Houston	255	PE
		Fort Worth to Brownsville	546	PE
3	Braniff Airways, Inc.	Chicago to Dallas (via Kansas City and Wichita)	965	ME
		Chicago to Kansas City	411	ME
		Fort Worth to Brownsville	516	MPE
		Fort Worth to Galveston	288	MPE
		Fort Worth to Amarillo	315	MPE
4	Central Airlines, Inc.	Washington to Detroit	469	MPE
5	Chicago and Southern Airlines	Chicago to New Orleans	872	MPE
6	Delta Air Service Corp.	Dallas to Charleston, S. C.	1061	MPE
7	National Parks Airways, Inc.	Salt Lake City to Great Falls	489	MPE
8	General Airlines, Inc.	San Diego to Salt Lake City	702	MPE
9	Gorst Air Transport, Inc.	Seattle to Bremerton	15	PE
10	Hanford Airlines	St. Paul to Kansas City	529	MPE
		Sioux Falls to Bismarck	315	MPE
11	National Airways, Inc.	Boston to Bangor	213	MPE
		Boston to Burlington	193	MPE
12	National Airlines System, Inc.	Daytona Beach to St. Petersburg	149	MP
13	North American Aviation Corp., Eastern Air Lines Division	New York to New Orleans (via Atlanta)	1296	MPE
		New York to Miami (via Charleston, S. C.)	1144	MPE
		Chicago to Jacksonville	933	MPE
		New York to Washington	209	MPE
14	Northwest Airlines, Inc.	St. Paul to Chicago (via Milwaukee)	408	PE
		St. Paul to Chicago (via Rochester)	356	PE
		St. Paul to Fargo	215	PE
		Fargo to Seattle	1267	MPE
		Chicago to Winnipeg	834	MPE
15	Pan American Airways, Inc.	Miami to Havana	229	MPE
		Miami to San Juan	1180	MPE
		San Juan to Paramaribo	1378	MPE
		Paramaribo to Buenos Aires	4840	MPE
		Miami to Cristobal (via San Salvador)	2228	MPE
		Miami to Cristobal (via Kingston and Barranquilla)	1810	MPE
		Barranquilla to Port of Spain	1021	MPE
		Miami to Nassau	188	MPE
		Tampa to Havana	339	PE
		Brownsville to Mexico City (via Tampico)	496	MPE
		Mexico City to San Salvador	951	MPE
		Kingston to Port au Prince	304	PE
		Port au Prince to Santo Domingo	161	PE
		Belem (Para) to Manaos	852	PE
		Vera Cruz to Merida	530	PE

(*See Next Column*)

Route No.	Operator	Routes Operated	Route Mileage	Class of Service
15a	Pan American Airways, Inc. (Aerovias Centrales)	Los Angeles to Mexico City	1684	PE
		El Paso to Durango	663	PE
		Nogales to Mazatlan	665	PE
16	Pan American Grace Airways, Inc.	Cristobal, Canal Zone to Montevideo, Uruguay (via Santiago, Chile)	4552	MPE
17	Pennsylvania Airlines & Transport, Co.	Washington to Detroit	410	PE
		Detroit to Milwaukee	265	MPE
18	Seattle-Victoria Air Mail, Inc.	Seattle to Victoria	74	M
19	Transcontinental and Western Air, Inc.	New York to Los Angeles (via Chicago)	2594	PE
		New York to Los Angeles (via Columbus and St. Louis)	2567	MPE
		New York to Chicago (via Pittsburgh)	756	PE
20	United Air Lines, Inc.	New York to San Francisco	2647	MPE
		Kansas City to Chicago	411	PE
		San Diego to Seattle	1161	MPE
		Salt Lake City to Seattle	816	MPE
		Pendleton to Spokane	169	PE
		Spokane to Seattle	230	PE
		Seattle to Vancouver	119	PE
21	Varney Speed Lines, Inc.	Pueblo to El Paso	519	MP
21a	Varney Speed Lines, Inc. (Lineas Aereas Occidentales)	Los Angeles to Mexico City (via Nogales)	1682	PE
22	Wedell-Williams Air Service Corp.	Houston to New Orleans	329	MPE
23	Wilmington-Catalina Airline	Wilmington to Avalon	31	PE
24	Wyoming Air Service, Inc.	Cheyenne to Pueblo	199	MPE
		Cheyenne to Billings	380	MPE

M—Mail. P—Passenger. E—Express.

sufficient volume to warrant operations. The company did, however, attempt to maintain its organization intact at each station stop, and to render all possible service, until it was learned definitely that the contract mail system was to be changed without regard to existing companies or their operations in certain fields. Gradually schedules were abandoned, but only where they were showing a direct and increasingly heavy loss in revenues. Bearing in mind that the system would fly no mail until temporary contracts were granted, and that the temporary contracts eventually must give way to some more permanent arrangement, the management curtailed its operations and consolidated its routes to the 6,792 route miles at the beginning of 1935.

Mail flown by the system, because there were no mail contracts between February 20 and May 20, and owing to curtailment of routes and schedules, amounted to less than 800,000 pounds in 1934 as compared to nearly 1,500,000 pounds in 1933. Passenger traffic, for the same reasons, dropped slightly from 113,000 in 1933 to about 96,000 in 1934. Air express, however, showed promise of rapid growth. In 1934 American Airlines carried 365,000 pounds of air express, the largest volume in its history.

Prospects for 1935 were considered particularly bright for American Airlines in view of the efficiency with which operations were being carried on, the important territory served by the various divisions of the company and the outlook for a constructive national policy calculated to foster the normal growth of air transportation. American Airlines employed 1,151 persons at the beginning of the new year. Its planes stopped at 54 cities in 22 States. Operating divisions included: New York-Buffalo-Detroit-Chicago, Boston-New York-Washington-Detroit-Cleveland-Dallas-Fort Worth-Los Angeles, Detroit-Cleveland, New York-Detroit-Chicago-St. Louis-Dallas, Fort Worth-Los Angeles, New York-Albany-Cleveland, Washington-Cincinnati-Chicago, New York-Albany-Montreal, and Washington-Nashville-Memphis-Dallas.

Bowen Air Lines

Bowen Air Lines at the beginning of 1935 was operating a passenger and express service with Wasp-powered seven-place Lockheed Vega cabin planes between Fort Worth, San Antonio and Brownsville and between Fort Worth, Dallas and Houston, Tex., making connections with the Pan American Airways System into Mexico south of Brownsville, and also connecting with other air lines at Dallas and Houston. A passenger might leave Dallas at three o'clock in the afternoon, land at Brownsville that evening, leave Brownsville over Pan

American Airways next morning and arrive in Mexico City in time for luncheon.

Braniff Airways

At the beginning of 1935 Braniff Airways planned to enlarge its fleet of transport planes and install multi-motored equipment on all schedules. The company announced that it would increase its activities toward developing air mail, passenger and express traffic during the new year. Braniff Airways, with general offices in Oklahoma City, Okla., discontinued operations between Oklahoma City and Chicago on March 17, 1934, awaiting developments in air mail legislation. It received Contract 9 to carry mail between Chicago, Kansas City, Wichita, Ponca City, Oklahoma City, Dallas and Fort Worth, the bids being based on single-motored planes. After receiving the mail contract the company resumed passenger operations and extended its service to include passenger traffic at all its air mail stops.

Central Airlines

One of the new companies arising out of cancellation of old contracts and resultant air mail legislation, Central Airlines was formed in April, 1934, and became the successful bidder on route 11 between Washington, D.C., and Detroit, Mich. The company was making three round trips daily in October, with 2,414 miles of flying. Equipment included Lycoming-powered tri-motored Stinsons and Lockheed Vegas. The operations base was maintained at Detroit City Airport, with the general offices at Allegheny County Airport, Pittsburgh. The company reported steady passenger traffic conditions, attributed to the need for fast transport between the industrial centers on its route and NRA headquarters in Washington. High speed passenger planes with greater load capacity were considered prime requisites for continued development, and officers of Central Airlines had plans for installing additional equipment in 1935.

Chicago and Southern Air Lines

Having been the successful bidder on air mail route 8 between Chicago and New Orleans, the Pacific Seaboard Air Lines on May 4, 1934, abandoned its former coastal passenger route between Los Angeles and San Francisco, and transferred its base to Memphis, Tenn. Early in 1935 the name of the company was changed to Chicago and Southern Air Lines. Traversing the 903 miles of Mississippi

Valley between New Orleans and Chicago, the company made stops at Jackson and Greenwood, Miss., Memphis, St. Louis, Springfield and Peoria, Ill. Passenger service was started on July 13, 1934. Night service was to be started upon completion of the airways on that route early in 1935. The company announced that it would install multi-motored equipment as quickly as practicable, meanwhile operating a fleet of Bellanca and Pitcairn single-motored planes.

Delta Air Lines

Air mail contract 24 was awarded to Delta Air Lines in 1934, providing a daily schedule between Dallas, Tex., and Charleston, S. C., by way of Shreveport and Monroe, La., Jackson and Meridian, Miss., Birmingham, Ala., Atlanta and Augusta, Ga., and Columbia, S. C. Lycoming-powered seven-passenger Stinson cabin planes were used in that service. Delta Air Lines provided a direct service across the Gulf States connecting at Atlanta with Eastern Air Lines flying south to Florida cities and in turn making connections with Pan American Airways at Miami. The company planned to increase the number of schedules with the growth of traffic in 1935.

Eastern Air Lines

At the beginning of 1935 Eastern Air Lines, a division of North American Aviation, was operating 3,755 miles of passenger, express

NEW YORK-MIAMI AND BACK IN A DAY

Capt. E. V. Rickenbacker's one-day round trip flight in an Eastern Air Lines Cyclone-powered Douglas ends with a great reception at Newark Airport.

ALL ABOARD FOR THE SOUTH

Passengers about to leave Washington for Miami in one of the Eastern Air Lines Cyclone-powered Douglas transports.

and mail routes, and its planes were flying 13,106 miles every 24 hours. About 60 per cent of the flying was at night. Starting the year 1934 as Eastern Air Transport, operating 2,025 route miles between New York and Miama, Fla., the company was reorganized after cancellation of the mail contracts. As Eastern Air Lines it secured temporary contracts in May, and set out to preserve the good will which it had established by years of pioneering operations along the Atlantic seaboard.

The former operations between New York, Atlanta and Miami were extended to include three great divisions, New York-Miami, New York-New Orleans and Chicago-Miami. For the first time in the history of air transportation Eastern Air Lines at the end of 1934 was flying passengers, mail and express on eight-hour schedules at night between New York and Miami and nine-hour schedules between Chicago and Miami. Those services from the two northern cities made connections with the great Pan American Airways System at Miami. Passengers, mail and express arriving at Miami after only eight hours of flying at night could leave on Pan American planes for destinations to the West Indies, Central and South America.

Carrying on its development program planned prior to 1934, Eastern Air Lines during the year placed in service on the two routes to Miami 14 new Douglas transports. Curtiss-Wright Cyclone-powered Condors were operated between New York and New Orleans, and a new schedule with Douglas transports was to be added early in 1935. In January, 1935, the company was serving 32 cities in 15 States, and operating 11 round trips daily between its six terminal cities. It possessed the enviable record of having carried 325,000 passengers in

LUNCHEON TWO MILES HIGH

One of the Eastern Air Lines fleet of Cyclone-powered Douglas transports flying on schedules between New York and Miami, Fla., in eight hours.

25,000,000 miles of flying during the years of its operation, without serious injury to any passenger.

The operations department in 1934 installed a complete weather reporting system based on air mass analysis. Aircraft radio sets were improved, and more extensive radio facilities were installed throughout the Eastern Air system. A general reduction in fares between New York and New Orleans brought an 80 per cent increase in passenger traffic within 30 days. The new tickets were good for 30 days, with stop-overs, thus paralleling rate structures of surface transport agencies in the South. On September 27, the company became a bonded carrier, the first air line in the world to take such action. It meant that goods entering the United States by air or surface craft could be transported by Eastern Air Lines under bond for delivery to any city having a custom house. This was shown to be of special significance in the Latin American trade, facilitating delivery of air express anywhere. The 20 cities on the system having custom houses became in fact official ports of entry. They included Atlanta, Savannah, Charleston, Richmond, Winston Salem, Washington, Baltimore, Camden, Philadelphia, Chicago, Indianapolis, Louisville, Nashville, Newark and New York.

To demonstrate its new equipment Eastern Air Lines flew a Douglas transport from Los Angeles to New York with one stop. That record flight for passenger transport planes was described by Capt. E. V. Rickenbacker, who had charge of it, in these words:

"The 'Florida Flyer' was gassed and waiting for us as we boarded her at Union Air Terminal, Los Angeles, at 5:30 A.M. on November 8. After testing motors we went to the end of the runway and then took off at 5:44 Pacific Coast time. Pilots Si Morehouse and Capt. Charles W. France, vice president in charge of operations for Eastern Air Lines, took the ship up in a steady climb. Straight ahead the San Bernardino Mountains, a glittering array of peaks, stood silhouetted against the rising sun. We reached an altitude of 14,000 feet in 75 miles but continued to climb the ship to the 18,000 feet at which we wanted to fly on the transcontinental flight. It had been our original intention to fly the great circle course, which would have carried us over the Grand Canyon, Pikes Peak, southern Nebraska, central Iowa and into Chicago for refueling. We were carrying 650 gallons of gasoline. However, as we passed over Colorado we realized that head winds were delaying us, so we changed our course to stop at Kansas City for fuel.

"We notified the TWA base by radio and they were ready for us when we set the big ship down. Scores of men swarmed around the plane putting in gas, oil, and changing the radio frequency so we could communicate with Eastern stations. We were on the ground only 12 minutes.

"As we had 50-mile tail winds out of Kansas City, we quickly gained an altitude of 16,000 feet and then made our fastest speed of 260 miles in an hour. The winds fell off, however, as we reached the middle of Missouri, and the tail winds decreased to 25 miles an hour. We held a set course as we whizzed across Illinois, Indiana, Ohio and Pennsylvania. The ground was obscured in some places by the haze and low fog, but the 'Florida Flyer' kept its nose steady toward New York. After a quick circle of the field, we landed 12 hours, three minutes and 15 seconds after leaving Los Angeles. During the trip

A DOUGLAS FLIES "ON TOP"

TWA passengers leaving New York for a night flight to Los Angeles see a sunset as their ship climbs above the clouds of a winter storm, to be kept on its course by the Sperry pilot and a radio beam.

we had used only 75 per cent of the horsepower available from the two Wright Cyclone engines. We beat the previous transcontinental passenger transport record by 57 minutes and 30 seconds."

To further impress upon the public mind the superlative speed of new American transport planes and the reliability of engines, auxiliary and navigational equipment, Capt. Rickenbacker on November 13 took the Douglas "Florida Flyer" with a passenger in each of the 14 seats, on a one-day flight from New York to Miami and return. The flight took place on one of the most inclement days of the year, with high cross winds and heavy rains sweeping across many sections of the Atlantic seaboard. Nevertheless the "Florida Flyer" took off from Newark Airport at 6:10 o'clock in the morning, made but two stops, one at Washington, the other at Jacksonville, and landed in Miami at 2:30 that afternoon. Following a civic luncheon, the "Florida Flyer" with the same crew and passengers left Miami at 3:30 o'clock, again stopped at Jacksonville and Washington, and landed in Newark at 11:27 that night. It was significant that the passengers, who had flown 2,400 miles that day, were not fatigued enough to go home and go to bed; but rather they went to a New York hotel and attended a civic celebration in honor of the event.

General Air Lines

On May 8, 1934, Western Air Express, pioneer air mail and passenger line on the West Coast, passed out of existence as a transport carrier, and General Air Lines, a company set up to bid on the new air mail contracts, took over the former operation of Western Air Express between San Diego, Los Angeles, Las Vegas and Salt Lake City. Personnel and officers of the former company were retained by

AIR EXPRESS FOR A DOUGLAS

A variety cargo for General Air Lines out of Los Angeles.

General Air Lines. The former Western Air Express route between Cheyenne, Denver, Pueblo, Trinidad, Las Vegas, Albuquerque, El Paso and between Pueblo and Amarillo was discontinued, General Air Lines centering on operations between San Diego, Los Angeles and Salt Lake City, a route 778 miles long.

As before, General Air Lines operated the air gateway for United Air Lines into Southern California, connecting with all transcontinental planes of United Air Lines at Salt Lake City. One daily round trip schedule was being flown on the route at the end of the year. On October 15 General Air Lines replaced its former fleet of tri-motored Fokkers, which it introduced on the West Coast in 1928, with Boeing and Douglas transports. The initial flight was arranged with two planes carrying newspaper men, industrial and business leaders from Los Angeles to San Diego, Salt Lake City, Las Vegas and back to Los Angeles. The 1,500-mile flight was completed in one day, the group flying to San Diego for a breakfast meeting at the airport, then to Salt Lake City for a luncheon meeting, down to Las Vegas for a dinner meeting and back to Los Angeles by 11 o'clock that night.

At the end of the year the company still maintained its safety record, having carried 115,000 passengers during 15,000,000 miles of flying without serious injury to a passenger since the start of operations May 28, 1926, the first regular daily schedule on the Pacific Coast. Air express traffic increased more than 40 per cent in 1934.

Hanford Airlines

At the end of 1934 Hanford Airlines operated air mail contract 26 between Twin Cities and Omaha and between Bismarck, N. D., and Sioux Falls, S. D., letting out to Rapid Air Lines that part of the route between Omaha and Kansas City. Hanford Airlines turned over to Northwest Airlines its mail contract 16 between Chicago and Winnipeg, Canada, by way of Milwaukee, Madison, Rochester, St. Paul, Minneapolis, Fargo, Grand Forks and Pembina. Passenger and express service was offered on its mail routes.

Inter-Island Airways

Operating four Sikorsky S-38 amphibions the Inter-Island Airways, maintaining the only scheduled service in the Hawaiian Islands, received an air mail contract and on October 8, 1934, began daily service over the 120 miles of its westerly route between Honolulu and Kauai. The Honolulu base was located at Rodgers Airport at Oahu, across Pearl Harbor from Honolulu. The Kauai terminals were at Wailua and Port Allen airports. The Hilo route extended eastward from Honolulu to Hoolehua airport on Molokai, to Lanai Island, or to Maalaea airport on Maui Island, a distance of 110 miles; thence 125 miles across water to Hilo on Hawaii Island.

The importance of this flying service to residents or visitors in the Islands may be visualized by the flying time. The 120 miles between Honolulu and Kauai was spanned by the Wasp-powered Sikorsky amphibions within an hour and a half and on the outbound flight in

65 minutes, depending upon winds. The 110 miles between Honolulu and Maui was covered within 70 minutes, the 125 miles between Maui and Hilo in time ranging from 70 to 95 minutes.

At the beginning of 1935 Inter-Island Airways had a five-year record of having flown more than 1,255,000 miles and landing 47,869 passengers at their destinations without a single instance of personal injury.

Long & Harman

The firm of Long & Harman, Inc., proved the successful bidder on mail contract 15 when bids were opened by the Post Office Department in May, 1934. The route included three divisions, Amarillo to Dallas by way of Wichita Falls and Fort Worth, Tex., Dallas to Brownsville by way of Fort Worth, Waco, Austin, San Antonio and Corpus Christi, and Dallas to Galveston by way of Fort Worth, Waco and Houston. Passenger and express service was offered on those divisions. Late in 1934 the service was taken over by Braniff Airways.

National Airlines System

Air mail contract 31 was secured by D. K. Franklin and G. T. Baker late in 1934, providing for a daily schedule both ways between Jacksonville and St. Petersburg, Fla., a distance of 241 miles, with station stops at Daytona Beach, Orlando, Lakeland and Tampa.

National Airways

As the operating contractor for passenger and express traffic on the Boston-Maine Airways and Central Vermont Airways, the National Airways organization in 1934 operated out of Boston, Mass., with station stops at Portland, Augusta, Waterville and Bangor, Me., Manchester and Concord, N. H., White River Junction, Montpelier and Burlington, Vt., with a summer extension to Montreal. National Airways also held the air mail contract 27 between Boston and Burlington at the beginning of 1935.

Three railroads, the Boston and Maine, Maine Central and Central Vermont Railway, owned the Boston-Maine Airways and Central Vermont Airways, and the railroads handled traffic, advertising, publicity and other details of the passenger and express traffic, paying National Airways a predetermined rate for space in its planes which at the end of 1934 included a fleet of five Lycoming-powered 10-passenger Stinson transports. The planes were heated and equipped with radio. Daily trips over the 210 miles between Boston and Bangor were covered in two hours 20 minutes, including the three intermediate stops. The daily trips covering 191 miles between Boston and Burlington with four intermediate stops were made in two hours and 25 minutes.

Despite the lack of Federal aids to aerial navigation, except at the Boston Airport, National Airways reported 95 per cent operating efficiency during 1934. During the winter of 1933-34 heavy snow and soft conditions at the out-of-Boston fields prevented use of skis. Snow plows cut runways across the fields, and traction in cross-wind between snow banks, often six feet high, was secured by means of heavy duty wire chains with special calks for cutting into the ice. FERA funds enabled the airports to construct hard surface runways during the year. The company maintained direct connections with American Airlines operating south and east from Boston.

NATIONAL PARKS AIRWAYS

Wasp-powered Boeing transport in service between Salt Lake City and Great Falls, Mont.

National Parks Airways

The route of 517 miles between Salt Lake City, Utah, and Great Falls, Mont., with intermediate stops at Ogden, Utah, Pocatello and Idaho Falls, Idaho, Butte and Helena, Mont., was pioneered by National Parks Airways and operated continuously with a mail, passenger and express service until cancellation of the mail contracts. For a brief period after the cancellation passenger and express service was offered the public; and finally it too was suspended. When the Post Office Department again advertised the route for mail contracts, Alfred Frank, founder and president of the company, was declared personally eligible to bid; and he was awarded contract 19. He leased the property of National Parks Airways, and started operations in May. A twin Wasp-powered Boeing transport was installed in service on November 1, 1934, and plans were made for acquiring additional equipment of the same type during 1935.

Northwest Airlines

Northwest Airlines was reorganized from the former pioneer company Northwest Airways following cancellation of the mail contracts. Beginning June 1, 1934, the line operated daily service between Chicago and Seattle, flying about 5,200 miles daily, with three round trips between Chicago and Twin Cities and one round trip between Twin

NORTHWEST AIRLINES LOCKHEED

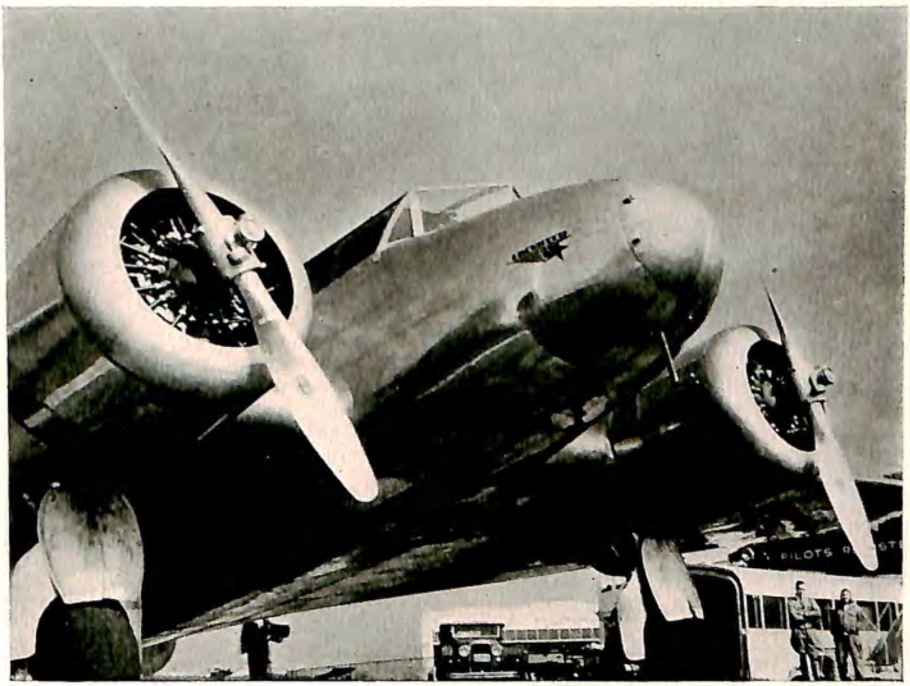
One of the Wasp-powered soundproofed Electra transports built for Northwest Airlines by the Lockheed Aircraft Corporation.

Cities and Seattle. At the beginning of 1935 the company had placed in service five new Wasp-powered Lockheed Electra transports to augment its old fleet of Lockheed Orions and Fords. Eight additional Electras were on order. With the Electras giving an air speed of more than 190 miles an hour and a block to block scheduled speed of more than 165 miles an hour Northwest Airlines speeded up its mail, passenger and express service between Chicago and Spokane, planning to extend the faster service to Seattle upon delivery of additional planes of that type. The new schedule called for departure from Chicago at five o'clock in the morning and arrival in Seattle at 5:45 in the afternoon, less than 15 hours elapsed time over the 2,000-mile route between the two cities. The Bureau of Air Commerce planned to have the entire northern continental airway, traversed by Northwest Airlines, fully lighted and in operation along the entire route early in 1935. At the same time Northwest Airlines had resumed operations on its old international route between Chicago, Twin Cities, Fargo and Pembina, N. D., leading to Winnipeg, Canada. Officers of the company reported a satisfactory passenger business, and believed that all three forms of traffic would develop rapidly in 1935.

Pennsylvania Airlines

The air mail situation and resultant legislation caused a reorganization of the pioneer Pennsylvania Airlines which on July 1, 1934, took the name of Pennsylvania Airlines and Transport Company. The new company also acquired the assets of the Kohler Aviation Corporation which had operated between Milwaukee and Detroit prior to cancellation of the mail contracts.

At the beginnnig of 1934 Pennsylvania Airlines was flying five round trips daily between Washington and Cleveland, carrying passengers, mail and express. Cancellation of the mail contracts in Febru-



NORTHWEST AIRLINES LOCKHEED ELECTRA

Wasp Junior-powered transport equipped with Hamilton Standard controllable pitch propellers.

ary caused a temporary decrease in service, but traffic improved gradually so that three and then four passenger schedules were operated. The new company maintained mail and passenger service between Milwaukee and Detroit, and developed its passenger and express service between Detroit, Cleveland, Pittsburgh and the national capital. In December, 1934, Pennsylvania Airlines announced the purchase of a fleet of Boeing 247-D high speed transport planes powered with Pratt & Whitney Wasps, which would speed up service between Detroit and Washington, thus altering the whole picture of air transportation in the mid-eastern section of the United States. At its station stops Pennsylvania Airlines made direct connections with four other trunkline systems, so that passengers might fly at three miles a minute speed between any of the larger centers in the country.

The new schedules put Detroit only slightly more than three hours from Washington, with Cleveland and Detroit only 40 minutes apart.

TWA AT KANSAS CITY

Six Wright Cyclone-powered Douglas transports ready to leave with full loads of passengers, mail and express, on schedules to Los Angeles and to Chicago and New York.

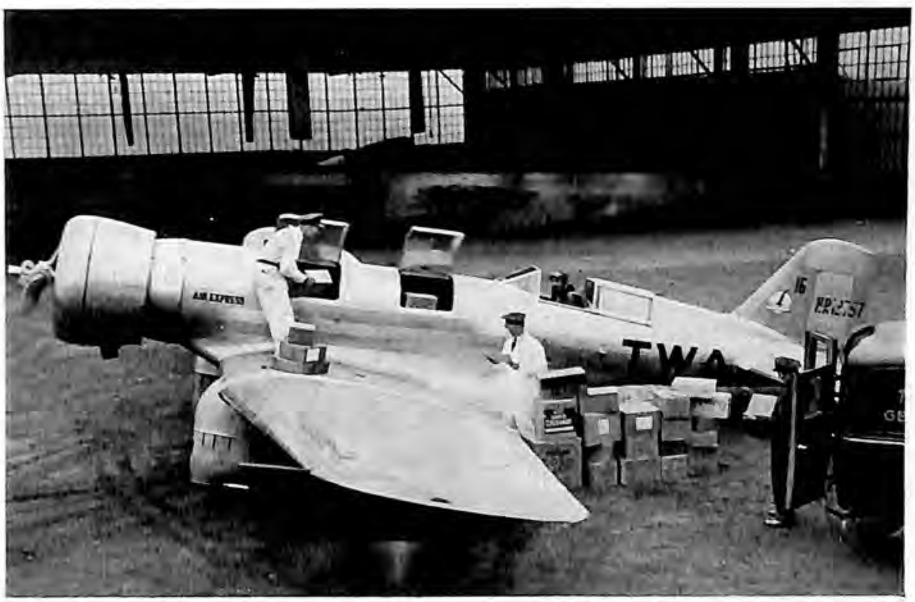
Pittsburgh was only 75 minutes from Washington; and making connections with Eastern Air Lines at the capital, one might fly from Pittsburgh to Miami in eight hours. With heated cabins, insulated from noise, with individual ventilators and adjustable seats, the Boeing transports offered the fastest and most comfortable service ever established between Washington and Detroit.

Rapid Air Lines

On January 1, 1934, the Kansas City-St. Louis division of Rapid Air Lines was discontinued because of competing services. On April 1, the Kansas City-Omaha division was discontinued, pending award of new mail contracts. On July 3 the Omaha-Kansas City operations were resumed, Rapid Air Lines carrying mail, express and passengers under a lease agreement with Hanford Airlines, which had received an air mail contract for route 26. Lycoming-powered, tri-motored Stinson transports were placed in service to take the place of single-motored Bellancas and Lockheeds operated previously. When United Air Lines discontinued its service between Omaha and Kansas City on September 1, Rapid Air Lines added another schedule for air mail and express. St. Joseph, Mo., was a station stop. The company planned to purchase new high speed equipment in 1935, provided alterations were made in the mail contract. Rapid Air Lines was also investigating the possibilities of establishing a through service from Winnipeg to the Gulf of Mexico, by way of Sioux City, Omaha and Kansas City.

Transcontinental & Western Air

TWA introduced the Douglas transport to the world early in 1934. Its fast, quiet and comfortable service with Douglas planes proved popular with the traveling public. At the beginning of 1935 TWA was operating passenger and express service on three round trips daily between Los Angeles and New York, two of the schedules being by way of Kansas City and Chicago, and the other by way of Kansas City and St. Louis. In addition, TWA had two round trips



A TWA NORTHROP GAMMA

Loading General Air Express cargo at Newark for its over-night hop to Los Angeles.

daily between Kansas City and New York by way of Chicago and another round trip between Chicago and New York. Nearly all schedules were being operated above 90 per cent capacity.

Passengers, mail and express at the end of 1934 were flying over TWA in the 26 Douglas planes then in operation in 16 hours from Los Angeles to New York. The time on the non-stop schedule between New York and Chicago was only four hours. TWA was maintaining two overnight schedules between New York and Los Angeles. Passengers could span the continent in a single night without the loss of a business day.

The manner in which TWA presented its new equipment to the public was dramatic. For several months it was generally known that TWA engineers had approved the new Douglas transport which had been designed and built to their specifications. Following service tests with the twin supercharged Wright Cyclone engines it was known that the Douglas represented a great advance in air transport equipment, its two engines, soundproofed cabin and seats for 14 passengers making it a fast, comfortable ship promising to carry profitable loads on the long non-stop flights necessary for a popular transcontinental service. Cancellation of the mail contracts in February, 1934, found TWA accepting delivery of its first Douglas.

The contract lines were to cease mail operations on February 19, and the Army Air Corps was to carry on thenceforth. At 10 o'clock on the night of February 18 Capt. E. V. Rickenbacker and a party of passengers filling all seats in the plane took off from Los Angeles on a maiden flight to New York. It was to be the last flight with mail until the lines regained their contracts; and Capt. Rickenbacker planned that it should be a flight worthy of public attention. He believed that Americans should learn of the new equipment which the lines were installing to improve their service just when the Government was cutting off one of their principal sources of revenue. Besides the passengers, Jack Frye, who was to pilot the plane, had seen nearly a thousand pounds of mail and a capacity load of air express stowed away in the big ship. Both Rickenbacker and Frye knew that severe winter storms lay ahead of them. A blizzard was due to sweep down from the Great Lakes and cross their path next day, and it would in all probability blanket the entire Atlantic seaboard.

"If you do not reach Newark by four o'clock in the afternoon, you will not be able to find it," they told Rickenbacker and Frye.

"We will land in Newark a few minutes before four o'clock," the pilots replied.

The big Douglas sped out of Los Angeles on its night run. Climbing rapidly it was headed for Tejon Pass in the Rockies which sep-

LOOKING UP AT A DOUGLAS

TWA (Transcontinental & Western Air) early in 1934 introduced the Douglas transport to the world with the fastest passenger service on earth.

arate the orange groves of California from the desert. Frye kept climbing to 12,000 feet, then 14,000 feet. In exactly three hours and 15 minutes he had brought the machine to a stop at Albuquerque, N. M., 712 flight miles from Los Angeles. Fifteen minutes were spent refueling, when the Douglas again took the air on a steep climb to hurdle the mountains and speed in the sunlight on a direct 584-mile hop to Kansas City, Mo. The Sperry automatic pilot did the actual work of handling the controls, leaving Frye and Rickenbacker free to navigate, watch their instruments and receive weather reports. The radio warned them of a storm over Missouri, and soon they could see black clouds ahead. Up they went, climbing 1,300 feet a minute to 8,000 feet, 10,000, 12,000, keeping constantly in the sunlight, and on top of the raging storm below. Columbus, O., reported 1,000 feet ceiling with the storm closing in on the airport. A hundred miles out the Sperry pilot was adjusted for the long glide into Columbus.

Within fifteen minutes after landing they were refueled and leaving the Ohio city, now obliterated from view. The Douglas was making its way toward New York in the grip of a terrific snow storm. Again the plane was put into a steep climb, 14,000 feet, 16,000 feet, and still the clouds were tumbling in great black masses above the plane. Not in the history of air transportation had any pilot dared to take a load of passengers through such weather. Nor did Rickenbacker and Frye take their passengers through it. They continued to climb. At 19,500 feet above sea level they came out on top, with the sun shining brightly. The thermometers outside the steam heated cabin registered 22 degrees below zero. Inside the passengers were comfortable with 70 degrees above, and enjoying the billowing clouds below. The Sperry pilot kept the nose of the ship pointed straight at Newark airport where the radio reported a high ceiling, though storm signals were up. They were riding in the clear sky above the storm, yet the occupants did not see the earth between Columbus and Newark. The plane was making 230 miles an hour. A hundred miles from Newark the Sperry pilot again was adjusted for the long glide earthward; the landing gear was let down and the flaps on the trailing edge of the monoplane wing were lowered to act as brakes and slow up the landing. The passengers filed out of the ship exactly 13 hours and two minutes after leaving Los Angeles. They had arrived more than two hours ahead of schedule, shortly after one o'clock in the afternoon. Their average speed from coast to coast had been 203 miles an hour, elapsed time.

"Aren't you going home?" somebody asked Capt. Rickenbacker.

"I am waiting here to see if our weather forecast at Los Angeles was correct," he replied. "They predicted a storm here at four o'clock."

Shortly before that hour great flakes began falling. As the hour struck the storm thickened to such intensity that all planes were grounded for the night.

The accuracy with which weather conditions across country had been forecast the day before was an example of the polar front or air mass analysis method developed at the California Institute of Technology in cooperation with the U. S. Weather Bureau. It was put into general use on the TWA system during 1934.

On May 13, 1934, Jack Frye in a Cyclone-powered Northrop Gamma flew from Los Angeles to Newark, N. J., in 11 hours 31 minutes, a record for cargo transport. His load included 355 pounds of mail and 85 pounds of express. He made only one stop, and that was 10 minutes at Kansas City for fuel. The flight was made to demonstrate the possibilities of one-stop mail service between the Atlantic and the Pacific; and TWA officials hoped to establish regular schedules in 1935.

To solve a radio problem encountered with the operation of the Douglas planes at high altitudes the TWA laboratories at Kansas City developed a new transmitter and receiver for use on all the company routes. TWA contemplated a greater frequency of schedules between major cities on its routes during 1935.

United Air Lines

Starting 1935 operations by completing its ten thousandth round trip from coast to coast over the route which it had pioneered in 1927, United Air Lines planned schedules for its popular passenger, mail and express service even faster than those which already had made this system a model for the rest of the world. At the end of 1934 passengers could leave New York an hour before midnight and land in San Francisco in time for an early dinner next day, or they might leave shortly before noon and eat their breakfast at the Golden Gate.

Using a fleet of 45 Pratt & Whitney Wasp-powered Boeing 247

CALIFORNIA FLOWERS FLY EAST

A 247-D Boeing transport of United Air Lines, Wasp-powered, takes on 450 pounds of cut flowers from the air express division of the Railway Express Agency for next day deliveries in Atlantic Coast cities.

transports, which were the first of the low-wing, twin-motored high speed monoplanes to enter scheduled service, United Air Lines flew a total of 15,000,000 miles in 1934, making its aggregate of scheduled flying 75,000,000 miles since 1927. About 6,000,000 miles were flown at night during 1934, over terrain that varies between sea level and high mountain passes on routes that extend from the Atlantic to the Pacific and from the northern to the southern border.

Regularity of service, developed during years of pioneering which had given the United system a trained pilot and ground organization unexcelled anywhere, accounted for the growth of traffic in 1934 when United Air Lines alone carried 147,000 passengers, a 15 per cent increase over the 1933 record; 568 tons of air express, a 150 per cent increase over 1933; and 3,000,000 pounds of mail, approximating half the total flown in the United States and twice the quantity flown by the lines of Great Britain, France and Germany combined.

In January, 1934, United Air Lines was serving directly 47 cities in 19 States on its 6,500 route miles. Its planes were flying 48,000 miles every 24 hours, about two-fifths of that mileage at night. After cancellation of the air mail contracts in February, 1934, United Air Lines continued to operate all schedules. Its organization was maintained intact. A month later it withdrew from the Omaha-Watertown route on which passenger traffic was unduly light.

With the award of temporary air mail contracts United Air Lines received contracts for route 1 between New York and California,

IN PORT AT CHICAGO

One of United Air Lines 55 Wasp-powered Boeing transports, with Hamilton Standard controllable pitch propellers.

route 11 between Seattle and San Diego and route 12 between Salt Lake City and Seattle. United Air Lines also submitted a bid on its former mail route between Chicago and Dallas, Tex., basing its estimates on multi-motored, high speed service. It lost that contract to a low bidder proposing to operate with single-motored planes, whereupon United withdrew its service between Kansas City and Dallas. It moved off the southwest route on the day of its eighth anniversary in pioneering operations in that territory. However, the company continued to maintain passenger and express service between Kansas City and Chicago.

After the split-up of the holding company, United Aircraft and Transport Corporation, the operating organization formed the United

Air Lines Transport Corporation; and the former operating divisions, Boeing Air Transport, Pacific Air Transport, National Air Transport and Varney Air Lines, were consolidated. With resumption of contract mail service, operating headquarters were consolidated at Chicago. The general overhaul and repair base for the entire system was located at Cheyenne, Wyo.

During the year United expanded its Pacific Coast service, projecting schedules north from Seattle to Vancouver, B. C., and south from San Diego to Agua Caliente, Mex., thus creating a "Three Flag Route" between Canada and Mexico. Other cities included in United service in 1934 were South Bend, Ind.; Kylerton, Pa.; Burlington, Ia.; and Wenatchee, Wash.

United Air Lines late in 1934 acquired ten new Boeing transports, model 247-D, a further development of the famous 247. It was the 247-D which Col. Roscoe Turner and Clyde Pangborn flew to third place in the London-Australia race, a feat which, combined with the Douglas winning second place, both against a field of special racing machines designed for the speed dash alone, placed American air line equipment far ahead of all the world's aircraft. Geared supercharged Wasp engines, Hamilton Standard controllable pitch propellers, larger engine cowling, better streamlining, improved passenger accommoda-

FLYING EXPRESS

A full load being fed into the maw of a United Air Lines Wasp-powered Boeing transport.

tions and greater soundproofing combined to make the 247-D superior to the older model; and United Air Lines commenced revising its schedules to accord with a higher speed of 189 miles an hour cruising with full loads at 12,000 feet altitude. After the 10 new models had entered service United Air Lines announced that early in 1935 it would modify its entire fleet of Boeing 247 planes to conform with 247-D specifications, thus giving the system a fleet of 55 247-D models for increased speeds on its coast to coast and border to border services.

In 1934 the engineers of United Air Lines helped to develop a new type light weight de-icer which was installed on all planes during the winter. The company's research and development laboratories designed and perfected a new type long wave aircraft receiver for picking up beacon signals and weather broadcasting, and a new type

UNITED AIR LINES LOS ANGELES STATION

Five Pratt & Whitney Wasp-powered Boeing transports at Union Air Terminal, Burbank, Calif., ready to take off on United Air Lines scheduled runs.

ground station short wave receiver, which became the first of its kind to be put in standard use. Experiments with a new type automatic pilot were carried on, with a view toward installing it on all planes when service tests should prove its complete development.

The question as to how fast passengers may fly in comfort was projected far ahead of normal speeds when a United plane carrying 10 passengers averaged 270 miles an hour with a heavy tail wind during 100 miles of flying between Rock Springs and Cheyenne, Wyo. None realized that the plane was traveling at more than normal scheduled speed.

The dramatic entered routine operations when the caretaker of an isolated Department of Commerce intermediate field became lost in a blizzard after starting out on snow-shoes to replenish his supplies.

When he was reported missing a United plane flew low over the area and its pilot, Ray Little, discovered the man floundering in deep snow. Rescuers, learning his whereabouts, were able to reach him from the nearest town. Six miners in the Nevada mountains were cut off from the outside world for months when heavy snow prevented their getting out or visitors coming in. A United Air Lines plane detoured off the airway and finally located the mining camp. While Pilot Don Broughton circled low, Stewardess Ida Novelli opened the door of the plane and bombed the camp with bags of food and other supplies. Six large sacks landed within 100 feet of the spot where the despairing miners had gathered.

United Air Lines maintained a weather division which was studying upper air climatic conditions reported by pilots by radio phone from planes flying over the New York-Chicago-Pacific Coast, the Chicago-Kansas City and the Seattle-San Diego routes. Reports on air temperature and other weather phenomena were radioed in by the pilots every 20 minutes. These were coordinated with the information supplied by the far-flung system maintained by the U. S. Weather Bureau.

Varney Speed Lines

Awarded air mail contract 29 in 1934 Varney Speed Lines started a mail, passenger and express service between Pueblo, Colo., and El Paso, Tex., with station stops at Las Vegas, Santa Fe and Albuquerque, N. M., making one round trip daily. Varney Speed Lines, known in Mexico as Lineas Aereas Occidentales, at the end of 1934 was also operating a passenger and express service each way thrice weekly between Union Air Terminal at Burbank, Calif., and Mexico City, using Lockheed Orions. The schedule provided for leaving Burbank in the morning and landing in Mexico City, 1,800 miles distant, late that afternoon. Leaving Mexico City in the morning, passengers were scheduled to land at the Los Angeles terminal during early evening.

Wedell-Williams Air Lines

Late in 1934 the Wedell-Williams Air Service Corporation, New Orleans, acquired the air line service which had been started by the Robertson Airplane Service Company, St. Louis, on July 25, 1934, after it secured an air mail contract for route 20. At the beginning of 1935 Wedell-Williams was flying mail, passengers and express over the 323 miles of route between New Orleans and Houston, Tex., with station stops at Baton Rouge, Lake Charles and Beaumont.

Wilmington-Catalina Airline

Operating a scheduled passenger and express service, six trips daily, with Douglas amphibions over the 31 miles of water between Wilmington, Calif., and Avalon, Catalina Island, the Wilmington-Catalina Airline carried 11,500 persons during 1934. A new seaplane ramp was installed at Avalon. The company also made 100 charter trips in southern California.

Wyoming Air Service

Using Lycoming-powered Stinson cabin planes Wyoming Air Service at the beginning of 1935 was operating mail, passenger and express schedules on the 201 miles of route, with mail contract 17, between Cheyenne, Wyo., and Pueblo, Colo., and on 405 miles of route, contract 28, between Cheyenne and Billings, Mont. Passengers might fly from Billings to Cheyenne in four hours. Cheyenne and Denver were only 50 minutes apart, and one might fly from Denver to Colorado Springs in 45 minutes. The 606 miles between Billings and Pueblo, spanned by Wyoming Air Service, was linked with the Varney Speed Lines operating schedules 530 miles between Pueblo and El Paso, Tex.

The Pan American Airways System

With increasing speed and efficiency, new and more luxurious aircraft and a remarkable record of achievement in linking the United States with 33 countries and colonies on three continents the Pan American Airways System at the beginning of 1935 was energetically planning still greater conquests of the air. Foremost among the intercontinental air line systems, despite the most aggressive efforts of other nations seeking to dominate key trade routes by flinging their own foreign air transport services to the far corners of the earth, Pan American Airways was speeding up international trade and travel and making it possible for more people elsewhere to carry on business relations with the United States.

With 31,606 miles of airways over which its fleet of 127 air liners operated on regular schedules, employing 2,594 trained men and women in all the complex and highly specialized fields incident to this new field of transportation, which demands speed with reliability as twin essentials of popularity, Pan American Airways ranked first as the world's most extensive air transport organization.

At the beginning of 1935, as the accompanying map illustrates much better than words can explain it, Pan American Airways, its subsidiaries and associated companies, were flying passengers, mail and express from United States terminals at Miami and Tampa, Fla., Brownsville and El Paso, Tex., Nogales, Ariz., and Los Angeles, Calif. From those northern terminals the system extended to the chief trade centers of the West Indies, Mexico, Central and South America. More than 2,000 miles of airways were being operated over the mountains and snow fields of Alaska. Pan American Airways was also operating 3,026 miles of regular routes in China, in partnership with the Chinese National Government. Those oriental lines were of es-

PAN AMERICAN'S MIAMI TERMINAL

Interior of the great international air transport base which Pan American Airways opened in 1934.

pecial significance in view of plans of the Pan American System to connect them with a new passenger, mail and express service across the Pacific by way of the Philippines and Hawaiian Islands direct to California.

Major extensions of sales channels and new agencies for the Pan American Airways passenger service in 1934, together with the Government's constructive measures for improving Latin American trade, increased passenger traffic about 30 per cent during the year. During the first nine months it was equal to that of 1933; but by December 31, 1934, it had aggregated 102,000 persons flown as compared to

78,074 in 1933. Executives, salesmen and commercial representatives traveling on business represented about 78 per cent of the traffic; and the records show that they took the airways route on their international trade missions because flying would save them two-thirds of the time and half the former cost of traveling. The year's traffic gave Pan American Airways a record of having flown during its brief lifetime 323,205 passengers a total of 103,625,883 passenger miles.

Air express between any point in the United States and any destination in 30 foreign countries became a fact in 1934 when Pan American Airways made a 20-year contract with the Railway Express Agency, affiliated with the trunkline railroad systems. Their door to door pick-up and delivery service was coordinated with the Pan American Airways System and made available to it exclusively for foreign shipments. At the same time Pan American Airways had very close working arrangements with the air lines operating in the United States so that it was possible for a shipper anywhere in the country to consign express by either rail or air, or combined rail-air service, to the foreign countries in the Pan American system.

After three years of negotiations with foreign governments Pan American Airways found it possible to establish its air express service in those countries. New legislation or amended statutes paved the way for a new and greatly simplified shipping document known as the "Pan American Airway bill." When the new express service became effective on August 1, 1934, Secretary of State Cordell Hull said: "In the present period of reconstruction, elimination of time and distance barriers between industrial centers and world markets is a vital element in trade recovery. Coordination of express shipping facilities of our national railroads with our international air transport system is of particular significance at this time. It represents one of the important steps taken by private enterprise to facilitate foreign trade expansion and for the improvement of international commercial relations."

Joseph B. Eastman, Federal Coordinator of Transportation, said in part: "Those who have created this new service are entitled to congratulation and the thanks of the country."

Reflecting the benefit of the increased facilities, the volume of air express carried by the Pan American Airways System in 1934 was 50 per cent higher than in 1933. During the last three months of 1934 express traffic was at the rate of two million pounds a year. It helped to swell the total cargo carried by Pan American Airways during its entire operations; and at the beginning of 1935 this grand total of mail and express had reached the great figure of 17,762,989 pounds transported by air in the international service between the United States and other nations.

Air mail volume showed substantial improvement on the main trunk air routes between North and South America. Although U. S. Post Office contract mail service provided schedules of only once a week, the revenue from foreign air mail carried by Pan American Airways for the account of the Post Office Department was expected to be in excess of two million dollars during the fiscal year. That substantial return was effected despite the disturbed economic conditions prevailing in all countries served by the international mail system. American trade with those nations was only 35 per cent of the five-year average. With normal trade restored by general improvement of

REFRESHMENTS ON AMERICAN AIRLINES

One of the Cyclone-powered Condor sleepers made up for daylight flying.

world economic conditions the air mail revenue accruing to the U. S. Post Office Department from the Pan American service was expected to cover its cost to the Government.

In addition to improvement of established services over 21,000 miles of airways serving 147 cities in the West Indies, Mexico, Central and South America, Pan American Airways in 1934 increased frequency of schedules to meet traffic demands on several routes and added 1,443 miles to its system, including the following: Los Angeles to Hermosillo, Mexico, 563 miles, providing through one-day service

PAN AMERICAN AIRWAYS SYSTEM

America's merchant marine of the air operates throughout that part of the Western Hemisphere south of the United States and also in Alaska and China.

to Mexico City (Aerovias Centrales); Managua, Nicaragua, to Tegucigalpa, capital of Honduras, 40 miles; Cartagena, Colombia, to Turbo and Quibdo, Colombia, 385 miles; Barranquilla-Medellin, Colombia, 355 miles, and Medellin-Palanquero, 100 miles (Scadta Airways).

The Pan American Airways System, through its partnership with the Chinese National Government, in 1934 continued operations of 3,026 miles of important air services in China and on the strategic coastal line between Shanghai and Canton, the key route to the trade centers of the Far East. Interior routes extended up the Yangtse River to Chengtu. The northern coastal route linked Shanghai with Peiping.

Pan American Airways in 1934 continued to operate regular air mail, passenger and express service on 2,040 miles of routes in Alaska, linking Fairbanks with Nome and Bethel; with plans at the close of

THE SIKORSKY S-42 TAKES OFF

One of the Pan American Airways new clipper ships, powered with four Pratt & Whitney Hornet engines, which broke 10 world records in two test flights.

the year for a new 675-mile mail route, Fairbanks to Juneau, to connect with the Alaska Steamship Company service to Seattle.

The Pan American Airways System at the beginning of 1935 had in operation 98 ground radio control stations with which its fleet of planes in flight maintained constant contact, securing weather reports and instructions on every occasion necessary to make the service wholly safe, reliable and increasingly fast. Among the new airports and bases completed in 1934 was the international Pan American marine base at Miami, eastern gateway of the system. A new passenger, mail and express terminal building, with facilities for loading and unloading four flying boats at once; dredging a 700-foot, mile-long channel to accommodate the largest types of marine equipment; bulkheading and filling in to add 13 acres to the base; and grading and landscaping were among the improvements which made the Miami terminal of Pan American Airways the largest marine air base in the world. At the end of the year new facilities were being completed at Nassau, San Juan, Para, Rio de Janeiro and other ports in Central and South America.

Orders for new equipment in six States supplied employment for 3,100 technicians and workmen during 1934 and the greater part of 1935. At the beginning of 1935 Pan American Airways was receiving delivery on its super-clipper four-motored flying boats and advanced types of land transports. The super-clippers included three trans-

INTERIOR OF SIKORSKY S-42

Two of the compartments in the Pan American Airways new clipper ships which entered service in 1934.

atlantic type Sikorsky S-42 Hornet-powered flying boats and three Glenn L. Martin transocean flying boats, Wasp-powered. Other new equipment included six new type single-motored high speed amphibion transports developed by Fairchild and Pan American engineers, and under construction at the Kreider-Reisner plant of the Fairchild Corporation, for use in coastal operations in Latin America and China; six of the new Douglas 14-passenger twin-motored Cyclone-powered transports and six twin Wasp-powered Lockheed Electra 10-passenger land transports. In addition, Pan American Airways had placed orders for four advanced type Sikorsky S-42 flying boats to exceed in range, speed and load the model of 1934. The new type, based on specifications developed by Pan American staff engineers and the System's technical committee, of which Col. Charles A. Lindbergh was chairman, was to be equipped with four new type Pratt & Whitney engines and other auxiliaries designed to improve efficiency for long range ocean operations up to 3,000 miles.

The first S-42 to be put in service, the "Brazilian Clipper," made its maiden voyage from Miami to Rio de Janeiro and Buenos Aires with a gross weight of 38,000 pounds and cruised at speeds of 155 to 170 miles an hour, breaking all records and bringing the great trade centers of South America two days nearer the United States.

The first Glenn L. Martin flying boat for Pan American Airways was delivered late in 1934, and at once met specifications. The largest flying boat in America, it represented in flight a gross weight of 51,000 pounds, carrying 14 passengers, a ton of mail and cargo for 3,000 miles non-stop. It could fly the Atlantic non-stop with 20 passengers and a ton of mail. Both the Sikorsky and Martin clipper ships amazed the engineering world with their speed, which for over-water flying craft of such weight and capacity, had never been approached in former ships. They proved capable of carrying full loads long distances at cruising speeds of about two and a half miles a minute.

The second of the 1934 Sikorsky S-42 ships delivered to Pan American Airways in December, 1934, was not equipped for passenger carrying but, rather, as a long range transocean training and survey craft with new and advanced instruments and tanks for more than eight tons of gasoline giving it a cruising range of more than 3,000 miles. It was to take part in the new experimental service across the Pacific by way of Honolulu and Manila.

ANOTHER PAN AMERICAN CLIPPER

One of the Pratt & Whitney Twin Wasp-powered transocean flying boats built for the Pan American Airways System by the Glenn L. Martin Company.

The demonstrated efficiency of the new clipper ships for ocean transport service led to an exchange of correspondence between J. T. Trippe, president of the Pan American Airways System, and Postmaster General James A. Farley relative to the first step in establishing for the United States a commercial air route across the ocean. Advising the Postmaster General of the practicability of establishing the first air transport service across the Pacific, Mr. Trippe's letter to the Postmaster General stated:

"As you are aware, the Pan American Airways System several years ago began the necessary preliminary development work in connection with the future establishment of transoceanic air services, as have the international air lines of several European nations.

"In 1932, we commenced the construction of four-engine flying boats suitable for transpacific service. In the Far East we have developed, jointly with the Chinese Government, an extensive air transport system, with some 3,000 miles of airways now in operation. We have already completed extensive ground and meteorological surveys covering the route from the United States to the principal trade centers of the Far East. Our technical staff, headed by Colonel Lindbergh, is now studying the question of terminal facilities on the Pacific Coast in relation to local weather conditions.

"In approaching the new engineering problems involved in conducting transocean air services across the Pacific, we have been greatly aided by the practical experience of four years operation directly across the Caribbean Sea, still the longest over-water air transport service in the world.

"In view of the recently announced interest of the Post Office Department in the establishment of a transpacific air mail service, and, particularly, in view of the aggressive steps now being taken by European nations to entrench their international air lines in the Far East, we feel that we should advise you that it now appears practicable for us to consider instituting at an early date an experimental air transport service to link our existing operations in the Orient with California.

"Our feeling that the inauguration of this experimental service is now practical is based on the recent successful flight tests of the 'Brazilian Clipper'—the first of the new transocean type four-engine flying boats developed by Pan American Airways. This latest clipper flying boat has a top speed of 191 miles per hour, and is capable of maintaining scheduled service over the longest open ocean stretch of the through route between California and the Far East.

"Experimental service when instituted over the Pacific would permit the securing of accurate data relating to 'upper air' wind and weather conditions and the selection of the westbound and eastbound flight routes best adapted to varying seasonal conditions. Flight personnel would be familiarized with the route, and with the technique of handling aircraft on long transocean flights.

"We shall, of course, keep you advised of the progress of our proposed experimental service, in order that your Department may have the benefit of this information in your final determination as to the practicability of transporting mail by flying boats across the Pacific."

In replying to Mr. Trippe's letter, Mr. Farley indicated the great interest of the Government in development of such a service and in the speeding up of communications and transport facilities over world trade routes where American commerce is confronted with intensive competition from other industrial nations. Mr. Farley's letter, which was made public with a copy of Mr. Trippe's communication to him, stated:

"I appreciate the courtesy of your letter of October tenth, in which you advise me that the Pan American Airways System has under consideration the institution at an early date of an experimental air transport service linking the United States from some point in California with the Far East.

"With the rapid development of air transport those who keep informed of its progress have, for some time, anticipated that air transport service across both the Pacific and Atlantic oceans would be soon established, and the Post Office Department, which is deeply interested in the extension and expansion of the air mail service to all parts of the world, has been looking forward with particular interest to the establishment of such service.

"It is gratifying to me to learn that the first transpacific service is to be inaugurated by an American company. The splendid pioneering work which the Pan American Airways has done in establishing and building up to a high degree of efficiency air transport routes circling Central and South America has attracted the attention of the entire world, and its remarkable success in these ventures undoubtedly augers success for a transpacific service.

"Not only is the Post Office Department interested in the development and extension of air transport service in the United States and to and in the territories and insular possessions of the United States, but the Government generally is interested in such service. It is also interested in the development of transoceanic service.

"It is a generally known fact that several of the European countries are actively engaged in promoting transoceanic service and that some of them are now projecting routes into and throughout the Far

East. These countries are aware of the trade benefits and improved relations between themselves and countries in the Far East to be derived from such lines.

"We in this country have already experienced such benefits as a result of the operations of the Pan American Airways System into the countries of Central and South America and we, too, are aware of the benefits which will result from the establishment of air transport lines from the United States to the Far East and from the United States to Europe. I congratulate your company on, not only what it has done in Central and South America, but upon the foresight and enterprise which prompts you to plan a transpacific service.

"While of course such a service will be advantageous to the entire country, it will be of particular interest to the Pacific Coast where its United States terminal will be located. The people on the Pacific Coast have for some time manifested a great interest in having such a service established and will, I am sure, give it wholehearted and enthusiastic support.

"I note from your letter that you will keep me advised of the progress of the proposed experimental service and I wish to assure you that the Post Office Department will watch the developments of this service with a great deal of interest."

NEW VOUGHT SCOUT

The SU-4 two-place enclosed scouting plane, powered by a Pratt & Whitney Twin Wasp Junior built for the Navy by the Chance Vought Corporation.

CHAPTER IX

NOTABLE FLIGHTS OF 1934

London-Melbourne Race—Army and Navy Alaskan Flights—New Flight Records—Wiley Post's Altitude Tests—The Laura Ingalls Flight—Kingsford-Smith's Pacific Flight—Other Transocean Flights—Byrd and Ellsworth Adventures.

AGAIN in 1934 men flew faster and higher than ever before, and there were others who piloted their winged machines to record achievements over land and sea.

By far the outstanding event of the year was the England to Australia—MacRobertson—air race in October. Nineteen countries and some seven different seas lay ahead of the contestants who dared race that course 11,300 miles long, a course extending nearly half-way around the earth, and not the most comfortable parts of it, either. Those who entered the London-Melbourne race hoping to win part of the $75,000 prize money put up by Sir McPherson Robertson had only to scan their maps to see that they must negotiate not only a large part of inhabited Europe, but also the Alps, considerable wilderness and open water, then over the inhospitable deserts of Arabia, the varying terrain of Persia and India, the Malay Peninsula with jungle or shark-infested waters awaiting the occupants of an unlucky plane, and on over still more jungles in Java or Borneo and still more seas even more infamous for their sharks, especially Timor Sea, and so to Darwin, after which one had only to keep up across the entire continent of Australia to Melbourne.

The whole world was invited to participate in the great race; and the reason why so few nations actually were represented at the start may be found in the growing sentiment against races, holding them to be significant of nothing except possible prizes for the winners. The race committee worked 18 months in an effort to set up rules and regulations for entrants that would assure this contest becoming a real classic of the air. It was a classic.

It won for the British the honor of having created a special airplane that took first place. It won for the United States a still greater international reputation for supremacy in the design and construction of transport planes, engines, propellers and other equipment, including American aircraft fuels. The winners used Stanavo gasoline. The race won for the Dutch additional fame for using American equipment in maintaining the best air line between Europe and the Far East. The rules and other circumstances cut the number of contestants from the original 64 to a final 20 at the start of the race on October 20, 1934. French, Italian, German and other entries, including several American, had been withdrawn.

There were two races, one for speed, the other a handicap with many more control stops. When the 16 days allowed by the rules for the handicap race expired on November 5, only 10 of the contestants had completed the flight to Melbourne; and they consisted solely of British and American airplanes and pilots, with the exception of one American plane being flown by Dutch pilots.

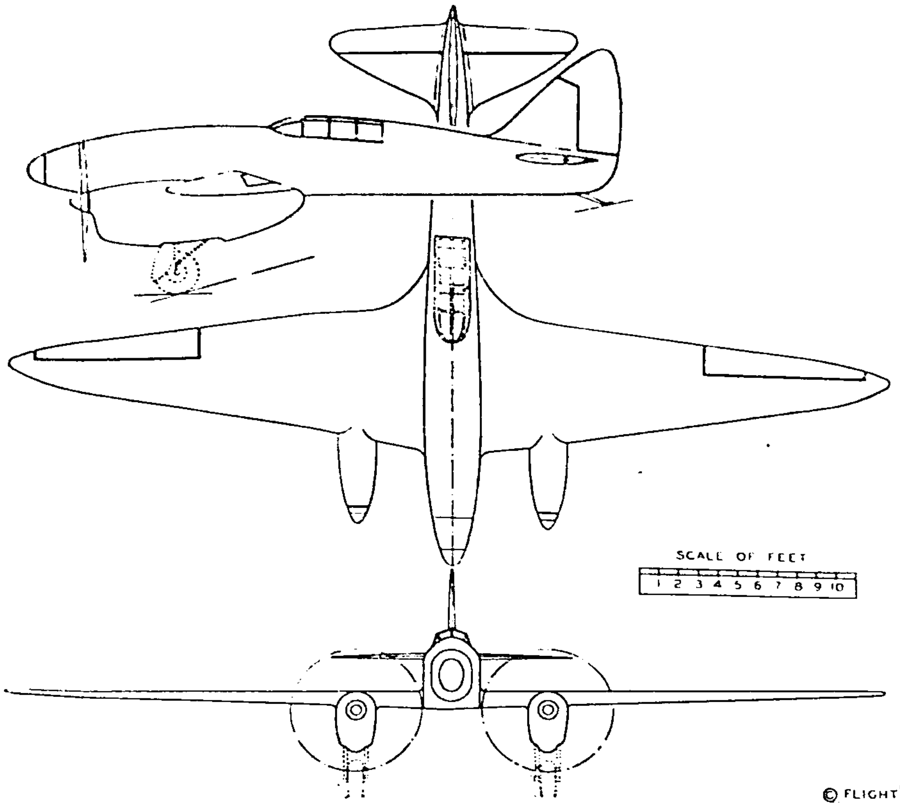
C. W. A. Scott and T. Campbell Black, flying one of the three special De Havilland racers built for the race, and powered by two special Gipsy engines, won the speed race and with it a gold trophy and $50,000, high honors and other trappings of well-earned fame.

THE SPECIAL DE HAVILLAND COMET

Special two-place speed plane which won the MacRobertson race being gassed up with American fuel just before the start of the classic from London to Australia.

They sped across the face of the earth for 11,300 miles in 70 hours, 54 minutes and 18 seconds, an average speed of 159 miles an hour for elapsed time and 190 miles an hour for flying time. Capt. James A. and Amy Mollison in a similar machine had led the field as far as Baghdad, flying non-stop at a great height to avoid bad weather. They crossed the Alps without seeing them. They made a great record as far as Karachi, India, their time being 22 hours, 26 minutes. Bad luck at Karachi and again at Allahabad, India, saw them passed by five other planes, and then engine trouble forced them out of the race.

While Scott and Black were leading, close behind them came K. D. Parmentier and J. J. Moll, pilots of the Royal Dutch Airlines who with three passengers and 30.000 letters were flying an American plane in the race, a Douglas transport powered with two Wright Cyclone engines—a machine purchased by the Dutch line for opera-



Courtesy Aero Digest

THE SPECIAL DE HAVILLAND COMET

Winner of the MacRobertson race.

tions on its regular route to Batavia, and even in this race scheduled to make all the usual company stops as far as the end of the line. The Douglas was in third place at Baghdad, but it passed the Mollisons and took second place at Allahabad, a position which it maintained to the finish.

Worthy of especial note, in view of the fact that the Douglas was operating as a regular transport ship, are some of the details of its flight. It left Rome, Italy, at 10:30 on Saturday morning, stopped at Athens and Aleppo and landed at Baghdad at 11 o'clock that night. Leaving again Sunday morning, after the passengers had slept comfortably in hotel beds, the by this time world-famous Douglas

THIRD TO REACH MELBOURNE

Clyde Pangborn and Col. Roscoe Turner under one of the Pratt & Whitney Wasps and Hamilton Standard controllable pitch propellers on their Boeing 247-D which they flew in the London-Australia race.

touched Jask and Karachi and landed at Allahabad Sunday afternoon, took off in an hour, but turned back to pick up a passenger inadvertently left behind, and sped on to Calcutta, India. Thence to Rangoon and on to Alor Star. Singapore came next, with a stop of 32 minutes, and then out over the sea to Batavia, on to Rambang, Koepang and over the dread Timor Sea to Darwin, Australia. Here the leaders, Scott and Black, had experienced engine trouble which delayed them several hours, but they managed to get away ahead of the Douglas and its Dutch pilots, who pushed on 538 miles non-stop to Charleville, to find that the British team had again beaten them away by a safe margin, although it had limped into Charleville on one of its two engines. The Douglas cleared Charleville and was out on the last leg, with some hope of overtaking the struggling Comet when a terrific thunder storm swept across its path, and the Douglas,

THE BELLANCA FLASH

Racer powered with a Pratt & Whitney Twin Wasp Junior engine built for Col. James C. Fitzmaurice to fly in the MacRobertson race.

its pilots having in mind the safety of their passengers and the fact that theirs was an air line ship, not a racer, finally made an emergency landing at Albury, on a racetrack from which they were able to take off only after discharging passengers and cargo. They landed at Melbourne in second place, having made the flight in 90 hours, 13 minutes and 36 seconds, an average of 125 miles an hour for elapsed time and 173 miles an hour for their flying time.

Another American air transport plane came in third in the race. Col. Roscoe Turner and Clyde Pangborn flying a Boeing 247-D powered by two Pratt & Whitney Wasp engines were fifth at Baghdad, fourth to reach Allahabad, third at Singapore and from there on to Melbourne. Against the six stops made by the British winners in their special two-seater racer, the Douglas with its heavy load had to make 16 stops for fuel and the Boeing 10 stops. Turner and Pangborn never saw Europe, they said, until they reached the Alps. They alone, of all the leaders in the race, were making their first flight over the route. They overshot Allahabad by 200 miles and had to turn back. They landed at Melbourne after an elapsed time of 92 hours, 55 minutes and 38 seconds, an average of 121.5 miles an hour; while their actual flying time was 85 hours, 22 minutes, 50 seconds.

The fourth arrival at Melbourne was another De Havilland special Comet racer, piloted by O. Cathcart-Jones and Ken Waller. Their elapsed time was 108 hours, 13 minutes and 45 seconds, and their flying time 93 hours, 32 minutes and 50 seconds.

Navy's Record Massed Flight

"It was a tough trip over, with low clouds and fog in our path from seven o'clock last night until early morning. But it was no worse than night flying we have experienced off the coast of Mexico

CONSOLIDATED NAVY PATROL P2Y-1.

Lead plane on the Navy's record flight to Honolulu soon after sighting the Hawaiian Islands.

and around San Diego." Thus Lieut. Comdr. Kneffler McGinnis commented on the U. S. Navy's massed flight from San Francisco to Honolulu January 10-11, 1934. His Squadron 10-F with six giant Wright Cyclone-powered Consolidated Navy patrol flying boats had flown non-stop from the Golden Gate to Pearl Harbor, not as a stunt but as routine transfer operations to their new base in Hawaii. They had done it in 24 hours and 45 minutes, and they had flown the 2,399 statute miles non-stop, thereby making three world records.

Commander McGinnis was the first naval officer in history to move a full squadron to a distant overseas base and carry out the flight as a routine movement of naval craft. This was the longest non-stop massed flight in history, exceeding the previous record made by General Balbo and his squadron flying 1,864 miles on the longest leg of their massed flight to the United States in 1933. The Hawaiian flight also broke the former record which was made by Commander McGinnis and his squadron in September, 1933, when they flew non-stop from Hampton Roads, Va., to the Canal Zone, a total of 2,060 miles. The Hawaiian flight was also the longest non-stop flight to be made in a seaplane, which made it a fourth world record, although it was broken on October 20, 1934, when Mario Stoppani flew from Monfalcone, Italy, to Massaua, Africa, a distance of 2,566 miles.

"We had plenty of fuel left, and I guess we could have gone on to Midway Island if necessary," said Commander McGinnis; and those who heard him thought of the possibilities of regular trans-pacific air service in the not distant future. The Navy flight brought out the value of most thorough and cautious preparations in over-water operations; and its success must be attributed to the efficiency with which it was planned.

Leaving the Golden Gate in clear weather on the afternoon of January 10, the squadron of six flying boats had in each plane five men, 1,700 gallons of gasoline, oil, a long-range radio outfit, emergency life rafts and life-saving equipment, navigational gear and about 100 pounds of food. To avoid even the appearance of making this a dare-devil stunt six naval vessels were stationed along the route, although the great Consolidated ships are real boats with wings, and are capable of alighting and taking off in rough water.

Soon after the departure the sky became overcast and at seven o'clock that night the squadron ran into fog. The pilots dived close to the surface hoping for clear air, but finding none they climbed back up to about a half mile altitude and commenced flying blind, that is, by means of their instruments and radio. A half hour later the fog became as thick as a solid wall, and the squadron opened out to

BACK TO WASHINGTON

The 10 Cyclone-powered Martin Army bombers return to the capital from their round-trip flight to Alaska.

avoid collision, now and then being invisible to one another and depending solely on their radio to maintain a sort of formation. Their Sperry gyro directional instruments kept them flying straight and on a level keel. At 8:30 o'clock that night the destroyer "Shenck", the second of their marker ships, radioed their position and offered a searchlight which was accepted. The entire squadron passed directly over the "Schenck" an hour later. Then Lieut. Jack Perry piloting one of the big planes became lost to the rest of the squadron, but after a few anxious minutes he radioed that he had again rejoined it.

Finally, about 1,000 miles out from the Golden Gate the flying fleet picked up the destroyer "Breeze", flew over it and on their way, with the fog gradually lifting and the rays of the moon beckoning in friendly fashion as they sped onward with the help of a favoring tradewind. Their westward flight, however, gave them two extra hours of darkness because they were flying away from the sun, but it finally caught up with them and they sighted Honolulu soon after dawn.

The Army's Alaskan Flight

Ten Wright Cyclone-powered Martin bombers, manned by 15 officers and 19 enlisted men of the Army Air Corps, flew out of Washington, D. C. on July 19, 1934, bound on a round trip to Fairbanks, Alaska, under the command of Lieut. Col. H. H. Arnold. They returned on August 20 with an exceptionally fine record of achievement. They had proved that it is possible to send massed flights to Alaska and have the planes and crews able to accomplish a tactical mission. They made an aerial mosaic of 20,000 square miles, photographing from the planes a strip of Alaska 400 miles long and 50 miles wide, a job that will form the basis for future defense of that region and at the same time will have considerable influence on the development of long range aircraft.

Photographing 20,000 square miles in three days, the only days, incidentally, in which the weather permitted photography, was a record feat; but on the return flight the Air Corps made another record. They left Juneau at 11:10 o'clock on the morning of August 17 and landed in Seattle, Wash., at 4:50 that afternoon, having covered the 943 miles non-stop. It was the first time that a mass flight had flown non-stop between continental United States and Alaska.

The round trip aggregated about 7,335 miles; and the ten Martin Army planes with their crews returned to Washington in as good condition as when they set out.

On the outward flight from Washington stops were made at Dayton, O., and Minneapolis, Minn., with the next stop at Winnipeg, Canada, on July 20. Regina, Saskatchewan, was their stop the next day, the 342 miles being covered in two hours, with Premier Bracken of Manitoba flying as a guest in Col. Arnold's plane. That same day they went on to Edmonton, Alberta.

The next leg of the flight, between Edmonton and Prince George, was rather hazardous. They had to fly low under broken clouds and break through Jaspar Pass in the Canadian Rockies at 5,000 feet altitude. The grandeur of the snow-capped mountains compensated them for much hard work, even when some of the pilots had to make two attempts before landing on the small, one-way and tree-lined field at Prince George. Thence the route lay 665 miles over the wildest section of the Yukon to White Horse, and all ten ships made it on schedule.

On July 24 the ten machines flew from White Horse to Fairbanks, 500 miles between 8 and 11:30 a.m. Two days later Captain Ross D. Hoyt and Lieut. Ralph A. Snavely set out for the North in two Douglas observation planes to determine the possible existence of any landing fields capable of receiving heavy bombers. They had an adventurous trip, finally reaching Nome, where they found the only landing field north of Fairbanks fit for the bombers, a fact of considerable importance to those responsible for the national defense. On their return to Fairbanks Hoyt and Snavely ran into heavy rain. At times they were forced out to sea, and finally they landed at Unalakleet for the night. The next day they got to Fairbanks by following the Yukon River.

Meanwhile several of the bombing planes had encountered the worst kind of weather as their crews tried to photograph the country. The base was transferred to Anchorage at one time, and the work carried on from there. One of the planes was forced down in the water at Cook Inlet. It was floated with the aid of gas drums and wing tanks, towed to port and hoisted out of the water after being submerged 12 hours. It was put in condition and made the return flight with the others.

Using Fairchild five-lens aerial mapping cameras the Air Corps crews worked at an altitude of 16,000 feet in weather below zero. On August 5 the crews of five planes photographed 8,829 square miles in 13 hours and 55 minutes, probably a record. Surely the total of 20,988 square miles in 3 days, the planes flying parallel courses 20 miles apart, stands as a record.

The non-stop flight from Juneau to Seattle was made over water, following the coast line, without touching Canada, however. Thus it demonstrated the feasibility of moving a tactical unit from the United States to Alaska without flying over neutral territory.

The Navy's Alaskan Flight

As the editor of *Western Flying* expressed it, "if it ever becomes necessary to defend the waters and territory of Alaska against invasion, the U. S. Navy will know how to find its way around in that vast and farflung possession. At least a rear-admiral, the officers and crews of a dozen Martin patrol boats and four aircraft tenders will form a nucleus of men who have had actual experience in those waters and with the weather conditions peculiar to the sub-Arctic regions."

The Navy's Alaskan expedition of 1934, commanded by Rear Admiral Alfred W. Johnson, with his flagship the "Wright" and the tenders "Sandpiper", "Avocet" and "Swan", set out the latter part of July and returned to their base at San Diego, Calif., late in August. The 12 Martin patrol boats formed squadrons 7-F, commanded by Lieut. Comdr. R. Irvine, and 9-F under Lieut. Comdr. H. T. Stanley, the two squadrons operating under the direct command of Lieut. Comdr. J. M. Shoemaker.

The planes ran into heavy fog conditions on their way up the coast line, but from Wrangell to Juneau, Alaska, the crews had enough visibility to view the scenic beauties, with glaciers glittering in occasional sunshine, snow-capped peaks on every side and countless waterfalls. Icebergs and floating ice became commonplace; yet the flight arrived at Juneau one day ahead of schedule.

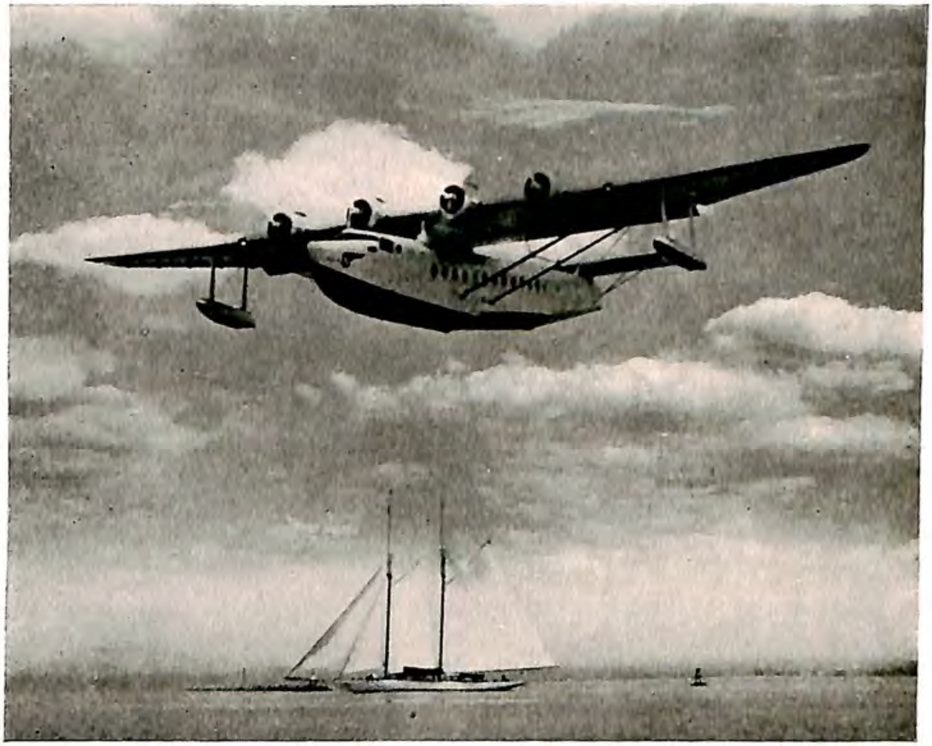
On August 6 the Navy flying boats left Juneau for Cordova and flew along the coast, Fair Weather Mountain rising a sheer 12,000 feet almost from the water's edge. On August 9 the flight went on to Seward by way of Valdez. Following numerous side trips over the surface, the Navy expedition flew away from Seward on August 13 on a series of tactical drills and exercises; and by August 17, all planes had gathered at Sitka where for five days the Navy men made side trips to points of interest and strategic importance. With the exception of a few bumpy landings and a loose connection on one plane which required repairs, the two squadrons arrived in San Diego on September 3, having had no trouble during the six weeks cruise.

Sikorsky S-42 Breaks 10 Records

On August 1, 1934, the first of the new Pratt & Whitney Hornet-powered Sikorsky S-42 ocean flying boats built for the Pan American Airways System went up and broke eight world records, making a total of ten such achievements for the year and putting the United States second only to France in the number of official international airplane records held by a nation.

Among the crew of six in the giant ship were Col. Charles A. Lindbergh, technical advisor to Pan American Airways, Edwin C. Musick, chief pilot for that line, and Capt. Boris Sergievsky, the Sikorsky chief test pilot. On April 26, 1934, the clipper ship of the air carried 16,608 pounds to a height of 6,671.7 feet, breaking the previous German record of 14,220 pounds made in 1929, and also took the official load of 11,023 pounds stipulated by F. A. I. rules, to a height of 20,406.7 feet, breaking the former German record. 6,561.66 feet, of 1929.

On the August flight the great flying boat went up to make her tests over Long Island Sound and the New York area, flying four times over a five-point course of 311 miles, between Stratford light-



NEARLY THREE MILES A MINUTE

A Pan American Airways Hornet-powered Sikorsky S-42 clipper ship passes a racing yacht.

house, George Washington bridge, Staten Island lighthouse, Block Island and Judith lighthouse. On this remarkable flight, evidencing the progress in American design and development of planes, engines and accessories, the Sikorsky S-42 carried 1,580 gallons of fuel, 555 pounds of oil, a dead weight representing a paying load of 4,410 pounds and her crew of six. Her gross weight was 36,163 pounds—more than 11 tons. That great weight was lifted into the air by four Pratt & Whitney Hornet standard engines, on this flight cruising and developing about 490 horsepower and using Stanavo 87 octane fuel, aided materially of course by the three-bladed Hamilton Standard controllable pitch propellers.

The S-42 averaged 160.4, 155.2, 156.1 and 158.1 miles an hour on her four laps—in all 1,244 miles of flying in seven hours 54 minutes. On one leg the flying boat made 178.2 miles an hour. Her eight world seaplane records won on that test were:

157.58 m.p.h. over 1,000 kilometers (621.369 mi.) breaking German record of 138.12 m.p.h. made in 1929.

157.319 m.p.h. over 2,000 kilometers (1,242.739 mi.) breaking French record of 117.39 m.p.h. in 1930.

157.58 m.p.h. over 1,000 kilometers carrying 500 kilograms (1,102.31 pounds) load, breaking German record of 138.12 m.p.h. in 1929.

157.58 m.p.h. over 1,000 kilometers carrying 1,000 kilograms of load, breaking French record of 118.08 m.p.h. in 1930.

157.58 m.p.h. over 1,000 kilometers carrying 2,000 kilograms load (4,409.24 pounds) breaking German record of 110.15 m.p.h. in 1928.

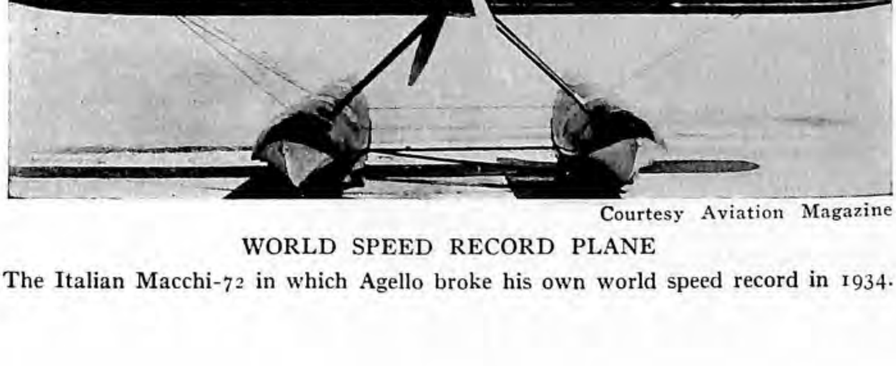
157.319 m.p.h. over 2,000 kilometers carrying 500 kilograms load, beating French record of 1930.

157.319 m.p.h. over 2,000 kilometers carrying 1,000 kilograms load, beating French record of 1930.

157.319 m.p.h. over 2,000 kilometers, carrying 2,000 kilograms load, beating French record of 1931.

Agello Beats Own Speed Record

Warrant Officer Francesco Agello, of the Italian air forces, beat his own record for speed and won a lieutenant's commission when on October 23, 1934, he sent an Italian high speed test plane over the official three-kilometer course four times, twice each way, at an



Courtesy Aviation Magazine

WORLD SPEED RECORD PLANE

The Italian Macchi-72 in which Agello broke his own world speed record in 1934.

average rate of 440.681 miles an hour. His former world record, made in April, 1933, was 423.76 miles an hour. Agello's plane was one of the special Macchi-Castoldi low-wing monoplanes, each powered with a Fiat A. S. 6 engine, with which the Italian air force high speed flight has been experimenting at Lake Garda for several years. The record machine carried wooden floats instead of the metal ones previously used. The experimental Fiat engine, being developed by the manufacturers for the Italian Government which paid all expenses, had 24 cylinders, set in two rows forming a 60-degree V. Each operated independently with its own crankshaft and airscrew revolving in opposite directions. The supercharger was geared to 20,000 r.p.m. The engine was rated to give 3,000 horsepower at 3,200 r.p.m. It weighed only 2,045 pounds, or 0.706 pounds per horsepower. Ready for flight, with pilot and full tanks, the plane weighed 6,670 pounds. American gasoline contributed to the Italian success. Stanavo fuel was used.

Courtesy Aero Digest

ITALY TAKES ALTITUDE RECORD

Donati lands his Caproni after flying to world record airplane height of 47,352 feet.

Donati's Record High Flight

On April 11, 1934, Commendatore Renato Donati, of the Italian air forces, went up from the Montecelio airport at Rome, Italy, and won success on his eighteenth attempt to break the world altitude record. His mark was officially recorded as being 47,352.219 feet, beating the previous world record established for France by Gustave Lemoine who on September 28, 1933, went to 44,819 feet. Donati flew a special modified Caproni 114 biplane with a supercharged British Bristol Pegasus engine.

Post's Altitude Attempts

Wiley Post, whose 1933 flight around the world in a week remained a record during the following year, supercharged his engine and in effect supercharged himself in a new kind of flying suit of his own conception and made two thrilling high altitude flights over Bartlesville, Okla., in December, 1934. He used the "Winnie Mae," the same Lockheed Vega, powered by a Pratt & Whitney Wasp

THIS IS WILEY POST

The noted pilot developed this supercharged suit for his stratosphere flights.

engine, with which he had twice flown around the world since the ship was built in 1930.

The Wasp engine had one supercharger on it when Post made his world flight of 1933. Preparing for altitude records he installed another supercharger which was calculated to boost the 4.37 pounds atmospheric pressure at 30,000 feet to about 15 pounds intake manifold pressure, corresponding to sea level and procuring power efficiency similar to that obtained when flying close to earth.

The pilot's helmet was fitted with valves, one of which admitted air under pressure from the first engine supercharger. The other valve admitted life-sustaining oxygen, so that the wearer at any height, even in the stratosphere, might mix his own air and have it of the same density to which he is accustomed on the surface. The helmet in turn was fastened air-tight to a rubber suit, and this really encased the pilot's whole body in the same sea-level pressure, while a nice balance could be maintained by letting the air out through the exhaust valves in the boots.

After a first flight on December 3, when he lost his bearings at a great height and landed out of gas 90 miles from his point of departure, Post spent several days completing preparations, and on December 7 went up again.

"I headed into the wind which I estimated was blowing about 200 miles an hour," said the pilot after he landed two hours and 26 minutes later. "From then on I could see without difficulty Oklahoma City 110 miles away and Elreno 150 miles west of my landing field. The thermometer outside registered 70 degrees below zero, yet I was comfortable. The flying suit worked perfectly after I had fastened the face-piece on my helmet and turned on the supercharger at 20,000 feet. They hang floral offerings on good race horses. I would like to hang one on that Wasp engine of mine. It ran like a clock, and that is the same engine that won the Los Angeles-New York race and then flew around the world twice, not counting the regular flying I have been doing. It has gone so far I would not even estimate how many miles have passed under it. As a result of this flight I am convinced that airplanes can travel at terrific speeds above 30,000 feet by getting into the prevailing wind channel." Post planned to continue his effort at breaking the record during 1935.

Woman Flies 17,000 Miles Alone

When Miss Laura Ingalls brought her Wasp-powered Lockheed Air Express to earth at Floyd Bennett Field, New York, on April 25, 1934, she had completed a 17,000-mile flight to South America and return alone, since her departure on February 28. She had left Miami, Fla., on March 8. She made stops at Havana; Merida, Yucatan; Managua, Nicaragua; Cristobal, C. Z.; Talara and Lima, Peru; and Arica and Antofogasta, Chile, en route to Santiago. Thence she crossed the Andes to Buenos Aires, the first American woman and the third woman in the world to do it alone. She followed the coast north to Rio de Janeiro and Para, Paramaribo and Port au Spain, Trinidad. Often rain forced her to fly only 15 feet above the water. From the mouth of the Amazon up the jungle-lined coast

LAURA INGALLS STARTS HER FLIGHT

Leaving North Beach airport, New York City, in her Wasp-powered Lockheed Air Express on a 17,000 mile solo trip around South America.

to Dutch Guiana she had to make two attempts to get through bad weather, flying by instrument only. The Pan American Airways stations and Stanavo fuel distributors rendered the aerial voyage invaluable assistance and helped make her flight one of the outstanding achievements of women in the air.

Kingsford-Smith's Pacific Flight

Sir Charles Kingsford-Smith and his navigator, Capt. P. G. Taylor, Australians flying an American Wasp-powered Lockheed Altair monoplane, flew from Brisbane, Australia, to Oakland, Calif., between October 20 and November 4, 1934. Their trip of 7,318 miles was made in three hops—1,760 miles from Brisbane to Suva, Fiji Islands, 3,150 miles from Suva to Honolulu and then 2,408 miles to Oakland airport. It was one of the outstanding stunt flights of the year, and its success was a tribute to American equipment and the courage of the aerial adventurers who dared make the long, hazardous trip over the open sea in a land machine. They carried 22 pounds of food and a little still for getting drinking water from the sea.

AUSTRALIA TO OAKLAND

Kingsford-Smith and Taylor land their Wasp-powered Lockheed Altair at Oakland municipal airport at the end of their Pacific flight.

Other Transocean Flights

The transocean flying season was opened May 14, 1934, when George R. Pond and Cesare Sabelli flew their Whirlwind-powered Bellanca Pacemaker from Floyd Bennett Field, New York, to Lahinch, Ireland, in 32 hours. Later they flew on to Rome, Italy, their original destination. They tried a return flight on August 18 but wrecked their machine when they became lost in Wales.

The second non-stop airplane flight ever made from continental Europe to New York was completed on May 28, 1934, when Maurice Rossi and Paul Codos landed their big Hispano-powered Bleriot monoplane at Floyd Bennett Field in an unsuccessful attempt to break their own non-stop distance record made in 1933 when they flew 5,657 miles from New York to Syria. Rossi and Codos had planned to fly non-stop from Paris to Los Angeles, but the strain of carrying 12,540 pounds of gasoline at the outset proved too much for their veteran French plane, and they had to drop down in New York. They had been in the air 38 hours 27 minutes.

On June 29, 1934, Benjamin and Joseph Adamowicz made their second attempt at a transatlantic flight from the United States to Poland. Flying the same red, white and blue Bellanca monoplane, powered with a Wright Whirlwind 330 horsepower engine, they took off from Harbor Grace and headed out over the ocean. They flew 2,500 miles in 30 hours and 24 minutes and then landed near the French coast at Saint André de Messei. After making the repairs necessitated by a rough landing they took off again but were again forced down at Nedlitz-Thermendorf, Germany. They reached Warsaw on July 2.

John Grierson set out from Rochester, England, on July 21, 1934, in his little Fox Moth plane powered with a 130 horsepower Gipsy motor on a second attempt at a solo Atlantic crossing by way of the northern islands. His first mishap occurred at Reykjavik, Iceland, when attempting to take off. This was the second time in two years that he had cracked up at this place. He then sailed back to England to have repairs made on the damaged parts of his plane. On returning he again took off but was forced down on an uninhabited part of the coast where he was found by searchers and then taken to Angmagsalik, Greenland. He then flew to Godthaab and thence to Ottawa via Kovunvituk. At Ottawa he again wrecked his plane on a landing in the river. He arrived in New York 55 days after leaving England.

On August 8, 1934, James R. Ayling and Leonard G. Reid left Wasaga Beach, Ontario, Canada, and pointed the nose of their De Havilland biplane toward Baghdad, trying to break the world record for distance flying held by Rossi and Codos. After flying 30 hours 50 minutes, including six hours of blind flying over the ocean, and covering 3,500 miles, they landed at Heston, London.

Dr. Richard U. Light and Robert F. Wilson flew their Wasp-powered Bellanca Skyrocket, equipped with Edo floats, from Cartwright, Labrador, by way of Greenland, Iceland, the Faroe Islands and on to the Orkneys between August 27 and September 6, 1934, and considered it only part of a round the world jaunt, thus making transocean hops rather commonplace adventures.

The only disaster in transocean stunt flights in 1934 was Charles T. P. Ulm's tragic attempt on December 3 to fly from Oakland, Calif., to Australia in a British land plane. He and his companions, George Littlejohn and J. S. Skilling, lost their bearings and were forced down by empty fuel tanks near Hawaii. An intense search by sea and air failed to locate the Ulm party, whose plane was not built for over-water flying, and was unfitted for floating in the sea.

Rear Admiral Richard E. Byrd's second Antarctic expedition to Little America made twelve major flights during the entire year

1934. About 200,000 square miles of Antarctic territory were added to the map as a result of these flights, and the area was claimed for the United States. On November 23, 1934, Admiral Byrd, with Harold June as pilot, flew the expedition's big Curtiss-Wright Condor 1,104 miles over Marie Byrd Land, crossed a plateau and located an extension of the Queen Maud mountains 170 miles ahead of the last point where past exploration had shown them to exist. Flying two miles high the party confirmed its belief that the mountain ranges of Antarctica are a continuation of the Andes of South America.

Lincoln Ellsworth, Sir George Hubert Wilkins and Bernt Balchen, famous polar pilot, in their ship the "Wyatt Earp", entered the Bay of Whales in Antarctica in January, 1934. Their Northrop plane, "Polar Star", was taken off the ship and berthed on the ice shelf for a test flight. Ellsworth and Balchen planned to fly across the Antarctic continent. The ice shelf was about 25 feet thick. Without warning it split apart, and the adventurers saw their plane drop into a crevasse, supported only by its wings. Then the floes started drifting, and the members of the party, hopping from one ice cake to another, chased the machine for a mile before they caught it. It was returned to the United States for repairs. The party was back on the other side of Antarctica, near Deception Island, late in 1934. On a round trip flight of 400 miles on January 3, 1935, Ellsworth and Balchen added to the map of the known world five islands, three fjords and several mountain peaks.

AT LITTLE AMERICA

Admiral Byrd's Curtiss-Wright Condor on Edo floats in the ice near his Antarctic base.

CHAPTER X

PRIVATE FLYING

Activities of Private Owners—Number of Planes and Pilots—Seaplane Bases—Air-Cruising—Hunting Outlaws—Exploration by Air—Prospecting—Sportsmen Fly to Game Fields—Aircraft in Business—Air Races—Gliding and Soaring.

MANY and varied were the ways by which airplanes saved time and money for private owners in 1934. Business men used planes in scores of different operations. Industrial companies trying to sell more of their products sent out their salesmen on long flying trips to visit more towns and call on more customers in the quickest possible time. Professional men, doctors, engineers, advertising experts, public officers and others accomplished innumerable missions by way of the air. Explorers, prospectors, big game hunters, fishermen and a host of others climbed into their planes and flew out over land and sea, mountain and jungle in an unceasing quest for adventure, new discoveries and extraordinary accomplishments. The year was remarkable for the variety of achievements accredited to the private pilot, flying either his own plane or the machines of some company, business house or other institution.

The Bureau of Air Commerce, of the U. S. Department of Commerce, reported in the United States and possessions 13,949 licensed pilots (compared to 13,960 at the end of 1933) and 8,322 licensed and unlicensed, but identified, aircraft (compared to 9,284 at the end of 1933) a very slight loss for 1934. The 6,339 licensed aircraft at the end of 1934 almost equaled the 6,896 licensed machines 12 months previously; while the number of unlicensed machines dropped from 2,388 at the end of 1933 to 1,983 in 1934. In addition there were 486 gliders.

California led all other States with a total of 897 aircraft, New York State was second with 814, Illinois third with 510, Pennsylvania fourth with 490 and Ohio fifth with 460. Approximately 2,000 airplanes were in the hands of private owners.

The Bureau of Air Commerce accounted for the 13,949 licensed pilots in these classifications: Those holding transport licenses 7,144; limited commercial licenses 1,006; industrial licenses 10; private pilot licenses 5,110; and amateur 679. Among the transport pilots about 670 held scheduled air transport ratings entitling them to command planes operated on the air lines of the United States. The total list of pilots included 371 women among whom 67 held transport licenses, 34 limited commercial, 225 private, 45 amateur and one autogiro.

The popularity of seaplanes for private owners grew in 1934 with development of marine flying terminal facilities in waterfront communities, such as the turntable ramps in New York at the foot of Wall Street and at Thirty-first Street on the East River. Those bases—designed originally by Edo Aircraft Corporation—handled many private ships as well as scheduled operations. A number of

MILES H. VERNON'S WACO D

The sportsman pilot and his Whirlwind-powered Waco D.

other progressive cities at the end of the year were planning similar facilities.

Throughout the year, winter and summer, groups of men and women, and youngsters too, might have been seen winging their way over the American countryside for the sole purpose of enjoying the magnificent views that one finds only from a grandstand seat in the sky. The fourth annual invitation seaplane cruise was made in July with 14 planes carrying 40 persons on a round trip between New York and the Thousand Islands in the St. Lawrence River. The aerial armada was commodored by Richard F. Hoyt, with George B. Post as fleet captain and Rudolph R. Loening chairman of the regatta committee. The colorful fleet of over-water craft included the new Curtiss-Wright amphibion, a Loening Monoduck, a Commuter, Sikorsky, Savoia-Marchetti, Fleet and Waco planes.

A complete list of the men and women who fly their own planes for the fun of it, and who would much rather fly across country than drive their own cars downtown during the rush hour, would present a cross-section of the social and business life of the United States. W. K. Vanderbilt, Alfred Gwynne Vanderbilt, four members of the duPont family, including Richard and Alice duPont who made the grand flying tour of the West Indies and South America, Senator William Gibbs McAdoo, Mr. and Mrs. Reginald L. Brooks, Mr. and Mrs. Grover Loening, Bernarr Macfadden the publisher, George Hearst, David Ingalls, Col. Edward A. Deeds—they are only a few of the increasing number of Americans who think nothing of flying

BELLANCA SENIOR SKYROCKET

Wallace Beery's new touring plane with all the latest equipment, including radio.

from one end of the country to another to keep a single social or business engagement or spend a few days with friends. The motion picture colony in Hollywood has become so air-minded that a star now creates much comment if he or she does not own an airplane and use it for all trips longer than 150 miles.

Earl Kelton, Paramount movie director, used a Stinson Model R to carry him and his friends on hunting trips in northern California. They reached camp in a few hours, and had the rest of the time for hunting, instead of spending most of their trip wandering over the surface getting there.

Governor Guy B. Park of Missouri headed a long list of distinguished persons who flew in the aerocade around his State during three days of July. The thirty ships participating were marshalled by Phil Love, one of Missouri's famous pilots. Louis C. Seaverns, of Chicago, with George Fisher, pilot, took his father and mother on a round trip flying cruise to Sarasota, Fla. It turned out to be a great adventure for they flew over forest fires raging in Kentucky, Tennessee and Georgia. Their Stinson monoplane covered the 2,345 miles of flying on 330 gallons of gasoline and 2½ gallons of oil, which with hangar fees, brought the cost of transportation to $98, as against $214 which they would have spent for railroad tickets, to say nothing about the vast saving in time. In August 21 sportsmen pilots made a massed flight from Portland to The Dalles, Ore., and return.

Three women from New York, sisters and all over 70 years of age, chartered a big monoplane and left Cairo, Egypt, in April, their flight itinerary including Jerusalem, Baghdad, Babylon, Teheran,

AERONCA FLYING CLUB

Aeronca planes, Aeronca-powered, ready for a flying picnic at Cincinnati, O.

Istanbul and Athens, thence to the end of the trip at Bremen, in north Germany, in less than four weeks after the start. The adventurers were Mrs. William H. Moore, Mrs. L. I. Knight and Mrs. William H. Colvin, whose husband accompanied the party. Most of their days were spent looking down upon antiquity from the comfortable cabin of their plane. At night they sought shelter in primitive native inns, wherever they might be. It was a long, long cry back to the days of that terrestrial ship of the desert, the camel, plodding his patient way over the hot sands while his passengers scanned the far horizons for dust storms or marauding bands. Camels are going out of fashion among visitors to the desert countries of the Near East.

Dr. Richard U. Light, professor in the Yale School of Surgery, and Robert Wilson, of New Rochelle, N. Y., put their Wasp-powered Bellanca Skyrocket on Edo floats and set out on a leisurely

MODERN HUNTING IN AFRICA

The noted explorers, Mr. and Mrs. Martin Johnson, in their Wasp-powered Sikorsky amphibions frighten a herd of wildebeeste near Tanganyika.

world flight in midsummer. They flew up to Greenland and crossed to Europe by way of Iceland, thence visiting Europe and Asia. They flew to the Philippine Islands, and returning to the United States by boat, made another air tour in the Western Hemisphere. On their return in January, 1935, they had flown 29,000 miles without even a forced landing.

Up and down the United States officers of the law sped in their flying ships to add one more point to the fact that gunmen, gangsters and crooks cannot get away with it. Time and again outlaw bands seeking refuge in out of the way places found to their sorrow that the eye of the law has limitless vision when it becomes an eye in the sky. Agents of the Department of Justice chartered planes and chased Dillinger's gang out of one State and into another, then another, and kept them constantly on the move. The gangsters in turn hired planes and made getaways on several occasions; but airplanes, being civilized machines requiring civilized attention, betrayed the bandits when they came to earth for gasoline and repairs. There was no hold-up or kidnapping in which planes did not figure to some extent. Even after the bandits were captured, rescue by their fellow-criminals was made impossible by whisking the prisoners out of sight in planes and landing them secretly very often hundreds of miles away near some convenient prison where only armed guards were present to receive them.

Dr. Barnum Brown, of the American Museum of Natural History in New York, covered 9,000 miles in a survey of the western States

LUSCOMBE PHANTOM

A Warner-powered plane for the private owner.

and made many important discoveries which he believed would have eluded any party seeking to pry into the secrets of the earth as it existed thousands, even millions of years ago. Immense tracts, sometimes covering thousands of acres, were explored in Wyoming, first by air. When they showed promise of containing fossils the party would land and explore. Invariably they found their aerial surveys correct. In New Mexico and Arizona Dr. Brown's party located hitherto unknown sites of human habitations believed to have been occupied by the earliest peoples in that section, according to the general knowledge of the surrounding countryside as obtained from the air. Scientists had explored that section on foot for years but had never found the new archaeological sites, one of which is near Pueblo Bonito, N. M., and the other near Winslow, Ariz.

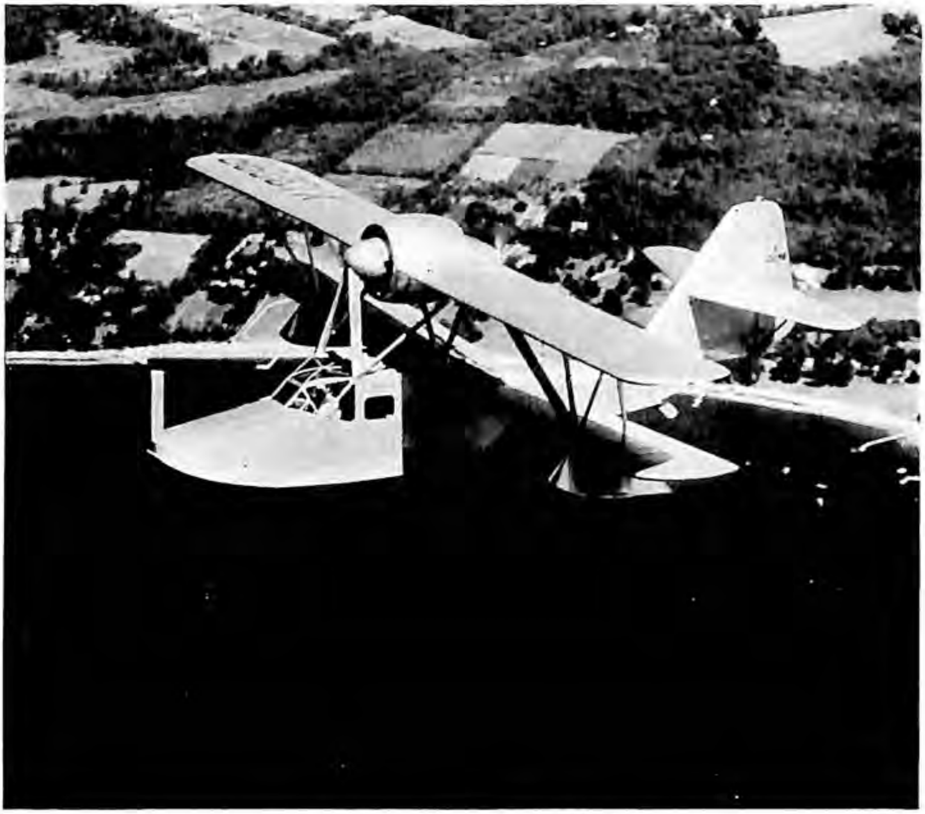
The airplane offers a birdseye view of such vast dimensions that hundreds of square miles can be minutely studied in hours as against months and years of arduous labor on the surface. Such was the experience of Lewin B. Barringer and his party in Victor Dallin's Bellanca plane on an exploring trip to determine the nature of the great scars on that particular part of the earth's face known as South Carolina. Great craters, some of them more than a mile wide, and nearly round, had defied the scientists who had explored the region near Florence, S. C. For years it had been assumed that the numerous craters had been caused by winds and tides when the sea extended over that region. The aerial survey offered convincing evidence, however, that the saucer-like holes had been made by a comet which had split into fragments and bombarded the earth with meteors.

The famous explorers, Mr. and Mrs. Martin Johnson, took two Sikorsky planes with them on their most recent African adventure when they traversed thousands of miles over the wilderness of Kenya and Uganda meeting strange peoples and even stranger members of the animal kingdom.

FAIRCHILD CABIN MODEL 24
A three-place plane for the private owner.

During the summer Bradford Washburn and his companions of the Harvard-Dartmouth expedition conquered the great Malaspina Glacier in Alaska. They worked for months making their preparations and one day took off on a flight with photographic equipment. Within five hours they had taken more than 200 pictures of one of the largest coastal glaciers in the world, flying above snow-capped peaks and ice fields at heights of two miles. Later, the plane circled over the camp of the party which was climbing Mount Crillon, dropping messages. They also used the plane to drop food supplies for the advance party of climbers; losing only two cans of peas in a total of 1,200 pounds of various foods and things dropped from a height of 7,000 feet above the snow-covered slopes of the mountain.

Innumerable were the instances during the year when men and women had the thrilling experience of making unexpected discoveries from the air, such as that of Bernard F. Davis who studied an aerial picture of Ashdown Forest near London, England, and found that



CURTISS-WRIGHT AMPHIBION

The Commuter, Whirlwind-powered, designed by Capt. Frank Courtney, a five-place pusher biplane with a third wheel to prevent nosing over in landing.

it betrayed the existence of a road built by the Romans when they occupied the island. In fact, it was the first Roman road to have been discovered in England during the last 200 years, and its course for the first time offered convincing evidence that the Romans used London as a clearing port for their ships.

Twelve days by burro over dangerous trails of the Andes Mountains and thence down the River Kaka in Bolivia on small rafts of wood formerly awaited the daring prospectors who for hundreds of years have tried to find the lost lodes from which the Incas procured gold for their fabled treasures, the same gold which the Spaniards failed to find in the sixteenth century. One hour of flying in a Sikorsky amphibion saved days of surface travel for Ralph A. O'Neill and his associates working claims in the heart of the Bolivian jungle. Not only were they flying back and forth to civilization, but they were flying mining equipment over the Andes and setting up machinery, building homes with modern conveniences and maintaining a constant store of food, medicines and other supplies without which, men born to the comforts of the town would not long survive and work in that wilderness.

Where a pack train would take 10 difficult days of weary, hazardous wandering through mountain passes Gordon Barry and his Lockheed Orion made a daily round trip between Mazatlan on the west

A BEECHCRAFT FOR BUSINESS
Model 17-R with Wright Whirlwind engine.

coast of Mexico and the San Luis mine 70 miles inland. He flew between the seaport and the mine in 25 minutes, carrying mail, passengers, supplies, anything at all so long as it would go into his ship: and he took out the gold milled at the mine. Amazing was Barry's explanation of the ease with which the new type retractable landing gear made such flying reasonably safe. The great danger in the past was forced landings in rocky country, when wheels catching in the ruts or bumping against stone would nose the plane over and wreck it. Barry was prepared for forced landings. He would keep the wheels up and land the plane on its bottom as a skid. The twelve American families at the mine depended upon Barry to keep them in touch with the outer world, because in wet weather nothing, not even a mule, could travel over the surface.

During the year Frank Whaley and Harry Nelson of Seattle, Wash., flew up to Nome, Alaska, and thence on a prospecting trip by air to locate a gold claim discovered by Indians. The Northwest recorded a dozen instances of flying food supplies and even dynamite to mining camps isolated by storm and flood. In Nelchina, Alaska, six miners and as many dogs dragged a huge log back and forth across one of the few open spaces, laboring for days until they had leveled off a field big enough to permit planes to land with supplies and an increasing number of prospectors. Throughout the world the high price of gold sent thousands of old-timers once again into the back country seeking the precious metal; but no longer did they wait for trails to clear and storms to abate. They were making the long journeys by air.

WACO CABIN YKC

A four-place executive's plane with 225 h.p. Jacobs engine.

Ten tons of grain were showered over seven northern New Jersey counties when 18 planes participated in the winter game feeding program of the Consolidated Sportsmen of New Jersey. Cut off from their regular food supplies by heavy snows the deer in north Maine were starving to death when public-spirited citizens donated money and bought food, then, under the direction of the State Game and Fish Commissioner, flew it into the region where the herds had been spotted from the air. At the same time a growing number of sportsmen were using flying craft to shorten their journeys to hunting grounds in a dozen States. Fred H. Harris of Brattleboro, Vt., used his Waco to get him into big game territory. The number of flying sportsmen on the Pacific Coast increased amazingly with the availability of landing fields in the game country of the Far West and in Mexico. Many week-end hunting trips took the place of one or at most two tedious trips a year. Instead of days spent getting to a place where one can hunt, an hour or two will put your hunter within walking distance of his camp. During 1934 hundreds of airplane landings were made on the Tunnel, Monache Meadows and Templeton landing fields, bringing sportsmen to the fishing grounds in the Inyo National Forest in California.

One of the most consistent sportsman pilots in 1934 was Dr. John D. Brock of Kansas City, Mo., who had been flying his own plane for years, having acquired the habit of flying once a day regardless of the weather or his destination. He would leave his office and fly down to his 2,700-acre tract 250 miles distant in the Ozark Mountains and there fish in his own trout stream. The Kansas City Chamber of Commerce gave him a prize for being the city's champion private pilot.

A STINSON FOR BUSINESS

Lycoming-powered Stinson cabin plane with Lycoming-Smith controllable pitch propeller, used by the Cleveland Pneumatic Tool Company.

One of the most meritorious of aerial hunting pastimes was running to earth the coyote which makes life miserable for the wild stock in the West. Flying out of Billings, Mont., a party of hunters bagged 22 coyotes within two weeks. Colorado hunters did even better. They got as many as 15 in a single day.

Amateur sportsmen having nothing better to shoot at because of closed seasons flew out and chased coyotes, which can be shot from the planes when they do not make cover, because of all the animals protected by law an exception is made with wolves and coyotes. Nothing has been found in their favor. They can be shot from the air, and they alone of all the so-called game are considered fair sport for the hunter who uses his plane in actual hunting. It was fair enough to use planes to get to the hunting grounds, but after that it is not considered cricket. Witness, for example, the pilot who was arrested in Oregon. He was accused of mercilessly driving wild geese off their protected preserve where they sought sanctuary, then herding them through the air across open water to the blinds where hunters awaited them with a barrage.

More peaceful and none the less thrilling was the flying of four Nebraska ranchers whose ranges aggregate more than 300,000 acres. It was impossible to traverse that vast country and keep track of cattle from the surface, especially after severe storms. They did it by airplane, flying out and checking their herds in the only possible and by far the quickest way.

THE KINNER SPORTWING
A two-place ship with 125 h.p. Kinner engine.

C. C. Anderson of Stockton, Calif., managed a 773-acre walnut orchard from the air. With 10 miles of concrete pipe lines and more than 300 miles of contour irrigation ditches on the property a week or more of steady hiking would be necessary to cover the surface between the rows of trees. Anderson went up daily during the growing season, flying back and forth some 600 feet over the orchard. He checked the flow of water in the irrigation ditches, inspected the condition of the trees and observed the result of spraying operations. He could do the job in an hour or two, thus saving a week of hiking. Moreover, he gave the entire property a thorough examination every day, instead of once or twice a month which would be the best he could do by surface methods. The results were more and better walnuts.

Lawrence Holland of Ogden, Utah, used his Stearman to fly everywhere within a radius of a thousand miles when he went out to buy up cattle and sheep. He landed on the best spot he could find at a ranch, bought a few carloads of stock, and was off again to the next place. He traded with ranchers in Idaho, Utah, Nevada and Oregon; and the buyers who used only automobiles found Holland their most active competitor.

During the flood at Wallace and Kellogg, Ida., in the winter of 1933-34, five airplanes formed the only connecting link between those towns and the outside world. More than 50,000 pounds of

AERONCA ON EDO FLOATS

Don Cooke's Aeronca on Edo floats at his home in Easthampton, Long Island, N. Y.

supplies were flown in and 500 passengers flown out before surface traffic was restored.

Literally thousands of different uses were found for private aircraft in business. The fastest delivery service ever devised "for any point in the State" was maintained by the Rochester Photo Supply Company of Tulsa, Okla., using a Stinson Junior. It was becoming more popular month by month, and recognized as a tremendous asset in the growing business of the firm which delivered purchases by air anywhere in Oklahoma. Moss Patterson, of the Oklahoma Transportation Company, guided the destinies of bus operations covering 1,200 miles in three States. He flew his Waco cabin plane to division points, covering most of them in a single day; and he found that he could get around and take care of the business by flying about 300 hours a year. He estimated his expenditures for this aerial travel to be about 10 cents a mile, including all overhead.

"The cost of operation a mile does not exceed that of an automobile," said Burnside Smith, president of the Mayflower Transit Company of Indianapolis, Ind., speaking of his Waco plane in maintaining close contact with more than 300 furniture warehouse organizations with which he did business throughout the country. He fitted the cabin of his plane with a full length cot that he might sleep while his pilot flew him from one city to another. When W. W. Wright, of the General Outdoor Advertising Company, wanted to sell space to clients in Omaha, Neb., he took them up in the air and showed them just where heavy traffic on the highways made outdoor

CONSOLIDATED LIGHT TRAINER
A Fleet F-10-G powered by a Menasco engine.

advertising desirable. The Public Address Service Company of Dallas, Tex., handled the sound equipment in 120 movie houses in Texas, Arkansas and Oklahoma. R. Z. Glass, the head of the firm, used his Lambert Monocoupe to cover the territory, transport films and carry service engineers on emergency repair jobs, sometimes hundreds of miles away. Herbert G. Fales, high official of the International Nickel Company of Canada, maintained a Lockheed Vega and a Stearman sport plane near his New York City headquarters, doing all possible traveling by air.

Almost daily one reads in the newspapers exploits of the famous pilots who are now handling the aviation departments for industrial concerns. The oil companies are among the leaders in this field, using planes for every conceivable kind of transportation, advertising, executive transport, sales trips, business surveys and emergency errands between offices and various units in the field. Notable among the aviators whose work has distinguished them during the last year are Alford J. (Captain Al) Williams of the Gulf Refining Company, James H. Doolittle and James G. Haizlip of the Shell Petroleum Corporation, J. D. "Duke" Jernigan of the Texas Company, Harry W. Howze, Humble Oil, Dudley Steel of Richfield Oil, Art Goebel of Phillips Petroleum, and a host of others.

The Consolidated Lobster Company of Gloucester, Mass., maintained a fleet of boats which operated far and near along the New

OVER THE ROCKY MOUNTAINS

C. C. Moseley in his Whirlwind-powered Curtiss-Wright Speedwing on a jaunt over the peaks of Southern California.

England coast, for the sole purpose of bringing into port these delicacies which have a nation-wide market. Cold weather, storms at sea and a variety of conditions can upset the most careful planning of a lobster fleet; and lost time in that business means huge financial losses when delays keep crews idle at their posts. So the company acquired a plane to operate out of Gloucester on any kind of mission requiring speed. Radio enabled the pilot to contact any ship in the fleet, find out when it was in trouble and help in any emergency. And in emergency, too, when surface conditions prevented shipments, the airplane would take aboard a cargo of lobsters to go flying out to market for delivery when the market needed them most.

Milk was flown into Chicago, a thousand quarts to a plane, when a strike tied up the surface delivery system. Doctors saved the lives of patients by flying to the most isolated places when minutes meant life or death.

National Air Races

The national races at Cleveland, Ohio, from August 31 to September 3, 1934, thrilled the greatest crowds in the history of flying shows in the United States. Special racing planes, acrobatic machines and new gadgets designed to let pilots win flying contests were notable for their excellent construction and streamline finish. Douglas Davis made the highest speed of the meet when he hurled his Wedell-Williams Wasp-powered racer through space at 306.215 miles an hour. He won the Bendix transcontinental dash from Los Angeles to Cleveland at an average speed of 216.237 miles an hour. J. A. Worthen in a racer of the same type won second place at 203.213 miles an hour. When Vincent Bendix offered $3,500 to the pilot who would break the existing coast-to-coast record, Roscoe Turner in his Wedell-Williams Hornet-powered Special sped on to New York and broke his own transcontinental record by one minute 58 seconds, making a new all time coast-to-coast mark of 10 hours, two minutes and 57 seconds. Turner also won the Thompson Trophy Race after Douglas Davis, who had been leading, crashed on the seventh lap of the twelve-lap contest. Lee Miles was a consistent winner of the Shell dashes in his Menasco-powered Miles and Atwood Special. Roy T. Minor won second place in the Thompson Trophy Race with his Brown Special, Menasco-powered. A total of $38,020 in cash prizes was distributed among the contestants whose racing fortunes may be summarized by their winnings, as follows: Roscoe Turner $8,625, Douglas Davis $7,765, Roy Minor $4,085, Lee Miles $3,935, Johnny Worthen $3,250, Harold Neuman $2,515, Art Chester $2,055, Roger Don Rae $1,660, S. J. Wittman $1,205, Earl Ortman $640, Walter Wedell $425, Joe Jacobson $330, Art Davis $160, Roy Hunt $160, H. Rasmussen $160, and Owen R. Tilbury $40.

The Pan American races at New Orleans rivaled the famous Mardi Gras, held at the same time, in providing thrills and entertainment for the huge crowds visiting the city from February 14 to 19, 1934. Shushan Airport, the new $4,000,000 air terminal, received a baptism of flying in all its varied and amazing forms. Milo Burch-am, of Long Beach, Calif., and Michel de Troyat, of France, brought the crowd to its feet with their stunts, and then to make this meet most astonishing, Harold Johnson, an air mail pilot of Chicago, went up in a tri-motored plane and did most of the stunts that the others had performed in their special small craft. S. J. Wittman set a new world record for light planes when he drove his red racer, weighing only 430 pounds, at a speed of 62.137 miles in 27 minutes, 6.7 seconds, a rate of 137.5 miles an hour.

The sixth annual All American races at Miami, Fla., January 11 to 14, 1934, attracted sportsman pilots from all sections of the country. Hundreds of private pilots and their ladies, their children and in some instances their grandchildren, took occasion to emulate the birds and fly south for the big meet. Jack Wright, of Utica, N. Y., made a world record for light cabin planes when he averaged 167.484 miles an hour over a closed course of 62.137 miles. Lee Miles made 194.511 miles an hour over a 15-mile triangular course. Howard Hughes, the motion picture producer, averaged 185.707 miles an hour over a 20-mile course in the sportsman pilot free-for-all contest. Jimmy Wedell made 253.717 miles an hour over two laps of a 15-mile course. Larry Sharples, of Philadelphia, took first prize of $2,599 in the sportsman pilot's race from Orlando to Miami, leading a field of some 90 airplanes.

The growing popularity of the Ninety-Nines, a club of women pilots numbering among its members nearly all the galaxy of flying stars who prefix their names with Miss or Mrs., was evidenced by many women's flying meets which that organization held in different cities in 1934.

Under the Soaring Society of America motorless flying in 1934 won increasing popularity as a sport, a training medium for power plane flying and a means of aerodynamic and meteorological research. The highlight of the year in performance was the world record flight (later bettered by German pilots) of Richard C. du-Pont. He soared 158 miles across country from Elmira, N. Y., the scene of the Fifth Annual National Soaring Contest, to Basking Ridge, N. J. This outstanding performance, made possible by favorable thermal conditions on the afternoon of June 25, 1934, exceeded the world record of 136.8 miles established by a German pilot in 1931 and the American record of 121 miles which duPont had made along the Shenandoah ridges in September, 1933. He used an Albatross II sailplane built in 1934 by the Bowlus-duPont Sailplane Corporation, which moved its factory from Los Angeles to Wilmington, Del., in September, 1934. DuPont led all contestants in points won and was named national soaring champion for the year.

The annual contest at Elmira was held June 23-July 8. The 63 contestants flew eight sailplanes and 24 secondaries (also called utilities) for 117 hours 31 minutes. There were 128 launchings from the three ridges used, eight of them airplane tows. There were also eight airplane tows from the American Airlines airport. Sixteen "B" (gliding) and 16 "C" (soaring) licenses were issued.

Two women, Mrs. Barnaby and Mrs. Dorothy C. Holderman, of LeRoy, N. Y., received their soaring licenses in 1931. In 1934 Mrs. Holderman made a duration flight of four hours and 31 minutes, the longest any American woman had ever soared, to win the duration competition open to both men and women flying secondaries, and the duration contest for women only. Mrs. Richard C. duPont soared for four hours and 21 minutes. Excellent flights were made by Miss Margaret Kimball, of Lexington, Mass., and by Miss Gretchen Reighard, of Mansfield, O. The second annual soaring expedition to the Shenandoah Valley in September centered at Big Meadows, Va., where the National Park Commission had constructed the first Federal soaring site.

COL. LINDBERGH'S LAMBERT MONOCOUPE

It nestles beneath a Douglas transport which he, as chairman of TWA'S technical committee, approved for that line's passenger service.

CHAPTER XI

AERIAL SERVICE

Miscellaneous Operations — "Fly Yourself" Planes for Hire — Charter Services—Revenues from Public Projects—Sightseeing and Sport Travel—Marine Aerial Services—Aerial Photography.

BOY and girl sweethearts eloping from irate parents and irate parents pursuing elopers, bandits fleeing from the law and officers chasing bandits, salesmen hurrying to make sales and their bosses hurrying after to make sure they had made them, candidates for office and rival candidates, sportsmen hunting for the fun of it and hunters making a business of hunting—they were only a few of the tens of thousands of persons who were phoning local airports at the beginning of 1935 to hire taxi airplanes to take them up and away to wherever they wanted to go in the fastest vehicle yet devised. There had been more than thirty million miles of such flying in the United States during 1934.

Flowers and bugs, seeds and dynamite, movie comedies and news reel tragedies, medicines, furs and fish, tools and parts to repair broken machinery, everything perishable or needed in a hurry at any place off the beaten track of regular air line schedules might have been seen speeding overhead day or night in one of the 4,500 airplanes estimated to have been in use among aerial service and miscellaneous flying organizations in the United States on January 1, 1935. The number of aerial repair stations approved by the Bureau of Air Commerce had increased in 12 months from 139 to 150 at the beginning of the new year.

The "drive yourself" idea of renting motor cars was spreading rapidly in the field of fixed base flying operations. Hundreds of operators had found that they could rent planes to amateur pilots for occasional flights or cross-country tours; and this business showed much promise of development. It was significant that pilots who could not afford to maintain their own machines were still enthusiastic enough to rent equipment when they had the means. For example, the Robinson Air Service, Rochester, N. Y., rented planes for 708 of the 2,568 flights made by its four machines in 1934.

Popularity of the charter service, in which one hires a pilot and plane to fly him direct on an individual trip, was growing rapidly as the country emerged from the depression. Development of night flying and ability of aerial service pilots to fly by instrument in bad weather accounted for the growth of charter service; and logically, because the patrons could depend upon getting through to their destinations with little chance of being grounded en route, prevalent in the not so distant past. This was noted especially by the Washington Aircraft and Transport Corporation, operating from Boeing Field, at Seattle, Wash. During the year more than 250 cross-

NEW KELLETT AUTOGIRO

The KD-1, Jacobs-powered, wingless, controlled by tipping the rotor blades.

country charter flights were made by that company, with much night flying. Most interesting, aside from the scenic flights over the Olympic mountains, Puget Sound and Mt. Rainier, were the flights of passengers and express to Vancouver or Victoria, B. C., to catch Pacific steamers after missing connections at Seattle.

The policy of Government bureaus to hire private companies for special flying missions and thus encourage commercial flying proved a boon to many operators, in some instances forming an important part of their business for the year. Hiring private concerns to fly high for weather observations, forest fire patrol, transportation of men and supplies, aerial photographic work, crop dusting and surveying, and many other activities combined with the orders from States, counties and municipal governments, served to augment cash receipts from transients. Mountain Airways Corporation, of Laramie, Wyo., had 38 hours of weather flying during the year, much of it blind flying and some at altitudes up to 18,000 feet. Noteworthy was the fact that those companies maintaining first-class equipment for day and night work and pilots capable of instrument flying received the bulk of the business.

FOUR-PLACE CABIN WACO
Model CJC, with Wright Whirlwind engine.

Typical of the sightseeing service rendered by many companies was that of Grand Canyon Airlines, Inc. Operating from Grand Canyon, Ariz., under State franchises, the company made two daily scenic flights over the Canyon during nine months of the year. Besides its fixed base airport, the company had a field at Fredonia, another on the North Rim and six fields at trading posts in the Indian reservations. It had a State franchise to operate daily service between Phoenix, Grand Canyon and Salt Lake City; but like so many other companies was delaying operations pending more settled business conditions. The Canfield Flying Service, of Williston, N. D., besides routine aerial service and school, was on air patrol for the Montana, Dakota Power Company's high lines and gas lines. It also specialized in taking big game hunters into Canada. Another specialty was exterminating coyotes on sheep ranches and hunting horse thieves from airplanes. Wholly different was the work of the Viking Flying Boat Company, with a fleet of planes for rental and charter service, a repair shop for overhaul and an aerial garage at New Haven, Conn. A large number of the Viking patrons were Yale University students.

Aerial service over water was growing rapidly because of the perfection of marine air terminal facilities during 1934. The water rudder for seaplanes taxiing on the surface provided the control necessary for such craft to operate in congested areas. It remained for the Edo Aircraft Corporation of College Point, Long Island, N. Y., to devise floats and ramps, especially the large turntable ramp for heavy craft, such as those installed by the City of New York in 1934, and which are fully described in the chapter on airways and airports.

The new terminal at the foot of Wall Street, named the Wall Street Skyport, was operated by New York and Suburban Airlines during the 1934 season. This line conducted a commuting service between Oyster Bay and Port Washington, Long Island, and Wall Street from July 17 to September 28, using a 12-place Bellanca Airbus on pontoons. Residents of Long Island's north shore were able to reach their offices in the financial district in a few minutes. The company also operated a charter service between the Wall Street Skyport, Martha's Vineyard, and Nantucket Island. Sightseeing trips over New York were offered to the public, and they were becoming increasingly popular at the end of the season. More than a thousand persons were flown from the Wall Street Skyport during the few weeks of operations. The base was also used by Sky Harbors, Inc., using a Fleet seaplane in sightseeing and instruction operations.

Although forced to operate without the modern advantages of New York's marine air terminal, a number of other scheduled water flying services were maintained during the year. The Island Airways ran a service connecting New Bedford, Mass., with Woods Hole, Vineyard Haven and Nantucket for the third successive season. The planes met the boats and train arrivals at the pier in New Bedford harbor and saved about nine hours on a round trip to Nantucket. An over-water service was operated at Rockland, Me., flying passengers to their destinations within any radius.

Independent operators in the lake front and shore districts throughout the country were developing a flourishing business carrying fishing and hunting parties into inaccessible areas, and summer residents between their places of business and the waterfront resorts. Sightseeing flights were increasing in popularity at the recreational centers. Among operators of marine aerial service were William H. Wincapaw, of Winthrop, Mass., Intercity Airlines, of Boston, Mass., Land O'Lakes Airways of Delafield, Wis., Hayward Lakes Airways of Hayward, Wis., Essington School of Aviation at Essington, Pa., Scenic Airways of Ely, Minn., Fogg Flying Service of Lake Winnipesaukee, N. H., Kingston Rhodes Airways of Ely, Minn., Seaplanes, Inc., of Seattle, Wash., and Cape Cod Seaplanes, Inc., of North Falmouth, Mass.

Increased use of aerial photographs in advertising, real estate promotion, city planning, open land and forest surveys and highway construction at the beginning of 1935 indicated a steady development of business for the fixed base operators equipped for either photography or carrying aerial camera men. The Fairchild Aerial Surveys, operating several divisions throughout the United States, McLaughlin Aerial Surveys, Ashley C. McKinley, Inc., Ames Skyways and other companies flew thousands of miles in 1934 on aerial photographic missions alone. By far the greater bulk of the business, however, emanated from Government and State agencies. More than a hundred thousand square miles were mapped by air for Government bureaus.

Important work for the aerial service industry was accomplished by the Independent Aviation Operators of the United States, including in its membership fixed base operators, flying schools, airports, aircraft distributors, repair stations and miscellaneous services. Through its headquarters in Washington, under the direction of Louis R. Inwood, the organization presented a complete report before the Federal Aviation Commission representing the opinion of the entire miscellaneous flying industry. Regional directors were kept informed of daily developments; and gradually the needs of aerial service were made known to the public, members of Congress and State officials. Officers of the Independent Aviation Operators of the United States included Oliver L. Parks, president; William Long, executive vice-president; and Howard T. Ailor, secretary and treasurer. Ray W. Brown was chairman of the executive rules committee including Harold C. Westfahl, Charles Cox and Edward Ball. The regional directors included Milo Oliphant, Tex Rankin, Joe Plosser, Fred Sheriff, Homer Bredouw, L. G. Mason, J. C. Bennett, jr., Harold Darr, C. E. Harman, E. W. Wiggins, Lee D. Warrender and C. H. Warrington.

During the year the Independent Aviation Operators of the

United States appointed a national advisory committee to help work out plans for the future of the aerial service industry. The chairman of this committee was Bernarr Macfadden, the publisher. Other members included Col. Theodore Swann, Col. W. Jefferson Davis, C. C. Mosley, C. S. (Casey) Jones, L. P. Bonfoey, Dr. John D. Brock, Fred D. Fagg, jr., Robert Renfro, Henry King, John Wentworth, William McGraw and Col. W. E. Easterwood.

The Independent Aviation Operators of the United States in 1934 secured from the NRA the Commercial Aviation Industry Code for the miscellaneous flying industry.

The code was administered by the National Code Authority for the Commercial Aviation Industry, with headquarters in Washington, D. C. Louis R. Inwood was the executive officer. Other members of the code authority were: Region 1, E. W. Wiggins, E. W. Wiggins Airways, Inc., Providence, R. I.; Region 2, Lee D. Warrender, Casey Jones School of Aviation, Newark, N. J.; Region 3, L. G. Mason, Montgomery School of Aeronautics, Montgomery, Ala.; Region 4, J. C. Bennett, jr., Louisville Flying Service, Louisville, Ky.; Region 5, Milo Oliphant, Michigan Aeronautical Corporation, Ypsilanti, Mich.; Region 6, Homer Bredouw, Bredouw-Hilliard Aeromotive Service, Inc., Kansas City, Mo.; Region 7, Harold Darr, Curtiss-Reynolds Airport, Glenview, Chicago, Ill.; Region 8, C. E. Harman, Dallas School of Aviation, Dallas, Tex.; Region 9, Tex Rankin, 311 Lumbermen's Building, Portland, Oreg.; Region 10, Fred Sheriff, Montana Air Service, Helena, Mont.; Region 11, J. B. Plosser, Grand Central Flying School, Glendale, Calif.; Member at large, Oliver L. Parks, president, Independent Aviation Operators of the United States, Parks Air College, East St. Louis, Ill.

A LONG-RANGE BEECHCRAFT

The Beech Aircraft Company's four-place cabin Cyclone-powered biplane, with flaps, radio and Hamilton Standard controllable pitch propeller, equipped for long non-stop flights.

CHAPTER XII

AIRWAYS AND AIRPORTS

Blind Landing System Conquers Fog—The Federal Airways—Development of Airways Radio—The Nation's Airports.

FOG, the implacable foe of the traveler on land and sea and in the air, fog creeping over the earth without warning to blot out everything that might point the way, fog the last nemesis of the pilot who defies bad weather and seeks a refuge after a weary flight through mighty winds, rain or freezing snow—that last arch enemy of those who take to the air in ships was to be forever vanquished during 1935 if the amazing blind landing experiments of the previous year could be made wholly practicable for common use.

During 1934 the Bureau of Air Commerce adopted for further development the radio blind landing system of the Army Air Corps, and made plans for installing equipment along a transcontinental air route for commercial service tests. More than 150 successful landings were made by pilots in a tri-motored transport plane, with the cockpits hooded so that the occupants could see nothing outside the machine as it cruised to within gliding distance of an airport and then actually glided safely down a radio beam to a designated spot on the field.

An important factor in the Air Corps blind landing system was the radio compass in general use for cross-country air navigation. The radio compass operated in conjunction with any broadcasting station within its frequency and power range, and permitted a pilot to fly toward the transmitter from any direction. The ground apparatus included two landing transmitters, each a low-power broadcasting station equipped with a gas-driven generator for power supply and a collapsible mast antenna. This outfit was compactly mounted in a small truck. Each truck was equipped with a small secondary transmitter operating in conjunction with a second instrument located near the radio compass indicator on the instrument panel in the plane. This secondary transmitter caused a light to flash in the plane as the airplane passed over the ground station, or airport.

In operation the two trucks were stationed on an imaginary line crossing the landing field in the direction along which the plane should land. One truck would be about two miles from the airport, the other about 1,500 feet from the edge of the landing space. The pilot flying in blind, solely by instrument, tuned to the frequency of the inner station, the one nearest the airport, when he was 30 or 40 miles away. This led him directly overhead. He knew it by the flash of light on his instrument board. He then tuned to the frequency of the outer station and flew to a point over it. One or more trips between the two stations established his into-the-wind course, which he then clocked on the plane's directional gyro.

On the final approach he would come down to about 800 feet, as indicated by his sensitive altimeter. Then with his course set on the directional gyro he passed over the outer transmitter, throttled the engines down and held the plane in a power glide at an angle

FAST NAVY SCOUTS

Grumman two-place SF-1 scouting planes, Wright Cyclone-powered, flown by VS Squadron 3B from the carrier "Lexington."

which let him pass over the inner station at an altitude of about 150 feet. From this point he depended upon his directional gyro and flight instruments for the rest of the glide to the runway.

At the beginning of 1935, the Bureau of Air Commerce, under Eugene Vidal, Director of Air Commerce, with Assistant Director Rex Martin in charge of air navigation, had in operation 18,896 miles of lighted airways in the United States, with 3,496 additional miles under construction. The Air Navigation Division of the Bureau of Air Commerce reported 1,266 rotating and 189 flashing beacons in use on the lighted routes. Pilots in flight could receive weather reports from 71 radio communication stations, and 91 radio range beacons helped them in maintaining a true course. They were further aided by supplementary radio service provided by 23 low and medium range marker beacons and 61 regular marker beacons. For emergency landings on the Federal Airways between regular airports there were 248 lighted intermediate fields and seven unlighted fields on the daylight routes. In addition there were 580 marked auxiliary fields for emergency landings.

On January 1, 1935, 11,631 miles of teletypewriter circuits carried weather reports the length and breadth of the Federal Airways System, to be passed on to pilots. There were 206 teletypewriter stations at airports and other weather-reporting posts. In addition, the Weather Bureau was maintaining 335 airway stations equipped with radio communication facilities and local teletypewriter service, and 185 airway stations radio equipped but without teletypewriter service.

RECEIVING WEATHER REPORTS

A pilot picks up complete facts about conditions on his course. U. S. Weather Bureau and Bureau of Air Commerce stations teletype the data to the airports.

With the cost defrayed by PWA funds some 3,000 miles of new lighted airways were nearing completion at the end of 1934. The airways included the northern transcontinental route between Seattle, Wash., and Minneapolis-St. Paul, Minn.; Fargo, N. D., and Pembina, N. D.; New Orleans, La., and St. Louis, Mo.; Tulsa, Okla., and St. Louis, Mo.; Galveston, Tex., and Waco, Tex.; Nashville, Tenn., and Washington, D. C.

During experimental work in 1934 Bureau of Air Commerce radio engineers found a way of showing visually the signals of the radio range beacons on the instrument boards of aircraft. These signals were ordinarily received through headphones, but with a converter box and an instrument with two needles, one vertical and the other horizontal, across its face, the pilot could see them. When the plane was on its course the two needles crossed in the exact center of the instrument, but when it swerved off to one side, the horizontal needle would swing in that direction.

The problem of increasing the efficiency and reliability of radio range reception in mountainous country was exhaustively studied during the year. A peculiar phenomenon which has hindered good reception in mountains took the form of multiple or split courses, so that pilots often received additional "on course" signals when "off

BECKONING THROUGH THE NIGHT

The United Air Lines base at Cheyenne, Wyo., ready for the night planes.

course" signals should be heard. Although a positive cure for that phenomenon on the long range beacons had not been entirely worked out, the Bureau at the beginning of 1935 had adopted a new type of airway installation in which the difficulty was practically eliminated. By setting up completely equipped intermediate landing fields at 50-mile intervals, connected by beacon lights in a direct line, to replace the long range radio beacons, and using at each field small radio beacons of only 25 miles range, the trouble encountered with the beacons having longer ranges was reduced to an absolute minimum. Two-way radio stations were also installed at the intermediate landing fields. Using the miniature beacons at more frequent intervals, the Bureau of Air Commerce could lay out an airway around corners, if necessary, much more effectively than with the ones of long range. Thus, in mountainous country an airway might be routed through passes and valleys, whereas with the big radio beacon a course had to lie in a straight line, regardless of the terrain, for at least 100 miles. The new system was used on new airways started during the year, and, if proven definitely effective, it was to be made standard on all routes.

Engineers also found a way to transmit voice and the radio range beacon signals on the same frequency. By using the converter

THE WALL STREET SKYPORT

Turntable ramp, long dock and waiting room built by the City of New York with FERA funds permits air traffic into the heart of the financial district.

box employed to show the beacon signals on the instrument board, they devised a means whereby voice messages and the signals could be received by a pilot at the same time.

The development of a transmitter to send up a vertical beam over a radio range beacon station and turn on a red light in an airplane cockpit, thus showing the pilot that he is in the cone of silence over the station, was another achievement of the year. The cone of silence, a dead space over the antenna towers of a radio range beacon, was an important landmark to a pilot flying blind, for when he hit this area he knew that he was over the station. The development promised to become standard at all range beacons.

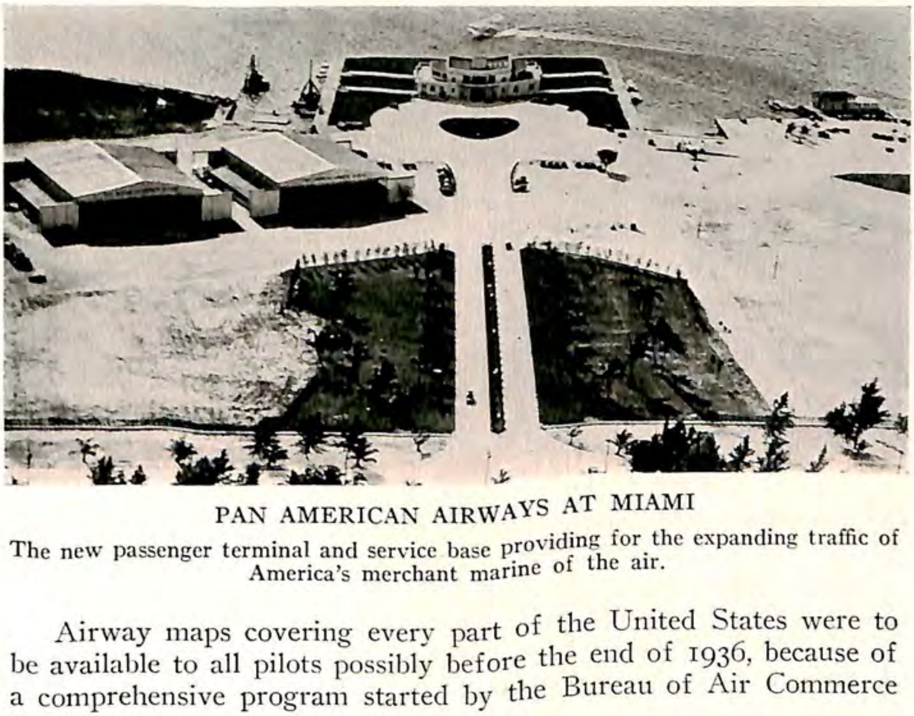
The Bureau of Air Commerce owned its teletypewriter machines but leased the land wires annually. To reduce this annual expense, the Bureau began experiments with radio as a substitute. Two radio-operated teletypewriter circuits were set up between Washington and Baltimore under a special committee to study the problem.

ARRIVALS FROM SALT LAKE CITY

A General Air Lines Cyclone-powered Douglas transport lands on schedule at Burbank, its Los Angeles terminal.

Other studies as to the possibility of transmitting typed or handwritten messages by radio were under way at the beginning of 1935. One, the facsimile method of transmitting messages, was based on the scanning beam principle. The message to be sent was typed or written on a strip of paper tape. The tape with the message was led into the transmitting set where the scanning beam passed rapidly over the letters and caused radio impulses to be broadcast. At the receiving end the impulses were translated into extremely narrow black lines which made up the separate letters of the words. The scanning beam passed over each letter numerous times; thus, the character appearing on the tape in the receiving machine was made up of a similar number of tiny black lines.

To show pilots a landing field not having lights, or one operating its lights only at specific times and not having an attendant present to turn on the lights for unexpected arrivals, the Bureau of Air Commerce installed amber colored course lights on airway beacons at or near such fields. The amber lenses were used in a beacon's course lights, which were fixed projectors pointing out the direction of the airway and flashing a code signal telling the pilot the number of the beacon.



PAN AMERICAN AIRWAYS AT MIAMI

The new passenger terminal and service base providing for the expanding traffic of America's merchant marine of the air.

Airway maps covering every part of the United States were to be available to all pilots possibly before the end of 1936, because of a comprehensive program started by the Bureau of Air Commerce late in 1934.

The Bureau already had 28 sectional airway maps, each covering an area about 325 miles from east to west and 150 miles from north to south. There also were 22 Bureau of Air Commerce strip maps showing airway routes not covered by sectional airway maps. The sectional airway mapping project, undertaken several years before, contemplated charting the entire United States with 87 maps. As sectional maps appeared, strip maps covering routes across the same areas were discontinued. These maps were compiled and printed by the Coast & Geodetic Survey.

An allotment of funds from the Public Works Administration enabled the Bureau to employ a large force of draftsmen and several additional pilots and observers for flight checking, so that the entire program of 87 maps might be completed within two years. The maps were drawn to a scale of 1 to 500,000, or about eight miles to the inch. They showed geographical features, political divisions and cities. The features significant to airmen such as airports, beacon lights, radio

NEW PITCAIRN WINGLESS AUTOGIRO

James G. Ray landing the direct control autogiro on Pier 9, East River, New York City.

stations, and magnetic variations were printed in red that they might show clearly.

Another mapping project started during the year was the millionth-scale series. These maps were to be on sheets approximately the same size as those of the regular sectional airway maps, about 20 by 40 inches, but because the scale was smaller, each map showed about six times as much area. The millionth-scale maps were intended for high speed long distance flying. For example, the pilot starting on a coast-to-coast flight would use these maps. Instead of carrying a dozen sectional airway maps, he would require only half as many millionth-scale maps.

The Bureau of Air Commerce listed a total of 2,297 airports and landing fields in the United States and Alaska on January 1, 1935. Nearly all were open to the public. They included 702 municipal, 570 commercial, 259 intermediate, 580 auxiliary, 58 Army, 24 Navy and 104 miscellaneous. Of the total 664 were either fully or partially lighted for night flying.

During 1934 a joint program of the Bureau of Air Commerce and Civil Works Administration, primarily to provide work for the unemployed, resulted in more than 1,000 airport and landing field projects financed with public funds. Approximately 60 per cent of the projects were on new airports and fields, while the rest were improvements to existing airports. It was believed that the additional landing fields would develop many systems of State airways feeding into the main trunkline routes.

THE MIDNIGHT FLYER

One of the TWA fleet of Cyclone-powered Douglas transports about to leave Kansas City on a six-hour run to New York. Sixty per cent of air transport flying in the United States is at night.

Closely allied with airport improvements was the roof marking program of the Bureau of Air Commerce and the Civil Works Administration. Thousands of persons were employed to paint in huge letters on the roofs of outstanding buildings the names of towns, that pilots flying off the airways might be able to determine their location simply by glancing down at any community over which they were passing at the moment.

The problem of making airports self-supporting and in the case of private ventures, return dividends to stockholders, was uppermost in the minds of most operators at the end of the year. Testimony before the Federal Aviation Commission showed that the airports of the United States had not been able to make money on aviation activities alone. The great areas of land required for level, open spaces devoted solely to landing and taking off planes invariably left an airport operation with a deficit. But the answer to such complaints might have been that the actual land required for State highways, city parks and streets, public playgrounds and other projects occupying much space are not noted for their revenues, but are looked upon as desirable for the public convenience and necessity.

On the other hand those airports offering the public something besides a place to go and see planes come in invariably had demonstrated their popularity, and in cases where the airport had buildings, approaches and concessions, with entertainment appealing to the public, encouraging prospects for future profits developed during the year.

Shushan Airport, offering both land and water facilities at New Orleans, La., was opened in February, 1934, and attracted nationwide attention because of the beauty of its buildings, its complete equipment and the facilities for public entertainment. Four paved runways each more than a half mile long on 300 acres of artificial land from the bottom of Lake Pontchartrain, a modern administration building, two large hangars, a seaplane ramp, lighting, drainage, and radio and fire-fighting equipment combined to make Shushan Airport one of the finest terminals in the United States, and one that should serve as a model for other communities. Another development equally as meritorious was the municipal airport at Birmingham, Ala., one of the show places of the city. It became a social and recreational center during 1934, and the management adopted a policy of making all fees, storage and service charges as low as possible, on the principle that constant use of the airport is of more value to any municipality than its revenues.

More than 300,000 visitors in 1934 admired the Allegheny County Municipal Airport at Pittsburgh, Pa. Runways were lengthened and plans projected for a wide increase in activities during 1935. Improvements contemplated filling a ravine on the northern boundary a mile long and 600 feet wide, construction of a large reservoir with automatic pumping equipment for fire protection, new hangars, a central steam heating plant, new roads and landscaping.

Lack of adequate terminal facilities in Philadelphia materially assisted the Central Airport, across the Delaware River at Camden, N. J., to develop amazing popularity aside from regular air transport traffic in 1934. Central Airport had a swimming pool, a first-class grocery and produce market, a beer garden styled after the famous establishments of the Old World and a number of smaller concessions.

Hadley Airport at New Brunswick, N. J., reported a 40 per cent increase in business during the last four months of 1934 as compared to the same period in 1933. Located only 10 minutes from the heart of the city, the Sacramento, Calif., municipal airport reported growth of business and more daily visitors at the end of the year.

Tacoma Field, the Pierce County municipal airport at Tacoma, Wash., also reported better business developed by improved financial conditions and greater activity on the part of private airplane owners using the field as a base. It was improved with lengthened runways and a new floodlighting system. Boeing Field, at Seattle, Wash.; Floyd Bennett Field in New York City; the Fort Wayne, Ind., municipal airport; Hartford, Conn., municipal airport; the Indianapolis, Ind., airport; Roosevelt Field at Mineola, Long Island, N. Y.; the Union Air Terminal at Burbank, Calif., with 41,680 landings in 1934, and the Grand Central Air Terminal at Glendale, Calif., were among the progressive municipal and commercial fields improved during the year, with noticeable increase in popularity.

BELLANCA AIRCRUISER SEAPLANE

Wall Street commuters used this Cyclone-powered transport with Edo floats between their Long Island homes and New York's financial district.

The problem of landing passengers from large seaplanes, which long retarded the growth of marine air traffic in and about large cities, was solved in 1934 with the development by the Edo Aircraft Corporation of College Point, N. Y., of an ingenious seaplane ramp operating on a turntable so that the largest craft might be docked out of water in less than half a minute.

A large float was connected to the bulkhead or pier line by hinged gangways with suitable cross bracing so that the tide element was eliminated. The outer end of the float was built in the form of a wooden ramp with an incline of approximately one to nine. This sloping portion, however, was in reality a turntable built in flush with the surface of the ramp and so located that the waterline passed through its center with the lower portion under water and the upper part dry.

In 1934 the City of New York built two Edo-type turntable terminals 85 feet long and of much more elaborate design. The diameter of the turntable, of steel construction with wooden planking on the deck, was 45 feet. It was operated by an electric motor. When a seaplane came up and its keel was firmly aground on the turntable an attendant pulled a switch. In 30 seconds the lower part, under water, became the upper part out of water. The same operation raised this upper part several feet so that the plane might discharge its load dry.

One of the New York terminals at the foot of Wall Street on the East River was appropriately named Wall Street Skyport. The other turntable ramp was installed in the East River at Thirty-first Street. Another was to be built at Floyd Bennett Field in 1935, to serve as a terminal for a shuttle service.

Seaplane bases of that type appealed to waterfront municipalities because their cost was insignificant as compared to the cost of an airport development and because they served such a convenient and useful purpose in bringing passengers directly to their business and residential sections. A number of cities indicated a desire to follow New York in the development of similar equipment during 1935.

OVERHAUL AND REPAIR

A corner of the main service base of United Air Lines at Cheyenne, Wyo., with Wasp-powered Boeing transports being overhauled.

CHAPTER XIII

AIRSHIPS AND BALLOONS

Stratosphere Adventures—Gordon Bennett Races—Operations of the "Macon" — Ocean Airship Lines Projected — Goodyear-Zeppelin's Blimps.

SHORTLY after noon on July 28, 1934, Major William E. Kepner and Captains Albert W. Stevens and Orvil A. Anderson, of the Army Air Corps, were working hard at one thing or another in the sealed gondola beneath the great hulk of their balloon, two and a third acres of rubberized cloth fashioned into a bag which now hung 60,613 feet above sea level—more than 11 miles over the sun-baked plains of Nebraska. Straight above them the sky was inky black, simply because in that rare atmosphere with no dust or moisture the sun had nothing to shine against.

The gondola was comfortably warm, 10 degrees above freezing. The thermometers outside registered 80 degrees below zero. This stratosphere flight of the Army Air Corps and the National Geographic Society had started from the vicinity of Rapid City, S. D. The three officers had come within 624 feet of the world record made by Comdr. T. G. W. Settle and Major Chester Fordney in 1933. They were confidently awaiting the moment when they would surpass the 1933 record. Then their balloon commenced ripping apart.

From then on the adventurers worked harder than ever. In 45 minutes they had dropped down to 40,000 feet. In 30 minutes more they were down to 20,000 feet. Here was the moment for quick action. They climbed out on top of the gondola and looked at their torn balloon. Great rents were beginning to appear in the lower part. Suddenly the entire bottom of the bag dropped out.

They had cast off much of their great load of ballast and scientific instruments, some of which were floating earthward on parachutes. Back in the gondola again they cut loose more apparatus. At 10,000 feet, less than two miles above the surface, they were still laboring inside the gondola. At a little more than half a mile from the earth they made ready to leave. Capt. Anderson got out on top of the gondola, to find that his parachute pack had caught in something and was open. There was only one thing for him to do, gather the folds of his parachute under his arm and jump. As he jumped the balloon exploded.

The gondola fell like a stone. Capt. Stevens twice tried to climb out a port hole. The air blast forced him back. On the third attempt he lunged at the opening, went through it and out, pulling his rip-cord as he turned right side up. As his chute opened part of the balloon fabric fell on it; he side-slipped and managed to work the wreckage off. Major Kepner, as commander, had been the last to leave. His chute opened and he was floating safely just a few seconds before the gondola hit the ground with a terrific thud, to flatten out like an eggshell. A large share of the scientific instruments and data remained intact; and in that respect the flight was

THE ARMY'S NON-RIGID AIRSHIP
The TC-13 built for the Army by Goodyear-Zeppelin.

very much of a success. It also provided the year's greatest thrill in lighter-than-air.

Using the Settle-Fordney record flight balloon of 1933 Dr. and Mrs. Jean Piccard went up for stratosphere adventures from the Ford Airport at Dearborn, Mich., on the morning of October 23, 1934. They drifted south and soon lost sight of the earth because of a layer of fog surmounted by dense clouds. They landed safely in the trees near Cadiz, O. Their official altitude was 57,979 feet.

The Russian stratosphere balloon which went up from Mazilovo, near Moscow, on January 30, 1934, crashed and killed all occupants after seven and a half hours in the air. Andrey B. Vasenko, Paul F.

Fedoseyenko and Ilya Usyskin made up the crew. They carried much scientific apparatus; and from time to time had reported by radio uncalibrated instrument recordings of their altitude, at the last about 70,000 feet, unofficial. The speed of their descent from great heights, with progressively accelerated velocity, caused the gondola to break away from the balloon. The air-minded Soviet Government gave the victims a hero's funeral and placed their ashes in the Kremlin.

On August 18, 1934, Max Cosyns and Nérée van der Elst went

THE "MACON" VISITS NEW YORK
The Navy's latest American-built Zeppelin a half mile above the metropolis.

up for a stratosphere balloon flight from Hour-Havenne, Belgium, made an official altitude of 52,952 feet, and drifted over Germany and Austria. Shortly before dark they landed safely near the village of Senaulje in Yugoslavia.

Sixteen entrants, three each from Germany and Poland, two each from Belgium, Switzerland, France and the United States, and one each from Czechoslovakia and Italy, participated in the annual Gordon Bennett balloon races starting from Warsaw, Poland, September 23, 1934. The United States Navy balloon piloted by Lieuts.

Charles H. Kendall and Howard T. Orville, and the Buffalo Courier-Express balloon piloted by George R. Hineman and Milford K. Vanik, represented the United States. Poland won the first two places in the race, the winner traveling 826 miles before landing in Russia. Belgium won third place.

The Navy's rigid airship "Macon", stationed at Sunnyvale, Calif., made a noteworthy cross country journey to the mooring mast at Miami early in 1934, operating from there in Fleet exercises off Panama and the Caribbean area, returning later to California.

Lieut. Comdr. H. V. Wiley took over command of the "Macon" in July and resumed Fleet exercises when the battle fleet returned to the Pacific in the fall. Earlier in the year the "Macon" left Sunnyvale with the San Francisco morning papers, cruising unannounced toward Hawaii. It picked up President Roosevelt's ship, the "Houston", 1,500 miles at sea. The "Macon's" planes, which had been used for scouting ahead of the "Macon", returned, hooked on, got their papers and made delivery on the "Houston" deck.

The "sub cloud car", suspended by a cable below the airship so that the latter can hide in the clouds while the observer in the tiny gondola beneath directs operations through the telephone line in the cable, was used extensively in 1934.

The General Board of the Navy recommended further ship operations with the Fleet to test the usefulness of airships, also construction of a new training ship approximately the size of the "Los Angeles."

In 1934 the U. S. Department of Commerce became interested in ocean airship lines as proposed by the Goodyear-Zeppelin Corporation and two corporations formed to operate such services, the International Zeppelin Transport Corporation and the Pacific Zeppelin Corporation. Assistant Secretary Ewing Mitchell presented to the Federal Aviation Commission a recommendation phrased in cooperation with the National Advisory Committee for Aeronautics, and designed to get a commercial airship line under way. Mr. Mitchell recommended an appropriation of $17,000,000 to provide two Zeppelin type airships, one smaller metal-clad airship, an Atlantic coast terminal, and $500,000 for airship research. The plan called for leasing the ships, when completed, to private operators.

The German "Graf Zeppelin" in 1934 completed its sixth year of passenger flying on the South American schedule. The total ocean crossings had reached 75. A new airship dock was being built by the Brazilian Government at Rio de Janeiro to perpetuate the service. The LZ-129, newest Zeppelin being completed at Friedrichshafen, was to have a gas capacity of 7,070,000 cubic feet, being about 500,000 cubic feet larger than the "Macon". It was to be equipped with Diesel engines and have cabin space for 50 persons. The German Zeppelin company planned to start a service between the United States and Europe in 1935.

On the night of February 12, 1935, the "Macon" crashed in the sea near Sunnyvale, Calif., and sank with two of her crew. The others left the airship safely.

Navy flight training at Lakehurst, N. J., was given aboard the large non-rigid K-1 and the veteran metal-clad MC-2. Army officers were interested in the coast patrol operations of the TC-13, the world's largest non-rigid ship, based at Langley Field, Va. The TC-13, like the "Macon", boasted a sub car permitting the airship to throttle down its motors and hide in the clouds while an observer was lowered in the little car to within sight of an objective.

THE "MACON" LEAVES HOME

The Navy's airship off on a flight from its hangar at Sunnyvale, Calif.

The Goodyear-Zeppelin fleet of blimps, the only privately owned airship fleet in the world, continued to roll up impressive mileage and passenger totals during the year. The "Puritan" and "Reliance" operated throughout the summer at the Century of Progress exposition and the "Resolute" at New York. The ships moved to Florida for the winter, basing at Miami and St. Petersburg. The "Volunteer" remained at Los Angeles, making occasional trips to San Francisco and the Sacramento Valley. The "Defender" was based at Akron. A new ship, the "Enterprise", of 123,000 cubic feet capacity and powered by two Warner Super Scarab engines, was built during the year to replace the "Pilgrim", which after eight years service had been set up in the Smithsonian Institution. The "Enterprise" was an eight-passenger ship with a ceiling of 9,000 feet and a speed of 68 miles an hour.

A new airship dock was constructed at Washington, D. C. in 1934. The "Enterprise" was assigned to that city as a base of commercial operations. The Goodyear fleet had covered 1,795,758 miles and carried 168,500 passengers up to December 1, 1934, without any passengers being hurt. Seven Goodyear pilots had taken rigid airship training at Lakehurst and 15 were commissioned in the Naval Reserve. Two Goodyear pilots served during the summer as officers on the "Graf Zeppelin". The extensive training program was pursued by the company to secure officer and crew personnel for the projected American transoceanic passenger Zeppelins.

A COLLEGE OF THE AIR

The Boeing School of Aeronautics at Oakland Airport, maintained in cooperation with United Air Lines.

CHAPTER XIV

EDUCATION AND TRAINING

Student Pilots—Schools for Pilots and Mechanics—Degrees in Aeronautical Engineering—Other Courses—Minnesota Wins Loening Trophy.

THOUSANDS of young men and women in the United States were studying aviation at the beginning of 1935. They were learning to be executives or pilots, aeronautical engineers and designers of aircraft and parts, or specialists in the countless different trades employed in the various branches of the industry and other agencies concerned with flying.

The Bureau of Air Commerce, with J. Carroll Cone as Assistant Director in charge of regulations, reported 10,570 persons to whom it had issued student pilot permits during 1934. That number, only slightly below the total for 1933, indicated that hard times had not discouraged the youth of the nation from wanting to pilot aircraft. The student whose instructors permitted him to solo a plane had to put in 25 hours of piloting before receiving his amateur pilot license. He could obtain a private pilot license after 50 hours, and by passing more rigid tests after 50 hours he might obtain a limited commercial license permitting him to carry passengers for hire. The transport pilot license could not be secured without 200 hours experience and a more thorough training. The non-commercial pilots, amateur and private, were required to take physical examinations every two years. They might renew their licenses by mail.

Replies to questionnaires sent to educational institutions, flying schools, and mechanics trade schools described excellent facilities for training pilots and mechanics in all sections of the United States. Nowhere was there a community so far from a training center but that one might take courses and still be within reasonable distance of his home.

Many of the leading flying schools had reduced tuition to a minimum. The rates were determined by the courses. Among the schools in the United States teaching either flying or aircraft trades, or both, were the Boeing School at Oakland, Calif., the Grand Central Flying School at Glendale, (Los Angeles) Calif., Parks Air College at East St. Louis, Ill., Casey Jones School of Aeronautics at Newark, N. J., and New York City, The Aeronautical University at Chicago, Ill., Penn School of Aviation at Pittsburgh, Pa., Safair flying school and the Roosevelt Aviation School, both at Roosevelt Field, Mineola, Long Island, N. Y., D. W. Flying Service at Leroy, N. Y., Spartan School of Aeronautics at Tulsa, Okla., Lincoln Airplane & Flying School at Lincoln, Neb., Furniture Capital Air Service at Grand Rapids, Mich., Dallas Aviation School and Air College at Dallas, Tex., Los Angeles Aircraft, Ltd., at Inglewood, Calif., Ryan School of Aeronautics at San Diego, Calif., United Air Services at Floyd Bennett Field, New York City, Northland Aviation School at Minne-

THE WEST POINT OF THE AIR
Army Air Corps training center, Randolph Field, Texas.

apolis, Minn., Wisconsin School of Aviation at Milwaukee, Wis., New York University Ground School at New York City, Intercity Airlines School at Boston, Mass., Muncie Aviation School at Muncie, Ind., California Air Service School at Alhambra, Calif.

To the above list might be added, if space permitted, the hundreds of aerial service flying organizations at more than 1,000 airports in the United States. Most of them gave some kind of flying instruction, and they welcomed inquiries from prospective students.

No profession offers more possibilities for romantic achievement and fame than that of the aeronautical engineer. A relatively new science—Orville and Wilbur Wright gave it to the world when they invented the airplane only 32 years ago—aircraft designing is still in its infancy. New discoveries, hundreds of them, are being made every year. An average of three aircraft inventions are filed in the patent office at Washington every day.

Fourteen institutions reported for this book at the end of 1934 a total of 1,665 students taking courses leading to a degree in aeronautical engineering. Several special technical schools outside the universities and colleges were devoted solely to aviation, among them

THE ANNAPOLIS OF THE AIR

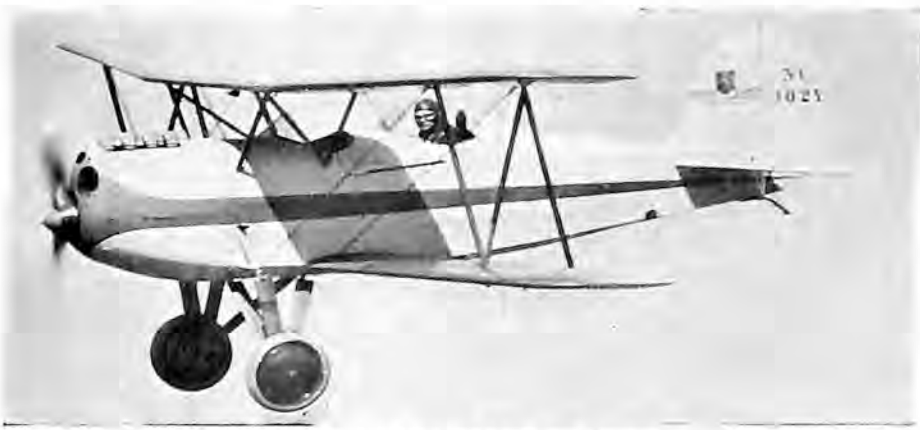
The Navy's new land flight training center, Corry Field, Pensacola, Fla.

The Aeronautical University at Chicago, Ill., the Curtiss-Wright Technical Institute of Aeronautics at Glendale, Calif., and Parks Air College at East St. Louis, Ill., giving degrees in aeronautical engineering.

Among the colleges and technical schools giving degrees in aeronautical engineering the following submitted reports and other statistical matter for this book: Alabama Polytechnic Institute at Auburn, Ala., University of Cincinnati at Cincinnati, O., Daniel Guggenheim School of Aeronautics at New York University, New York City, University of Detroit at Detroit, Mich., Georgia School of

Technology at Atlanta, Ga., Louisiana State University at Baton Rouge, La., Massachusetts Institute of Technology at Cambridge, Mass., University of Michigan at Ann Arbor, Mich., University of Minnesota at Minneapolis, Minn., Rensselaer Polytechnic Institute at Troy, N. Y., and Stanford University in California.

Among the colleges giving courses in aeronautics, many leading to degrees in mechanical engineering, were the United States Military Academy at West Point, N. Y., United States Naval Academy at Annapolis, Md., Albion College at Albion, Mich., Agricultural and Mechanical College of Texas, at College Station, Tex., Armour Institute of Technology at Chicago, Ill., Bradley Polytechnic Institute at Peoria, Ill., University of California at Los Angeles, Calif., Carnegie Institute of Technology at Pittsburgh, Pa., Central College at



GREAT LAKES SPORT-TRAINER

A two-place open biplane model, 2T-1A, with a cruising speed of 90 miles an hour.

Fayette, Mo., Clarkson College at Potsdam, N. Y., The State Agricultural College at Fort Collins, Colo., The Clemson Agricultural College in South Carolina, Kansas State College of Agriculture and Applied Science at Manhattan, Kans., Kenyon College at Gambier, O., Lehigh University at Bethlehem, Pa., Montana State College at Bozeman, Mont., University of Nevada at Reno, Nev., University of New Hampshire at Durham, N. H., New Mexico State College at State College, N. M., The University of North Carolina at Chapel Hill, N. C., North Dakota State School of Science at Wahpeton, N. D., The University of North Dakota at Grand Forks, N. D., Northwestern University at Evanston, Ill., Norwich University at Northfield, Vt., The University of Oklahoma at Norman, Okla.,

FAIRCHILD SPORT PLANE

Model 22, Warner-powered, produced by Kreider-Reisner.

Oklahoma Agricultural and Mechanical College at Stillwater, Okla., the Oregon State College at Corvallis, Ore., The Rhode Island State College at Kingston, R. I., Rose Polytechnic Institute at Terre Haute, Ind., South Dakota State College at Brookings, S. D., Syracuse University at Syracuse, N. Y., Valparaiso University at Valparaiso, Ind., Virginia Polytechnic Institute at Blacksburg, Va., University of Virginia at Charlottesville, Va., Wilberforce University at Wilberforce, O., Worcester Polytechnic Institute at Worcester, Mass.

The Grover Loening Intercollegiate Flying Club Trophy, awarded annually to the college flying club putting in the most hours in the air, went to the Midwest for the first time when it was presented to

AN AIRPLANE BUILT FOR TWO

The Kinner Sportster with a Kinner motor.

the University of Minnesota Flying Club for 1934. Second prize was awarded to William and Mary College.

Miss Jean Barnhill accepted the trophy on behalf of the Minnesota club, first woman to be thus honored. The presentation was made by Edward P. Warner, vice chairman of the Federal Aviation Commission. Grover Loening, the donor, said it was a pleasure to present a trophy to a girl who could fly as well as a man.

Harvard College, which had won the trophy for three of the five years it has been awarded, received honorable mention in 1934, as did Dartmouth. William and Mary recipients, who won the trophy in 1933, predicted that they would come back for the silver cup in 1935.

COMDR. FRANK HAWKS AND THE CONDOR

The famous speed pilot inspects a Curtiss electric controllable pitch propeller.

CHAPTER XV

LAWS AND REGULATIONS

National Association of State Aviation Officials—State Laws of 1934 — Federal Legislation of 1934 — Bureau of Air Commerce Regulations.

THERE was a minimum of Federal and State aviation in 1934; but all signs indicated that there would be an increase in the number of laws established during 1935. Possibly the most important development of the year was the position assumed by the National Association of State Aviation Officials. It promised to bring about uniformity in laws and regulations governing the operation of aircraft, both intrastate and interstate.

The National Association of State Aviation Officials held its annual meeting in Cheyenne, Wyo., September 27-29, 1934. Delegates from 31 States were present. A Uniform Regulatory Act for States was approved, and copies were sent to all Governors suggesting that all or part of the provisions be incorporated in new legislative programs. The Association reported that States with properly selected aviation directors or commissions were making the best use of Federal funds on aviation projects.

The Association drafted a comprehensive set of recommendations to the Federal Aviation Commission, and was represented at the public hearings by Fred Smith, Fred D. Fagg, jr.; Gill Robb Wilson, Fred Sheriff, George Logan and A. B. McMullen. In November, 1934, the Association with three other national organizations formed a Joint Aviation Coordinating Committee to harmonize, where possible, the opinion of aviation leaders on all matters concerning aeronautics, such as legislative problems and programs, regulations, airports and airways development, and specific questions concerning relations between the public and the industry. The other bodies forming the Joint Aviation Coordinating Committee were the Aeronautical Chamber of Commerce of America, the Independent Aviation Operators of the United States and the National Aeronautic Association.

State Laws Passed in 1934

In 1934 Iowa passed a law providing for a State commission. Mississippi adopted regulations governing transport of light wines and beer into the State. New York State amended the general municipal law prohibiting certain structures within an airport zone, giving municipalities the right by condemnation, purchase or otherwise, to remove any obstruction within 1,500 feet of a landing field. Illinois, Kentucky, Michigan, Minnesota, Mississippi, New York, Pennsylvania, South Carolina, Texas and Washington passed airport enabling acts. New York amended its insurance laws to include aircraft. Rhode Island also amended its insurance laws to include aircraft fire insurance. New Jersey adopted a new act for its State highway commission which includes airport development, and another act creating a State planning board to develop all kinds of transportation, including air.

STEPHEN J. PATTERSON'S WACO
At the Aviation Country Club, Hicksville, Long Island, N. Y.

That State also adopted a law designed to protect the interests of aircraft operators and workers having claims against the machine for repairs or supplies furnished. New York extended the life of its temporary aviation commission to permit it to complete its report on a development program, and adopted another law prohibiting the voluntary operation of aircraft on Lake Mahopac. Rhode Island made an appropriation providing for State aeronautical equipment.

Federal Laws Passed in 1934

The Air Mail Act of 1934 is quoted in full in the appendix, not for its permanent value but as an example of the kind of laws which retard the development of aviation. There were only two good features of that Act. It reduced the air mail postage rate to six cents an ounce or a fraction thereof. It provided for the Federal Aviation Commission and its report to Congress on what should be the national aviation policy, with recommendations for specific programs. The rest of the Act was more harmful to the progress of air transportation than any other legislation in the history of human flight. It should be added that few persons believed the law would live beyond the year provided for carrying out some of its essential terms.

The Public Airport Act of 1934 authorized the leasing of public lands for use as public aviation fields and permitted the Secretary of War to assume full control of such fields in an emergency.

CONSOLIDATED PT11-C TRAINER

A two-place open land or seaplane primary or advanced trainer.

The Independent Offices Appropriation Act of 1934 empowered the President to cancel any contract made by the Federal Government prior to June 16, 1934, on the grounds that it is not required in the public interest and that modification or cancellation will save the Government money. The President could determine the amount of compensation for cancellation of the contract cancelled, and if the contractors did not like it, they might later sue the Government for an additional amount, not exceeding the amount named in the contract. The Act also limited to $17,500 the annual salaries of officers of corporations holding contracts.

The 1934 Amendments to the Air Commerce Act of 1926 provided for investigation of aircraft accidents and publication of the results of such investigations, granted registration of aircraft owned by aliens but prohibited such machines from operating in interstate or foreign commerce, provided for minimum safety requirements for air lines, empowered the Secretary of Commerce to compel owners of anything over navigable waters to install at their own expense signal lights and other signals for the protection of air navigation, and defined more clearly the penalties for violating the immigration, public health and customs laws.

Bureau of Air Commerce Regulations

Regulations of the Bureau of Air Commerce, Department of Commerce, governing the operation of scheduled interstate air lines, were extensively revised to comply with the provisions of the Amendment to the Air Commerce Act adopted in 1934.

AERONCA C-3 FOR TWO

A side-by-side sport or utility plane, with a 36 h.p. Aeronca C-113B engine.

A fundamental requirement of the air line regulations is that each line shall hold a certificate of authority, granted after inspection by the Bureau reveals that equipment is adequate and airworthy, and that personnel are competent and experienced. Pilots are required to hold scheduled air transport ratings, calling for at least 1,200 hours of flying, including at least 500 hours of cross-country flying and 75 hours of night flying. The candidate has to demonstrate a high degree of proficiency in the use of radio and other aids to air navigation, and an understanding of weather analysis and forecasting. He is given a test in instrument and radio flying during which he puts an airplane through an extensive series of maneuvers while seated in a hooded cockpit.

For the more difficult tasks in scheduled air transportation the air line regulations now require the use of multi-engine aircraft, and it is further required that such an aircraft be capable of continuing flight and reaching the next established landing area if one of the engines fails in flight.

Operation with single-engine aircraft is authorized during daylight hours, over terrain where forced landings can be made safely in emergencies. In general, single-engine craft are not to be used for night flying, but an air line operator may obtain special permission for an operation in which the airplane leaves one terminal in daylight and arrives at another after dark, if circumstances are such that safety is not jeopardized. For other types of operation, over mountains,

CONSOLIDATED ARMY TRAINER

Consolidated Aircraft Corporation's model 21-C, with 300 horsepower Wasp Junior engine.

swamps, bodies of water, forests and at night, multi-engine aircraft are required.

Multi-engine craft are authorized to engage in extensive instrument and radio flying, provided they are properly equipped for such operation. They may be cleared for flights when it is known that the pilot will have to fly blind over a considerable portion of the route. Single-engine aircraft, faced with such weather contingencies, are to be held on the ground; they are not authorized to take off for intentional instrument flying, except when special approval is given for operations over the top of fog or clouds. However, single-engine aircraft are required to have radio and instruments, and are permitted to fly blind for short intervals when the occasion arises while they are in flight.

The new regulations require each operator to designate divisions of his air line, a division consisting of the round trip flown by one pilot. Specific instructions are to be drawn up for flying over this division, including such provisions as the minimum height of ceiling and minimum visibility, altitude to be flown and methods for taking off and landing through low fog. These and other definite instructions are given to the pilot for flying the particular division. They are to be written into an operations manual, and the section of the manual containing provisions of this character is to be approved by the Bureau of Air Commerce.

CURTISS-WRIGHT ADVANCED TRAINER
Developed for the Air Corps, and powered by a 250 h.p. Wright Whirlwind engine.

The pilot is to familiarize himself with these special requirements for the division (as well as general requirements that apply everywhere), to make five training flights over the route, land at all the airports and intermediate fields, and make use of radio and other aids to air navigation before he undertakes regular operation. If he is moved to another division, he must qualify similarly for operation there before he can have a regular assignment.

Another provision in the revised air regulations concerns dispatchers. Those employees, who study weather reports and decide whether aircraft are to be cleared or held on the ground, must be approved by the Bureau of Air Commerce. Their qualifications and duties are outlined by the regulations.

Regulations governing licenses for non-commercial airmen continued on the basis established in 1933. In that year the experience requirements for the various grades of pilot licenses were made: Amateur, 25 hours; private, 50 hours; limited commercial, 50 hours; and transport, 200 hours. Written examinations and flight tests are progressively more exacting as higher grades are attained. Although the experience requirement for private and limited commercial is the same, the tests for the limited commercial license are more difficult. Non-commercial pilots (amateur and private) have to report for physical examinations only once in two years instead of annually, as they did before the regulations were revised, and can renew their licenses by mail.

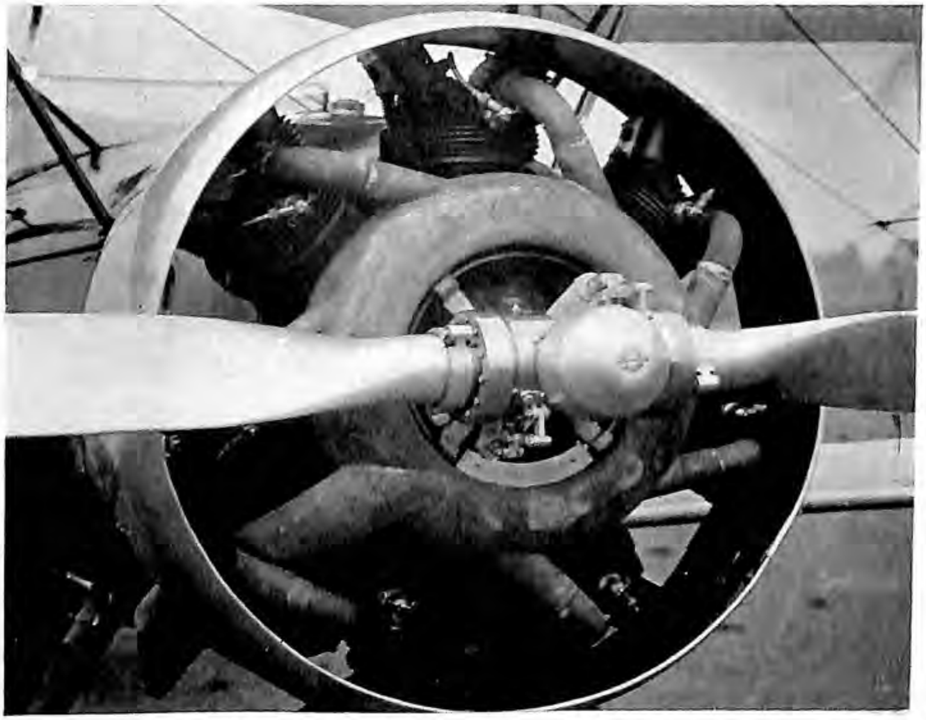
NEW SCOUT FOR THE NAVY

A Wright Cyclone-powered Grumman two-place scout XSF-1.

A revised form of Aeronautics Bulletin No. 7-A, Airworthiness Requirements for Aircraft, was issued in 1934.

Before approving an aircraft the Bureau of Air Commerce requires that it meet the standards set up by Bulletin No. 7-A with respect to strength and suitability of various parts and components, individually, and as assembled in the completed airplane. The design drawings and specifications are analyzed to make certain that the requirements are met on paper, the airplane is inspected in the factory to assure that it is built according to the plans, and the completed airplane is flight checked. The Bureau then issues an approved type certificate for the airplane (or approval without A.T.C. if only a limited number are to be produced). After this approval has been given, all airplanes built in accordance with the approved plans and specifications are eligible for Federal licenses. An airplane also can be licensed without prior type approval, but in that case it is subject to all the requirements and tests applying to the approved type certificate or approval without A.T.C.

The airworthiness requirements were revised in 1934 to bring them into line with practices in designing and manufacturing which have been made possible by recent research and experimentation. While this was being done, another new feature was introduced. The old Bulletin 7-A included considerable explanatory material, making suggestions to the designer which assisted him in planning his craft in such a way that it would meet the airworthiness requirements. In the revision, all this explanatory material was eliminated from the regulations themselves and printed along with much additional material of the same character in a supplementary bulletin entitled Aeronautics Bulletin No. 26, Design Information for Aircraft.



ECLIPSE VARIABLE PROPELLER HUB

The new automatic variable pitch propeller hub brought out by Eclipse Aviation Corporation in 1934.

CHAPTER XVI

ENGINEERING AND MANUFACTURING

Amazing Progress Made by Airplane Manufacturers of the United States—Notable Developments in Aircraft Engines, Propellers, Instruments, Radio, Fuels and Other Accessories.

AIRPLANES, aircraft engines, propellers and other accessories produced by scores of manufacturing companies in the United States had a world-wide reputation of being the best of their kind at the beginning of 1935. Practically every nation on earth was buying American aircraft products because American airplanes during the previous 12 months had demonstrated that they could fly faster and farther and carry their passengers in greater comfort than was thought possible only a few years ago. Proof of that international popularity lay in the fact that during 1934 the value of American aircraft, engines and other aeronautical products shipped abroad was more than $17,000,000, which was nearly twice the $9,000,000 of 1933 and more than the foreign sales of Great Britain, France and Italy combined. The graceful lines of the new planes built in 1934, whether for air line service, military operations or private flying, their streamlined bodies, retractable landing gear and tapered wings were matched in beauty only by the interiors of the commercial cabin craft which were comfortable to the point of luxury, noiseproofed, perfectly heated and thoroughly ventilated. Those obvious characteristics were accompanied by advanced engineering features which also became obvious after a flight, when one realized that he had flown for hundreds of miles at an average speed of from 2½ to 3 miles a minute, and that accomplished at great heights of from two to three miles above the earth, in comfort.

Among the organizations forming a common meeting ground for the various units of the industry and contributing in no small way to the evolution of the flying machine from an experiment to a practical vehicle of everyday life, essential in peace and in war, were the following: Aeronautical Chamber of Commerce of America, American Society of Mechanical Engineers, Institute of the Aeronautical Sciences, Manufacturers Aircraft Association, National Aeronautic Association and the Society of Automotive Engineers.

Aeronautical Chamber of Commerce

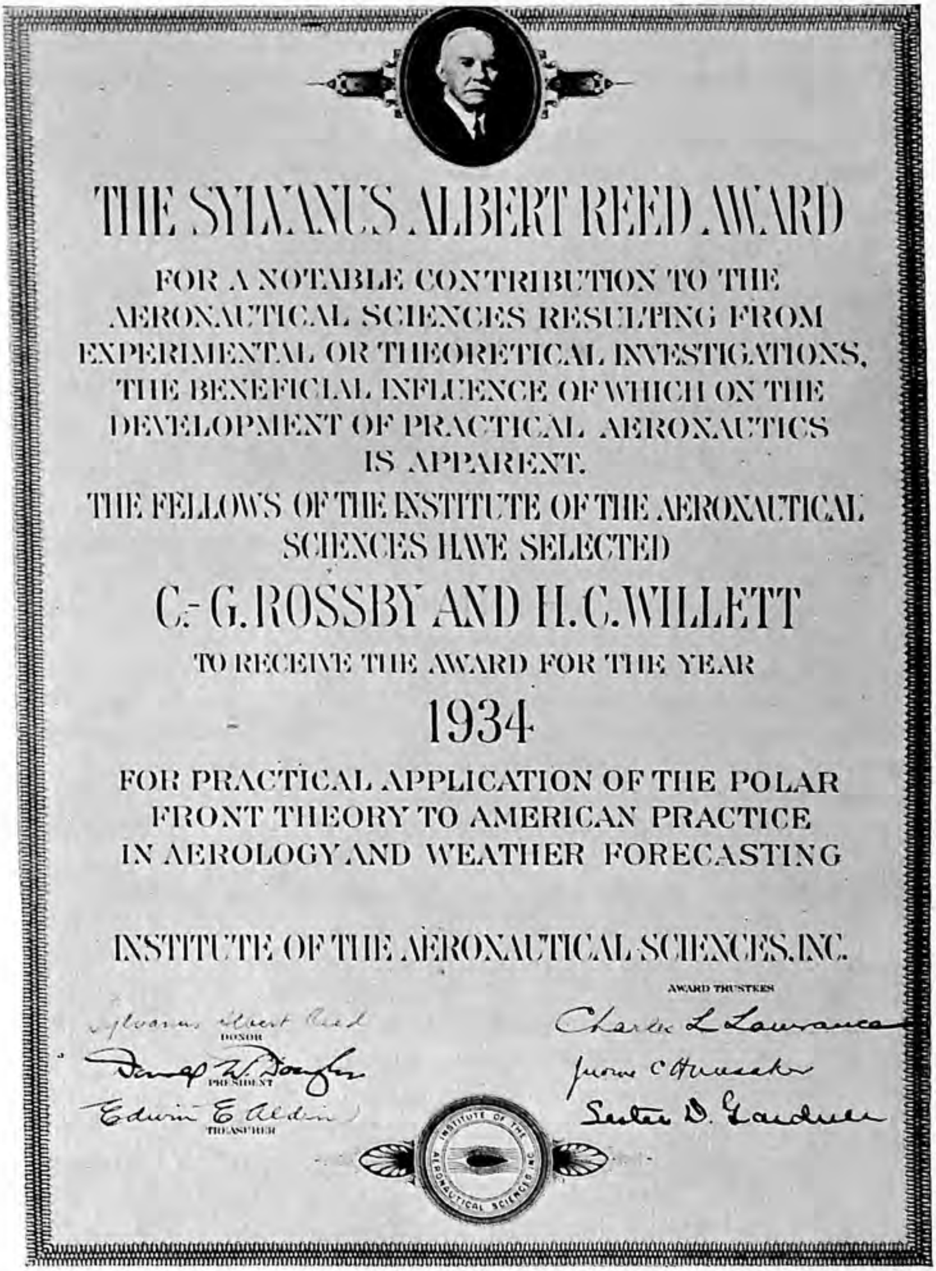
The Aeronautical Chamber of Commerce of America, as the trade association for the industry, included in its membership nearly all the manufacturing and air transport companies and a majority of the important accessories manufacturers, also leading airports, flying schools and aerial service operators. During the year the Chamber held 78 meetings of the various branches of the industry, cooperated with States and municipalities in developing facilities for private flying and represented the industry before the Federal departments, special commissions and investigating bodies concerned with aviation. At the beginning of 1935 the Chamber was negotiating a code for the aircraft manufacturing industry and, among many other activities, was cooperating with municipalities in the development of seaplane operating facilities in the business centers of waterfront communities.

American Society of Mechanical Engineers

The Aeronautic Division of the American Society of Mechanical Engineers held its 1934 meeting June 19-21 at Berkeley, Calif., under the auspices of the San Francisco section of the University of California. The Institute of the Aeronautical Sciences cooperated. The Aeronautic Division is actively assisting the main committee on aircraft safety and inspection and the aviation committee of the American Engineering Council. The Division planned to hold its 1935 technical meeting in St. Louis in September, and a technical session also at the semi-annual meeting of the Society in Cincinnati, O., June 19-21.

Institute of the Aeronautical Sciences

The Institute of the Aeronautical Sciences presented to the Federal Aviation Commission in 1934 a comprehensive set of recommendations for the continuation of research in aeronautical science and engineering. The Institute also in 1934 started work on a complete index of all published aeronautical pictures. The Institute's Journal of the Aeronautical Sciences was to be published as a bi-monthly in 1935. An endowment fund was started for the Institute, with an objective of $250,000. Charles L. Lawrance, the retiring president, at the dinner of the Institute during the third annual meeting at Columbia University January 29-30, 1935, presented the "Sylvanus Albert Reed Award" to Prof. C. G. Rossby and Dr. H. C. Willett of the Massachusetts Institute of Technology, for their work in introducing into the United States the Norwegian meteorological polar front theory and applying it to weather forecasting for air lines of the United



THE SYLVANUS ALBERT REED AWARD

FOR A NOTABLE CONTRIBUTION TO THE AERONAUTICAL SCIENCES RESULTING FROM EXPERIMENTAL OR THEORETICAL INVESTIGATIONS, THE BENEFICIAL INFLUENCE OF WHICH ON THE DEVELOPMENT OF PRACTICAL AERONAUTICS IS APPARENT.

THE FELLOWS OF THE INSTITUTE OF THE AERONAUTICAL SCIENCES HAVE SELECTED

C.-G. ROSSBY AND H. C. WILLETT

TO RECEIVE THE AWARD FOR THE YEAR

1934

FOR PRACTICAL APPLICATION OF THE POLAR FRONT THEORY TO AMERICAN PRACTICE IN AEROLOGY AND WEATHER FORECASTING

INSTITUTE OF THE AERONAUTICAL SCIENCES, INC.

Sylvanus Albert Reed
DONOR

Donald W. Douglas
PRESIDENT

Edwin E. Aldrin
TREASURER

AWARD TRUSTEES

Charles L. Lawrance

Jerome C. Hunsaker

Lester D. Gardner

INSTITUTE OF THE AERONAUTICAL SCIENCES INC.

CERTIFICATE OF REED AWARD

States. The award was established by Dr. S. A. Reed, who developed the duralumin metal propeller. It is to be awarded annually by the 52 Fellows and Honorary Fellows of the Institute for a notable contribution to the aeronautical sciences. Forty-six scientific papers were read at the annual meeting. Donald Douglas, who developed the famous transport bearing his name, was elected president of the Institute for 1935.

Manufacturers Aircraft Association

Operations under the cross-license agreement administered by the Manufacturers Aircraft Association in 1934 continued to show an increase in the number of patents acquired by members of that organization, a total of 108 patents having been reported during the year, 43 with claims for compensation and 65 without such claims. At the annual meeting on February 28, 1935, Frank H. Russell was re-elected president and S. S. Bradley general manager, a position which he has held since the date the Association was organized in 1917.

A total of 32,264 airplanes had been licensed under more than 700 patents owned or controlled by members of the Association up to January 1, 1935. As in previous years, the major object of the cross-licensing plan, namely, the prevention of wasteful patent litigation within the industry, was realized in full, no suits for infringement having been filed on any of these patents during the year.

The Association continued to maintain a Patent Research Division from which information concerning patent matters may be obtained. This Division keeps members informed of important patent developments in this and foreign countries, and publishes for distribution to members a Digest of all current United States and British airplane patents, including abstracts of the patent specifications and official drawings. The Patent and Research Library of the Association now includes copies of United States and foreign airplane patents, books and other publications and documents, which are used extensively in connection with validity and infringement investigations. Facilities are also provided whereby the Association may negotiate licenses for the benefit of members under patents owned or controlled by parties who are not subscribers to the cross-license agreement.

The contract relationship between the Association and the Government, which enables the War and Navy Departments to obtain licenses under all the patents coming within the scope of the cross-license agreement on the same terms as members of the Association, was continued for another year.

The National Aeronautic Association

The National Aeronautic Association in October 1934 was host to the Fédération Aéronautique Internationale, the aeronautical sport governing body of the world, and composed of the national aero clubs of 34 countries.

During the year the Contest Committee issued sanctions for 16 events. Licenses were issued to 795 pilots and 28 world records were established for the United States. The major air meets included the Miami Air Races in January, the Pan American Races at New Orleans in February and the National Air Races at Cleveland in September.

During the spring and early summer an extensive campaign was waged by the Civil Aeronautics Committee in an effort to bring about a reduction in air mail postage. The goal sought was a letter rate of five cents an ounce, an aerogram at three cents and a postal card at two cents. A reduction to six cents an ounce for air mail letters was obtained from Congress. Senator William Gibbs McAdoo of California was elected president of the Association for 1935.

Society of Automotive Engineers

The Society of Automotive Engineers held seven aviation sessions during the annual meeting in Detroit in January and the semi-annual meeting at Saranac Inn, N. Y., in June, 1934. Fifteen technical aeronautic papers were presented on as many phases of the art. In addition, 15 aeronautic meetings were held by the Sections of the Society during the year, when papers on varied aeronautic topics were presented.

The Manly Memorial and Wright Brothers medals, annual awards of the Society, were presented to Rex B. Beisel, Chance Vought Corporation, A. Lewis MacClain, Pratt & Whitney Aircraft Company, and F. M. Thomas, De Havilland Aircraft Company of England, collaborators in the paper "The Cowling and Cooling of Radial Air-cooled Aircraft Engines."

Activities of the principal manufacturers are summarized here to show how they contributed to the extraordinary development of American aircraft during 1934.

Airplane Manufacturers

Aeronautical Corporation of America, Cincinnati, O., sold about 40 per cent more Aeronca planes in 1934 than during the previous year. The Aeronca C-3 was better streamlined, and improvements were made in the landing gear. It was a two-place high wing monoplane powered with the Aeronca E-113B engine, with a fuel consumption of three gallons an hour, a high speed of 93 m.p.h., cruising at 80 and landing at 35 m.p.h. Its weight empty was 503 pounds, useful load 425 pounds, including two persons. Aeronca planes were in service in Canada, England, Alaska, Mexico, Cuba, Philippine Islands and Brazil. The plane could be equipped as a seaplane, and with Edo floats was becoming increasingly popular along the Atlantic Coast.

Air Transport Manufacturing Company, Ltd., Glendale, Calif., produced a high-wing six-place cabin plane powered with three Kinner K-5 engines. It had a stated high speed of 140 m.p.h.

Aircraft Mechanics, Inc., Colorado Springs, Colo., had several models, the Bullet C-7, four-place cabin low-wing, with 175 h.p. Wright Whirlwind; Flyabout D-1, a two-place Continental-powered monoplane; the D-2, powered with a Szekely SR3-0 45 h.p. engine; Eaglerock A-14, a three-place open biplane with 175 h.p. Whirlwind; the A-13, with Curtiss Challenger, and the A-15 with Kinner K-5 100 h.p. motor.

Airplane Development Corporation, Glendale, Calif., a division of the Cord Corporation, was making deliveries on the Vultee V-1A single-engine transport plane stated to have a guaranteed cruising speed of 205 m.p.h., carrying eight passengers and two pilots. The production program contemplated 50 planes of that model a year. American Airlines had 10 in service, while others had been delivered to Canadian Colonial Airways and various public utility and mining companies. The Vultee V-1A was an all metal single-engine low-wing cantilever monoplane with split trailing edge type wing flaps, and was designed as a high speed transport for regular service or as an executive's plane. It was equipped with the Wright Cyclone model F 735 h.p. motor, and had fuel capacity for 1,000 miles of cruising. It was flown at a high speed of 225 m.p.h., landing at 63 m.p.h. On January 15, 1935, Major James H. Doolittle flew a Vultee transport from Burbank, Calif., to Floyd Bennett Field, New York City, in 11 hours 59 minutes, breaking all records for passenger transport planes and coming within 117 minutes of breaking the record for all planes made in 1934 when Col. Roscoe Turner dashed across the continent in 10 hours two minutes. Major Doolittle was accompanied by Mrs. Doolittle and Robert Adamson of the Shell Oil Company. On this flight he encountered ice and bad weather, which forced him to fly at 16,000 feet. He flew blind by instruments alone between Colorado and Richmond, Va. Noiseproofing by Western Electric engineers was a feature of the cabin, which was 68 inches high. As an air liner the Vultee seated eight passengers two abreast, with a wide aisle between, each chair with individual ventilators, heaters, reading lights, ash trays and foot rests. The cabin contained running ice water. A rear compartment held a fully equipped lavatory. The baggage room and radio installation were in the rear. The cantilever wing was faired into the fuselage. The wheels retracted flush with the bottom surface of the wing. The fuselage was of monocoque type, without longitudinals. The tail surfaces and wing were of shell construction, with fin and stabilizer built solidly into the fuselage. The plane had a length of 37 feet, wing span of 50 feet and height of 10 feet two inches. Its weight empty was 1,236 pounds, its full fuel load 5,457 pounds, pay load 1,810 pounds and gross weight 8,500 pounds, with an absolute ceiling of 20,000 feet.

Autogiro Company of America, Willow Grove, Pa., continued its development of rotor-type flying machines. Models PA-18 and PA-19 were continued on the company's design list. Late in 1934, Model PA-22, a direct control, wingless autogiro, was demonstrated. It was a two-place side-by-side cabin machine with a Pobjoy-R 75 h.p. engine. The diameter of the rotors was 32 feet. Its weight empty was 600 pounds, gross weight 1,140 pounds, top speed 105 m.p.h., cruising speed 90 m.p.h., range 350 miles with 17 gallons of gasoline. The take-off speed was 25 m.p.h. in a level run of 60 feet.

The Beech Aircraft Company, Witchita, Kan., designed and marketed new Beechcraft models of its high speed four-place cabin planes for the commercial trade. Model B17L was built around the Jacobs L-4 225 h.p. engine, had a gross weight of 3,150 pounds, a stated cruising speed of 152 and high speed of 175 m.p.h., with a cruising radius of 750 miles. Retractable landing gear and wing flaps were standard equipment. Model A17F was a four-place cabin biplane built around the Wright Cyclone engine, with speed above 200 m.p.h., and with controllable pitch propeller, radio, wing flaps and de luxe furnishings as standard equipment. Models 17R and B17E of similar design were powered with Wright 420 and 285 h.p. engines respectively. The company planned to continue improvements to increase speed and performance of the established Beechcraft design. The Jacobs-powered Beechcraft was sold for export to England, Mexico and South Africa during 1934, and at the beginning of 1935 the company was negotiating for sales in Holland, Belgium, Spain, Brazil, Panama and China.

Bellanca Aircraft Corporation, New Castle, Del., produced both commercial and military planes having increased performance and possessing many other improvements over previous models. Bellanca models were popular in a number of foreign countries as well as in the private, aerial service and general utility markets in the United States. The 1935 model Senior Skyrocket de luxe six-place cabin, externally braced high-wing monoplane, Wasp-powered, and convertible into a seaplane with twin Edo floats, was fully equipped for night flying, and was purchased by several veteran users of private flying craft, among them Frank W. Fuller, jr., and Wallace Beery. That model was equipped with trailing edge flaps, Eclipse direct-drive electric starter, shatter-proof glass windows, upholstered arm chairs for five passengers, Sperry horizon and directional gyro. It carried a useful load of 2,300 pounds, had a service ceiling of 25,000 feet, high speed of 190 m.p.h. at 7,000 feet, and cruised at 175 m.p.h. on 75 per cent power at 12,000 feet. The Senior Pacemaker in design and dimensions was similar to the Skyrocket, and was powered with either Whirlwind or Wasp Junior engines. It carried six persons, had a high speed of 165 m.p.h., cruising at 155 m.p.h. at 12,000 feet, with a service ceiling of 18,000 feet and a range of more than 1,200 miles. The Aircruiser was a 12- to 15-place or cargo transport sesquiplane powered with Cyclone or Hornet engines. As a passenger plane it had a gross weight of 10,853 pounds of which 4,870 pounds were useful load, a cruising speed of 155 m.p.h., ceiling 20,000 feet and range 710 miles. As a cargo plane, such as the Aircruiser purchased by the El Dorado Mining Company of Canada for transporting ore over a 1,200-mile route, it carried a payload of more than a ton and a half, cruising at 155 m.p.h. The Bellanca twin Cyclone-powered bomber, landplane or seaplane, was a sesquiplane useful as a troop transport, ambulance or cargo-carrier. As a landplane it had a stated high speed of 190 m.p.h. at 7,000 feet, cruising 172 m.p.h. at 12,000 feet, service ceiling 23,500 feet, normal range with 300 gallons of gasoline, 710 miles; weight empty 8,216 pounds, normal useful load 5,920 pounds including 2,825 pounds of bombs and ammunition and 425 pounds of armament, including three machine guns. It carried a crew of four. At the end of 1934 the Bellanca factory had received back for checking and complete overhaul the famous Bellanca Flash which Col. James Fitzmaurice had entered in the London-Melbourne race as "Irish Swoop" and which failed to start in the race because of the race committee's ruling that it could not start until it had passed its landing test required for the load which Col. Fitzmaurice intended to take into the air. Col. Fitzmaurice had not made the prescribed tests prior to leaving for England because of a misinterpretation of the race rules, which were framed under International Commission for Air Navigation requirements that one must land with full loads instead of dumping to reduce weight. The U. S. Bureau of Air Commerce had permitted dumping of gasoline to lighten loads, and it was assumed that the Flash met all qualifications because it was equipped to dump any remaining load and land with its fuel tanks empty. The race committee stood by its ruling on the technicality. The entry was withdrawn because there was no time to make the test prior to start of the race. A few days later, however, the plane passed its landing test with full load of 8,350 pounds gross weight, thus proving the contention that the machine was qualified. When Col. Fitzmaurice attempted to break the record of the winners in the race, he discovered soon after starting that the tires had swelled enough to prevent the wheels being retracted into the holes. Being forced to fly with his undercarriage down would reduce his speed by 25 miles an hour. The Flash was returned to the United States for minor alterations, particularly enlargement of the wheel slots in the wing. Its tests had proven conclusively that no questions of strength or

BELLANCA ARMY CARGO PLANE

A Hornet-powered transport developed from the Bellanca aircruiser.

handling qualities were involved. The Flash was a low-wing externally braced two-place monoplane, its body 26 feet 6 inches long, wing spread 46 feet 1¾ inches. It was powered with a Pratt & Whitney Twin Wasp Junior engine.

Boeing Aircraft Company, Seattle, Wash., a unit of the Boeing Airplane Company, in November, 1934, completed delivery on orders for 75 twin Wasp Boeing 247 and 247-D transports. The United Air Lines received 70 of the transports, forming the largest commercial transport order ever to be filled by an aircraft plant. The Pennsylvania Airlines and Deutsche Luft Hansa were among other companies acquiring Boeing transports. The Boeing 247-D was flown by Turner and Pangborn in the London-Melbourne race, winning third place for speed and also, because they flew the longer course dotted with handicap control stops, being eligible for handicap prizes. It was a feature of a pioneering effort in aircraft manufacturing started by William E. Boeing, who in 1934 was awarded the Daniel Guggenheim Medal for "successful pioneering and achievement in aircraft manufacturing and air transport." The announcement accompanying the award read: "He deserves particular credit for the development of an outstanding aviation manufacturing and transport organization throughout the United States. It was his vision and willingness to spend his own money which has resulted in the formation of one of the best manufacturing and transport organizations in the world." Under Mr. Boeing's direction the air lines of the United States became the first to fly passengers at night on regular schedules over long distances, the first to operate tri-motored passenger planes under the same conditions and the first to make routine use of two-way radio telephones. The last 15 of the 75 transports delivered in 1934, the 247-D, represented several improvements over the 247. The 247-D was equipped with two geared supercharged 550 h.p. Pratt & Whitney Wasp engines and three-bladed Hamilton standard controllable pitch propellers. It had a stated top speed of 220 m.p.h., a cruising speed of 189 m.p.h. at 12,000 feet and 180 m.p.h. at 8,000 feet, with a service ceiling of 25,400 feet, a landing speed of 62 m.p.h. and cruising range of 800 miles on 75 per cent power. Larger engine nacelles, N.A.C.A. cowling and sloping windshield were new features of the 247-D, as were new soundproofing developed by new-type insulation in the cabin, elimination of individual ventilators and reduction of propeller tip noise. A hot air heating system was adopted. Flush type rivets were used on the leading edge of wing and stabilizer. The elevator and rudder were of metal construction, fabric-covered, instead of the all-metal construction on the original 247. The 247-D also had a trailing edge flap built into the rudder. The gross weight was 13,650 pounds with payload of 2,582 pounds, including 10 passengers, crew, baggage and cargo. The weight empty was 8,940 pounds and useful load 4,710 pounds. The wing span was 74 feet and length 51 feet 4 inches. The Boeing company also during the year delivered 111 all-metal single-seat Wasp-powered P-26A pursuit planes for the Army Air Corps. The P-26A was an externally-braced monoplane with a wing span of 27 feet 11⅝ inches, length 23 feet 7¼ inches. It was rated one of the fastest aircooled fighters in the world.

Consolidated Aircraft Corporation, Buffalo, N. Y., produced planes for the Army and Navy and for several foreign governments. At the beginning of 1935, Consolidated and Fleet primary or advanced trainers were in operation in Argentina, Brazil, Canada, China, Hongkong, Mexico, Paraguay, Portugal, Roumania, Spain, Turkey, Colombia, Cuba, Peru, Siam and Russia. The Soviet used the Fleetser model 17 special transport in the "Chelyuskin" rescue as narrated in the chapter on adventures in the air. Consolidated P2Y-1 long range patrol and bomber flying boats were used by the Navy in its record flight to Honolulu as detailed in the chapter on notable flights. That type was also being used in Colombia, and at the beginning of 1935 the Japanese Government was planning to install a number of such boats, purchased from Consolidated, on its over-water air transport routes. During the year Consolidated reported new business as being approximately 75 per cent Army and Navy and 25 per cent foreign export. New designs included the P-30, a refinement of the YIP-25 two-place Army fighter; the A-11, similar to the P-30 except that the P-30 was for high altitude pursuit tactics while the A-11 was designed for ground attack work; the PT-11C, similar to the PT-11 Army trainer except for Wright engine and convertibility for use with Edo twin all-metal pontoons, and Fleet model 10-G, a trainer with inverted Gipsy Major 130 h.p. engine for European export. The P2Y-3 patrol boat was powered with two Wright Cyclone engines rated 710 h.p. each and had a gross weight of 20,794 pounds, high speed of 142 m.p.h., cruising 117.5 and stalling speed of 61 m.p.h., with a service ceiling of 14,000 feet and 1,580 miles normal and 3,000 miles maximum cruising radius. At the beginning of 1935 Consolidated had orders for 70 Fleet trainers for foreign governments, service test orders for P-30 and A-11 types for the Air Corps and an order for 23 P2Y-3 patrol flying boats for the Navy.

Curtiss Aeroplane & Motor Company, Inc., Buffalo, N. Y., a division of Curtiss-Wright Corporation, concentrated on the production of military planes and production of accessories. Two new designs were produced for the U. S. Navy. One was the Curtiss XF13C-1, a single-seat fighter high-wing all-metal monoplane, with slots and flaps, enclosed cockpit and retractable landing gear, powered with a 14-cylinder, two-row radial Wright Whirlwind R-1510 engine. An outstanding feature of the design was the excellent vision afforded the pilot. The other Navy type was the Curtiss XO3C-1, a two-place observation biplane amphibion, with slots and flaps in the upper wings, and supported by a stainless steel pontoon into which the land gear wheels retracted. Delivery was completed on 46 Wright Cyclone-powered Curtiss A-12 Shrike attack low-wing, all-metal monoplanes for the Air Corps, and they were used in the Army's mail operations early in the year. A new Falcon two-place observation and attack plane was designed and built for the export field. It was powered with a Wright Cyclone engine and equipped with single strut landing gear and closed cabin. Curtiss also delivered to the Navy

27 BF2C-1 single-place biplanes, Wright Cyclone-powered, and with retractable landing gear, for service on the carrier "Ranger."

Curtiss-Wright Airplane Company, Robertson, Mo., a division of Curtiss-Wright Corporation, served both the commercial and military markets in 1934. An outstanding development was its introduction of the AT-32 Condor All-Sleeper transport, a biplane with two Wright Cyclone 715 h.p. engines and having a stated high speed of 190 m.p.h. Seats used during the day could be converted into upper and lower berths during flight, 12 berths in all, slightly longer than a Pullman berth and fully equipped. The Condor sleepers were placed in regular night service between Los Angeles and Fort Worth and between Chicago and New York. A new biplane bomber, BT-32, was developed, and sales made to several foreign countries. The BT-32 was powered with two Wright Cyclone 700 h.p. engines and carried loads of 4,050 pounds of bombs or ammunition. It could be converted into an ambulance ship with 12 litters or a troop carrier for 24 soldiers with full field equipment. An advanced military trainer, a two-place biplane with 250 h.p. Wright Whirlwind engine, was designed for export. Production was continued on the Curtiss-Wright trainer, a two-place biplane with 175 h.p. Wright Whirlwind motor, and the Osprey, a two-place biplane fighter with 420 h.p. Wright Whirlwind engine. Both the trainer and Osprey were popular in the export market. Built for the commercial market were the Curtiss-Wright Sport, a three-place biplane with 175 h.p. Wright Whirlwind engine, and the Curtiss-Wright Speedwing, a one- to three-place biplane with 250, 330 or 420 h.p. Wright Whirlwind motor. A new Curtiss-Wright amphibion with many novel features, the Commuter, was designed and built under the supervision of Capt. Frank Courtney. It was designed to combine high performance and large load capacity with ample passenger accommodations and comfort. It was a five-place machine, and included a three-wheel landing gear, two wheels behind the center of gravity and one in the nose of the hull, landing in the same position on land or water. It was a pusher type, equipped with the 365 h.p. Wright Whirlwind engine. The propeller was driven by a 31-inch extension shaft. Biplane wings were used, with a large stagger, thus permitting the lower wing to be placed behind the passenger cabin so that it caused no obstruction to vision.

Douglas Aircraft Company, Inc., Santa Monica, Calif., in 1934 produced commercial and military planes. The Douglas Army observation plane O-38B is portrayed by the three-view drawing in the military design section. The Douglas Dolphin amphibion with two Pratt & Whitney Wasp engines, both six- and eight-place models, had a stated high speed of 156 m.p.h. at 10,500 feet, cruising speed of

140 m.p.h. and landing speed at sea level of 64 m.p.h. Its service ceiling was 19,800 feet and absolute ceiling 20,400 feet. Its gross weight was 9,500 pounds, useful load from 2,542 to 2,770 pounds. The Douglas transport DC-2, which achieved world popularity in 1934 because of its records on air lines of the United States and its taking second place in the London-Melbourne race, was described by the builders as follows: Powered with two Wright Cyclone SCR-1820-F3 engines rated at 710 b.h.p. at 7,000 feet at 1,950 r.p.m., gross weight 18,200 pounds, payload 3,400 pounds (equipped with radio but not including automatic pilot), high speed 212 m.p.h. at

NEW CONSOLIDATED TRAINING PLANE
The Fleet 10, powered by a Kinner engine.

8,000 feet, cruising speed 200 m.p.h. at 14,000 feet on 75 per cent power, 186 m.p.h. on 62.5 per cent power, stalling speed 60 m.p.h., service ceiling 23,200 feet, cruising range 1,085 miles on 75 per cent power, 1,210 miles at 62.5 per cent power, wing area 939 square feet. Equipped with Pratt & Whitney SDG-1690 Hornet engines rated at 700 h.p. at 6,500 feet, gross weight 18,200 pounds, payload 3,400 pounds (equipped with radio but not including automatic pilot), high speed 212 m.p.h. at 7,500 feet, cruising speed 200 m.p.h. at 14,000 feet on 75 per cent power, 186 m.p.h. on 62.5 per cent power, stalling speed 60 m.p.h., service ceiling 23,200 feet, cruising range 1,085 miles on 75 per cent power, 1,210 miles on 62.5 per cent power. The Douglas transport was a low-wing all-metal monoplane transport, with the Sperry method of soundproofing, and embodying the latest practice in streamlining, with fillets and retractable landing gear. It could be equipped for 16 to 20 persons. The passenger cabin was

26 feet four inches long, five feet six inches wide, and six feet three inches high. The overall length of the fuselage was 62 feet, the wing span 85 feet. Split trailing edge flaps were built into the lower side of the wing to increase lift and slow down landing speed. The Royal Dutch Airlines ordered a number of Douglas transports which it installed on fast schedules between Amsterdam and Batavia, Dutch East Indies. In the United States TWA, American Airlines, Eastern Air Lines and Pan American Airways were among the companies using Douglas transports at the beginning of 1935.

Fleetwings, Inc., Bristol, Pa., designed and placed under construction for flight tests early in 1935 its model F401 amphibion, to be fabricated entirely with stainless steel. It was a four-place cabin, high-wing monoplane with retractable landing gear. It was powered with a Jacobs 225 h.p. engine, had a wing span of 40 feet six inches and was 31 feet 5½ inches in length.

Granville, Miller and DeLackner, Springfield, Mass., brought out the Q.E.D., a low-wing, two-place externally braced monoplane powered with a Pratt & Whitney Hornet motor. It had wing flaps for low landing speed and tandem cockpits covered, with dual control. It had a wing span of 34 feet three inches and was 27 feet two inches in length. It was flown in the MacRobertson race from London to Bucharest by Miss Jacqueline Cochrane and Wesley Smith.

Great Lakes Aircraft Corporation, Cleveland, O., operated at near capacity in 1934, employing 550 persons. The Great Lakes BG-1 dive bomber was produced on order for the Navy. Two new experimental planes were also developed for the Navy. Production was continued on the 2T-1A Sport-Trainer, and a new commercial airplane was developed for both the domestic and export markets. The 2T-1A was a two-place biplane powered with an American Cirrus engine. It had a wing spread of 26 feet eight inches, length 20 feet and nearly four inches. The 2S-W was a two-place biplane with a 145 h.p. Warner Super-Scarab engine. The XSG-1 was a two-place observation biplane amphibion with a Pratt & Whitney Wasp Junior engine. It had a wing span of 35 feet and an overall length of 32 feet and nearly seven inches. The Great Lakes BG-1 dive bomber, one of the mystery planes of the Navy, was a two-place, single-engine biplane, with machine gun equipment and, close under the body between the landing gear struts, a rack for a heavy bomb. Plans for 1935 included further development work calculated to broaden the scope of the company's activities in the military, commercial and export fields, also additional BG-1 dive bombers to be constructed for the Navy.

Grumman Aircraft Engineering Corporation, Farmingdale, N. Y., produced single-seat fighters for the Navy and utility type amphibions for the Navy and Coast Guard. Its model JF-1 amphibion was designed to meet Navy specifications for an amphibion to be used in target towing, aerial surveying, photography and various expeditionary missions. The Navy JF-1 was a metal biplane powered with a Pratt & Whitney twin-row Wasp, and had a stated high speed of 170 m.p.h., loaded. The Coast Guard JF-2, adapted from the same design, was powered with a Wright Cyclone engine.

Hall-Aluminum Aircraft Corporation, Bristol, Pa., produced for the U. S. Navy an experimental biplane flying boat XP2H-1, of metal construction with fabric-covered wings. It was powered with four Curtiss geared Conqueror engines, had a stated high speed of 140 and cruising speed of 120 m.p.h. It measured 112 feet between wing tips; its hull was 67 feet 6½ inches long. Empty, it weighed 20,417 pounds. Equipped as a patrol boat its gross weight was 34,800 pounds. It had an estimated cruising range of 4,000 miles with a crew of seven. Early in 1935 it was flown from Norfolk, Va., to Coco Solo, Canal Zone, non-stop.

Hammond Aircraft Corporation, Ypsilanti, Mich., was formed in

SIDE VIEW OF FAIRCHILD CARGO PLANE

The loading door permits quick transfer of heavy freight or supplies.

1932 for experimental work and manufacture of a three-place open biplane, the Hammond 100, powered with a Kinner K-5 engine. When on May 15, 1934, the Bureau of Air Commerce issued specifications for a two-place, light commercial type plane, and requested bids on 25 built to those specifications, the Hammond company became one of the bidders. The bids of 14 companies were opened August 27, 1934, and on October 18 the Hammond company was awarded a contract to build 15 of its model Y, a two-place side-by-side closed, low-wing pusher monoplane to be powered with a Menasco B-4 engine. The bid price was $3,190 a plane. A feature of the Hammond model Y was its three wheels, the third wheel being under the nose. That was designed to prevent nosing over in landing, also permitting landing at stalling speed or up to cruising speed. It was stated that the ship could not be stalled on the take-off, and that it would have a very steep glide if desired, to facilitate landing in small spaces. The top speed was to be more than 110 m.p.h. and the landing speed about 35 m.p.h. It was designed to fly about 20 miles to a gallon of gasoline.

Kellett Autogiro Corporation, Philadelphia, Pa., at the beginning of 1935 had carried out an 18 months intensive research and development program, producing a new type of autogiro without wings, ailerons, elevators or rudder and incorporating the control of the giro in the rotor blade system. It was known as model KD-1. The Kellet direct control wingless autogiro was a two-place machine with tandem cockpits and dual control system. The control was accomplished by means of the three-bladed rotor system inclined by moving the control stick in the conventional manner. The new autogiro possessed higher flying speed and lower landing speed. With a Jacobs L-4 engine rated 225 b.h.p. at 2,000 r.p.m. the KD-1 had a stated 125 m.p.h. high speed, 103 cruising and 16 m.p.h. minimum speed in level flight. Its stated rate of climb at sea level was 1,000 feet a minute, take-off 60 feet and landing run zero. A simple adjustment permitted the three rotor blades to be folded back over the tail surfaces, thus simplifying hangar storage, and making overall dimensions in that position 25 feet six inches by 10 feet three inches. The gross weight was 2,050 pounds, useful load 700 pounds, rotor diameter 40 feet, gasoline capacity 49 gallons, cruising range 3½ hours, 361 miles. The manufacturers were producing the KD-1 for three distinct kinds of operations, military, commercial and air mail shuttle service from airports into the heart of cities. The KD-1 landed on piers in repeated demonstrations and its builders believed it offered a solution to the problem of making roof landings in thickly populated areas. Kellett autogiros were in use throughout the United States, in Brazil, Argentina and Japan. The company was also engaged in development of its sky advertising business for which, together with Louis Bleriot, the Kellett company held basic patents. In 1934 a number of licensees were appointed and contracts executed for more than 200 advertisers.

Kinner Airplane & Motor Corporation, Ltd., Glendale, Calif., produced four types of airplanes powered with Kinner engines. The Envoy was a four-place cabin transport type low-wing monoplane, with external wire bracing, and electrically-operated wing flaps or brakes to give it a landing speed of 46 m.p.h. Powered with the new Kinner C-7 engine it had a rated high speed of 165 and cruising speed of 150 m.p.h. Adjustable metal propeller, dual control, safety glass in windshield and cabin windows, streamlined landing gear, wheel pants and radio were features of the Envoy. The Sportster with Kinner

THE KINNER ENVOY

A four-place cabin ship with 300 h.p. Kinner engine and all the latest equipment, including radio.

100 or 125 h.p. motor was a two-place side-by-side low-wing monoplane designed for students and amateur pilots, and reported especially suitable for instruction purposes because of its maneuverability. The Sportwing, also a two-place side-by-side low-wing monoplane with Kinner 125 h.p. motor, had a stated top speed of 120 m.p.h., low landing speed and range of four hours. Late in 1934 the Kinner company delivered to the Bureau of Air Commerce a number of its new Playboy models, a two-place externally wire-braced low-wing cabin monoplane, with the Kinner R-5 160 h.p. motor, a stated top speed of 137 m.p.h., cruising at 125 and landing at 55 m.p.h., a service ceiling of 14,000 feet, gross weight of 2,215 pounds with useful load of 754 pounds, including pay load of 270 pounds.

Kreider-Reisner Aircraft Company, Inc., Hagerstown, Md., a subsidiary of Fairchild Aviation Corporation, improved its former designs and produced new airplanes in 1934. The Fairchild 22, a two-place open-cockpit monoplane with a Wright Gipsy 90 h.p. engine, was improved, as was the same model equipped with a Warner Super-Scarab engine. The 1935 model had a cantilever retractable landing gear and slotted ailerons such as those used on the Fairchild 24. The Fairchild 24 with Warner Super-Scarab engine introduced in 1934 proved so popular that it was continued with only minor improvements. The Fairchild 24 was a cabin high-wing monoplane with seating arrangements for three persons and accommodations for plenty of baggage, or for two persons and excess baggage. Its popularity lay in its control and ease of handling, and it was designed to give the novice pilot greater confidence. The Fairchild 24 weighed empty 1,354 pounds with normal useful load of 796 pounds, had a high speed of 134 to 137 and cruising speed of 118 to 120 m.p.h. With the Super-Scarab engine rated at 145 h.p. at 2,150 r.p.m. the fuel capacity was 40 gallons, normal range 500 miles and fuel consumption nine gallons an hour. The landing speed was between 40 and 45 m.p.h. A single-engine cargo transport, Fairchild XC-31, was designed and delivered to the Air Corps. It had a wing span of 84 feet, length 55 feet and height of 15 feet 10 inches. Its weight empty was 7,322 pounds, with useful load 5,078 pounds and gross weight 12,400 pounds. It was powered with a Wright Cyclone R-1820-25 motor rated at 750 h.p. at 1,950 r.p.m. at sea level. Its top speed was stated to be 160 m.p.h., landing with full load at 52 m.p.h. because of flaps, with range of five hours. It was equipped with a big loading door and a cargo chute, the latter permitting delivery of food and other supplies by parachute. Six litters or benches for 14 soldiers with full equipment could be installed. Kreider-Reisner at the beginning of 1935 was completing the first of its order from Pan American Airways for a high speed amphibion for service in South America and China. It was to be a 10-place transport. Another new plane was in production, a four- or five-place cabin low-wing monoplane designed for private owners, particularly business men requiring fast transportation with plenty of room and comfort. The new cabin plane was to be powered with a Lycoming, Jacobs or Continental engine ranging between 225 and 280 h.p.

Lambert Aircraft Corporation, Robertson, Mo., with its subsidiaries, Monocoupe Corporation and Lambert Engine Machine Company, Moline, Ill., made further refinements in the Lambert 90A de luxe Monocoupe, a two-place cabin monoplane, equipped with the Lambert 90 h.p. engine, an aircooled, five-cylinder radial. The cabin was made six inches wider, with a wider door. Standard equipment included wheel pants, dual controls and wing flaps. The plane had a cruising speed of 115 and a top speed of 135 m.p.h. The Lambert 90A experimental model was similar to the 90A de luxe in appearance. The Monocoupe model D-145 was powered with a Warner Super-Scarab. Model 125 was powered with a Warner Scarab. The 90A Monocoupe as a seaplane had a high speed of 115 m.p.h.

Lockheed Aircraft Corporation, Burbank, Calif., continued to produce and improve its single-engine Orion, Vega and Altair models, and delivered numbers of its new high-speed, all-metal twin-engine Electra air liners. Improvements in the single-engine monoplanes included the use of supercharged altitude engines and controllable pitch propellers which greatly increased performance characteristics. The Orion and Altair were further improved with split type wing flaps and long-travel oleo shock struts. The Altair flown by Sir

THE LOCKHEED ELECTRA

A Wasp-powered transport carrying 12 persons.

Charles Kingsford-Smith on his Pacific flight was similar to the Orion except for its seating arrangement. The Orion was a seven-place single-engine, low-wing cabin monoplane with a retractable landing gear. The Electra was a 12-place, low-wing, twin-engine monoplane for air transport service. Pan American Airways, Northwest Airlines in the United States and Swissair lines of Switzerland were among the operators using Electras at the beginning of 1935. Single-engine Lockheeds were being flown in France, Switzerland and several other countries. Lockheed put in the Electra the latest refinements. It was powered with Wasp Juniors and on special orders with other Wasp motors. It was noiseproofed, with a new type of double vertical tail surfaces to give better stability and control on one or both engines. The cabin, wing and tail surfaces were of duralumin monocoque construction. The use of wing flaps permitted greater wing loading.

At the end of the year James V. Piersol, aviation editor of the Detroit News and pilot of its famous reporter's and photographic planes, took delivery on a special Orion for his paper. It was powered with a Wasp S1D1 engine. The cabin held three seats, a desk for the flying reporter or radio operator, a radio transmitter for broadcasting outdoor events of public interest, a Sperry automatic pilot, floats to replace the landing gear in over-water operations, and three Fairchild aerial cameras so installed that pictures might be taken at any angle. One camera mounted in the leading edge of the left wing shot straight ahead like a fixed machine gun. The machine gun sight on the pilot's windshield served as a view-finder. The pilot could aim the plane at the view to be shot, press a trigger on the control stick and the camera would take pictures at two-second intervals, 110 exposures with one loading. A second camera took pictures through the cabin floor, while a third in the rear, manually operated, could be projected up, side or back. During four years of operations the veteran Lockheed Vega of the Detroit News was used by Piersol on 350 assignments. He made 1,097 flights, covering a total of 121,511 miles without serious trouble of any kind.

Grover Loening Aircraft Company, Inc., Garden City, N. Y., continued development of its Duckling model, a two-place, Warner Scarab-powered pusher type amphibion, and carried on flight tests of a new amphibion, the Monoduck, powered with a supercharged Wright Whirlwind engine and equipped with split flaps to reduce landing speed.

Luscombe Airplane Company, Trenton, N. J., produced the Luscombe Phantom, a two-place, high-wing cabin monoplane powered with a Warner engine. It had a wing area of 132.5 square feet, was 21 feet long and had a wing spread of 31 feet. It carried a gross load of 1,950 pounds and had a stated top speed of 168 m.p.h. Its climb was 1,400 feet a minute, and equipped with wing flaps it landed at 45 m.p.h. The circular monocoque fuselage was of 17ST dural shaped under a power hammer to a double curvature. The wings were fabric-covered. The Phantom was licensed for two persons, 65 pounds of baggage and fuel for 550 miles.

The Glenn L. Martin Company, Baltimore, Md., produced two kinds of aircraft, its model 139, a twin-engine midwing landplane bomber developed from the Martin 123, and the Martin 130, a four-engine monoplane flying boat for transocean service. Of 48 bombers of the 139 design delivered to the Army Air Corps in 1934, 15 were equipped with Wright Cyclone engines and designated Type YB-10, and 23 were equipped with Pratt & Whitney Hornets and designated Type YB-12. The Martin bomber was all-metal in construction with the exception of its fabric-covered rudder and elevator, with inside bomb bay and retractable landing gear. Eighty-eight were on order for the Air Corps at the beginning of 1935. The new Martin flying boats, three of which were on order to take their places with the Pan American Airways clipper fleet, were the largest of their type to be built in the United States. They had a wing spread of 130 feet, with hulls 90 feet 10½ inches in length. Each had a gross weight of 51,000 pounds, and could carry 48 passengers. For Pan American service the Martin clipper was fitted to carry 14 passengers, a ton of mail and cargo for 3,000 miles non-stop at about 150 m.p.h. It was powered with four Pratt & Whitney Twin Wasp geared and supercharged engines rated at 800 h.p. each. A distinctive feature of the Martin

THE STINSON RELIANT

A Lycoming-powered four-place cabin monoplane used by the Bureau of Air Commerce.

flying boat was the use of short "seawings" rather than wing floats or pontoons to provide lateral buoyancy.

North American Aviation, Inc., New York, at the beginning of 1935 had acquired the manufacturing facilities of General Aviation Manufacturing Corporation and B/J Aircraft Corporation; and had under way a development program directed toward design and production of high speed planes.

The Northrop Corporation, Inglewood, Calif., continued to produce all-metal low-wing monoplanes for commercial transport, private executive owners, special missions and military purposes. The Delta model was a full cantilever monoplane designed for long range, high speed cargo and passenger service. In general design it was similar to the older Alpha model, but it had a stated 100 per cent greater payload capacity and increased performance for a given horsepower. The Delta was being produced in a number of variations at the beginning of 1935. One model, the single control Delta transport, had a length of 31 feet one inch, a cabin seating eight passengers, gross weight of 7,000 pounds of which 2,900 pounds were useful load. The cargo or baggage space was 30 cubic feet. The Delta dual control transport provided for two pilots and six passengers. It had a gross weight of 7,350 pounds, of which 2,850 pounds were useful load, with 25 cubic feet of baggage space. The Delta single control mail plane had a cargo compartment of 175 cubic feet, weight empty 3,925 pounds and useful load of 3,075 pounds. The Delta tandem dual control model had 155 cubic feet of cargo space, weight empty 4,100 pounds and useful load of 3,250 pounds. The Northrop Gamma was similar to the Delta, with 48 feet wing spread, all-metal construction and single engine. Its length of 29 feet 10 inches was somewhat shorter than the Delta models ranging between 31 and 32 feet. The Gamma single pilot cargo plane had 110 cubic feet of cargo space, weight empty 3,950 pounds and useful load 3,400 pounds. The Gamma was also built with tandem controls for the Ellsworth Antarctic expedition. The British Air Ministry in 1934 bought a Northrop bomber powered with a Wright Cyclone 710 h.p. motor, with a speed in excess of 200 m.p.h. The Northrop models were designed for either Wright Cyclones or Pratt & Whitney Wasps or Hornets. The passenger models were soundproofed and fully equipped with radio, Sperry automatic pilots and other aids to avigation. All models had high speeds of more than 200 m.p.h., the maximum being that of the Gamma with 226 m.p.h. Their service ceilings ranged between 18,800 and 24,700 feet. They were equipped with wing flaps, and their landing speed with full load was 62 m.p.h. Their cruising range lay between 1,430 and 1,780 miles. At the beginning of 1935 the Northrop company had a number of orders from the export field.

Ryan Aeronautical Company, San Diego, Calif., produced the Ryan S-T, to the designs of T. Claude Ryan who built Col. Lindbergh's "Spirit of St. Louis" with which he made the New York to Paris hop in 1927. The S-T was a low-wing, externally braced, two-place sport monoplane equipped with wing flaps and trimming tabs, dual control, convertible open or closed tandem cockpits. It was powered with a four-cylinder Menasco Pirate aircooled in-line engine, either B-4 rated 95 h.p. or C-4 rated 125 h.p., with 24 gallons fuel capacity and cruising range of about 400 miles. The S-T had a wing span of 29 feet 11 inches, length 21 feet eight inches, empty weight 1,027 pounds with useful load 543 pounds, a stated cruising speed of 120 m.p.h. and service ceiling of 15,500 feet.

St. Louis Aircraft Corporation, St. Louis, Mo., specialized in the design and production of parts for the Air Corps engineering section at Wright Field. During 1934 the company devoted production facilities to the manufacture of skis for Army aircraft. At the beginning of 1935 the engineering department had on hand a number of experimental projects for both the Army and the Navy, including airplanes. The company's policy was to maintain advanced engineering to meet the requirements of the military and naval services with regard to technical improvements in planes and auxiliaries.

Seversky Aircraft Corporation, Farmingdale, N. Y., late in 1934 was awarded a War Department contract for 35 basic training type planes to be built after a modified design of the all-metal Seversky amphibion which in 1933 made an amphibion speed record of 179 m.p.h. The new trainers were to be two-place low-wing monoplanes powered with Wright Whirlwind engines.

Sikorsky Aviation Corporation, Bridgeport, Conn., a division of United Aircraft Corporation, continued production and improvement of its S-40 and S-42 models, and during the year brought out a new design, the S-43, a convertible amphibion to be powered with two Pratt & Whitney engines and capable of various uses, as a 25-passenger or 1,000-pound cargo transport with a maximum range of 2,500 miles. It had a gross weight of 17,541 pounds as an amphibion or 17,850 pounds as a seaplane and was designed to carry useful loads of between 7,720 and 9,114 pounds. The hull was 51 feet long and the wing spread 84 feet. A new clipper type developed from the S-41 models familiar on the Pan American Airways was the S-42 which entered service on that air line system in 1934, after capturing ten world records for performance, as detailed in the chapter on notable flights. During acceptance tests the first S-42, which became the Pan American "Brazilian Clipper," developed a top speed of 191 m.p.h. It had a wing spread of 114 feet two inches, cabin length 68 feet eight inches and, when loaded, weighed 38,000 pounds, with a cruising range of 1,200 miles at 150 m.p.h. It had accommodations for 32 passengers and a crew of six. Four 750 h.p. Pratt & Whitney Hornet motors set in the leading edge of the wing gave the S-42 its great power, while a fairly high wing loading, among other advanced engineering features, enabled the ship to display remarkable smoothness in any kind of air, much to the comfort of passengers. Among the special features were the Hamilton controllable pitch propeller, Sperry automatic pilot and soundproofing of rubberized, sterilized animal hair. To illustrate the vast amount of work and quantities of materials which enter into the manufacture of flying craft the Sikorsky company submitted these facts about the S-42. Its payload of 16,608 pounds, carried on one flight, exclusive of crew, fuel, etc., would equal 93 passengers. The wing took 2,800 square feet of sheet metal, while the hull covering required 2,462 square feet. Hull and wing together required an area equal to three city lots. More than one and a quarter mile of control cables went into each S-42, which also contained 400,000 (three miles) of rivets. More than 1,500 square feet of American walnut veneer were used in the passenger compartments; and more than a mile of electric wiring was used in each plane. Excluding engines and propellers there were nearly a million and a half parts in the S-42, which required 600 gallons of paint, primer, lacquer, bituminous paint and dope—enough to give 60 cottages one coat each. By the time the first S-42 was completed and flown 375 photographs had been taken of the progress work. Four complete wind tunnel models were built and tested during the design; and 12 water-testing hulls were constructed while the boat hull was being designed. Forty-six complete wind tunnel reports were made during the aerodynamic analysis. The design data alone, not including data on materials, filled 1,855 closely typed pages, enough for five complete novels. To build one S-42 required 1,400 blueprints, 600 research and experimental drawings and innumerable sketches. The original S-42 order included three ships for Pan American Airways. Late in 1934 Pan American placed another order with Sikorsky for four more clipper ships, these to be a modification of the S-42 model and designated S-42B. They were to have trailing edge wing flaps and more powerful Pratt & Whitney engines, giving them a non-stop cruising range of 3,000 miles at an average of 156 m.p.h.

Stearman Aircraft Company, Inc., Wichita, Kan., a division of Boeing Airplane Company, concentrated its efforts on the development of trainers for the Army and Navy. The model 70 trainer, powered with a Lycoming R-670 engine, was constructed primarily to Army specifications and submitted to Wright Field for test. When tests were delayed at Wright Field the plane was submitted to the Navy for inspection and test. Following tests at Anacostia and Pensacola early in 1934, bids were opened on that type in May, and Stearman was awarded a contract for 41 NS-1 Navy trainers. The first plane of that contract was delivered to Anacostia for trial board tests late in the year. The Navy trainer, equipped with a 220 h.p. Wright Whirlwind engine, had a high speed of 125 m.p.h. and service ceiling of 14,000 feet. The fuselage was of welded steel tube frame, fabric covered. The wings were of laminated spruce spars, spruce ribs and aluminum alloy channel drag struts, all fabric covered. The landing gear was full cantilever type, oleo equipped. Bids for Army Air Corps primary training equipment were opened October 12, and the

Stearman company submitted an Army revision of the Navy trainer as model 75. It was to be powered with a Wright Whirlwind rated 225 h.p. at 2,000 r.p.m., with the Lycoming R-670 as alternate installation. A commercial type, model 81, convertible to various commercial and military uses was demonstrated on a tour in South America. It could be used for long distance mail carrying with a cruising range of 1,000 miles, as a long distance flight trainer, light observation, attack or bomber. Stearman planes were being operated throughout the world at the beginning of 1935.

Stinson Aircraft Corporation, Wayne, Mich., a division of the Cord Corporation, at the beginning of 1935 was producing five models, Model A, SR-5A, SR-5E and two O models. Model A was a three-

A STEARMAN MODEL 73

Primary training plane developed for the Navy as NS-1, Wright Whirlwind-powered.

engine passenger and cargo transport powered with three Lycoming R-680-5 engines with rated 260 h.p. at 2,300 r.p.m. It had a gross weight of 10,100 pounds and payload capacity for 1,860 pounds, a stated high speed of 181 m.p.h., cruising at 161 m.p.h. and 63 m.p.h. stalling speed. It carried two pilots, eight passengers and 800 pounds of baggage, mail or express. It was equipped with flaps and a retractable landing gear. The wing was double-tapered sesqui-spar, externally braced from fuselage to upper side of wing. The 41 cubic feet of baggage space in the cabin was augmented by two mail bins in the wing. Special insulation contributed to noiseproofing. The gas capacity was 160 gallons, with consumption at 42 gallons an hour.

Standard equipment included three Lycoming-Smith controllable pitch propellers with chrome-vanadium steel blades and Sperry horizon and gyro. The SR-5A had a Lycoming engine rated 245 h.p. at 2,300 r.p.m., gross weight 3,550 pounds, 650 pounds payload, 133 m.p.h. high speed, 120 cruising and 58 m.p.h. stalling speed. Model SR-5E had the 225 h.p. Lycoming engine, gross weight 3,325 pounds, payload 575 pounds, high speed of 133 m.p.h., cruising at 120 m.p.h. and stalling at 53 m.p.h. Model O was equipped with either 225 or 245 h.p. Lycoming engines. The former had a gross weight of 2,750 pounds, 380 pounds payload, high speed 135 m.p.h., cruising at 122 m.p.h., stalling at 53 m.p.h. The latter O model at 3,200 pounds gross weight, 380 pounds payload, had 135 m.p.h. high speed, cruising at 122 and stalling at 57 m.p.h.

Taylor Aircraft Company, Bradford, Pa., was producing two models, two-place light monoplanes with convertible cabins, the Cub E-2 and the Cub F-2, powered with Continental A-40-2 and Aeromarine AR3-40 motors respectively. The Cub E-2 with its 37 h.p. Continental engine had a wing span of 35 feet three inches, gross weight 932 pounds, payload 170 pounds, a rated high speed of 85 m.p.h., cruising 70 and stalling 38 m.p.h. The Cub F-2 with Aeromarine 40 h.p. motor had the same dimensions as the E-2, a gross weight of 950 pounds, payload 175 pounds, high speed 92, cruising 85 and stalling 38 m.p.h. The cruising radius of the two models was about 200 miles. Their construction was the same, with high wing, tubular-braced and further supported above the fuselage by a steel tubular cabane. The wing was of solid spruce spars and aluminum alloy ribs, fabric covered, the fuselage of welded steel tubes fabric covered. The one cockpit seated two in tandem, and had dual controls with the front set removable.

Uppercu-Burnelli Corporation, Keyport, N. J., in 1934 produced its experimental transport UB-14 and continued production of Aeromarine engines. The UB-14 was a two-engine high wing monoplane transport with 71 foot wing span and 44 feet length. The Aeromarine AR-3 was a three-cylinder radial aircooled engine rated 50 h.p. at 2,125 r.p.m. The AR-340 was also a three-cylinder radial aircooled rated 40 h.p. at 2,050 r.p.m. The company was producing these engines at the rate of one a week.

Chance Vought Corporation, East Hartford, Conn., a subsidiary of United Aircraft Corporation, concentrated design and manufacturing activities on its Corsair convertible land or seaplane biplane types for military and commercial purposes. All Corsairs were powered with Pratt & Whitney engines. At the beginning of 1935 Vought planes were being operated in Argentina, Brazil, China, Cuba, Japan, Mexico, Peru, San Domingo and Siam. Germany was using Vought Corsair mail planes. From its first purchase shortly after the World War until the beginning of 1935 the U. S. Navy had bought more than 1,000 Vought Corsairs for carriers, battleships and cruisers. Production types for the Navy at the end of 1934 included a Hornet-powered two-place scouting Corsair, for operations aboard the aircraft carriers, and a Wasp-powered two-place observation Corsair, readily convertible from landplane to seaplane and capable of being operated from land, water, catapult or carrier deck. Recent deliveries to the Navy also included three new experimental types of advanced design and performance. The export line of Vought Corsairs included three basic types, the V-80 single-seat Corsair, V-90 two-seat Corsair and the V-100 Corsair Junior. The V-80 and V-90 were easily convert-

STEARMAN MODEL 81

A two-place, long distance basic training plane convertible for air mail or military service, powered by a Wasp Junior.

ible into seaplanes and were equipped for all kinds of tactical missions. The V-100 Junior was designed to fulfill all the functions of a light military airplane. It represented a simplified Corsair type to provide low initial cost and economy in maintenance. Dimensions of the Corsairs will be found in the design section. The V-80 landplane with normal gross weight had a stated speed of 197 m.p.h. at 6,000 feet, landing at 60.9 m.p.h. The V-90 Corsair was produced in two series, standard and super. It had tandem cockpits with transparent cabin open at after end to facilitate gunnery. It could carry from one to four fixed machine guns, one flexible gun installation and bomb racks on wings. With normal loads the standard and super V-90 Corsairs had speeds ranging between 184 and 191.5 m.p.h., and service ceilings from 22,600 to 25,600 feet. At the beginning of 1935 the Vought company had on order 85 scout-bombers for the Navy, known as model SBU-1, for service aboard the carriers. It was to possess high flying speed and low landing speed with the use of wing flaps, and was to be powered with the latest Pratt & Whitney Twin Wasp Junior 700 h.p. motor and equipped with the Hamilton Standard controllable pitch propeller. Another feature was to be the new adjustable N.A.C.A. cowl, with pressure baffles attached to the engine directing the cooling air against the cylinders, and controllable flaps attached to the cowl by means of which the cooling air might be regulated. A technical paper on the cowl having adjustable trailing edge flaps, prepared by R. B. Beisel of the Vought Corporation, A. Lewis MacClain of the Pratt & Whitney Aircraft Company, and F. M. Thomas of United Aircraft Corporation, had the unique distinction of winning both annual medals awarded by the Society of Automotive Engineers—the Wright Brothers Medal for outstanding developments in aircraft design and the Manly Memorial Medal for developments in power plant design.

The Waco Aircraft Company, Troy, O., produced four new models which it classed as modifications of its famous designs, and reported a satisfactory increase in sales of its entire line of six models, with prospects for still larger sales volume in 1935. Model UKC was a four-place cabin biplane, representing a refinement over the previous year and powered with the Continental 210 h.p. engine. Model YKC, similar in dimensions and also a four-place cabin ship, was powered with the Jacobs 225 h.p. engine, furnished with highly successful battery ignition. Model CJC, similar to the above, but with slightly larger upper wing and consequently increased wing area, had a slightly heavier gross loading and was powered with the Wright Whirlwind 250 h.p. engine. It was reported to be popular among sportsmen pilots and executives in the United States. A number of owners equipped it with Edo floats. An order of 25 CJC planes was being delivered to the Brazilian Government at the beginning of 1935 for mail and passenger transport service. Waco also produced a new three-place open biplane, model F-3, a successor to the line of F models produced since 1930. Model F-3 was powered with either Continental or Jacobs engines, and represented the latest developments in streamlining. The Waco WHD, designed and built in 1933 as a commercial plane, was also modified for production as a military model, WHDA. It could be provided with two bomb racks carrying 10 bombs weighing 25 or 30 pounds each, five in each rack, either one or two Browning machine guns in the lower wing and a flexible machine gun in the rear cockpit. Many interesting modifications of the WHDA included its design without armament as a three-place ambulance carrying a pilot and two patients. At the beginning of 1935 Waco planes were being operated in Alaska, Argentina, Australia, Brazil, British East Africa, Canada, Chile, China, Cuba, Egypt, England, France, Germany, Guatemala, Netherlands, Honduras, Mexico, Nicaragua, New Zealand, Norway, Paraguay, Philippines, Salvador and South Africa. The 1934 models were shipped to 14 of those countries. New export fields were being opened, and inquiries from prospective customers abroad were at the highest number in several years. Waco also found the private owner market growing steadily

THE STINSON MODEL A

Powered by three Lycoming engines and the Lycoming-Smith controllable pitch propeller, with seats for eight passengers.

in the United States especially among business and industrial houses requiring planes for their salesmen covering large territories throughout the country.

Waldo D. Waterman, Los Angeles, Calif., early in 1935 received a contract from the Bureau of Air Commerce to construct a tailless airplane in accordance with his designs submitted some months previously. The Bureau planned to test the suitability of the design for a safe, easily operated plane for private ownership.

Wedell-Williams Air Service Corporation, Patterson, La., brought out a new racer in 1934. It was a full cantilever low-wing monoplane with retractable landing gear and tailskid. Powered with an 800 h.p. Pratt & Whitney Wasp it was flown by James R. Wedell at New Orleans in February, 1934, making a world land speed record for 100 kilometers of 266.032 m.p.h.

Aircraft Engine Manufacturers

Aeronautical Corporation of America, Cincinnati, O., manufactured its own engine to power its Aeronca light plane. During the year the Aeronca E-113A engine was further improved and officially approved as Aeronca E-113B. It was the first engine to be approved by the Bureau of Air Commerce having quill or needle bearings on the connecting rod end bearings, considered especially desirable with high loading. The Aeronca engine was used extensively in light planes abroad. The Aeronca E-113B had a rated 36 h.p.

Allison Engineering Company, Indianapolis, Ind., a division of General Motors Corporation, continued development work on a series of liquid-cooled 12-cylinder V-type engines.

Jacobs Aircraft Engine Company, Pottstown, Pa., produced its new model L-4, seven-cylinder, aircooled radial motor, rated at 225 h.p. at 2,000 r.p.m. at sea level, with a compression ratio of 5.375 to 1, using ordinary aviation grade gasoline of 73 octane rating. The L-4 was developed for both commercial four-place cabin and military training planes, and was standard on Waco cabin and F-3 models, the 225 Beechcraft and Kellett autogiro. It was to be used on several new models to be introduced in 1935. The standard commercial model Jacobs L-4 motor introduced the use of battery ignition for the first time as standard equipment on a modern radial engine, using two Bosch distributors with coils and a Bosch LE-70/12-1700 generator. It provided quick starting, smooth idling and acceleration and effected a substantial saving in weight in planes carrying radio and other electrical accessories. Other features of the L-4 were magnesium alloy nose case and accessory case, saving weight, forged aluminum pistons, sodium-filled stems in Thompson exhaust valves and complete and closely spaced finning of the cast aluminum cylinder heads. It was equipped for installation of direct electric or compressed air starter, Breeze harness or Jacobs individual wire radio shielding, and installation of all types of propellers including the Hamilton Standard hydro-controllable pitch. The L-4's dry weight was 420 pounds with complete equipment including generator, giving the unusually low ratio in that power class of 1.87 pounds per h.p. The engine was also offered with dual Scintilla magneto ignition, designated model L-4M, weighing 435 to 440 pounds. The Jacobs company also continued to offer its model LA-1, a 170 h.p. seven-cylinder radial aircooled engine.

Kinner Airplane & Motor Corporation, Ltd., Glendale, Calif., had in production five models of its radial aircooled motors. The B-5, five cylinders, weighing 295 pounds dry with rated 125 h.p. at 1,925 r.p.m., had special bronze valve seats shrunk and rolled into place, with two Scintilla magnetos as standard accessories. The new rear exhaust type cylinder head had much closer and longer fins than those formerly used, and increased angle between valves. Battery ignition could be used on the B-5. The C-7, seven cylinders with rated 300 h.p. at 1,800 r.p.m., providing for battery ignition if desired, was designed to meet the demand for an all-purpose motor in that power class. It was suitable for military planes or four- to six-place transports for any use. The C-5, five cylinders, had a rated 210 h.p. at 1,900 r.p.m., weighed 420 pounds, or two pounds per horsepower, and also provided for battery ignition. The K-5, five cylinders, had an improved type of front exhaust cylinder head designed

NEW VOUGHT CORSAIR JUNIOR

A new two-place light military plane powered with a Pratt & Whitney Wasp Junior engine and equipped with full military installations.

so that nose or front type collector ring could be used if desired. It also had improved exhaust valves and completely enclosed push rods and valve mechanism. It had a rated 100 h.p. at 1,810 r.p.m., weighing 275 pounds. The R-5, five cylinders, was also equipped with rear exhaust cylinder head, provided for battery ignition and had a rated 160 h.p. at 1,975 r.p.m.

Lambert Engine & Machine Company, Moline, Ill., was producing the Lambert R-266-A radial aircooled engine rated at 90 h.p. at 2,375 r.p.m., and the Velie M-5, 65 h.p. at 2,000 r.p.m. The R-266 was said to consume only five gallons of gasoline an hour.

Lawrance Engineering & Research Corporation, Linden, N. J., continued its experimental development work on aircraft motors.

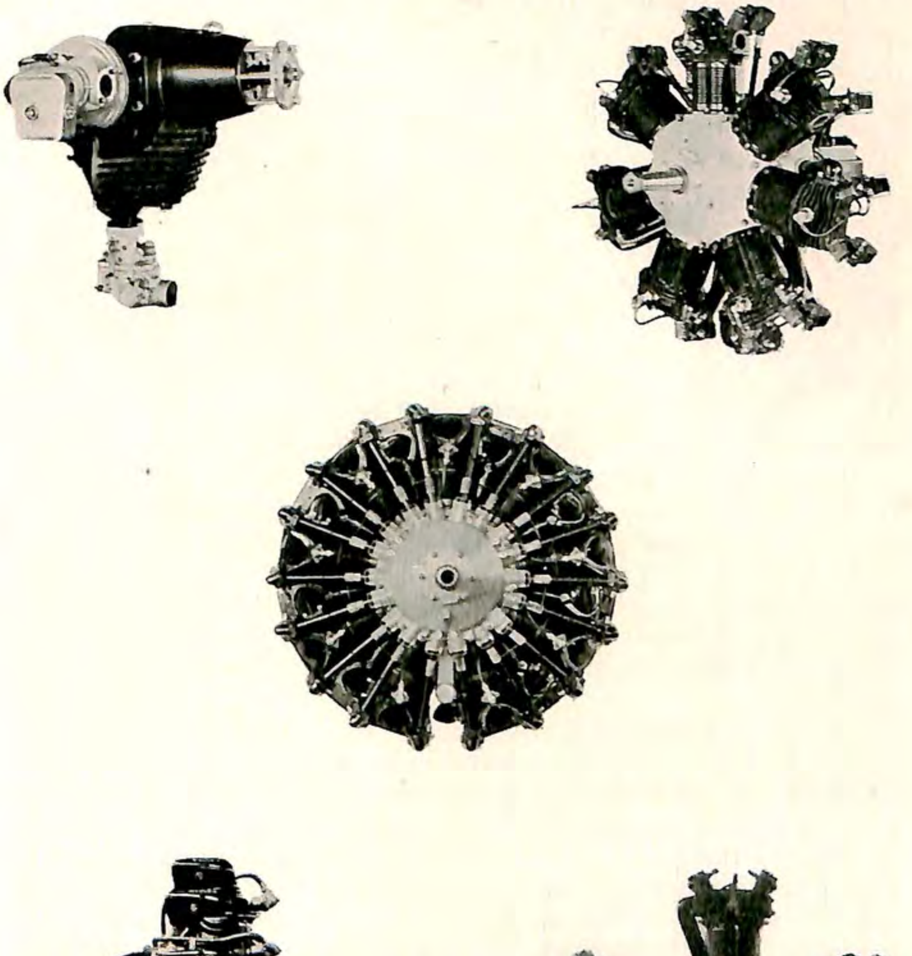
Lycoming Manufacturing Company, Williamsport, Pa., a division of the Cord Corporation, continued production of the R-680 series of its radial, aircooled engines. The company obtained approval from the Department of Commerce on a rating of 225 h.p. at 2,100 r.p.m. on the model R-680-4 engine with a 5.5 compression ratio using 58 octane fuel. Lycoming also received Department of Commerce approval to operate all engines at 2,300 r.p.m. for use with controllable pitch propellers. The Lycoming line of engines at the beginning of 1935 covered a complete range from 200 to 260 h.p., from 2,000 r.p.m. to 2,300 r.p.m. Fuel pump drive, vacuum pump drive, generator drive, dual tachometer drive adapter, gun synchronizer drive and radio shielding were optional equipment and could be applied to any Lycoming engine model. Lycoming engines were used in numerous private aircraft, aerial service equipment and on air lines.

Pratt & Whitney Aircraft Company, East Hartford, Conn., a division of United Aircraft Corporation, made available to the aviation industry a series of higher horsepower engines of correspondingly greater performance than earlier Wasp and Hornet models, all with added features making possible more economical operation, thus reducing the servicing problems and costs to operators. Many new features were embodied in the new H Series Wasp and the E Series Hornet, with altitude ratings of 575 and 750 h.p. respectively. Both engines represented the latest of their type, the development resulting from millions of hours of actual flight service since they were first made available for military and commercial use. All major parts of the two engines were refined and strengthened for longer life and greater durability. One of the far reaching innovations and possibly the most important single development of the company in 1934 was equipping the H Wasp and the E Hornet with automatic valve lubrication. It involved a change in engine design in order that pressure engine oil might be carried through the push rods, rockers, and rocker bearings to the valves and valve guides. That eliminated all periodic manual lubrication of those important parts. An automatic oil temperature valve which had been conceived by Pratt & Whitney engineers was also put into use on the latest models of the Wasp and Hornet. By means of a thermostat in this mechanism, oil at any temperature below 155 degrees Fahrenheit was returned directly to the oil supply tank immediately adjacent to the outlet, while oil above 170 degrees was passed through the oil cooler. The lubricant thus was brought to operating temperature almost immediately and automatically maintained at that temperature under all weather conditions. The company announced the development and application of a priming type carburetor utilizing its accelerating pump to supply the necessary charge for starting. That innovation kept fumes from the priming source away from the cockpit, made uniform the length of priming lines in every installation and reduced the possibilities of flooding and the resultant fire hazard. Less priming was necessary because of the larger shot provided through that means. A new design pedestal mounted cam providing greater rigidity was standard on all new engines as well as an improved supercharger drive, an improved supercharger drive clutch and a short type hot spot. Pratt & Whitney also developed a new type radio shield harness which proved to be a great improvement over types formerly used. It was constructed in two sections, a front and a rear manifold, to each of which conduits were attached to the spark plugs and magneto shields. The sectional construction of the harness permitted easy assembly and disassembly.

FOR THE AMATEUR PILOT

A Waco F3-YMF biplane with Jacobs 225 h.p. engine.

Pratt & Whitney engines, all of the fixed radial type, were in the higher horsepower brackets with horsepower ratings ranging from 320 to 800. Of these the smallest engine was the Wasp Junior, then the Wasp, the Hornet, the Twin Wasp Junior and the Twin Wasp. The Wasp Junior, with ratings of 320 h.p. at sea level to 400 h.p. at sea level and at 5,000 feet, was used in both private planes and transports such as the Lockheed Electra. The Douglas Dolphin delivered in France was powered with Wasp Juniors. All available Wasp models were of the new H series in either direct drive or geared form. Their ratings ranged from 525 h.p. at sea level to 550 h.p. at 8,000 feet and 500 h.p. at 10,500 feet. To the D series Hornet was added the new E series, an engine of higher horsepower and slightly less overall diameter. The E Hornet was equipped like the Wasp, with all the latest Pratt & Whitney design features, including pressure lubrication of the rocker and valve mechanism, and was available in either the direct drive or geared forms. Ratings on the Hornet increased from 635 h.p. at sea level to 750 h.p. at 7,000 feet. As with the Wasp, 80 and 87 octane fuels were recommended for the various models. The 14-cylinder two-row engine met demands for a high horsepower unit with a minimum frontal area. Pratt & Whitney's Twin Wasp Junior had a displacement of 1,535 cubic inches with overall diameter of 43⅞ inches and ratings of 650 h.p. with 80 octane fuel at 7,000 feet and 700 h.p. with 87 octane fuel at 8,500 feet. The Twin Wasp, a larger engine with an 1,830 cubic inch displacement, had an overall diameter of 47⅞ inches, and was rated at 750 h.p. with 80 octane fuel at 6,500 feet and 800 h.p. with 87 octane at 7,000 feet. Both two-row engines were available with either a 4:3 or 3:2 reduction gear of patented Pratt & Whitney design. Company officials reported a growing tendency toward the use of geared and supercharged engines for American military and air line operations. Through its own patented reduction gear designs the company was able to provide reliable equipment of that order because of extensive research in the reduction gear field carried on over a period of many years. It was believed to be partially responsible for the outstanding increased performance of current American transport designs. Close cooperation between the engine manufacturer, the plane manufacturer and the propeller manufacturer assisted greatly in that development. In the military and naval services the 14-cylinder two-row engines of the Twin Wasp Junior and the Twin Wasp types met with favor, and they were looked upon as being desirable for military power plants in both fighters and bombers. Pratt & Whitney motors powered the United Air Lines fleet of Boeing transports, and also many of the military and commercial planes which made record-breaking flights in 1934. Four Hornets powered the Sikorsky S-42 flying boat which made 10 world records for speed and altitude with loads. New H Wasps powered the stock Boeing 247-D transport plane which Turner and Pangborn flew to third place in the MacRobertson race from London to Australia. Pratt & Whitney engines were also popular in the foreign field. In the general plan of reorganization of the United Aircraft and Transport Corporation a new corporation was formed, United Aircraft Corporation, which absorbed the eastern manufacturing units of the former corporation. The Pratt & Whitney Aircraft Company became a subsidiary of this new organization together with the Chance Vought Corporation, the Sikorsky Aviation Corporation, the Hamilton Standard Propeller Company and the United Airports of Connecticut.



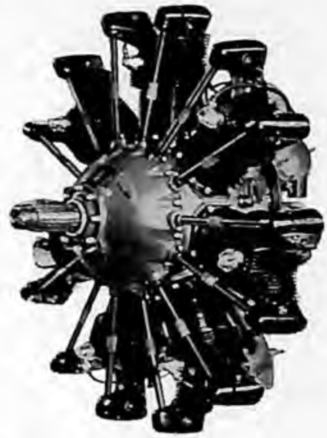
AERONCA, LYCOMING AND WARNER ENGINES

Aeronca E113-B, 36 horsepower (upper left); Lycoming R-680-4, 225 horsepower (center); Warner Scarab, 110 horsepower (upper right); Warner Super-Scarab, 145 horsepower (lower left); and Warner Scarab Junior, 90 horsepower (lower right).

Ranger Engineering Corporation, Farmingdale, N. Y., had completed development tests on several in-line aircooled types. Model 6,390, a six-cylinder inverted in-line aircooled engine with rated 120 h.p. at 2,150 r.p.m.; and Model V-770-SG, a 12-cylinder supercharged and geared 3:2 inverted 60-degree V in-line aircooled engine with rated 420 h.p. at 2,800 r.p.m., had been approved by the Bureau of Air Commerce and had passed Bureau of Aeronautics tests at the Naval Aircraft Factory. Other models included V-770, direct drive 12-cylinder inverted 60-degree V in-line aircooled, about 300 rated h.p. at 2,400 r.p.m., V-770-G, geared 3:2, 12-cylinder inverted 60-degree V in-line aircooled, about 325 rated h.p. at 1,860 r.p.m. at shaft; and V-770-S, supercharged, direct drive, 12-cylinder inverted 60-degree V in-line aircooled, about 350 rated h.p. at 2,400 r.p.m. The company contemplated several other models up to 800 horsepower and 24 cylinders. It stated that all developments were related one to another because 75 per cent of the engine parts were interchangeable.

The Warner Aircraft Corporation, Detroit, Mich., made improvements in its line of Scarab motors. The seven-cylinder aircooled radial Scarab had a rated 125 h.p. at 2,050 r.p.m. The Scarab Junior was a five-cylinder radial rated 90 h.p. at 2,025 r.p.m. The Super-Scarab was a seven-cylinder radial with rated 145 h.p. at 2,050 r.p.m. Warner also manufactured parts for the commercial airplane market.

Wright Aeronautical Corporation, Paterson, N. J., a division of Curtiss-Wright Corporation, continued engineering refinement, development and production of its aircooled radial Cyclone and Whirlwind and liquid-cooled Conqueror engines. During 1934 development of the Wright Series F Cyclone resulted in increasing the power rating of the former 675 h.p. at sea level to 690 h.p. at sea level, and the Cyclone rated at 645 h.p. at sea level was approved for 660 h.p. at sea level. At the beginning of 1935 the Series F Cyclone had these ratings: The Cyclone using 87 octane fuel, 715 h.p. at 1,950 r.p.m. at sea level, 735 h.p. at 4,000 and 710 h.p. at 7,000 feet; the Cyclone using 80 octane fuel 690 h.p. at 1,950 r.p.m. at sea level, 670 h.p. at 2,500 and 650 h.p. at 9,500 feet; the Cyclone using 73 octane fuel 660 h.p. at 1,950 r.p.m. at sea level and 620 h.p. at 4,500 feet. Unique features of the Cyclone included a new design of cylinder head with integral spark plug coolers, an 11-inch diameter supercharger impeller turning at relatively low speed, a greatly simplified accessory section, and a down-draft carburetor, the first of its type provided as standard equipment with a production radial aircooled engine. All models of the Cyclone were identical with exception of the compression ratio in models built for full throttle operations at sea level and the amount

JACOBS ENGINES
Jacobs LA-1, 170 horsepower (left); Jacobs L-4, 225 horsepower (right).

of supercharging applied in altitude performance engines. In the engines built for full throttle operations at sea level different compression ratios were used to obtain best performance with the fuel used in service. The 715 h.p. Cyclone using 87 octane fuel employed a compression ratio of 6.4 to 1, the 690 h.p. Cyclone using 80 octane a compression ratio of 5.7 to 1, and the 660 h.p. Cyclone using 73 octane a compression ratio of 5.3 to 1. The ratios were obtained by using pistons of three different designs. They were identical in weight and directly interchangeable without affecting any other part of the engine or rebalancing the crankshaft, a feature intended to be of special advantage to operators to whom the higher octane fuels were not available. If only 73 octane fuel could be obtained, the operator might use the Cyclone with pistons designed for a ratio of 5.3 to 1. Later, if obtaining 80 or 87 octane fuel, he might increase his power at relatively low expense by substituting pistons of higher compression ratio. All Series F Cyclones supercharged for altitude performance had a compression ratio of 6.4 to 1 regardless of fuel used. They differed from the engines rated at full throttle at sea level only in the speed of their supercharger drive gears. As all supercharger drive gears, regardless of ratio, were interchangeable, engines supercharged for altitude performance might be converted for full throttle operation at sea level by substituting supercharger drive gears of lower ratio. Conversely, engines designed for full throttle at sea level might be converted to altitude performance engines by replacing the original pistons and supercharger drive gears with those of higher ratio. All Series F Cyclones could be supplied with propeller reduction gears of 16:11 ratio. The 16:11 gear unit was of compact design, the exclusive use of spur gears indicating its simplicity. The Series F was also equipped with mechanism for installation of hydraulic controllable pitch propellers. The single row Whirlwind series was produced in three sizes and six models: nine-cylinder rated 420 h.p. at 2,150 r.p.m., nine-cylinder rated 365 h.p. at 2,100 r.p.m., nine-cylinder rated 330 h.p. at 2,000 r.p.m., seven-cylinder rated 285 h.p. at 2,000 r.p.m., seven-cylinder rated 250 h.p. at 2,000 r.p.m., and five-cylinder rated 175 h.p. at 2,000 r.p.m. An unsupercharged seven-cylinder Whirlwind was also produced and approved at 235 h.p. at 2,000 r.p.m. for 65 octane fuel. Several of that type were supplied to the U. S. Navy for training planes. The nine-cylinder Whirlwind received an additional Department of Commerce rating of 440 h.p. at 2,000 r.p.m., giving the nine-cylinder Whirlwind four power ratings. All nine-cylinder Whirlwinds were available in either direct drive or geared form. Geared Whirlwinds were supplied with propeller speed reduction units of 2:1 or 1.58:1 ratio. The 14-cylinder Whirlwind R-1510, a twin-row engine developed by Wright Aeronautical Corporation for the Navy, was further refined in 1934, and a number, including models producing 700 h.p. at sea level and high altitudes, in both geared and direct drive models, were installed in naval aircraft. The Curtiss Conqueror, only liquid-cooled aircraft engine on a production basis in the United States, was supplied in three unsupercharged and one supercharged approved models, including the direct drive rated 650 h.p. at 2,400 r.p.m., the geared 2:1 Conqueror rated 625 h.p. at 2,450 r.p.m. and the 7:5 geared Conqueror rated 675 h.p. at 2,450 r.p.m., all three being unsupercharged models. The 7:5 geared Conqueror was developed in 1934, its greater horsepower being achieved by increasing the compression ratio from 6.5 to 7.25 along with refinements in design. The Super-Conqueror, similar to the standard Conqueror in general design, was supercharged. The supercharger was of the built-in centrifugal type housed at the rear of the engine and driven through a shaft providing the required flexibility to protect supercharger gears and bearings from acceleration loads. Its rating was increased in 1934. Refinements were made in the engine structure. It was supplied in both direct drive and geared form, with a rating of 705 h.p. at 2,450 r.p.m. at 7,000 feet. Wright engines were standard equipment on many air lines in the United States and other countries, among them the Royal Dutch Airlines of Holland which ordered Wright Cyclones for its new Douglas and Fokker F-36 transports for the Amsterdam to Batavia route after its first Douglas, Cyclone-powered, had won second place in the MacRobertson race from London to Australia, though carrying a trans-

KINNER ENGINES

C-5, 210 horsepower (upper left); R-5, 160 horsepower (upper right); C-7, 300 horsepower (center); K-5, 100 horsepower (lower left); and B-5, 125 horsepower (lower right).

port load and flying 1,000 miles more than the winners of first place in their special racing plane. Cyclone-powered airplanes established many commercial records and made a number of spectacular flights in military operations during 1934. At the beginning of 1935 approximately 1,500 Series F Cyclones had been delivered to purchasers. Cyclone engines powered the new Curtiss-Wright Condors, Douglas DC-2 and Vultee transports of American Airlines, the TWA fleet of Douglas DC-2 transports, the Eastern Air Lines fleet of new Condor and Douglas transports and the Douglas transports used by Pan American Airways in Latin American operations.

Manufacturers of Accessories

Aero Supply Manufacturing Company, Inc., Corry, Pa., continued to produce a full line of accessories for the industry.

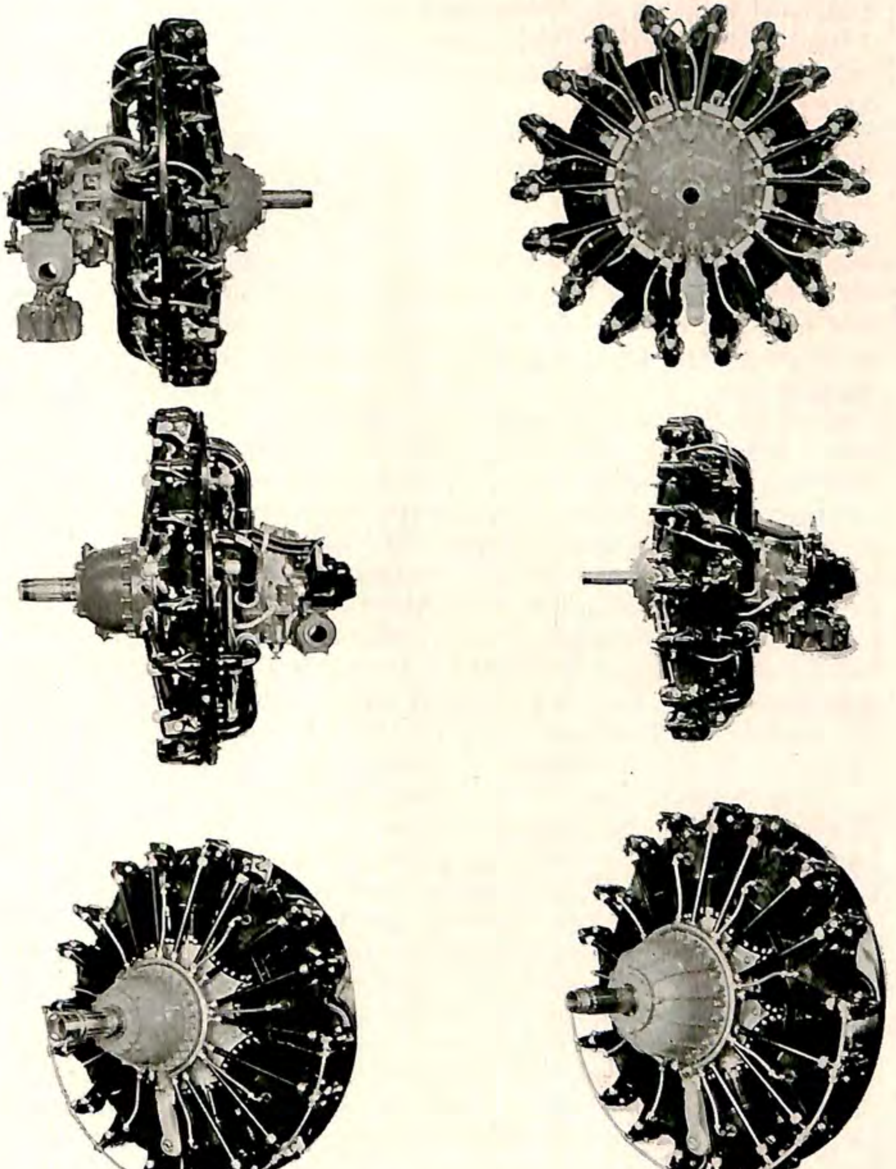
Air Associates, Inc., Garden City, N. Y., manufactured a line of flying clothes and special aircraft accessories and also acted as foreign distributor for many manufacturers of machines, engines and accessories.

Aircraft Radio Corporation, Boonton, N. J., produced aircraft radio equipment, and at the beginning of 1935 was expanding its facilities for a new line of radio parts.

Aluminum Company of America, New York, continued to produce its line of aluminum and aluminum alloy materials for aircraft construction. Corrosion resistant and high strength alloys were distributed throughout the industry. Wider application of Alclad materials was developed, Alclad being highly corrosion resistant sheet aluminum alloy products of the heat-treated variety having a high strength core to which were integrally bonded thin coatings of high purity aluminum. The electrolytic production afforded by the high purity coating effectively prevented structural deterioration of the high strength core under ordinary corrosive conditions, including salt water action. The company also produced highly corrosive resistant alloys of the cold rolled variety. Forged aluminum alloy propellers, castings and forgings for engine and fuselage construction advanced in quality in 1934. Other advances noted at the beginning of 1935 were the progress made in spot welding technique, permitting it to be applied to structural members of aircraft. The company expanded its facilities for technical advice and consultation with the industry.

American Gas Accumulator Company, Elizabeth, N. J., as agent for Sperry, BBT and AGA products, marketed airport lighting equipment, including floodlights, revolving beacons, boundary lights and interior lighting systems.

American Telephone and Telegraph Company, Inc., New York,



PRATT & WHITNEY ENGINES

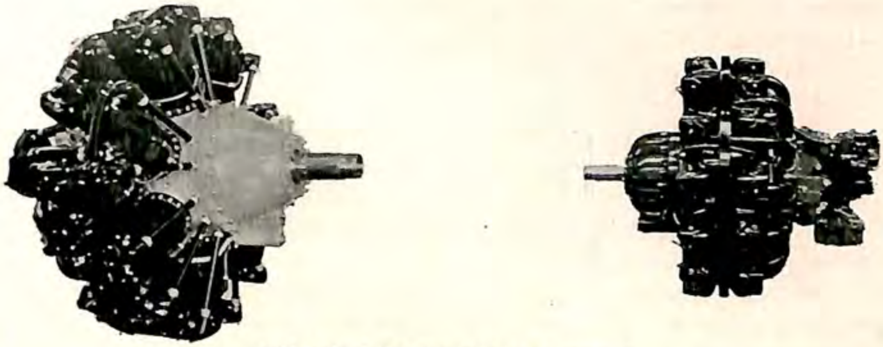
Series D Hornet, 625-700 horsepower (upper left); Wasp Junior, 320-420 horsepower (upper right); Series D Hornet, Geared, 650-700 horsepower (left center); Series D. Wasp, 500-550 horsepower (right center); Series E Hornet, Geared, 675-750 horsepower (lower left); Series H Wasp, Geared, 500-550 horsepower (lower right).

continued to supply the Government and air transport industry with teletypewriter circuits. More than 25,000 miles of the Bell system wires were in use by the Bureau of Air Commerce for dissemination of weather information.

Bendix Products Corporation, South Bend, Ind., produced the dual brake wheels which became standard equipment on the Douglas transport planes, and made a number of detail improvements in other types manufactured by Bendix. At the beginning of 1935 it had available a full line of hydraulic brakes for all wheels produced by the company, together with master cylinders and parking locks. The new pilot seat designed in 1933 was placed in production in 1934, conforming to the latest Army and Navy standards requiring difficult strength tests. The seat, weighing less than seven pounds and constructed of electric spot welded high grade aluminum alloy sheet, placed it among the unique developments of the year. Bendix oleo pneumatic struts were continued in production for a number of commercial and military planes, particularly the heavier transport class. The design of the struts was individual to each airplane model, thus there were many variations, including the use of internal submerged splines. One of the most important developments was the increasing use of magnesium for wheels on land planes, although it had not reached a practical state of development to warrant use on amphibions. The dual brake wheels were produced in magnesium for a number of transports but aluminum was still used for wheels equipping planes in tropical or seacoast service.

Berry Brothers, Inc., Detroit, Mich., in 1934 conducted considerable development work in the perfection of dopes to eliminate blushing, and it was found possible to produce dopes with far greater blush resistance and longer life than was believed possible a few years ago, yet at no increase in cost. In the pigmented dope line various pigments were perfected, enabling Berry Brothers to produce colored dopes that would retain color and lustre without fading or chalking. A new zinc chromate primer for all types of metal surfaces was developed, filling the exposure and non-corrosion requirements of naval aircraft. New types of flexible synthetic aircraft lacquers were developed and were under severe service tests at the bginning of 1935. Large quantities of aircraft finishes were supplied to governments in Europe, Asia and South America.

The B. G. Corporation, New York, continued to produce its B. G. mica insulated spark plugs in increasing quantities, owing to growth of American aeronautical export trade and new motor equipment on military and commercial aircraft. B. G. plugs were used in all sizes and types of aviation engines, both air and water-cooled, and ranging



PRATT & WHITNEY ENGINES

Series A Twin Wasp, 750-800 horsepower (left); Twin Wasp Junior Series A, 650-700 horsepower (right).

in power from the small two-cylinder sport engines to the largest and most powerful multi-cylinder engines used for commercial, military and racing airplanes. Of marked interest was the great increase in the use of radio shielded spark plugs. Formerly, when radio equipment was installed in an airplane, the spark plugs were enclosed in metallic shields, but the new practice was to use self-shielded spark plugs in which the shielding was an integral part of the plug, as was the case with the B. G. Hornet Model 4B-2-S. New B. G. equipment for heat-treating, testing and material processing contributed to make the latest model Hornet plugs give remarkable service results.

Breeze Corporations, Newark, N. J., supplied its 11-year-old market with flexible metal air hose, shielded ignition systems, aeroflex fuel and oil lines, fittings and aircraft navigation and running lights.

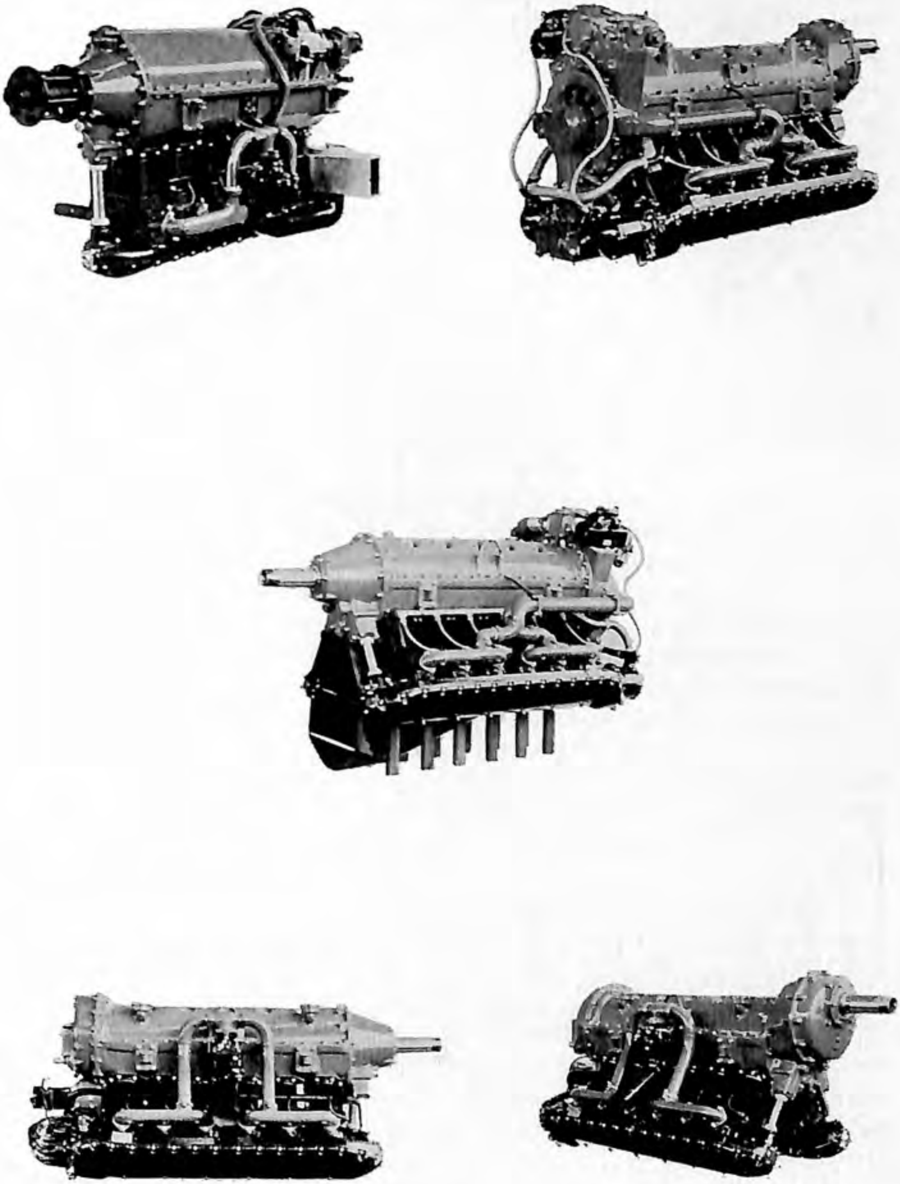
Brewster Aeronautical Corporation, Long Island City, N. Y., produced a complete line of aircraft accessories and equipment, including exhaust collectors, hot spots, cylinder head deflectors, engine cowling, fire-walls, pilot's seats, radio tables, ammunition boxes, flotation gear, fuel and oil tanks, complete water type landing gear, metal tail surfaces and metal wing cellules.

Champion Spark Plug Company, Toledo, O., produced the Champion Aero M-3 mica aircraft spark plug, suitable for use in all normal type aircraft engines. This plug performed satisfactorily wherever it was used, and a considerable market for it was built up during 1934. Champion continued to produce a lower priced line of specially designed ceramic aircraft spark plugs, including radio shielded types.

The Cleveland Pneumatic Tool Co., Cleveland, O., developed the principle of its Aerol Strut so that in landing the impact was taken by the strut on oil immediately upon reaching the ground, then in taxiing the impacts were taken on the air. The company developed a cantilever shock absorber for large planes, such as the Lockheed, Consolidated and Kreider-Reisner amphibion. The pneumatic type Aerol strut was used on the Lockheed Orion, and Kingsford-Smith's Lockheed was equipped with it on his transpacific flight. The company also developed a pneumatic B type riveter for dural rivets an eighth of an inch in size for airplane fabrication, and a pneumatic drill with right angle attachment of one-fourth inch for special use in construction.

Curtiss Aeroplane & Motor Company, Buffalo, N. Y., a division of the Curtiss-Wright Corporation, during 1934 delivered Curtiss electric controllable pitch propellers for airplanes operating in the United States, South America and China. At the beginning of 1935, 50 large three-blade geared engine propellers were on order for delivery to the U. S. Navy. The testing laboratory was constructed for service testing of various sizes of controllable pitch propellers on actual engines. Development in the actuating controls of the propeller permitted automatic operation for constant engine speeds and constant manifold pressure. Or the pilot might manually adjust the pitch indicator to a desired setting, and the propeller would automatically assume the indicated pitch. The Curtiss electric controllable pitch propeller could be feathered for improved flight on multi-engine airplanes in case one engine was out of operation. Negative pitch was also possible, lending assistance for maneuvering seaplanes while on the water. Production was also continued on the Curtiss anti-drag ring.

Eclipse Aviation Corporation, East Orange, N. J., a division of Bendix Aviation Corporation, in 1934 introduced the Eclipse automatic variable pitch propeller hub in which the pitch angle of the blades was varied automatically, without external control, so as to fulfill the requirements of all flight conditions. The No. 20 A. E. size hub received an approval certificate, and the company was working on larger sizes of similar design. The Eclipse external energizer, an auxiliary portable cranking device for the Eclipse inertia type starters, became standard airport equipment. The Eclipse vacuum instrument pump and Eclipse de-icer, the latter developed in cooperation with the B. F. Goodrich Company, were produced and sold in greater volume during the year. The Eclipse portable gasoline engine as an auxiliary power supply for aircraft was developed. It was a two-cycle engine operated independently of the main power plant and therefore available for generating equipment of other power driven devices in an emergency. It also permitted driving certain accessories without at any time depending on the main plant. The company reported con-



RANGER ENGINES

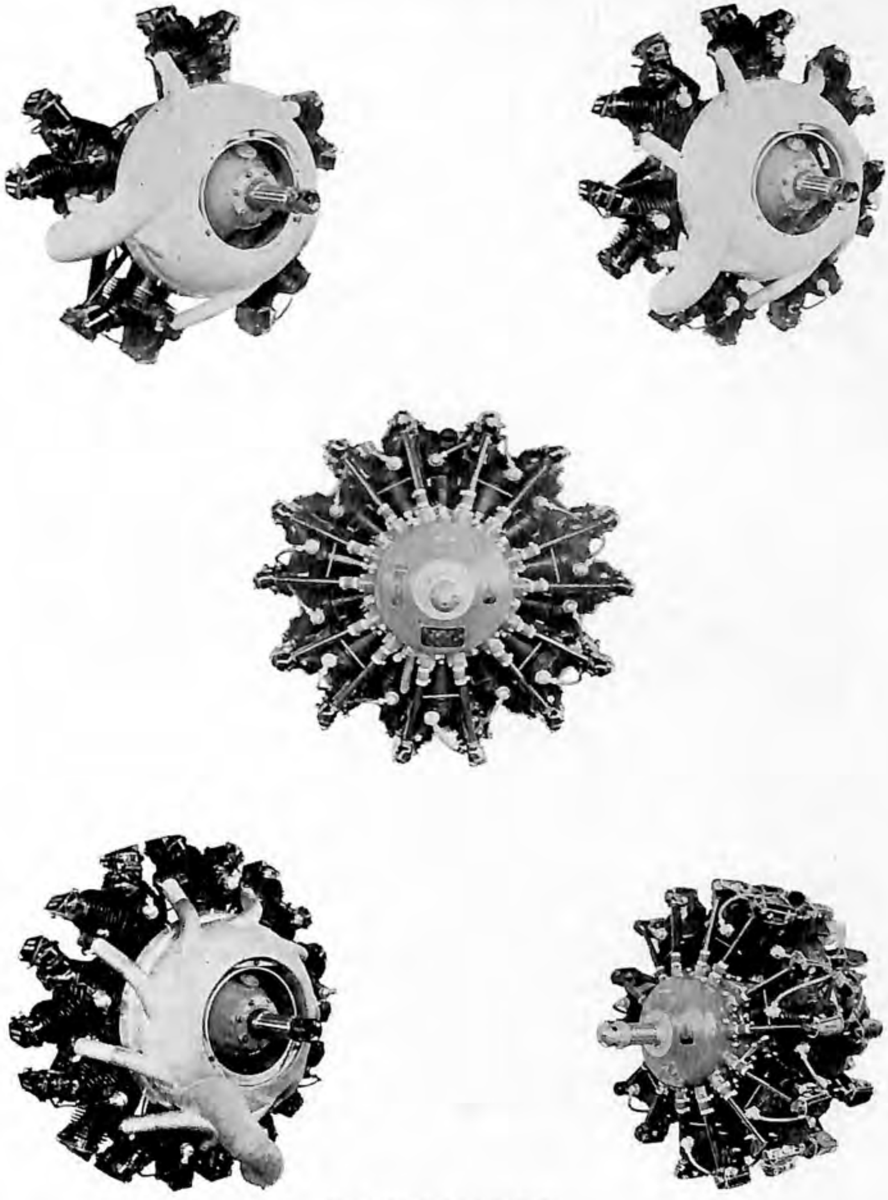
Model 6-390, 120 horsepower (upper left); Model V-770-SG, 420 horsepower (upper right); Model V-770-S, 350 horsepower (center); Model V-770, 300 horsepower (lower left); Model V-770-G, 325 horsepower (lower right).

siderable progress in development of alternating current equipment, with apparent saving in weight and simplicity of electrical power supply installations. Eclipse appointed foreign sales representatives in Europe, South America and Asia. The adoption of starting and generating units as standard equipment on small planes for sportsmen and private pilots, caused by the buyer's demand for such auxiliaries, combined with orders from the Army, Navy and air transport lines, produced an encouraging volume of business which showed much promise at the beginning of 1935.

Edo Aircraft Corporation, College Point, Long Island, N. Y., produced its line of Edo floats embodying numerous improvements, particularly streamlining high speed models, among which the 39-4000 Edo floats were the latest design introduced at the beginning of 1935. Thirteen different types of planes were flight-tested for the first time in 1934 as seaplanes on Edo floats. They included the Bellanca bomber, Curtiss-Wright Condor and Travel Air, General Aviation GA-43, National Security Airster, the Northrop Gamma, the Martin bomber, Stinson SR-5A, Taylor Cub, three Waco cabin planes and the new Waco WHD high speed convertible military and sport plane. Edo also made further refinements in its automatic retractable water rudders, and designed and built four new type floats which were added to the standard models. With exception of wings and shaft drive Edo built the Curtiss-Wright amphibion Commuter to the designs of Frank T. Courtney. Edo floats were built by licensees in Canada. Aeronca C-3 seaplanes were equipped with Edo floats and proved popular. Edo carried on an educational campaign to develop water flying facilities at waterfront cities. Edo-type seaplane bases, including turntable ramps and floats, were constructed at three points in New York City.

The Egyptian Lacquer Manufacturing Company, New York, continued to supply to the aircraft industry its line of clear and pigmented dopes, solvents, thinners, lacquer enamels, undercoats and other finishes for fabric, metal and wood parts, including special grades made to Government and other specifications. Continuous research developed in 1934 new and improved synthetic and pyroxylin base materials marking a distinct forward step in aircraft finishes, with the result that the demand for those materials was increasing at the beginning of 1935.

Fairchild Aerial Camera Corporation, Woodside, Long Island, N. Y., a division of Fairchild Aviation Corporation, continued production on its current models of aerial cameras, including the five-lens T-3A, introduced a new model of the CG-16 camera machine gun for training in aerial machine gunnery, and brought out the Cyclops



WRIGHT ENGINES

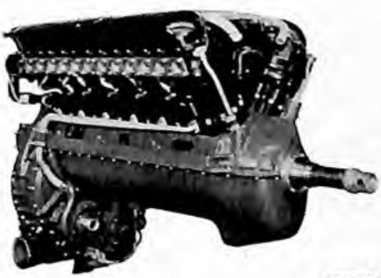
Whirlwind, 175 horsepower (upper left); Whirlwind, 250-280 horsepower (upper right); Geared 14-cylinder Whirlwind, 715 horsepower (center); Whirlwind, 330-365-420-440 horsepower (lower left); Direct Drive 14-cylinder Whirlwind, 700 horsepower (lower right).

camera for the use of aerial service operators and private pilots. A single assembly of photographs taken with the T-3A from an altitude of 20,000 feet covered 266 square miles. The CG-16 was adopted for military use. Fairchild also brought out a practical portable developing set for aerial camera film. A standard Fairchild K-3B automatic camera for vertical and oblique photography was supplied with special fittings for installation in the unique news-gathering Lockheed placed in commission by the Detroit News. In 1934, the Fairchild company took over exclusive manufacturing rights of the Kruesi radio compass, used extensively by the Army Air Corps. It began the manufacture of a large number of these instruments for the Army and made the device available to the commercial market for the first time. A number of refinements over the Army E-4 model were embodied in the commercial instrument to make it specially adapted to the requirements of civil aviation. The Kruesi compass was a key unit in the Army's blind landing system. It was a direction finder on the "homing" principle, a position finder in the air and on the ground, and could be used to make safe approaches to the airport in bad weather even without the aid of special ground signalling.

General Electric Company, Inc., Schenectady, N. Y.. continued its development program on superchargers, its test set-up measuring the power required and the exact amount of pressure rise obtained from a gear-driven supercharger at various engine speeds. Development was also continued on different types of two-stage superchargers for high altitude operation.

General Tire & Rubber Company, Akron, O., carried a full line of its patented General Streamline Airplane tires, designed to reduce parasitic drag and increase stability and the shock-absorbing qualities of the landing gear. The tire was produced in sizes of from eight to 18 inches for tail wheels and from 21 to 50 inches for landing wheels. The company used a Lockheed Vega plane in charge of its sales manager, Ray Brown, flying on numerous sales campaigns in 1934.

The B. F. Goodrich Company, Akron, O., through its aeronautics division, at the beginning of 1935 had improved designs of its transport airplane tires and developed new uses for rubber in aircraft manufacture. The new tire sizes incorporated the advantages of low pressure types. The engineers were concentrating on the possibility of eventual use of dual wheels and brakes on larger planes, necessitating special tire construction. They also developed greater dependability in tires, required by more rapid taxiing on the surface which exacts much greater service from both tires and brakes. Goodrich de-icers were adopted by the Army Air Corps and a number of air lines. Abrasion shoes, protecting wings and tail surfaces from rain



WRIGHT ENGINES

Geared F Cyclone, 750 horsepower (upper left); Direct Drive Cyclone F, 770 horsepower (upper right); Curtiss Super-Conqueror V-1570, 705 horsepower (lower left); Curtiss Direct Drive Conqueror, 650 horsepower (lower right).

during flight, were adopted as standard equipment by manufacturers of high speed planes. In 1934 Goodrich brought out a special valve for pneumatic tires used on beaching gear, permitting water to be used in the tires to assist in submersion of the heavier types of gear. A new type of soundproofed, light-weight ventilation hose for aircraft cabins was produced. Wiley Post's famous stratosphere suit was developed by Goodrich engineers in the company's laboratories. Goodrich tires and other aircraft products were being sold in increasing quantities abroad with the development of the foreign field for American airplane sales.

Goodyear Tire & Rubber Company, Akron, O., produced its hydraulic brake constructed on the multiple disc principle, and found growing markets, both domestic and foreign, for its line of Airwheel full balloon, low pressure tires. Retractable landing gears on large transport planes, pulling the wheels inside the wings in flight removed the once objectionable feature about large size tires, and the Airwheel was becoming increasingly popular because of its landing qualities on soft fields.

Gulf Refining Company, Inc., Pittsburgh, Pa., developed a growing market for its aviation gasoline and lubricants, and through its aviation department carried on a number of important projects in cooperation with various branches of the aviation industry.

Hamilton Standard Propeller Company, East Hartford, Conn., a subsidiary of United Aircraft Corporation, was awarded the Collier Trophy in 1934 for the "greatest achievement in aviation in America, the value of which has been thoroughly demonstrated by actual use during the preceding year." In making the award the National Aeronautic Association rendered this citation: "To the Hamilton Standard Propeller Company, with particular credit to Frank Walker Caldwell, chief engineer, for the development and demonstration of a controllable pitch propeller now in general use." Commenting on the remarkable showing made by the American Douglas and Boeing transports winning second and third place respectively in the MacRobertson London-Melbourne race the European technical press gave credit to the Hamilton Standard controllable pitch propeller as being a vital part of the machine which, with airplane design and engine efficiency, made American aircraft superior to all others. At the beginning of 1935 the U. S. Navy had received more than a thousand of the company's hydraulic type controllable pitch propellers. They were standard equipment on new production transports, six American air lines using them as well as lines in South America, China, Japan, Germany, France, Poland, Netherlands, Switzerland, Italy and Spain. An Air Corps squadron of F4B-4 fighters completed a full year of service with this propeller. United Air Lines alone had given it 200,000 hours of service. Licensees were manufacturing the model in England, France and Japan. In November, 1934, the company demonstrated for the first time publicly its latest development, a constant speed propeller, adding only four or five pounds more weight to the older type. The original Hamilton Standard controllable pitch propeller was limited to two pitch positions, a low-pitch position for take-off and climb, and a high-pitch position for cruising or high speed. In the "constant speed" propeller the early limitation to two positions was completely removed, and the propeller developed to the point where an infinite number of pitch positions were available; the optimum position being automatically selected for the pilot of all flight conditions. This automatic selection of blade pitch was of the utmost importance because continuous selecting of the optimum pitch setting by manual control would demand so much of the pilot's attention that it would be impracticable. From another point of view, the "constant speed" control acted as a governor, holding the engine revolutions to whatever operating speed the pilot might select, irrespective of load variations. Any tendency of the engine to either increase or decrease its speed, because of such load variations, was immediately counteracted by the automatic changing of the blade pitch in the direction necessary to bring the engine speed back to the selected operating speed. The constant speed control unit could be added to any two-pitch Hamilton Standard propeller in service.

The Stewart Hartshorn Company, Inc., New York, continued to supply the industry with streamline wire tie rods for external bracings manufactured by the cold reverse rolling method, the wires being drawn and cold-rolled from electric furnace carbon rod, special heat-treating processes creating high tensile strength.

Hurley-Townsend Corporation, New York, continued to produce its copper-cooled spark plugs in increased quantities, receiving a number of contracts from the air lines and Army Air Corps. In addition to the regular copper-cooled 300 type plug for high compression engines and type 437 for lower compression motors, the company also produced those two types equipped with the special H-T radio shield. Special models were also developed for extremely high b.m.e.p. motors. A special type of harness of less weight and not requiring removal of valve push rods to remove the harness ring was developed for the Pan American Airways clipper ships. H-T plugs were approved abroad by nearly all the leading engine manufacturers in Europe. Turner and Pangborn flying their Wasp-powered Boeing 247-D to third place in the London-Melbourne race used H-T plugs which they never changed.

International Flare-Signal Company, Tippecanoe City, O., continued to market its complete line of parachute flares, each type approved by the Department of Commerce.

Irving Air Chute Company, Inc., Buffalo, N. Y., during 1934 developed the Irvin Chair Chute, designed to provide occupants of cabin airplanes with full parachute protection. Owners of several private planes, including the Stinson and Waco types, had installed the chair chutes at the beginning of 1935. The company also manufactured a complete line of standard parachutes for the domestic and foreign trade.

Kendall Refining Company, Inc., Bradford, Pa., continued to supply the air line and private flying trade with its line of lubricants, specializing in its Kendall 30-Hour oil.

Kollsman Instrument Company, Inc., Brooklyn, New York, in 1934 expanded plant facilities and increased personnel to take care of domestic and foreign orders for Kollsman aircraft instruments. At the beginning of 1935 the company had brought out a number of new products, including a vertical speed indicator having extremely low lag, three new compasses with improved cylindrical lenses eliminating glare and reflection and equipped with Kollsman poly-plane compensators, a manifold gauge automatically computing manifold pressure and carburetor intake temperature, a sensitive manifold pressure gauge, a sensitive tachometer and a sensitive air speed indicator, all equipped with two pointers for correct reading and an engine unit gauge indicating temperature and oil pressure in a single standard size case. Kollsman also producing a lighting system with a self-contained light with each instrument, the light coming from a small electric bulb mounted in the center of the dial glass and providing uniform illumination of the entire instrument. The Kollsman sensitive altimeter was adopted as standard equipment on all Army and Navy planes and all commercial transports.

Leece-Neville Company, Cleveland, O., supplied the industry with three sizes of 12-volt, voltage-regulated engine-driven generators and three sizes of two-voltage generators to supply a high voltage for aircraft radio, at the same time making available the normal voltage types.

Lycoming Manufacturing Company, Williamsport, Pa., a division of the Cord Corporation, was the sole licensee for the manufacture and sale of the Lycoming-Smith controllable propeller, designed to permit aircraft engines to develop rated power for all flight conditions, at most efficient blade angles and for readjustment to particular power and atmospheric conditions at any altitude. The Lycoming-Smith propeller was produced in ten models, five 2-blades and five 3-blades, in diameter sizes ranging from eight feet six inches to 13 feet, covering a complete range of direct and geared engine sizes from 200 to 800 h.p. The change in blade angle was accomplished mechanically from engine power. The blades were turned about their longitudinal axis through a series of gears operated by the rotation of the propeller shaft. To change the blade angle the propeller gears were engaged or disengaged by means of a manual control or by an electrical solenoid control. A blade pitch indicator, showing constantly the exact blade angle at which the propeller is operating, was available as special equipment with the electric solenoid control.

Macwhyte Company, Kenosha, Wis., produced a line of streamline sections, showing improvements over the older oval or lenticular sections. Stainless steel rods with better corrosion resisting properties were produced during the year.

Norma-Hoffman Bearings Corporation, Stamford, Conn., pro-

LYCOMING-SMITH CONTROLLABLE PROPELLER

The blade pitch angle is changed mechanically with power supplied by the engine through a series of gears operated by rotation of the propeller shaft.

duced a number of new types of bearings for application to engines, instruments, controls, radio equipment and other aircraft auxiliaries, based on the experience of this company in that work since aviation became an industry. The bearings were built to specifications as required in the particular equipment for which they were needed.

Pacific Aeromotive Corporation, Ltd., Burbank, Calif., continued to supply the market with parts and special apparatus.

Parker Appliance Company, Cleveland, O., produced its special Parker aircraft piping equipment in brass and aluminum alloys. The connections were based on flanges on each of the tube ends to be joined. The flanges were wedged between the two parts of the pipe fitting screwed together.

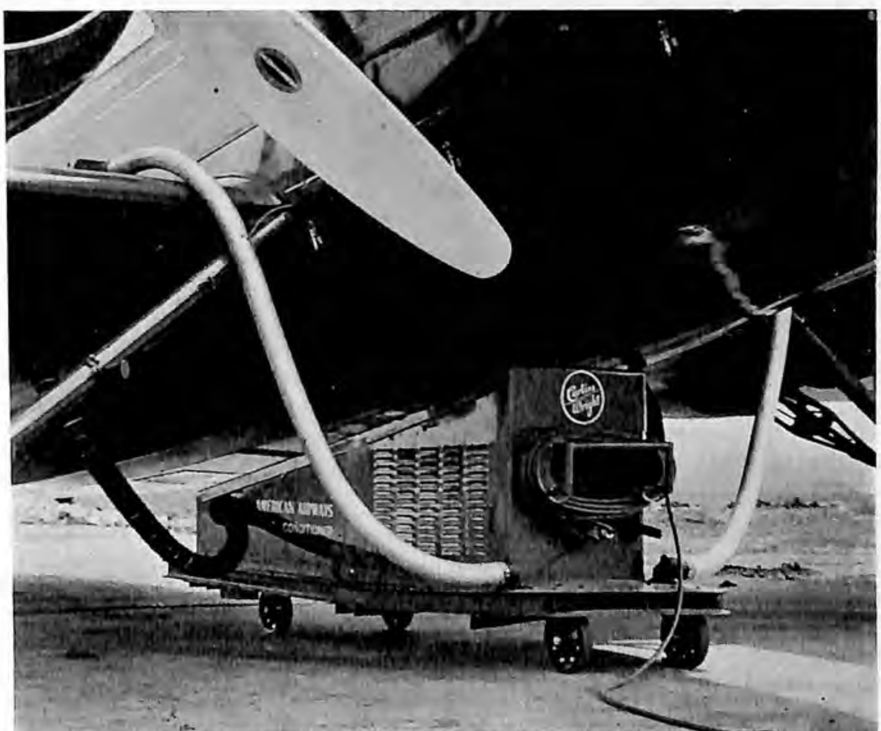
Pioneer Instrument Company, Inc., Brooklyn, New York, a subsidiary of Bendix Aviation Corporation, supplied its world-wide market with air distance recorders, air speed indicators, pitot and venturi tubes, altimeters, bank indicators, climb indicators, clocks, magnetic compasses, drift indicators, fuel gauges, supercharger gauges, tachometers and thermometers. Pioneer's 840 electric tachometer was introduced in 1934.

Pittsburgh Screw & Bolt Corporation, Pittsburgh, Pa., produced seven different designs of its Dicks hollow steel propeller blades as standard equipment for the Army and Navy, using both adjustable and the latest type of controllable pitch hubs. In diameter the designs ranged between seven feet nine inches for 200 h.p. engines to 13 feet for the 800 h.p. geared engines. All seven designs incorporated results of the latest Government research in resonant vibration frequencies in propeller blades. They were of the welded type, made of special electric furnace chrome vanadium steel and heat-treated after fabrication. During fabrication they were tested by the magnaflux method, which unfailingly reveals any serious defect in the steel or weld of a blade. Constructed of materials which resist corrosion and abrasion the Dick blades were adapted to the new hub designs, because bearing races might be located directly on the blade shank and the buttress threads carrying the centrifugal loads could be cut directly on the shank. At the beginning of 1935, they were being used by the Army, Navy and air lines.

The Pyle-National Company, Chicago, continued to supply the industry with airport and aircraft lighting apparatus, which was standard equipment on several air lines.

RCA Manufacturing Company, Inc., Camden, N. J., a subsidiary of Radio Corporation of America, through its division, RCA Victor, supplied its complete airport radio traffic control apparatus to a number of leading fields in 1934, notably Shushan Airport, New Orleans; Allegheny County Airport at Pittsburgh, Pa.; duPont Airport at Wilmington, Del., and Detroit City Airport. RCA Victor introduced its AVR-1 airport receiver, AVR-2 aircraft radio beacon receiver, AVR-3 aircraft communication receiver, AVR-5 airport receiver, AVR-5A general purpose receiver, and AVT-1 airport traffic control transmitter. Introduction of those models caused a general reduction in price levels on all aviation radio equipment. Models AVR-1, AVR-5, and AVR-5A airport receivers provided for the first time self-contained AC operated radio receivers suitable to home, office or airport use for reception of long-wave airways weather service, all short-wave services, including all aviation communication channels, and the regular entertainment stations. Model AVR-2 aircraft radio beacon receiver provided a very light, but rugged and reliable, complete aircraft receiver for remote or local control installation receiving all airways weather and radio beacon stations. Model

AVR-3 aircraft communication receiver provided a companion receiver to the AVR-2 but covered the high frequency bands used by aviation communication services. Model AVT-1 airport traffic control transmitter was a rugged, small and self-contained AC operated transmitter providing 15 watts of telephonic output on airport traffic control frequencies, crystal controlled. Its design was such as to offer maximum economies, for the speech amplifier portion of the transmitter could be used as a portion of a complete speech amplifier system for announcing traffic movement to passengers. An accessory to that equipment, a runway localizer kit, provided the additional materials required for a miniature radio beacon. Thus, from one simple traffic control transmitter, it was possible to develop radio traffic control, speech amplifier apparatus and a runway localizer, the additions being possible with no obsolescence of first-purchased equipment. Three new types of airport communication transmitters, a new



AIR-CONDITIONING A SLEEPER PLANE

An American Airlines Condor being air-conditioned with Curtiss-Wright equipment as the passengers retire before departure.

airport communication receiver, an aircraft transmitter and several new aircraft receivers were to be announced early in 1935. Efforts were directed toward development of more rugged and simple apparatus as well as reduction of cost, to permit more widespread adoption of the many radio applications to aviation. Private flying and aerial service operators provided an expanding sales outlet, as did the domestic air lines and foreign markets generally.

Richfield Oil Company of California, Los Angeles, Calif., continued to produce its special aviation fuels and install its field refueling stations at the airports in its territory. Richfield maintained an aviation department working in close cooperation with the industry. At the beginning of 1935 the company had been flying its own fleet of sales and executive planes for six years, during which time they accomplished a million miles of flying without the slightest injury to pilots or passengers.

John A. Roebling's Sons Company, Trenton, N. J., continued to supply the industry with special control cables, welding wire and other wire rope accessories.

Scintilla Magneto Company, Inc., Sidney, N. Y., a subsidiary of Bendix Aviation Corporation, developed and placed in production a new line of aircraft battery ignition, incorporating Scintilla pivotless contact breakers, a new type of automatic advance, complete radio shielding and the use of ball bearings throughout, requiring no relubrication in service. The units were supplied for all forms of engine installation, including individual timer mounting and magneto replacement mounting, either single or dual, for engines designed for magneto ignition. Dual installation permitted two timers to be mounted on one magneto bracket, leaving the second bracket free for mounting the generator. All units were inherently radio shielded, and were regularly supplied for individually shielded cable, and also were available for other types of harness if desired. A special feature of the radio shielded battery ignition switch provided for separate cables from both the generator and the battery. A new line of 14-cylinder magnetos was placed in production in 1934, embodying advanced features designed to anticipate future engine development. Outstanding features were their high speed pivotless breakers, moisture-proof coils and distributor gears enclosed in a separate grease-filled compartment. A new type Scintilla double-magneto, with characteristics paralleling those of the 14-cylinder line, was developed and put into production, as was a new series of shielded ignition switches and selector switches.

Shell Petroleum Corporation, St. Louis, Mo., the Shell Oil Company in the west and Shell Eastern Petroleum Products, Inc., New York, in 1934 marketed three grades of aviation gasoline, including

NEW SCINTILLA MAGNETO

It incorporates a new type of automatic advance, complete radio shielding and ball bearings throughout, requiring no relubrication in service.

Shell aviation gasoline, unleaded, 73 octane; Shell ethyl aviation gasoline, 80 octane; and Shell ethyl aviation gasoline, 87 octane. Shell aircraft oil was available for rocker arm and push rod lubrication. Each of the Shell companies maintained separate aviation departments for the purpose of cooperating with the industry to meet specific conditions. Shell maintained a fleet of seven airplanes which were used in making sales, transport of executive personnel and for actual service testing of Shell aviation products under actual flight conditions. To meet the demand for higher quality gasolines Shell developed and distributed a new unleaded, white 73 octane aviation gasoline for conventional engines. The improved Shell 80 and 87 octane gasolines contained smaller quantities of tetraethyl lead. The Shell products were available at nearly all important airports at the beginning of 1935, many resellers having been added during the last year. Shell reported increasing sales to the Air Corps and many air lines. As in the past, many of the important record flights of 1934 were made with Shell aviation gasolines.

Sinclair Refining Company, New York, developed the Sinclair Hamilton Propeller Lubricant 228, to maintain a film at all times between the spider arm and the bushing inside the blades of Hamilton Standard controllable pitch propellers. Engineers of the Sinclair Bureau of Standards developed a special lubricant designed to eliminate difficulties in rocker arm lubrication, known as Sinclair Pennsylvania Gear Oil SAE 250. They also developed the Sinclair Pennsylvania Aircraft Motor Oil as an engine lubricant meeting the requirements of the new motors used in air transportation. Sinclair aircraft products were used by the U. S. Navy and leading air lines.

Socony-Vacuum Corporation, New York, marketed its products developed for aviation, including lubricants and a fuel refined especially for aircraft engines and possessing exclusive climatic control characteristics.

Solar Aircraft Company, Ltd., San Diego, Calif., continued manufacture of exhaust collector manifolds and other aircraft parts and accessories. The company had specialized for a number of years on the design and construction of stainless steel exhaust rings, and manufacturers throughout the country made use of the services offered. Among the prominent new ships built during 1934 for which the company supplied collector rings were the Douglas DC-2, Northrop Deltas and Gammas, Boeing 247-D, Lockheed Electra, Sikorsky S-42, Martin flying boats and many single experimental planes built for commercial or military use. While stainless steel was used on the bulk of the rings manufactured, remarkable success was attained with a special iron alloy. Experiments were conducted on the corrosion resistance of nickel-chromium alloy.

Sperry Gyroscope Company, Inc., Brooklyn, New York, at the beginning of 1935 reported ten of the world's major air lines using planes "Soundproofed by Sperry" and at the same time general worldwide use of the Sperry horizon, directional gyro and automatic pilot. Nearly all the long, record flights of 1934, including 12 entries in the MacRobertson race, were made in planes equipped with Sperry gyro instruments. The new type directional gyro incorporating the ball bank indicator was adapted for commercial use, and it was considered valuable in making exact turns properly banked, because the directional gyro indicated the turn in degrees while the ball of the bank indicator showed whether or not the plane was being banked correctly. Its use in blind flying was growing because it permitted exact turns in radio beam flying. The Sperry automatic pilot was produced as a double unit instead of the former single piece. The double unit was considered more convenient because it might be removed without difficulty and one unit function independently of the other. The automatic pilot was becoming standard equipment on air line fleets, such as those of TWA, Pan American Airways and the Royal Dutch Airlines. At the beginning of 1935 the Sperry company was conducting a school for instrument mechanics of air lines using the horizon, directional gyro and automatic pilot. Instruction was given in operating principles of instruments, construction details and maintenance, the complete course requiring a month. Sperry soundproofing, as demonstrated on Curtiss Condors, including the Condor sleepers, and Douglas transports, led to its adoption on the new Martin flying boats for Pan American Airways. The widespread interest in reducing the noise in airplane cabins warrants detailed description of the Sperry method. Of prime importance was complete discontinuity between the power plant and the structure, achieved by using elastic fittings. Slow propeller tip speeds and location of propellers to give a good clearance between tips and cabin were other features of the soundproofing. Avoiding, where possible, passing the wing spars through the cabin, or in any event, covering them with acoustical materials to prevent sound radiation, the proper bracing of bulkheads in the cabins and the most cautious methods of attaching all equipment in the cabin were among the first rules of soundproofing. Felts, paper pulps, sheeted kapok, light fibre boards, snythetic fibres and other materials entered into the trim and lining of the cabin, their use depending on exact analysis of

THE CURTISS FALCON

A two-place observation plane powered by a Wright Cyclone engine.

the noise frequency which they were designed to eliminate. Doors and windows must be air-tight, the ventilating and heating system adequate and at the same time excluding all disturbing sound waves. Acoustical filters and other devices were employed. In soundproofing the Douglas transport the noise level at 200 miles an hour speed was brought down to 70 decibels above one millibar, thereby causing a degree of quiet equal to that of the average surface vehicle, and representing the comfort level in any form of transportation. That was accomplished by Sperry engineers, in the case of the Douglas transports, at the expenditure of only 166 pounds weight in soundproofing materials and interior trim, or an average of less than 11 pounds a passenger in those 16-passenger planes.

Stanavo Specification Board Inc., New York, organized in 1929 by the Standard Oil Companies of California, Indiana, and New Jersey, carried on its active program toward improvement of fuels and lubricants for aviation use. The efforts of this group, one of the pioneers in the field of fuel research, accomplished much in developing and standardizing products which made possible refinements in engine design, resulting in greatly increased performance. The Board determined the specifications and conditions under which Stanavo products were manufactured, tested, and guaranteed; thus assuring uniformity, regardless of where they were sold. Among the activities aggressively sponsored by the Board, in addition to the development of its own purely commercial projects, was a campaign for the international standardization of a method for testing and classifying the knock-suppressing tendencies of various fuels. This, with other similar co-operative efforts, resulted in the adoption by the aviation industry of the C.F.R. motor method of determining anti-knock rating of fuels. Working with engine manufacturers in compiling the Stanavo Fuel Chart, classifying American and foreign aviation engines according to the grade of fuel required for most satisfactory operation, resulted in the engine manufacturers generally adopting the policy of specifying a fuel of minimum knock rating for the proper operation of their engines. The Stanavo Pilot's Handbook, a vest-pocket size booklet for pilots, including a complete chart of U. S. Government and commercial radio facilities, was distributed free to American pilots. As the trend in air transport throughout the world continued toward the more general use of high speed equipment, the availability of the special fuels and lubricants required for such operations became more and more important. The Stanavo Specification Board, foreseeing the inevitable need for a world-wide system of distribution, had been working steadily toward that end, and 1934 saw its plans achieving realization. The Stanavo group of distributors included, in the export market, the affiliated interests of the Standard and Vacuum groups throughout the world. It covered a vast network with service facilities established along the routes of all the principal air lines, its representatives at every important aviation center on earth prepared to arrange for service and supplies at any point, however remote. Only through a distributing system of such magnitude could the ambitious flights of the past few years have been realized. The requirements of such projects as the London-Melbourne race could be supplied only by an organization quipped for coordinative action international in scope. In the London-Melbourne race, for example, a special atlas was compiled and supplies to each entrant coming to Stanavo for supplies. It contained complete and detailed information on conditions along the entire route, together with photographs, maps and plans showing the location of airports and all other facilities. Extra pumps and equipment were installed and additional personnel engaged at the main refueling stops so that, even though a number of contesting planes arrived simultaneously, there would be no delay in servicing them for a scheduled departure. When arrangements were being made to lay down supplies for the squadron of 10 U. S. Army bombers which flew from Washington to Fairbanks, Alaska, and return in 1934, the strike of longshoremen on the Pacific Coast tied up shipping, and it was necessary to charter a special boat to ship supplies from Vancouver to meet the Air Corps requirements in Canada and Alaska on time. Stanavo products were used by Lieut. Agello in his record speed flight of 440 m.p.h., by Kingsford-Smith on his transpacific flight,

A JACOBS-POWERED BEECHCRAFT

Cruising at 152 m.p.h., with fuel range of 550 miles.

Scott and Black, winners of the London-Melbourne race, the Navy record flight to Hawaii, and in many other outstanding events of 1934.

Steel Products Engineering Company, Inc., Springfield, O., was among the active concerns supplying the aviation industry with special machinery, tools and aircraft parts.

Superior Tube Company, Norristown, Pa., manufactured a line of tubing for aircraft under the management of S. L. Gabel, a pioneer in that field and a special aircraft tubing consultant for leading manufacturing companies.

The Texas Company, New York, continued to supply the Government, industry and other users of aircraft with its full line of Texaco aviation fuels, including gasoline, marfak grease and airplane oils in grades suitable for every engine and type of service.

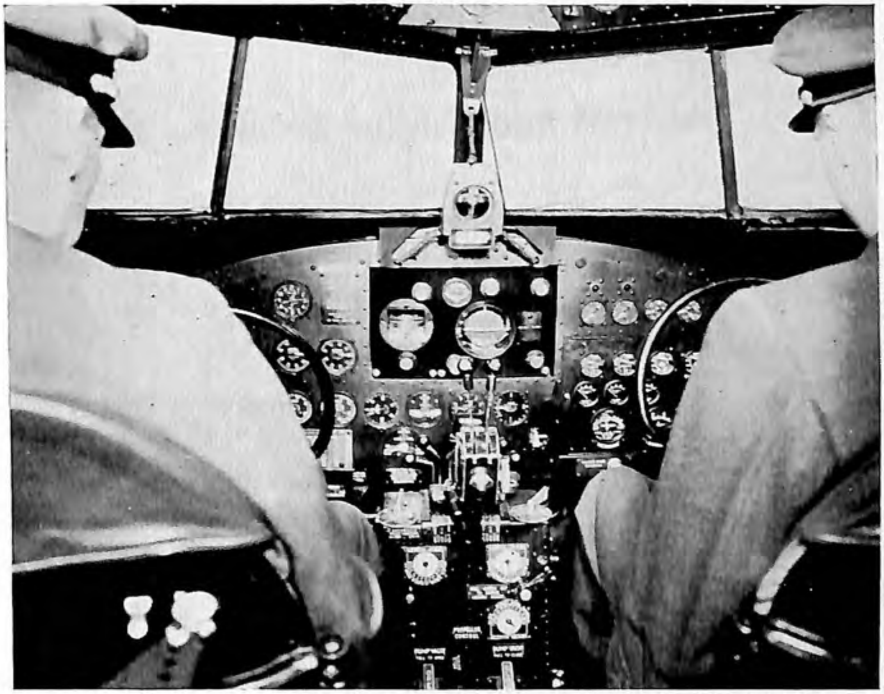
Thompson Products, Inc., Cleveland, O., produced for the aircraft engine trade valves of several types, including tungsten, cobalt-chrome and silchrome in both solid and hollow stem forms.

Thurston Cutting Corporation, New York, marketed its special line of Dartmouth Tex airplane fabric and other accessories.

The Vellumoid Company, Worcester, Mass., continued to market its special line of complete gasket assemblies for specific aircraft engines.

Western Electric Company, Inc., New York, produced aviation communication equipment which was standard on all major lines of the United States. At the beginning of 1935, Western Electric two-way radio was being flown 22,000 route miles daily and 110,000 plane miles every 24 hours. The Douglas transport planes were equipped at the factory with Western Electric radio systems. A new type of crystal, known as "AT" cut or substantially zero temperature crystal, was perfected by Bell Telephone Laboratories in 1934. It possessed the outstanding characteristic of retaining its precise frequency control regardless of all but extreme temperature changes, whereas in the past crystals in receivers and transmitters required constant temperature, and for that purpose were mounted in chambers thermostatically controlled to within one degree. With the new crystal, temperature regulation was needed only at zero or lower temperature. More than 800 new crystal units had been installed by air lines after June, 1934. Business houses operating their own planes developed a growing interest in radio, and two-way systems and beacon receivers were installed in 12 such planes. More than 60 complete sets were installed on American planes ordered by foreign buyers. At the beginning of 1935 Western Electric was receiving inquiries from prospective purchasers in every quarter of the globe. Anticipating the development of radio among private owners Western Electric planned to bring out early in 1935 a new type of radio equipment designed especially for the private pilot and his plane.

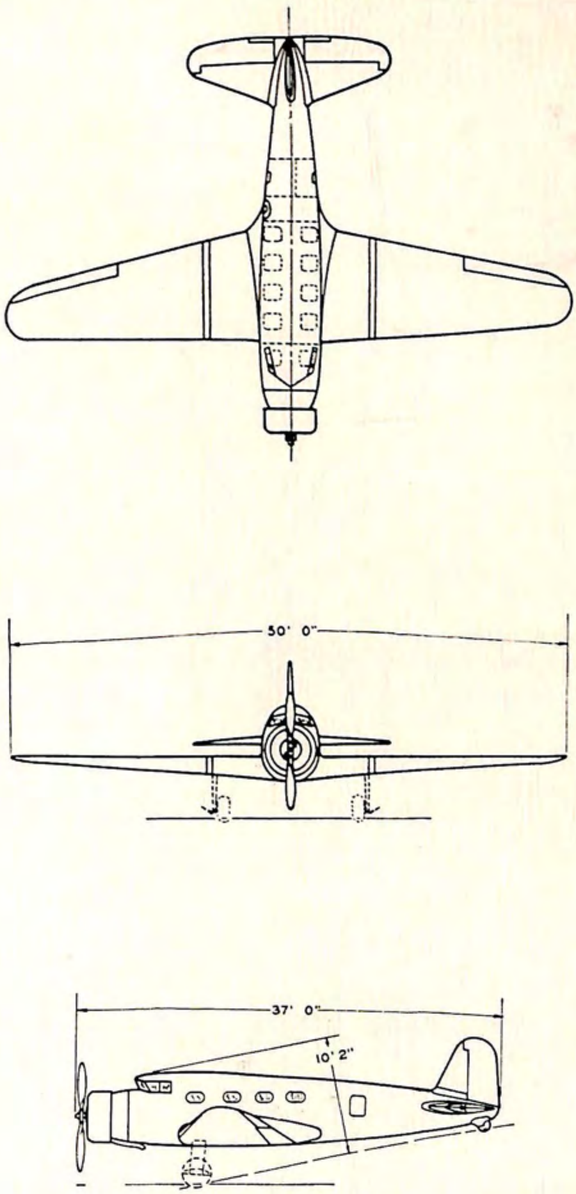
Westinghouse Electric & Manufacturing Company, Cleveland, O., produced a full line of equipment for airport lighting. Among its outstanding accomplishments of 1934 was the equipping of Shushan airport at New Orleans.



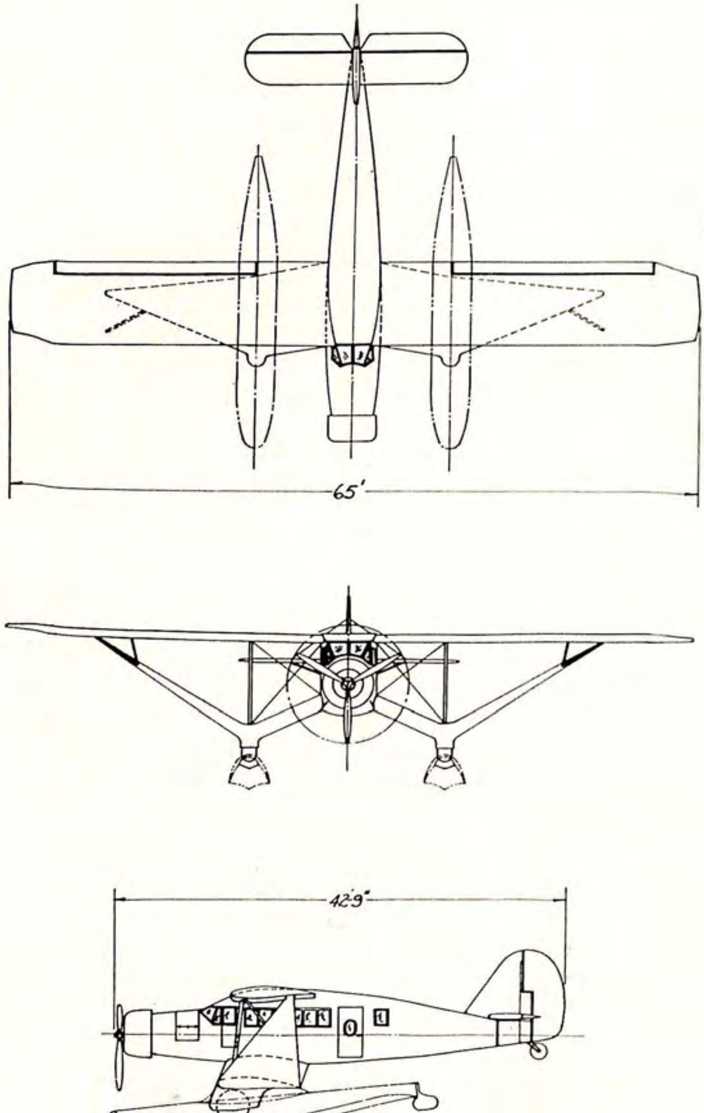
THE SPERRY PILOT

The cockpit of a TWA Douglas transport showing, center, the Sperry automatic gyroscopic control system which keeps a plane on its course and on a level keel at all times, leaving the pilots free to navigate and receive radio reports.

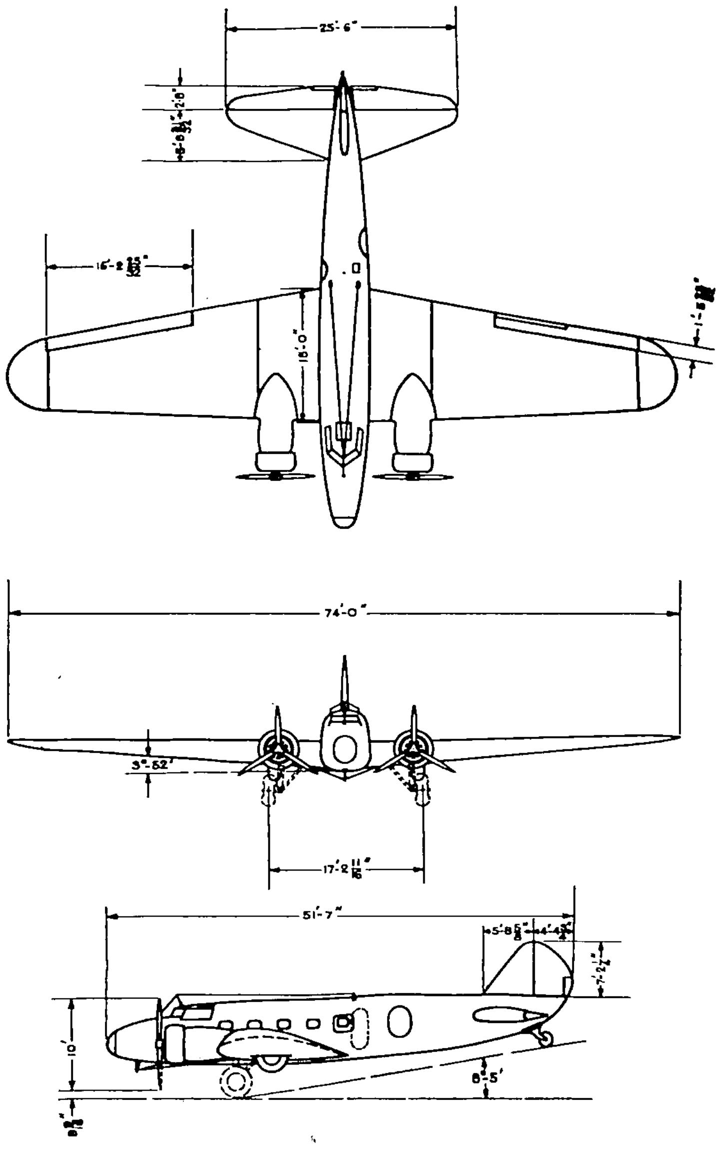
Aircraft and Engine Designs



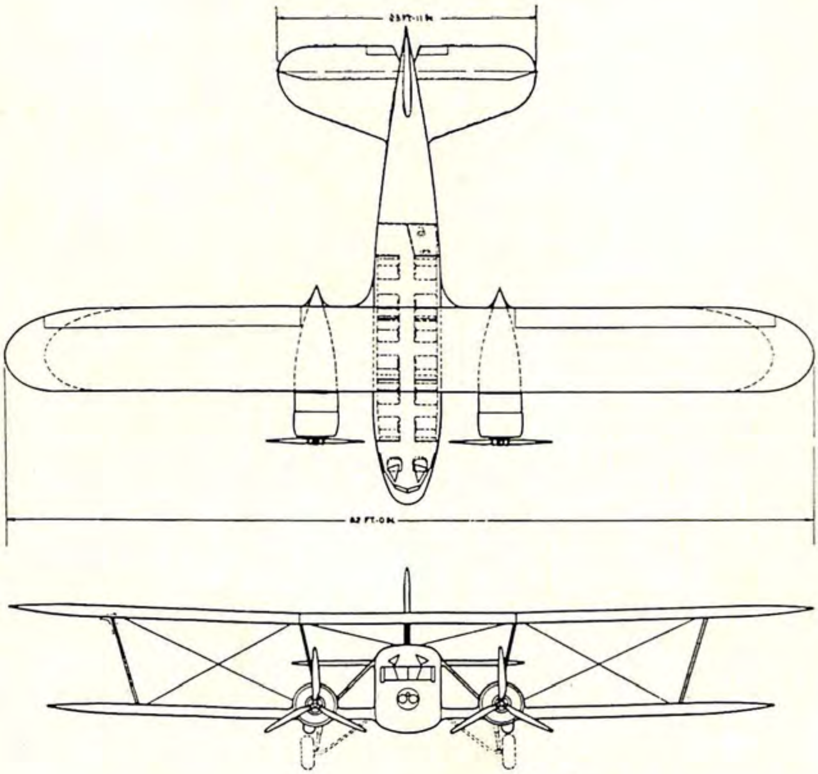
AIRPLANE DEVELOPMENT CORPORATION
Glendale, Calif.
MODEL V-1A —— 9-10 PLACE
ENGINE: WRIGHT CYCLONE



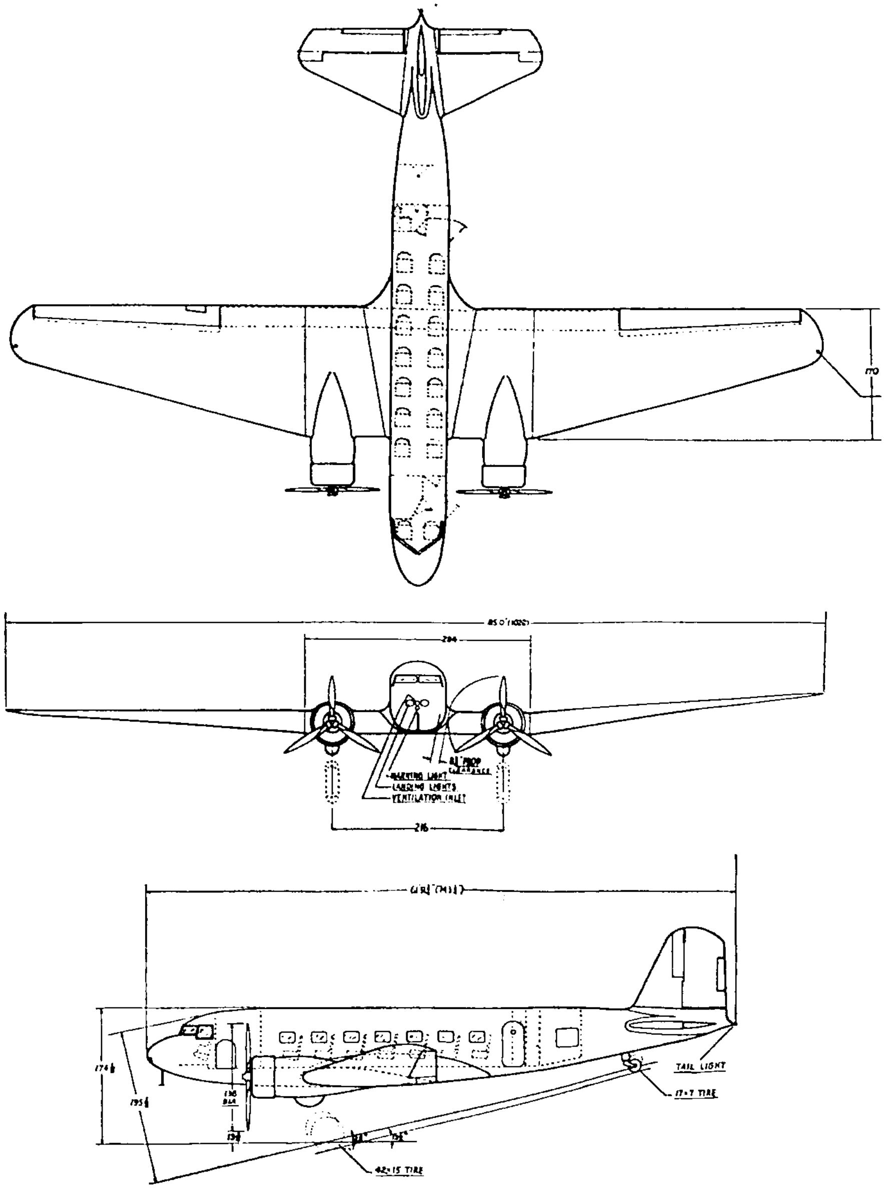
BELLANCA AIRCRAFT CORPORATION
Newcastle, Del.
AIRCRUISER TRANSPORT—LAND OR SEAPLANE —— 12-15 PLACE
AIRCRUISER—CARGO LANDPLANE
ENGINE: PRATT & WHITNEY HORNET
WRIGHT CYCLONE



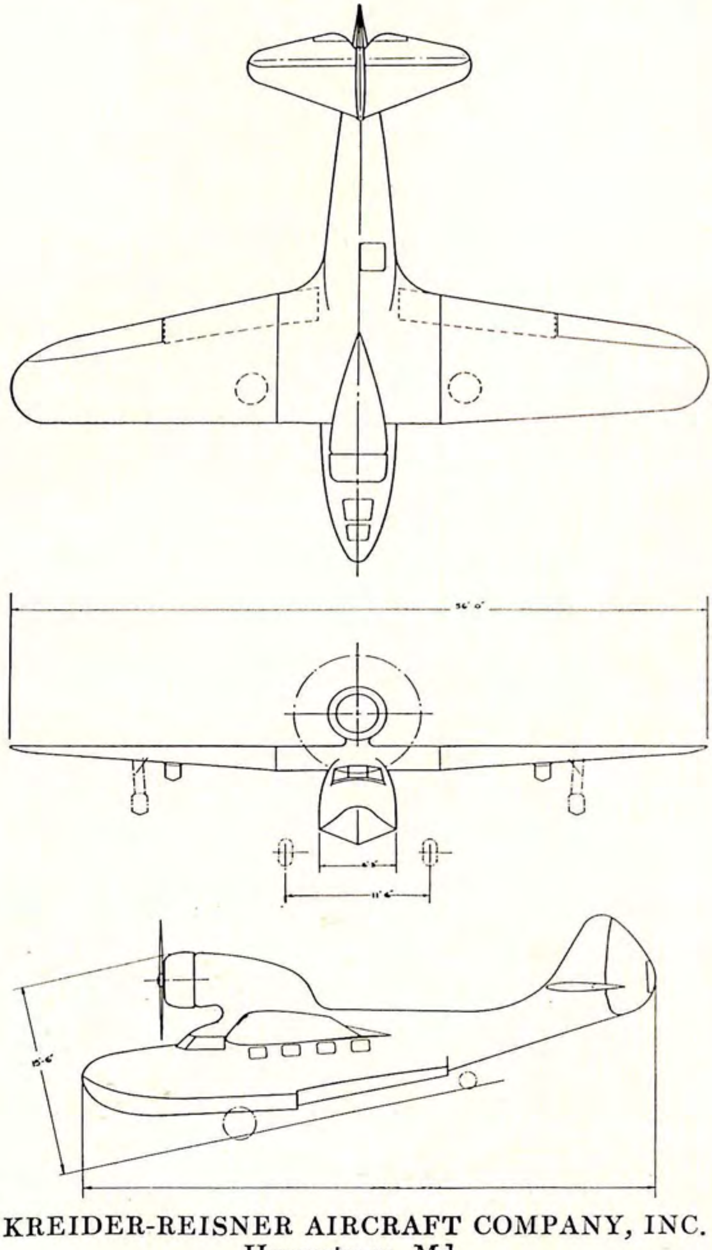
BOEING AIRCRAFT COMPANY
Seattle, Wash.
MODEL 247-D —— 12 PLACE
ENGINES: 2 PRATT & WHITNEY WASPS



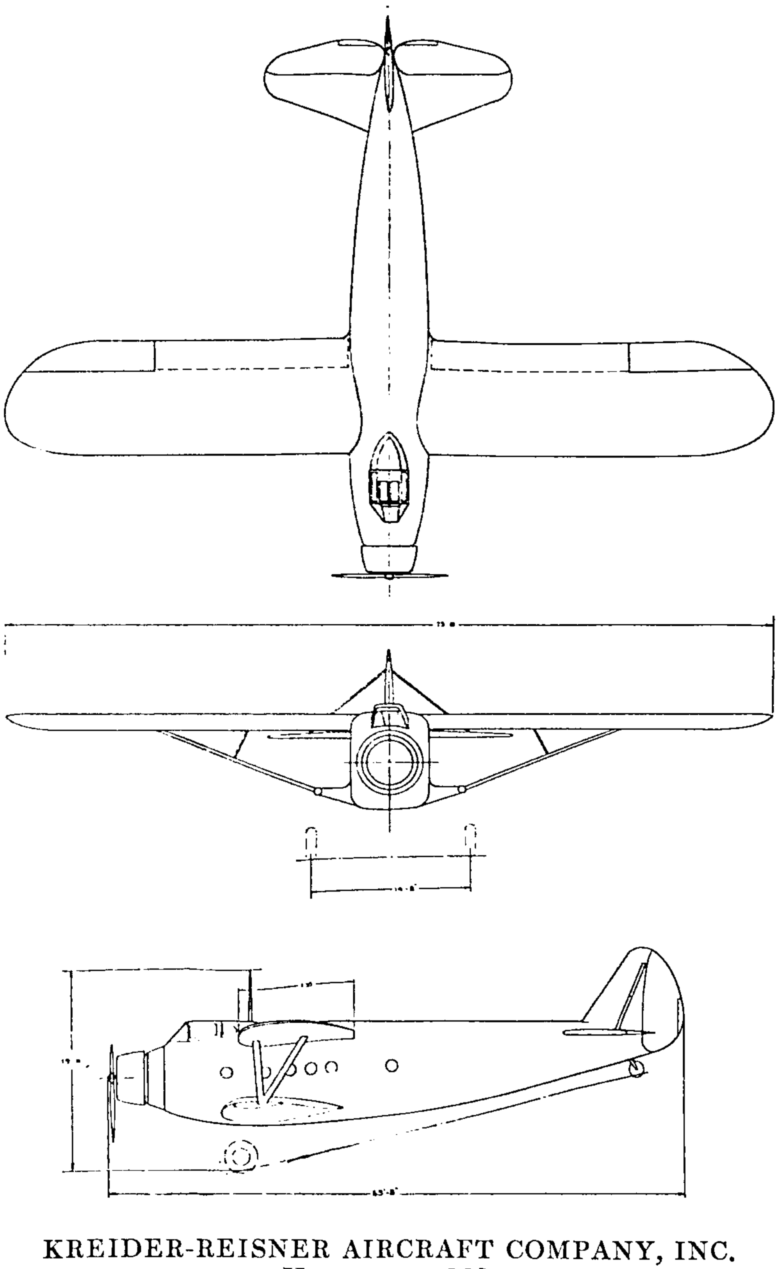
CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Mo.
Model AT-32 Condor —— 15 Place as All-Sleeper
18 Place as Day Plane
Engines: Two Geared Wright Cyclones



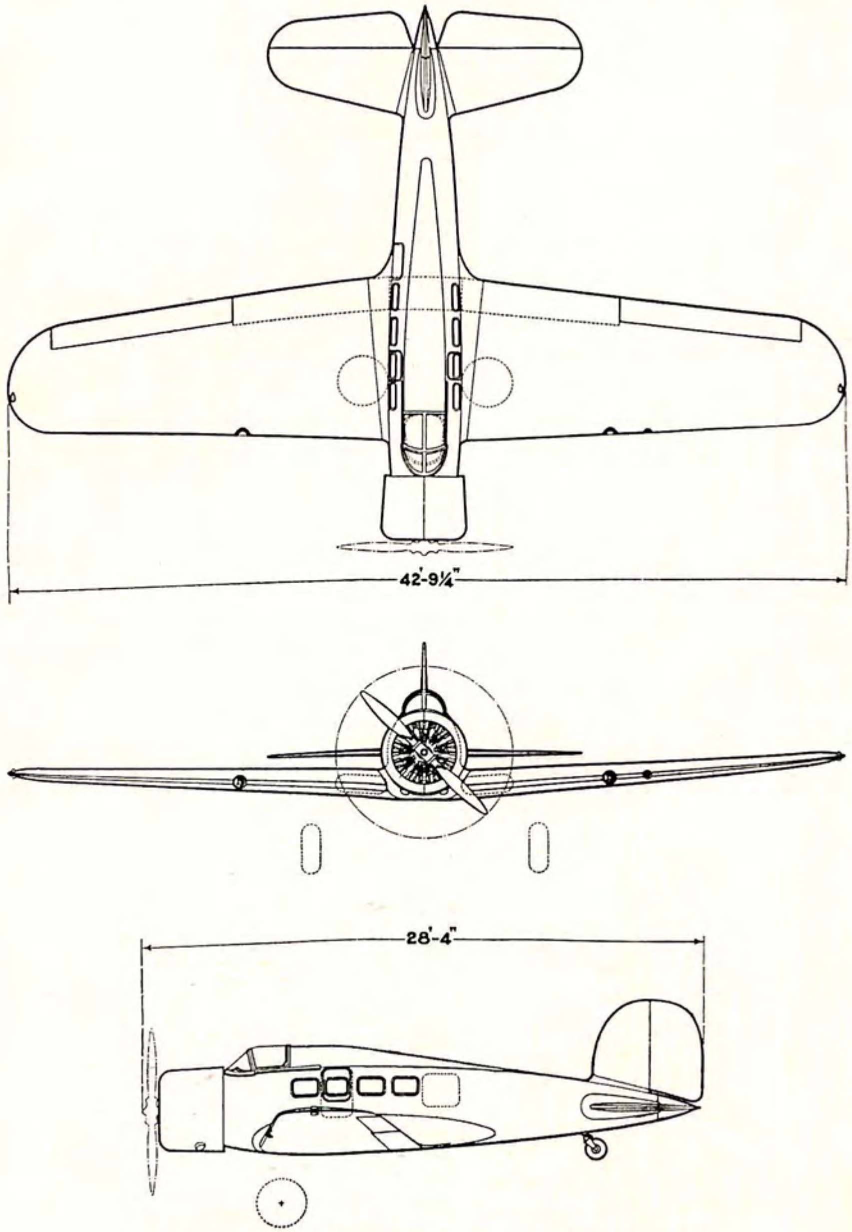
DOUGLAS AIRCRAFT COMPANY, INC.
Santa Monica, Calif.
TRANSPORT —— 16-20 PLACE
ENGINES: TWO PRATT & WHITNEY HORNETS
TWO WRIGHT CYCLONES



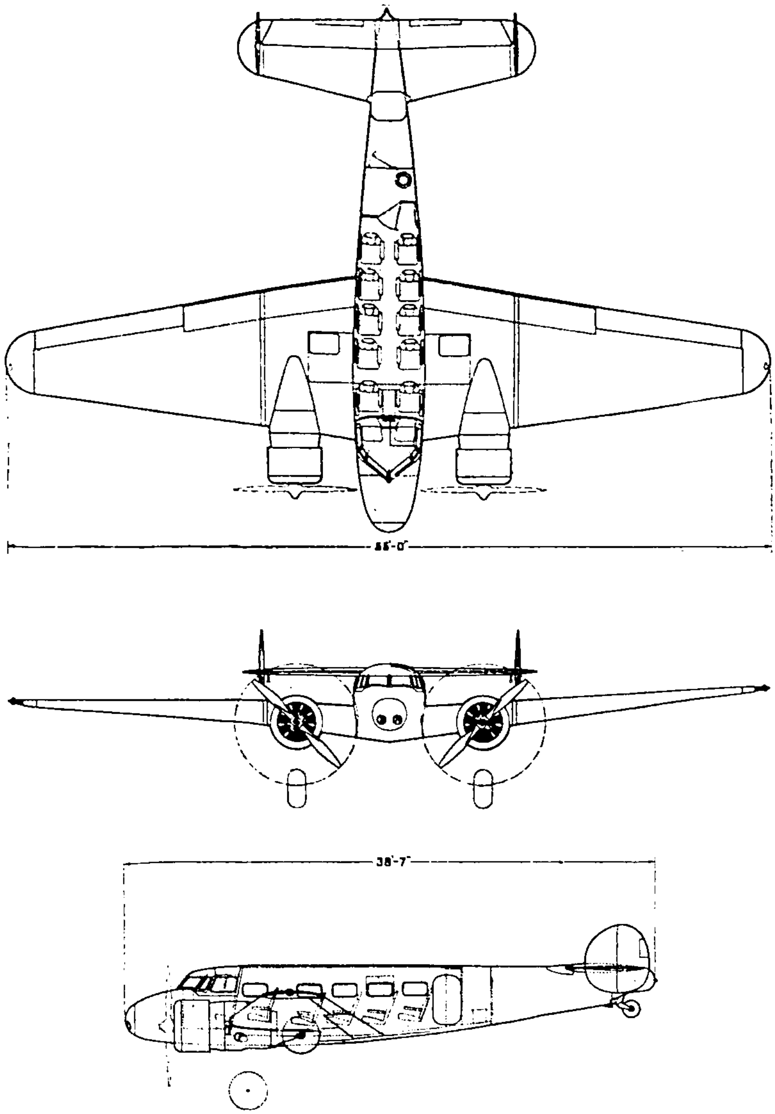
KREIDER-REISNER AIRCRAFT COMPANY, INC.
Hagerstown, Md.
MODEL XA-942 FAIRCHILD AMPHIBION — 10 PLACE
ENGINE: PRATT & WHITNEY HORNET
WRIGHT CYCLONE



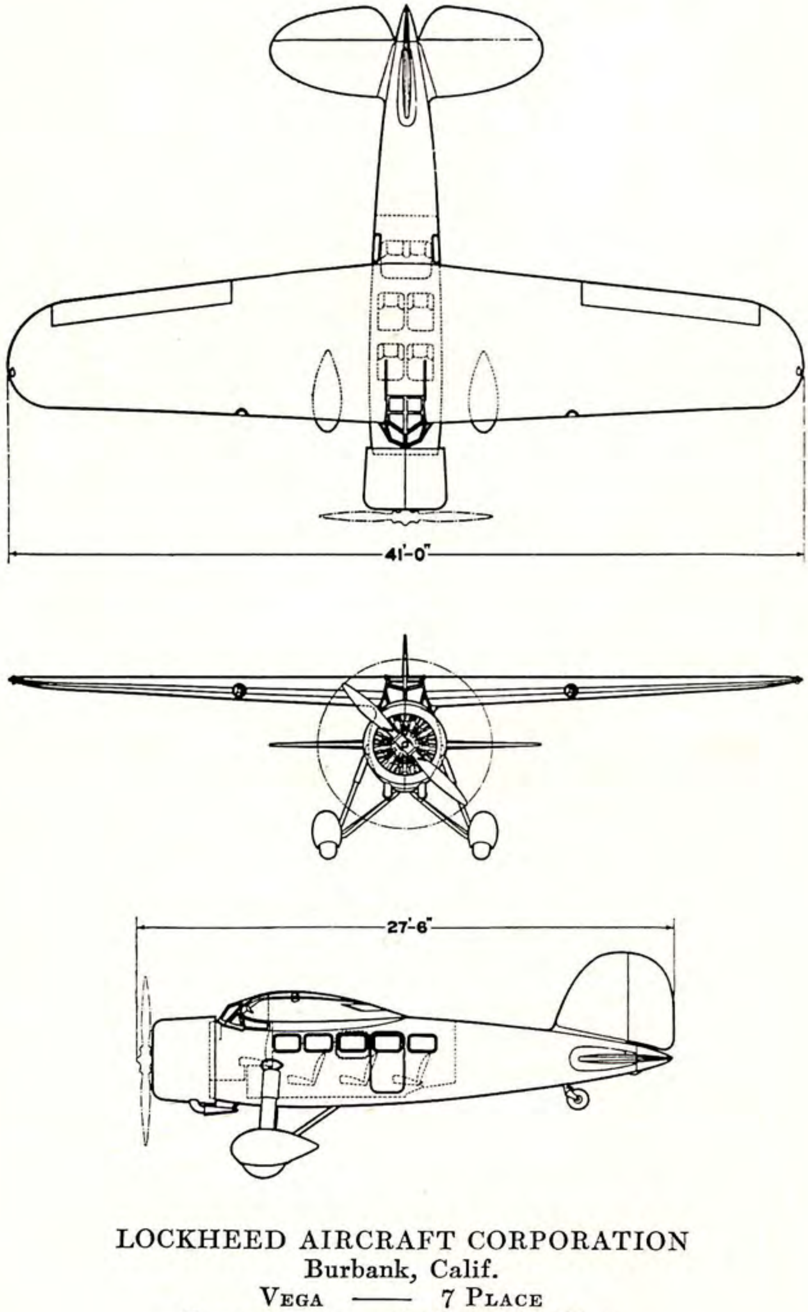
KREIDER-REISNER AIRCRAFT COMPANY, INC.
Hagerstown, Md.
MODEL XC-31 CARGO TRANSPORT —— 1-15 PLACE
ENGINE: WRIGHT CYCLONE



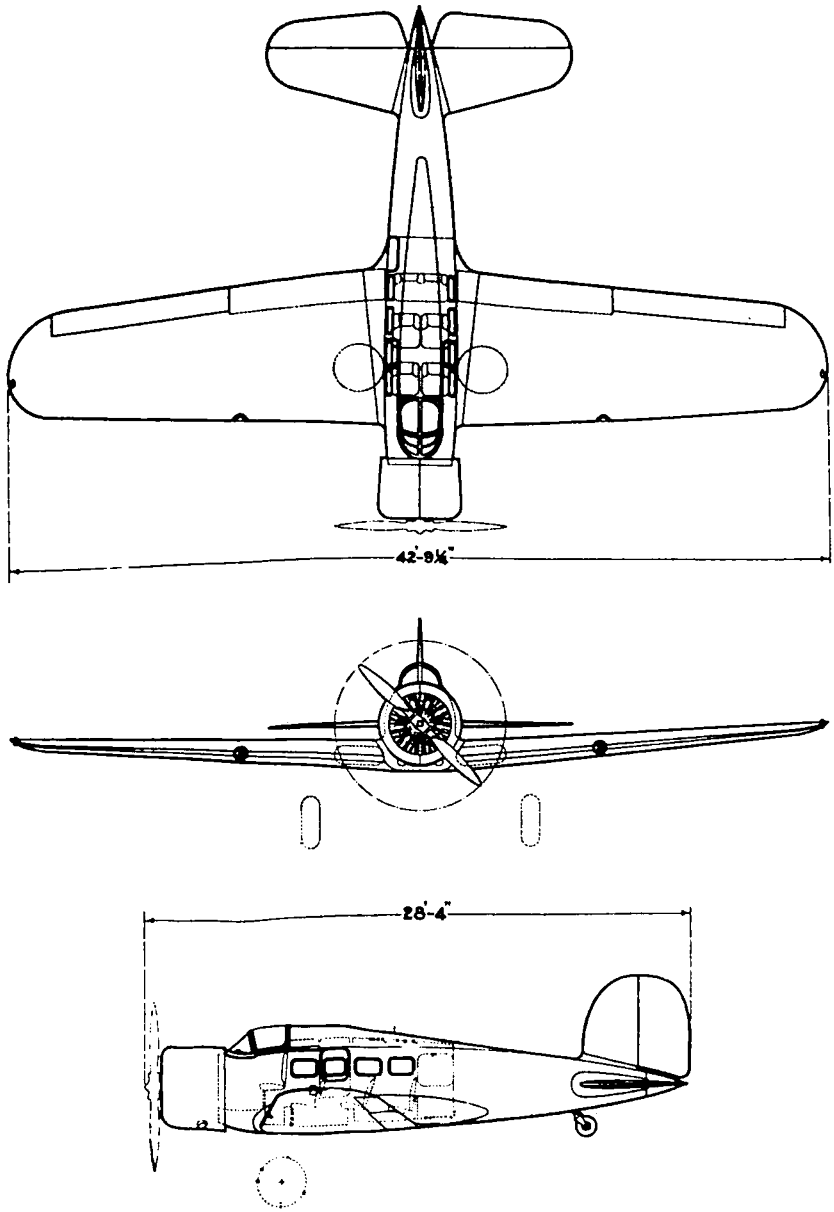
LOCKHEED AIRCRAFT CORPORATION
Burbank, Calif.
ALTAIR —— 1 PLACE
ENGINE: PRATT & WHITNEY WASP



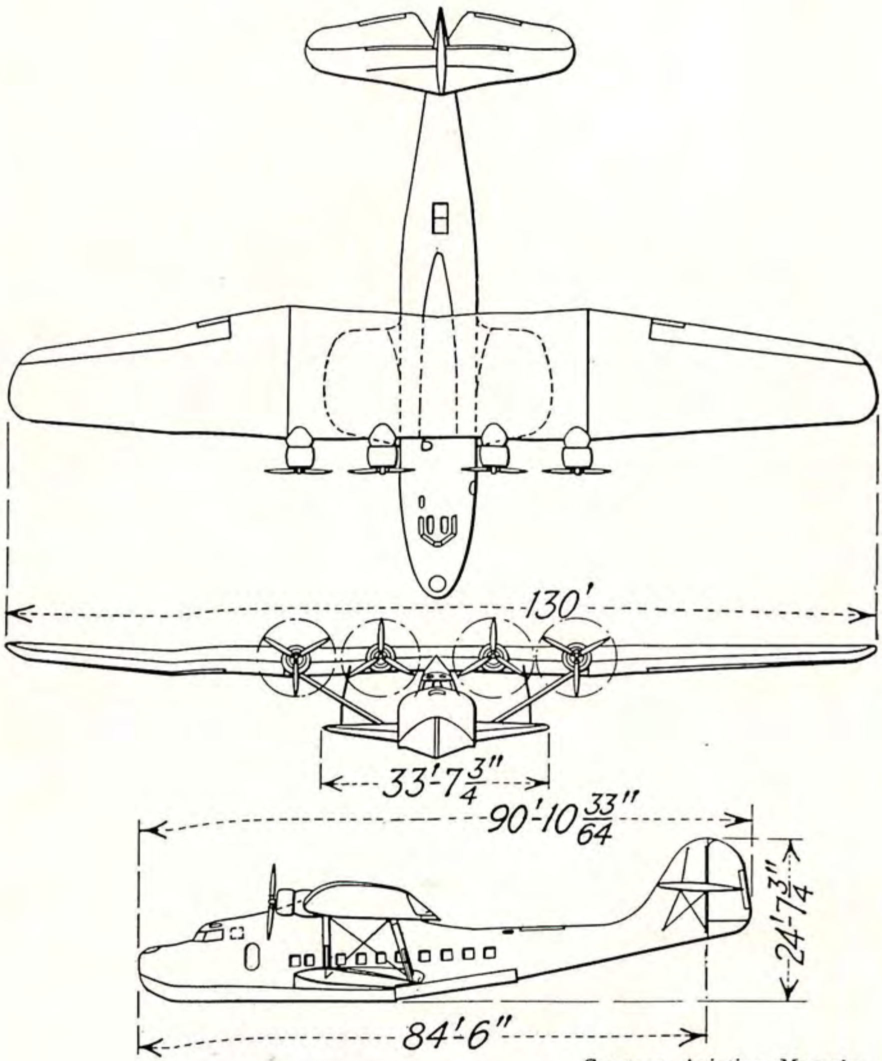
LOCKHEED AIRCRAFT CORPORATION
Burbank, Calif.
ELECTRA —— 12 PLACE
ENGINES: TWO PRATT & WHITNEY WASPS



LOCKHEED AIRCRAFT CORPORATION
Burbank, Calif.
VEGA —— 7 PLACE
ENGINE: PRATT & WHITNEY WASP

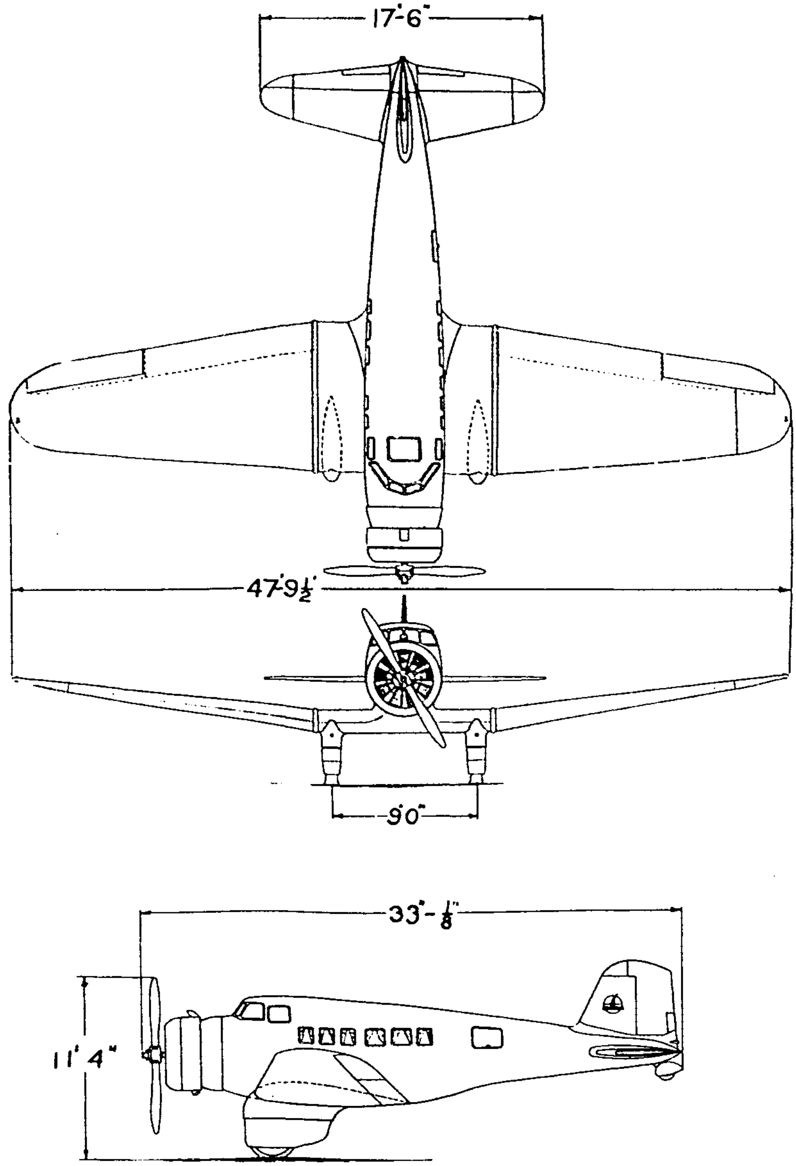


LOCKHEED AIRCRAFT CORPORATION
Burbank, Calif.
ORION —— 1-5 PLACE
ENGINE: PRATT & WHITNEY WASP
WRIGHT CYCLONE

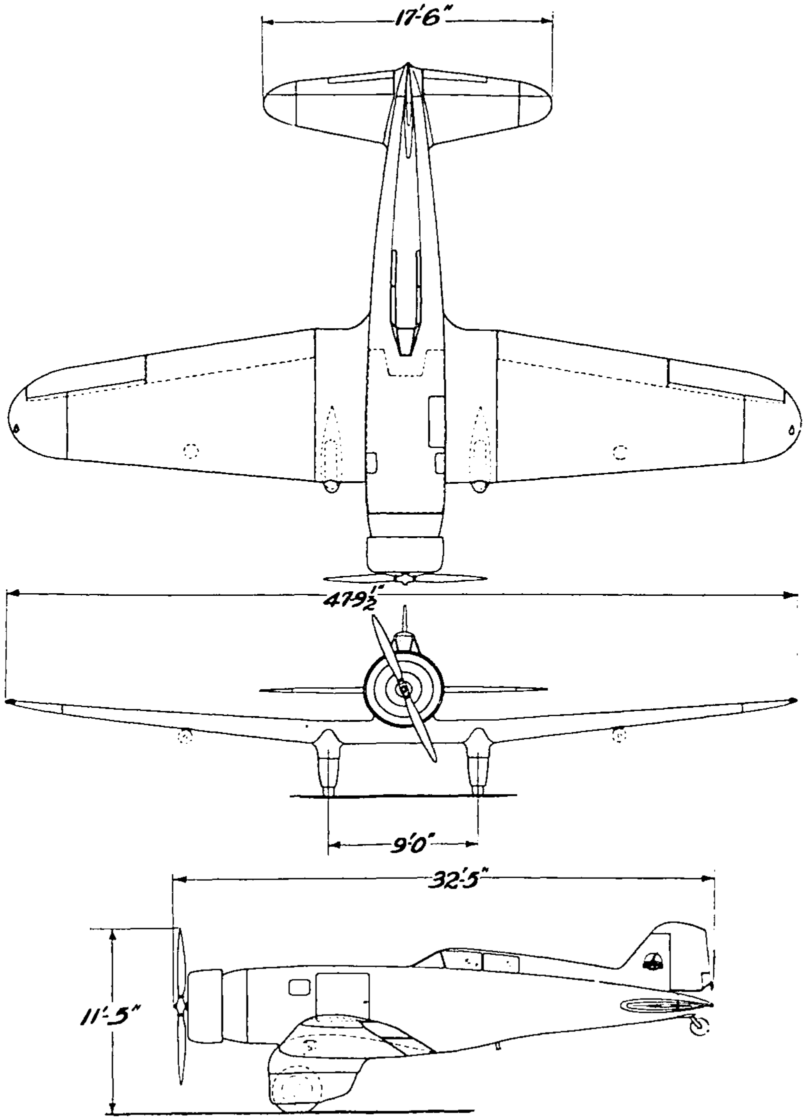


Courtesy Aviation Magazine

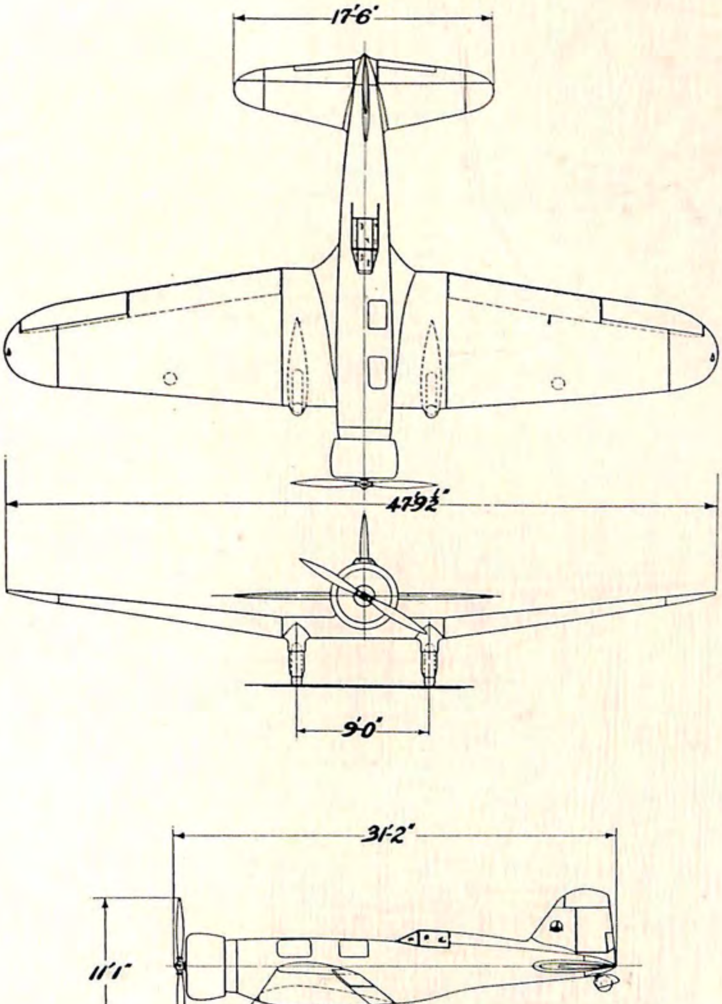
THE GLENN L. MARTIN COMPANY
Baltimore, Md.
MARTIN 130 —— 14-50 PLACE
ENGINES: FOUR PRATT & WHITNEY TWIN WASPS



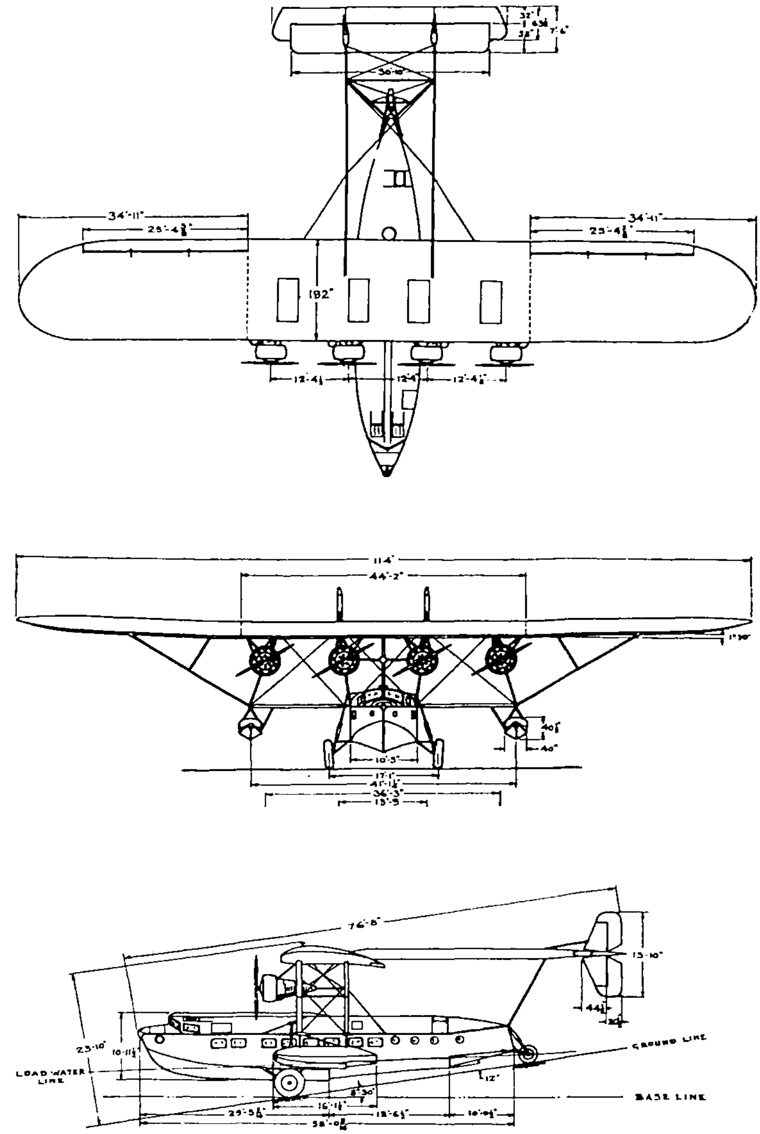
THE NORTHROP CORPORATION
Inglewood, Calif.
Delta Transport —— 7-9 Place
Engine: Wright Cyclone



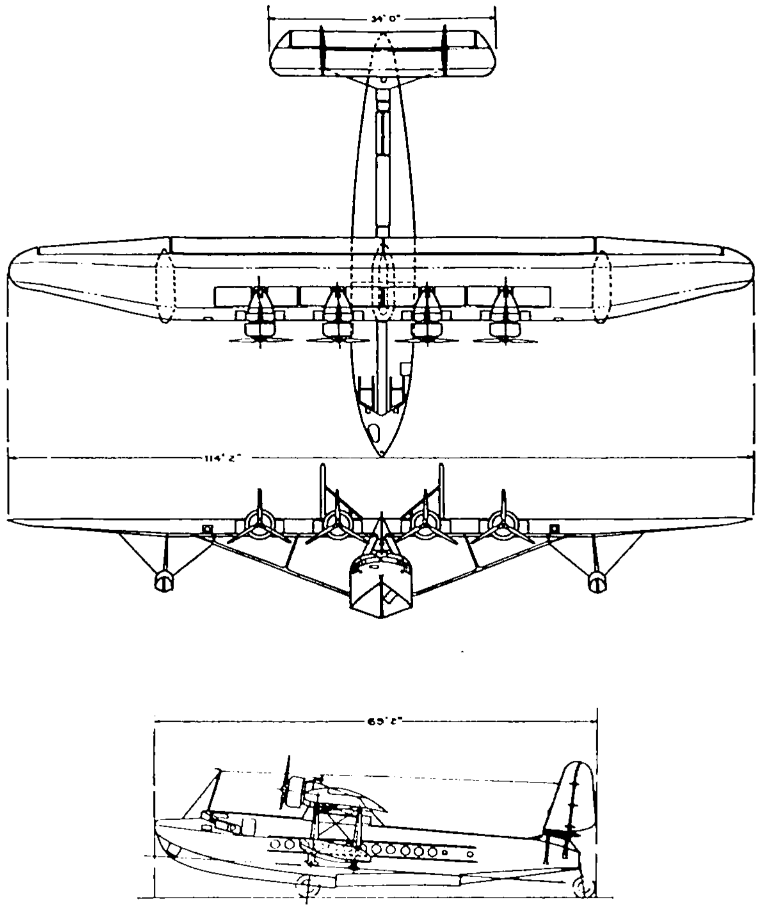
THE NORTHROP CORPORATION
Inglewood, Calif.
DELTA MAIL PLANE —— 1 PLACE
ENGINE: PRATT & WHITNEY HORNET



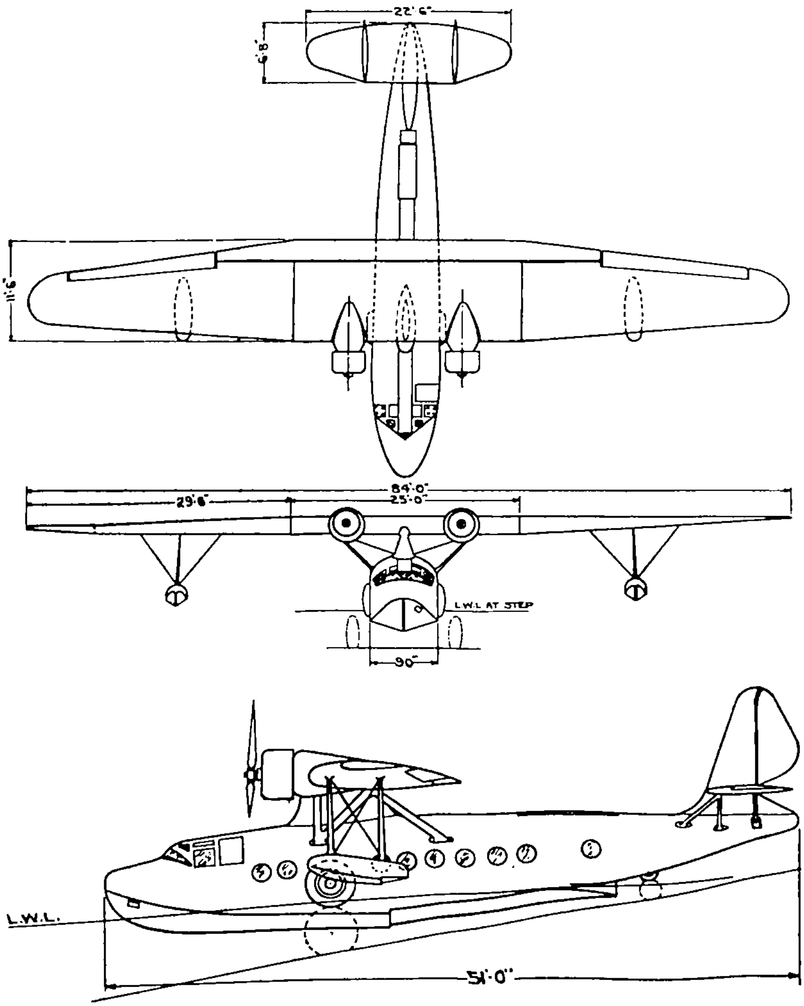
THE NORTHROP CORPORATION
Inglewood, Calif.
GAMMA MAIL PLANE —— 1 PLACE
ENGINE: WRIGHT CYCLONE



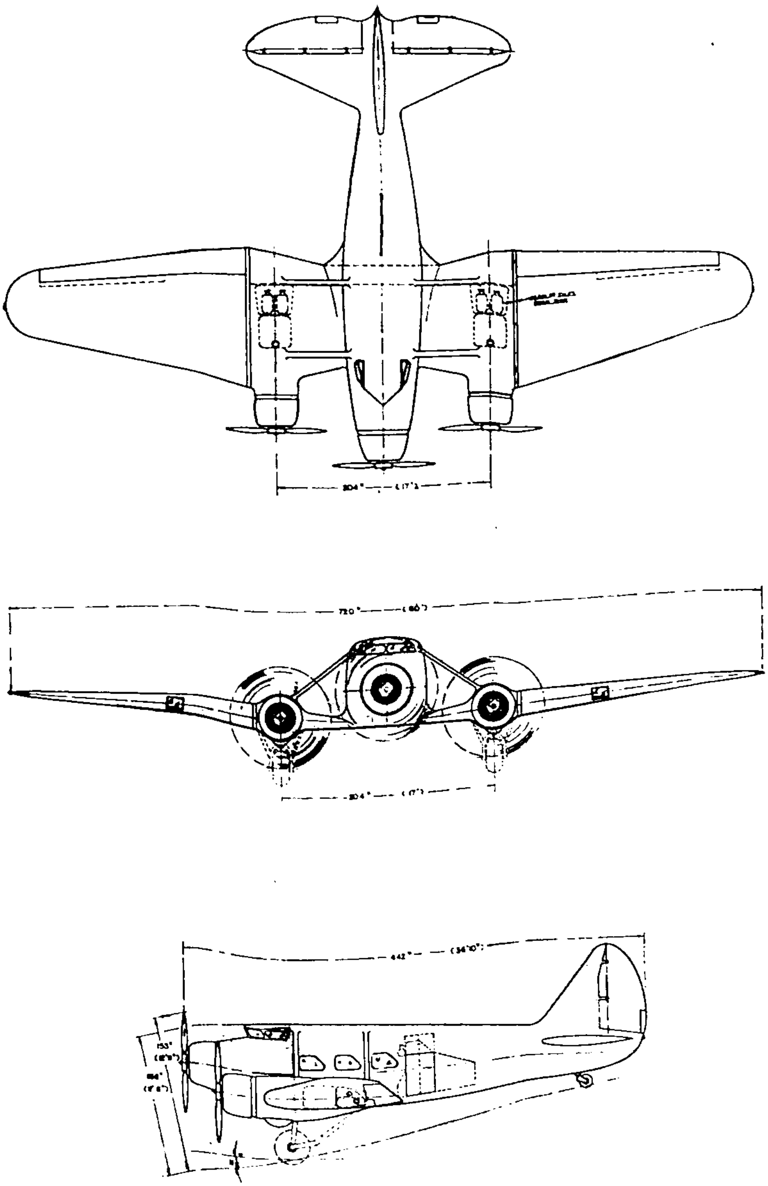
SIKORSKY AVIATION CORPORATION
Bridgeport, Conn.
AMPHIBION S-40 —— 38 PLACE
ENGINES: FOUR PRATT & WHITNEY HORNETS



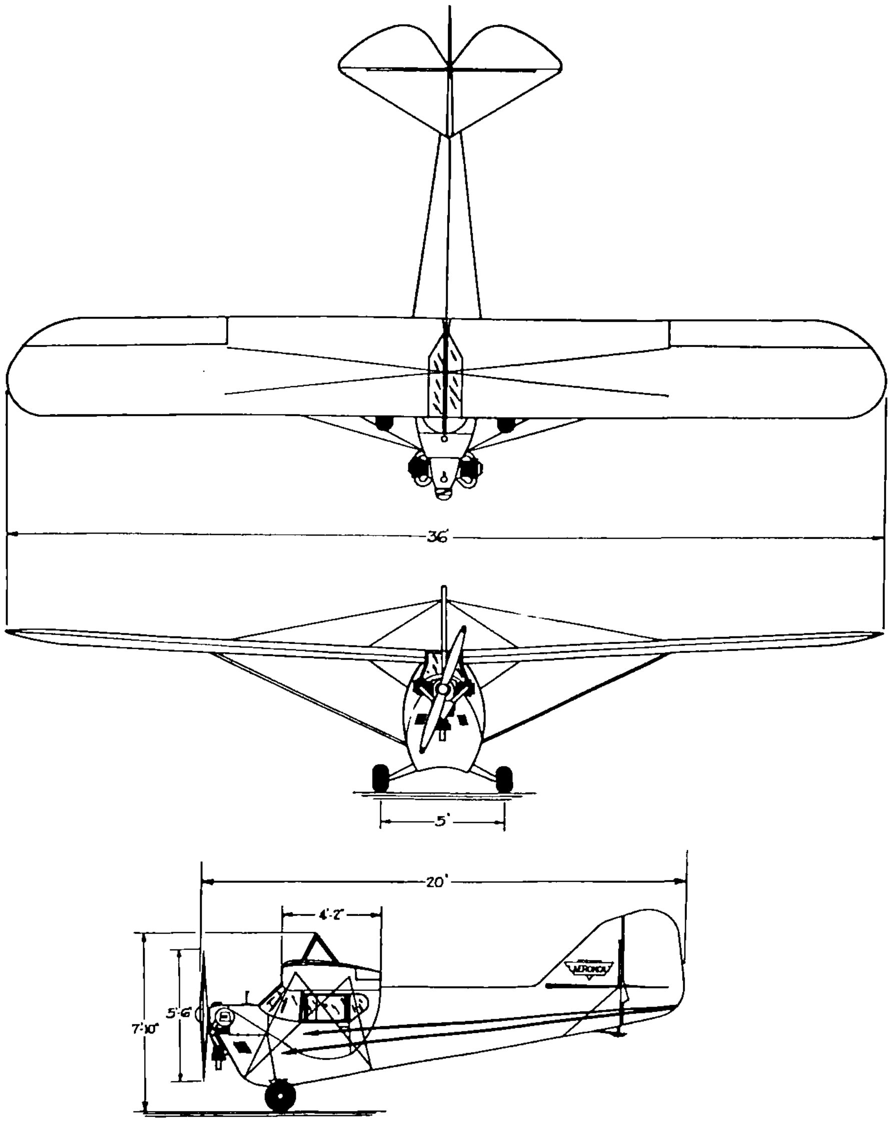
SIKORSKY AVIATION CORPORATION
Bridgeport, Conn.
Model S-42 —— 40-50 Place
Engines: 4 Pratt & Whitney Hornets



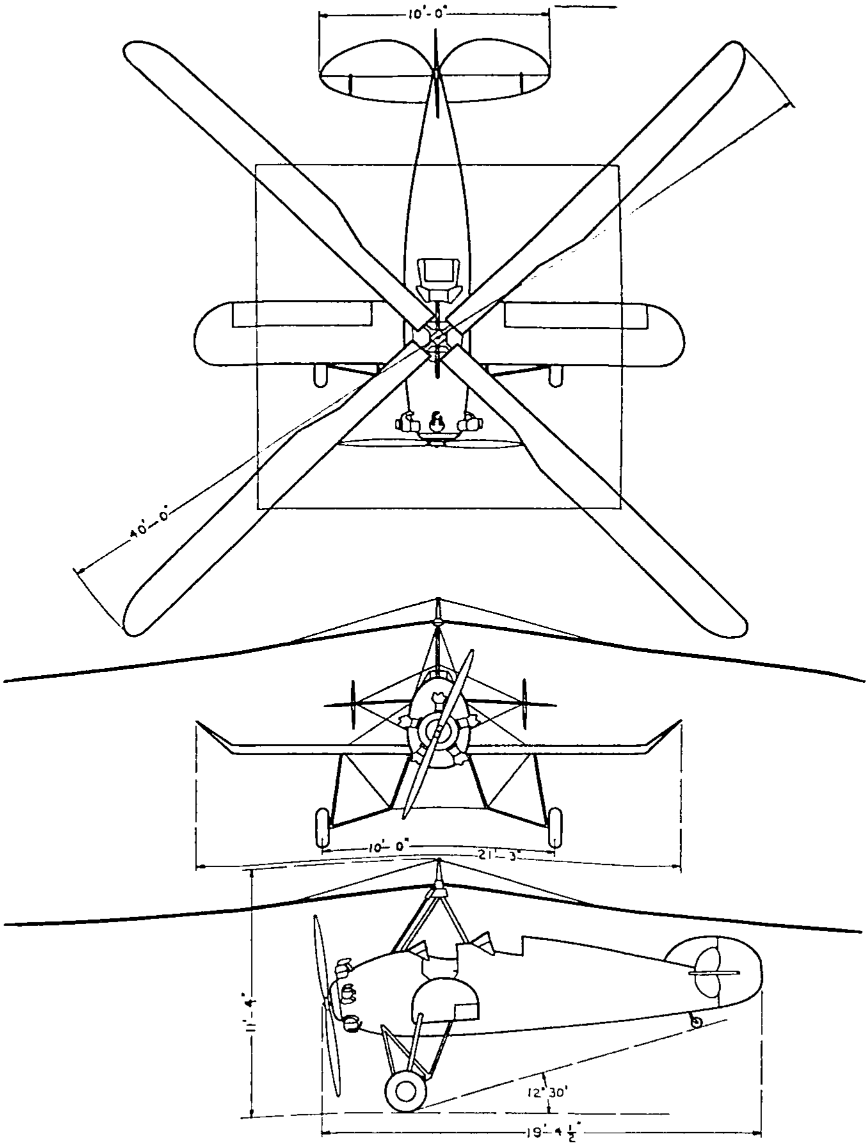
SIKORSKY AVIATION CORPORATION
Bridgeport, Conn.
S-43 —— 15-17 PLACE
ENGINES: TWO PRATT & WHITNEY HORNETS



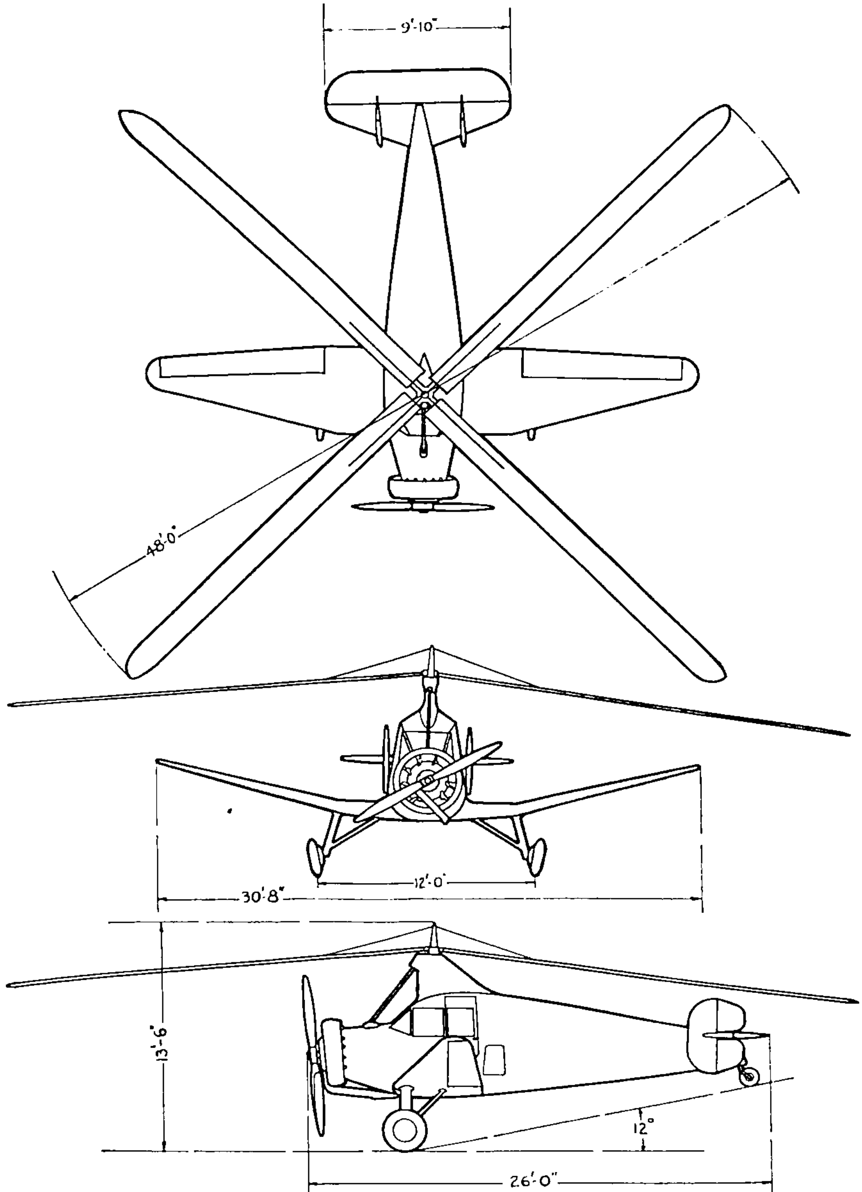
STINSON AIRCRAFT CORPORATION
Wayne, Mich.
Model A —— 10 Place
Engines: Three Lycomings



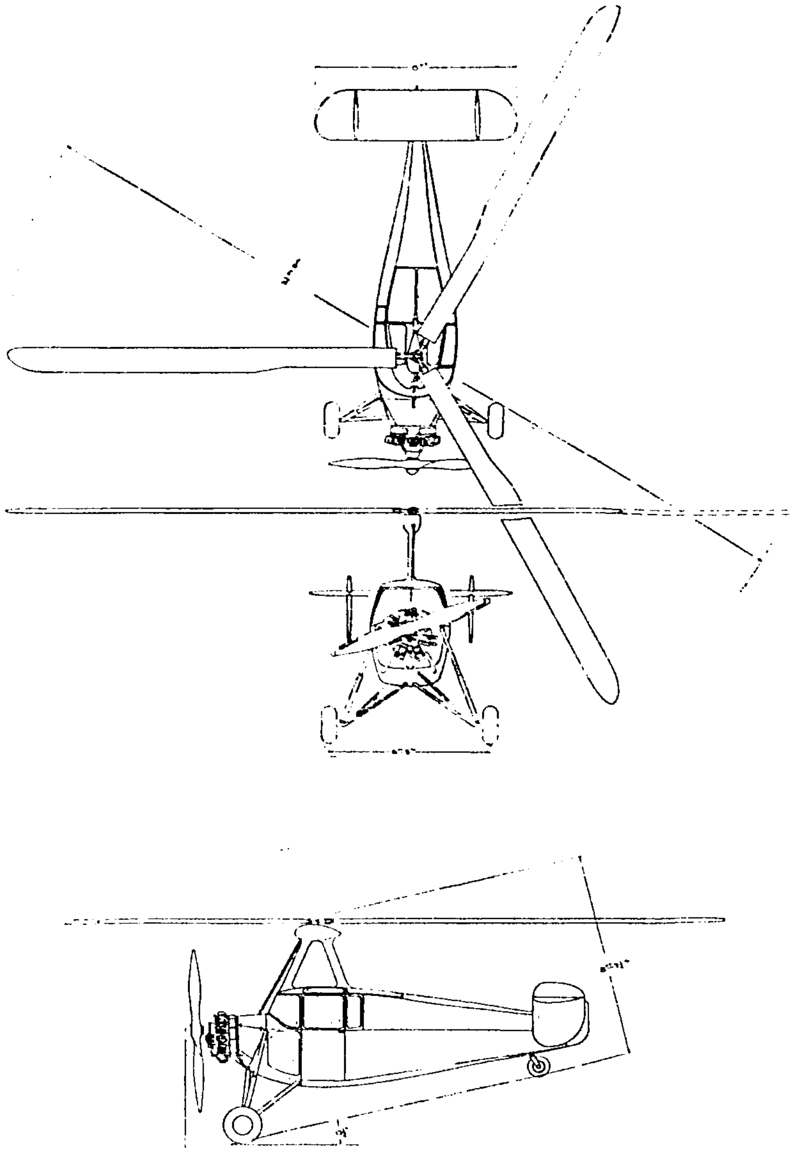
AERONAUTICAL CORPORATION OF AMERICA, INC.
Cincinnati, Ohio
MODEL: AERONCA C-3 —— 2 PLACE
ENGINE: AERONCA E-113B



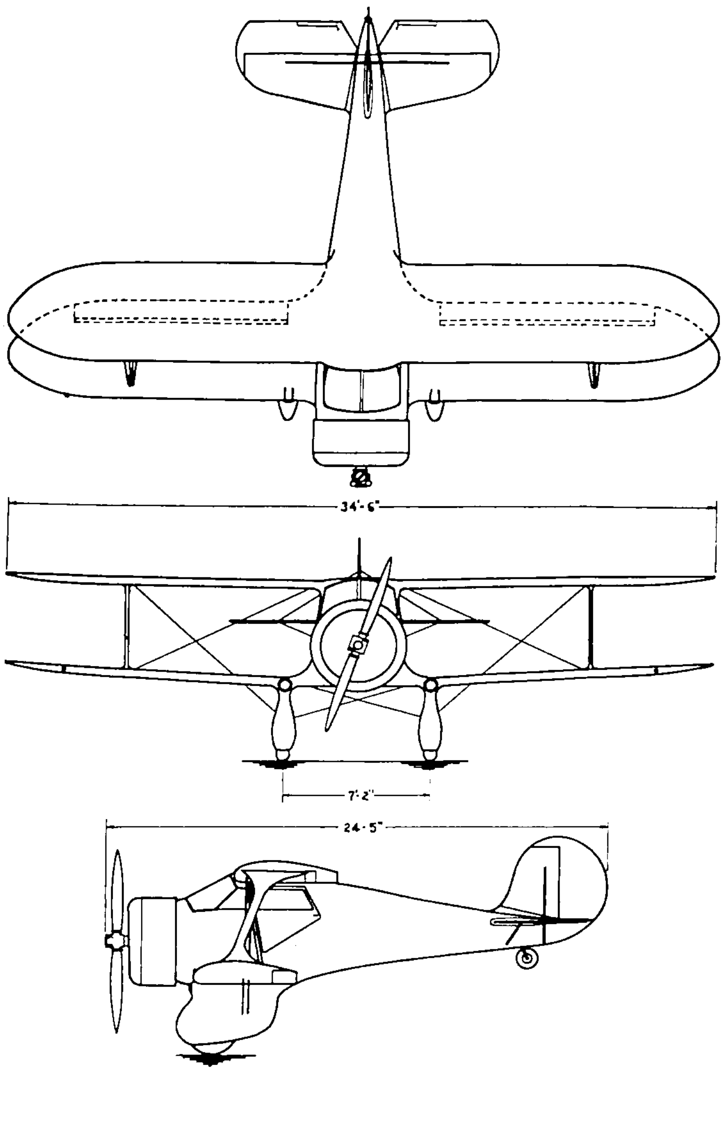
AUTOGIRO COMPANY OF AMERICA
Willow Grove, Pa.
MODEL PA-18 —— 2 PLACE
ENGINE: KINNER R-5



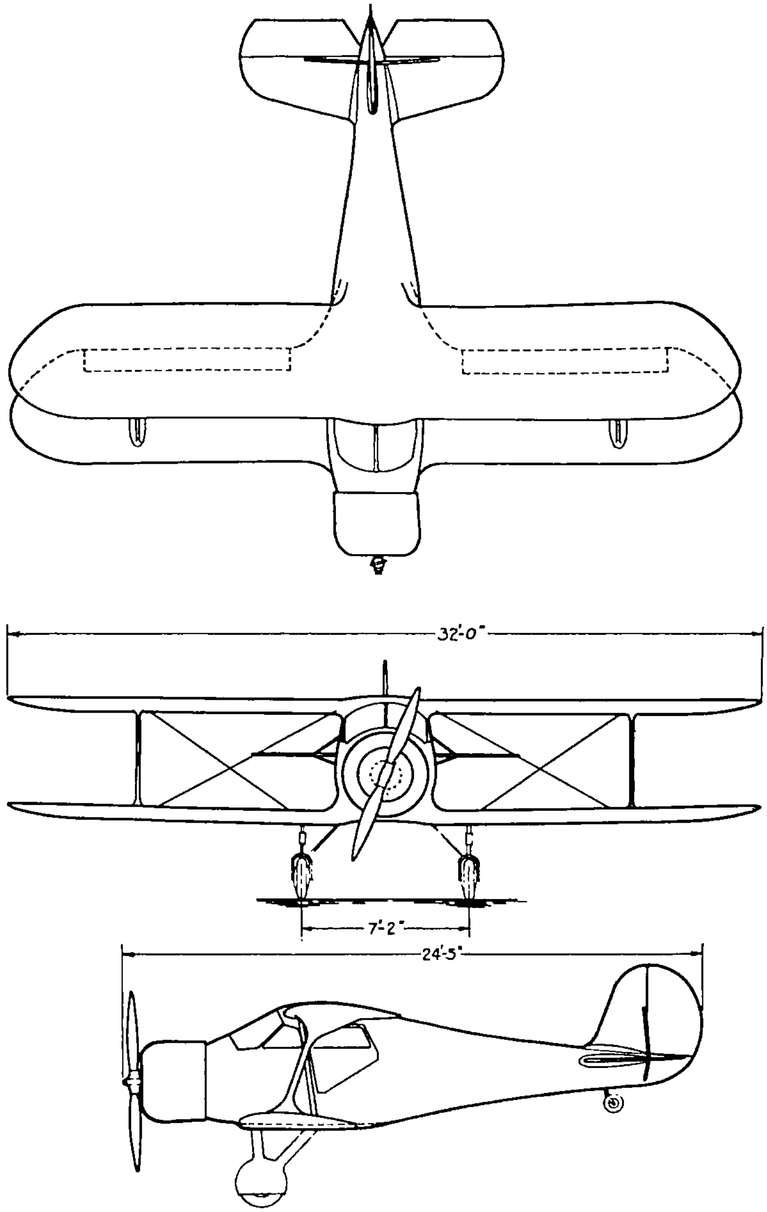
AUTOGIRO COMPANY OF AMERICA
Willow Grove, Pa.
Model PA-19 —— 4 Place
Engine: Pratt & Whitney Wasp
Wright Whirlwind 420 H.P.



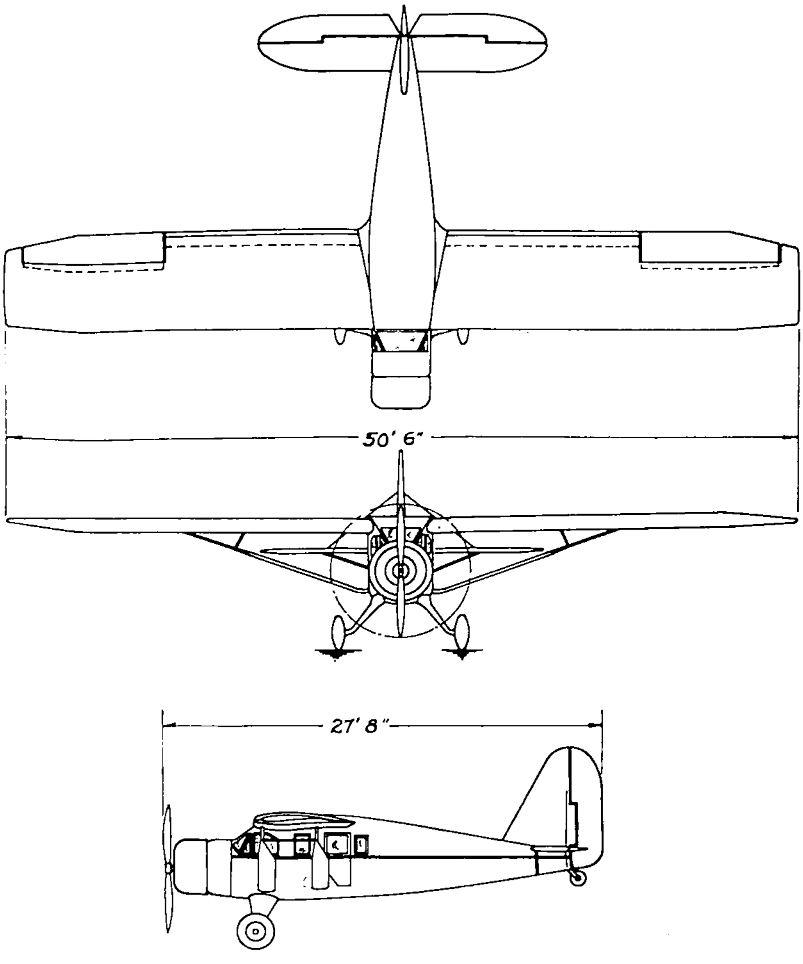
AUTOGIRO COMPANY OF AMERICA
Willow Grove, Pa.
PA-22 —— 2 Place
Engine: Pobjoy



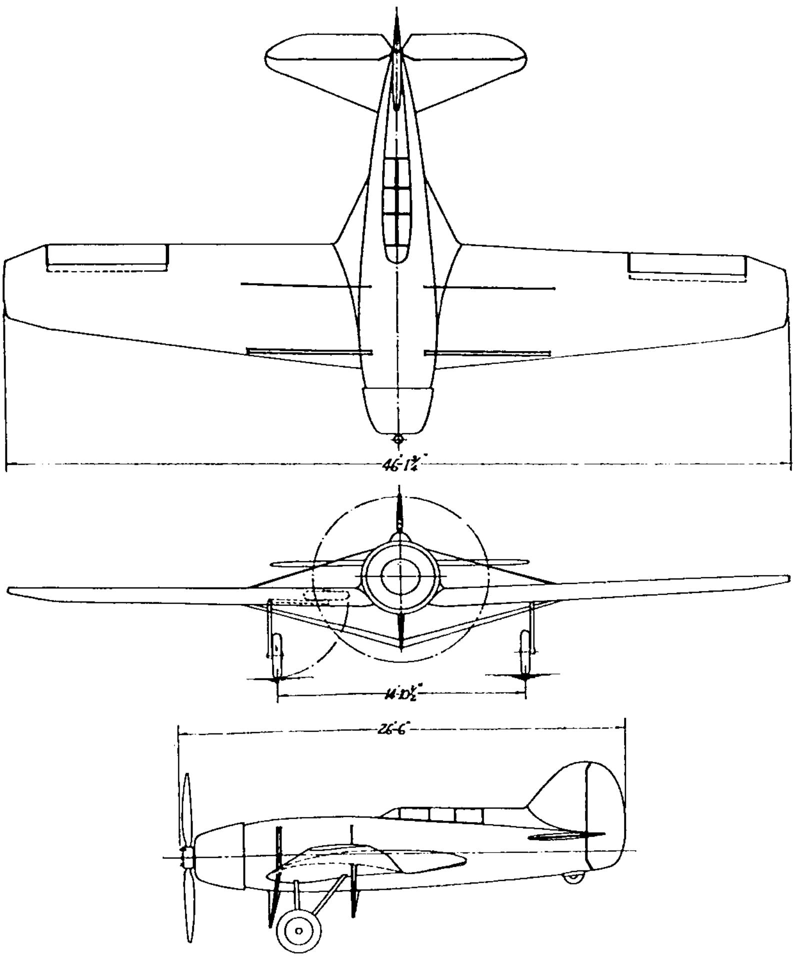
BEECH AIRCRAFT COMPANY
Wichita, Kans.
MODEL A17 —— 4 PLACE
ENGINE: WRIGHT CYCLONE



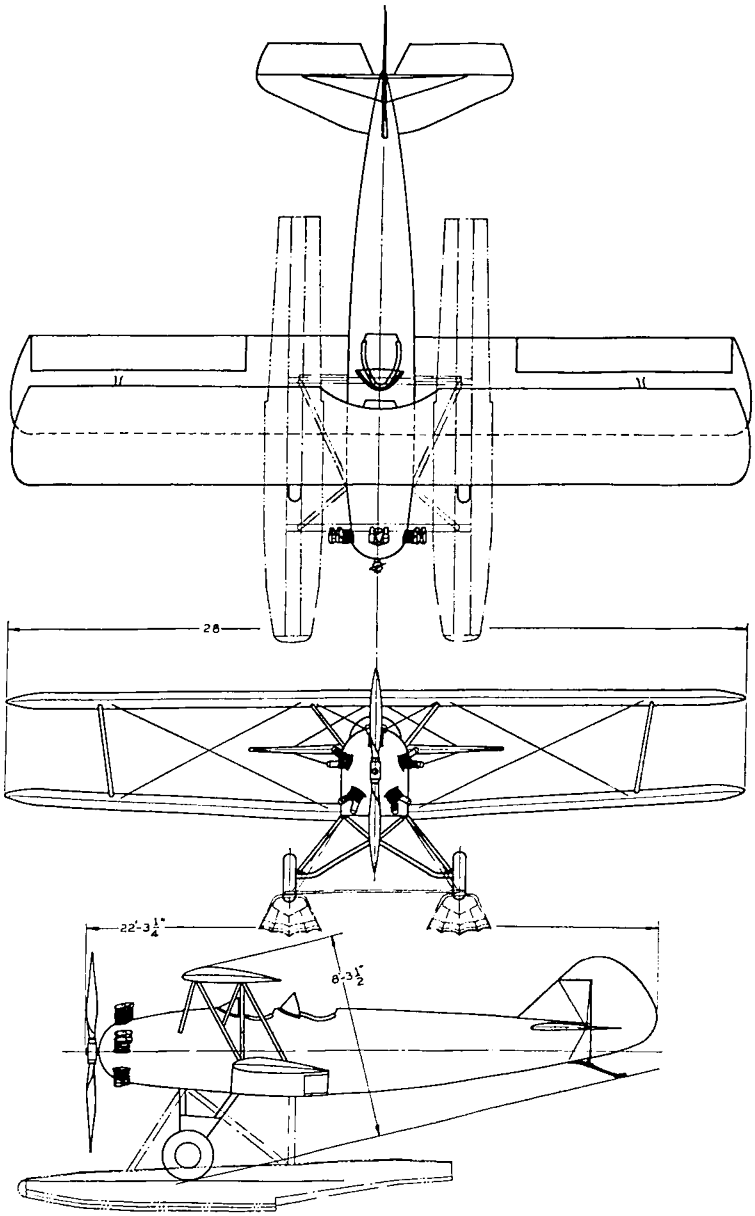
THE BEECH AIRCRAFT COMPANY
Wichita, Kans.
MODEL B17L —— 4 PLACE
ENGINE: JACOBS L-4



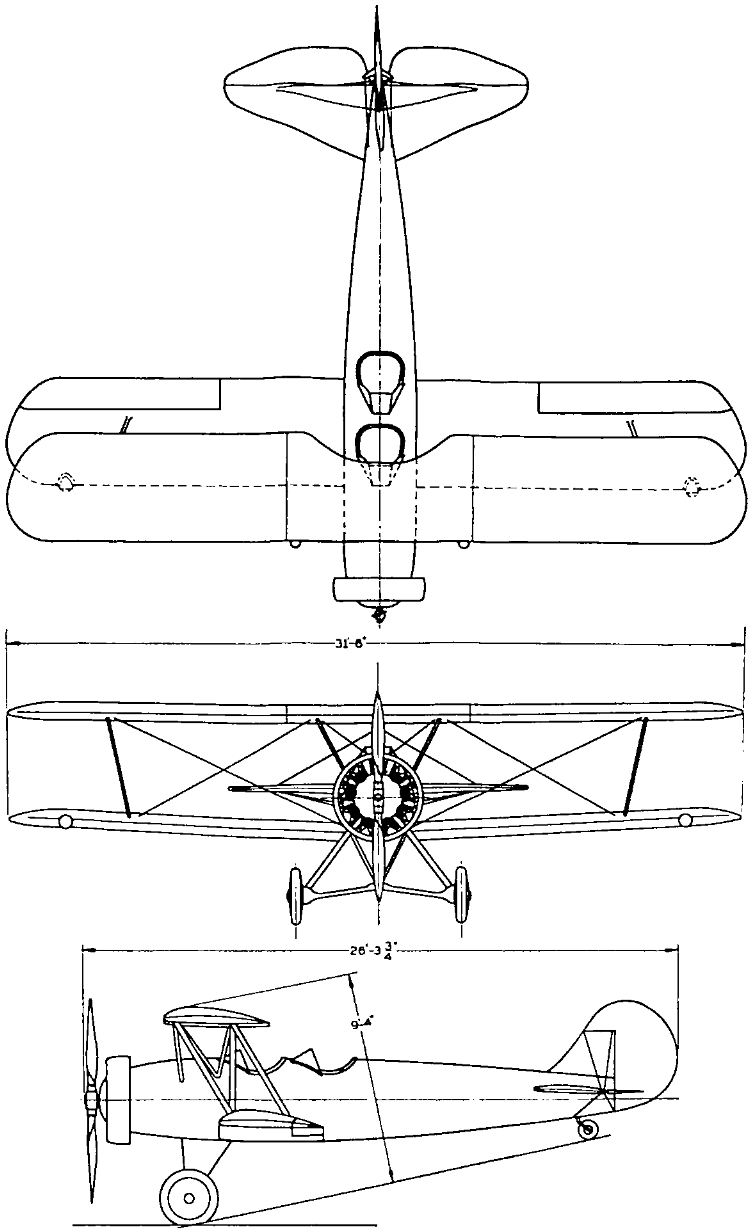
BELLANCA AIRCRAFT CORPORATION
Newcastle, Del.
SENIOR PACEMAKER —— 6 PLACE
SENIOR SKYROCKET —— 6 PLACE
ENGINE: PRATT & WHITNEY WASP



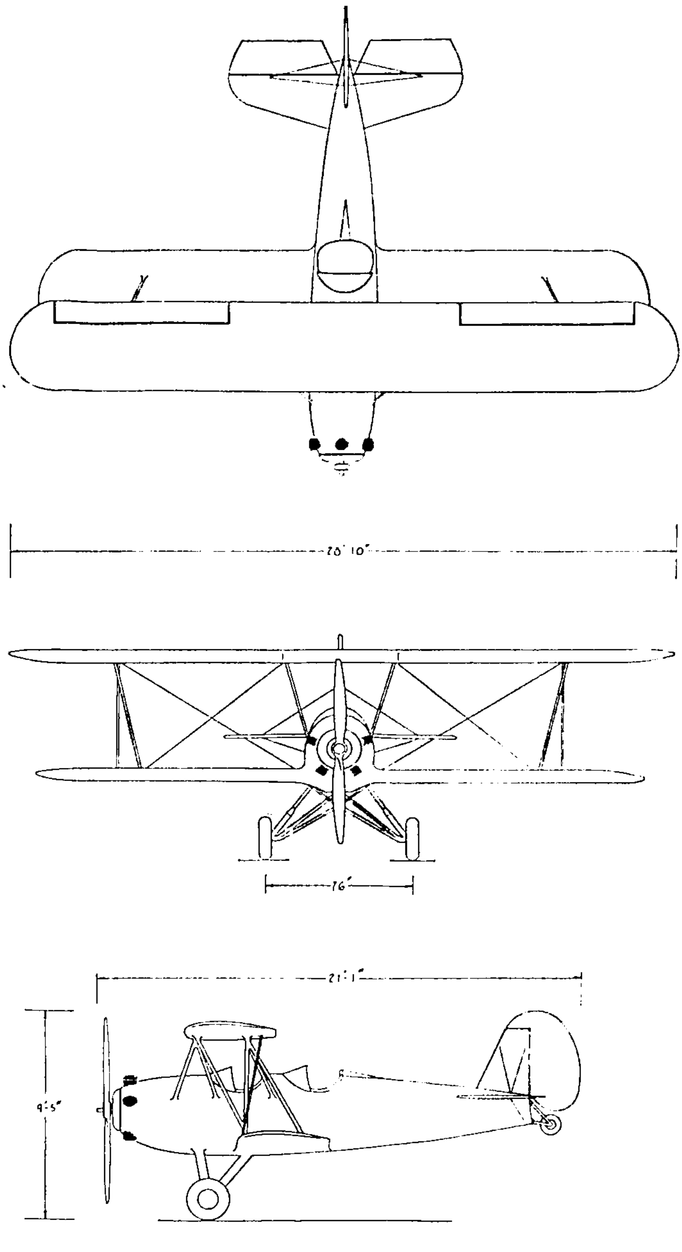
BELLANCA AIRCRAFT CORPORATION
Newcastle, Del.
FLASH—LONG-RANGE RACER —— 2 PLACE
ENGINE: PRATT & WHITNEY TWIN WASP JUNIOR



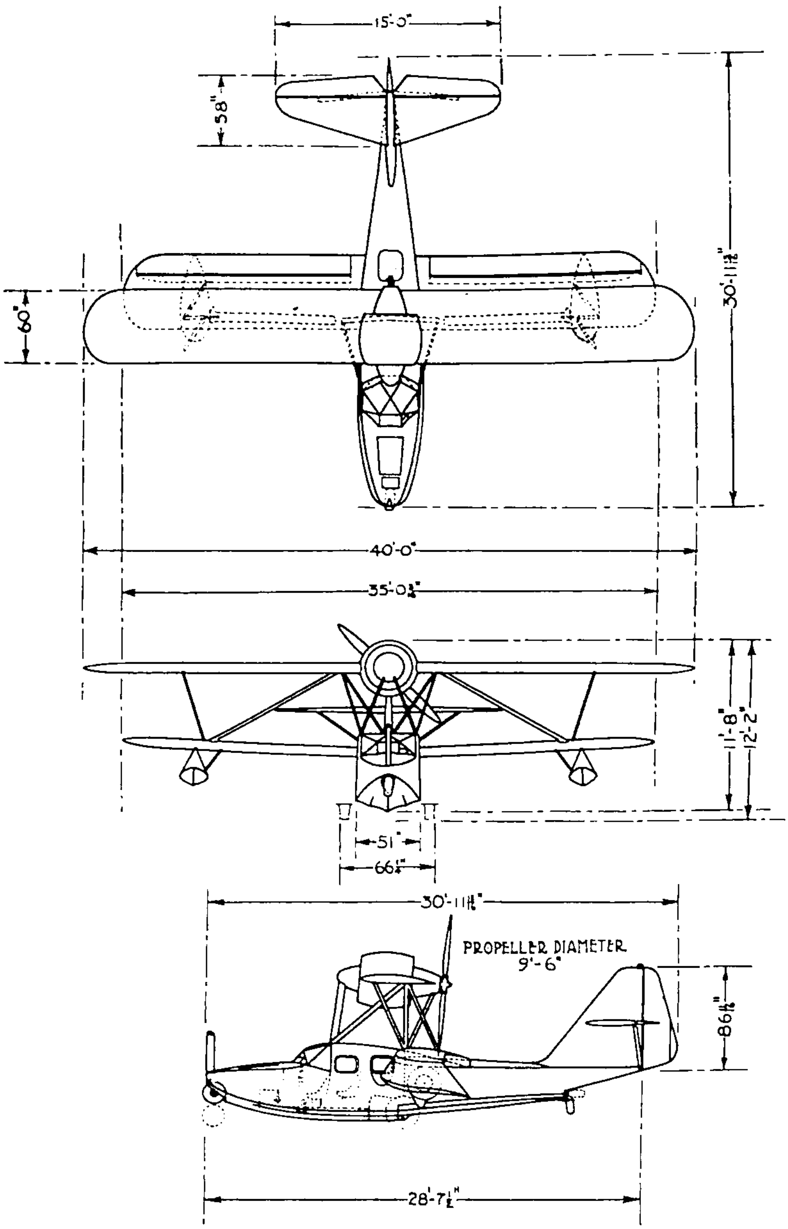
CONSOLIDATED AIRCRAFT CORPORATION
Buffalo, N. Y.
MODELS: F-5, 10 & 11 —— 2 PLACES
ENGINES: KINNER K-5, B-5 & R-5



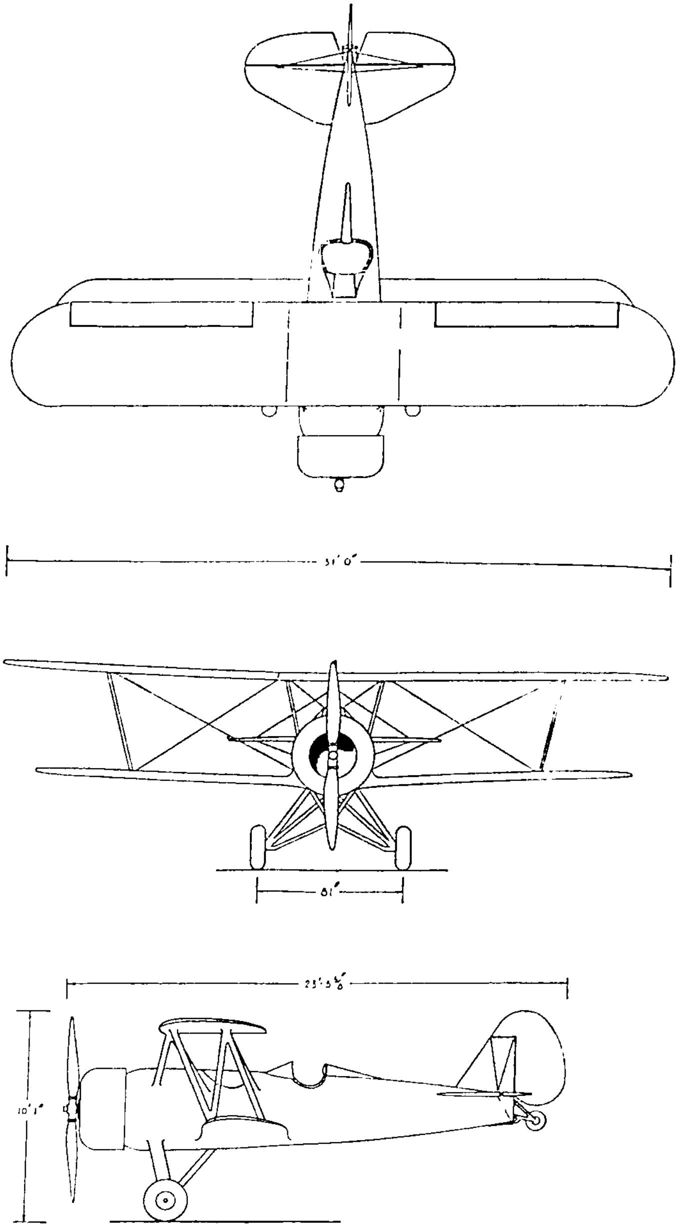
CONSOLIDATED AIRCRAFT CORPORATION
Buffalo, N. Y.
Models 21-C, D —— 2 Place
Engine: Pratt & Whitney Wasp Junior
Lycoming



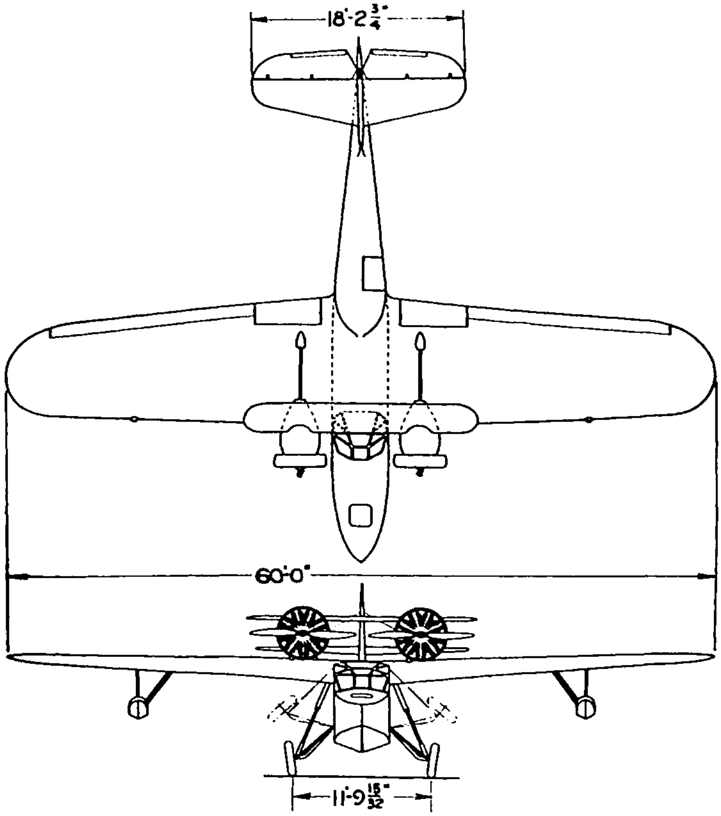
CURTISS-WRIGHT AIRPLANE COMPANY
St. Louis, Mo.
Model 16-E —— 3 Place
Engine: Wright Whirlwind 175 H.P.

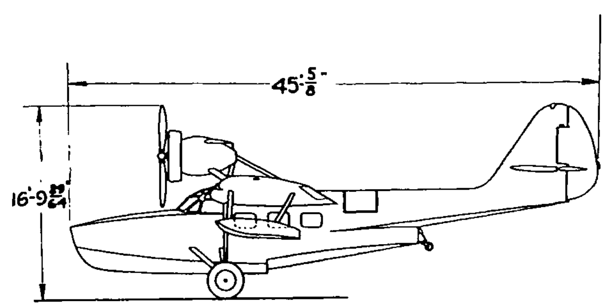


CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Mo.
AMPHIBION —— 5 PLACE
ENGINE: WRIGHT WHIRLWIND 365 H.P.

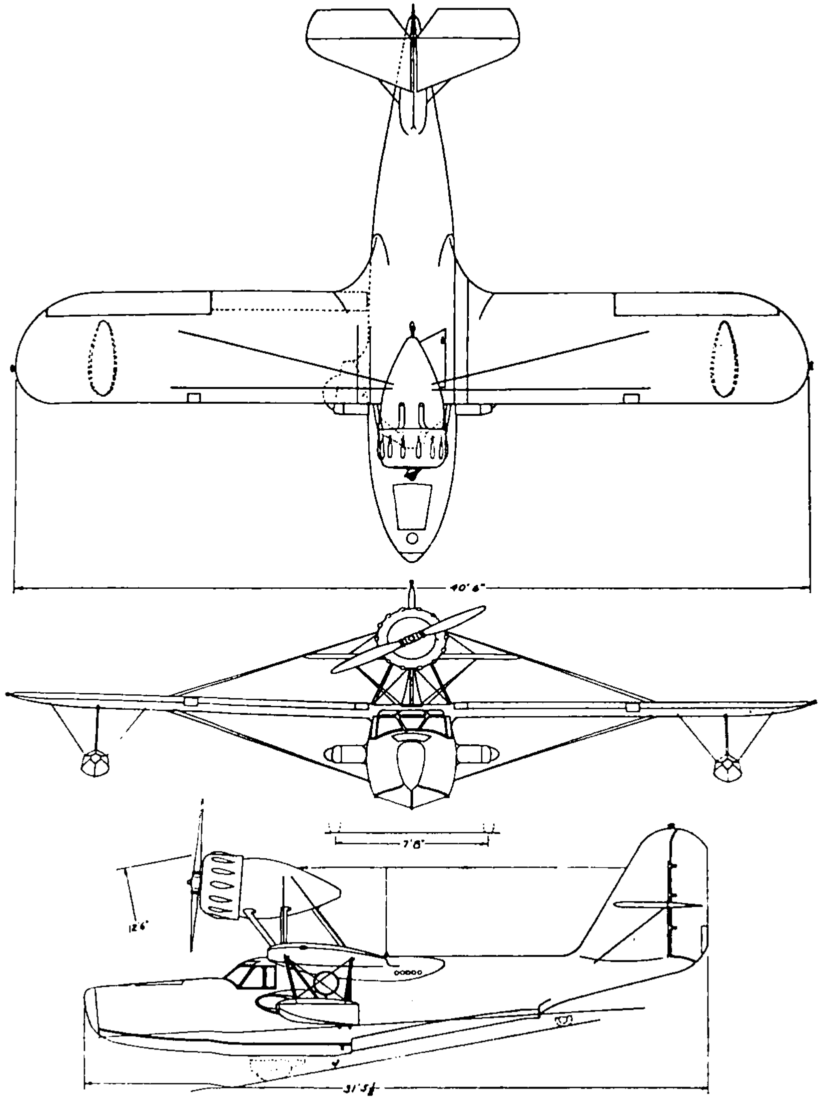


CURTISS-WRIGHT AIRPLANE COMPANY
St. Louis, Mo.
SPEEDWING —— 1-3 PLACE
ENGINES: WRIGHT WHIRLWIND 250, 330, 420 H.P.

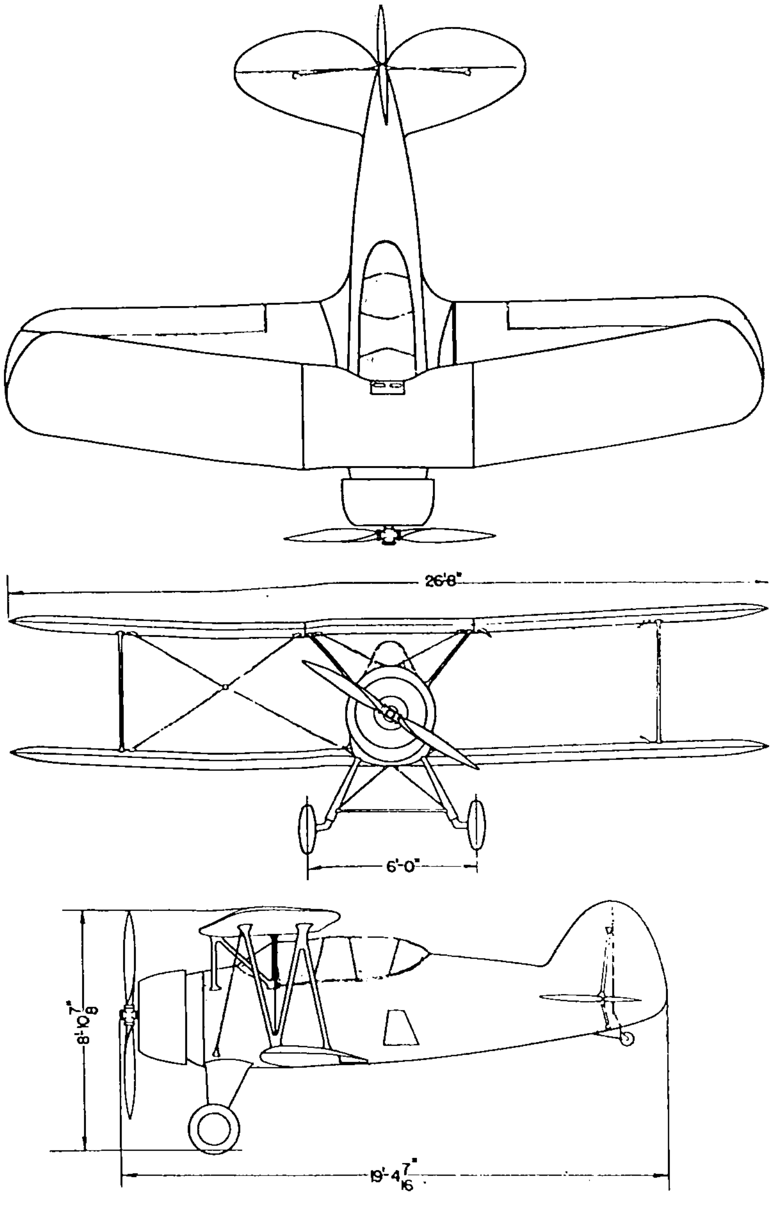




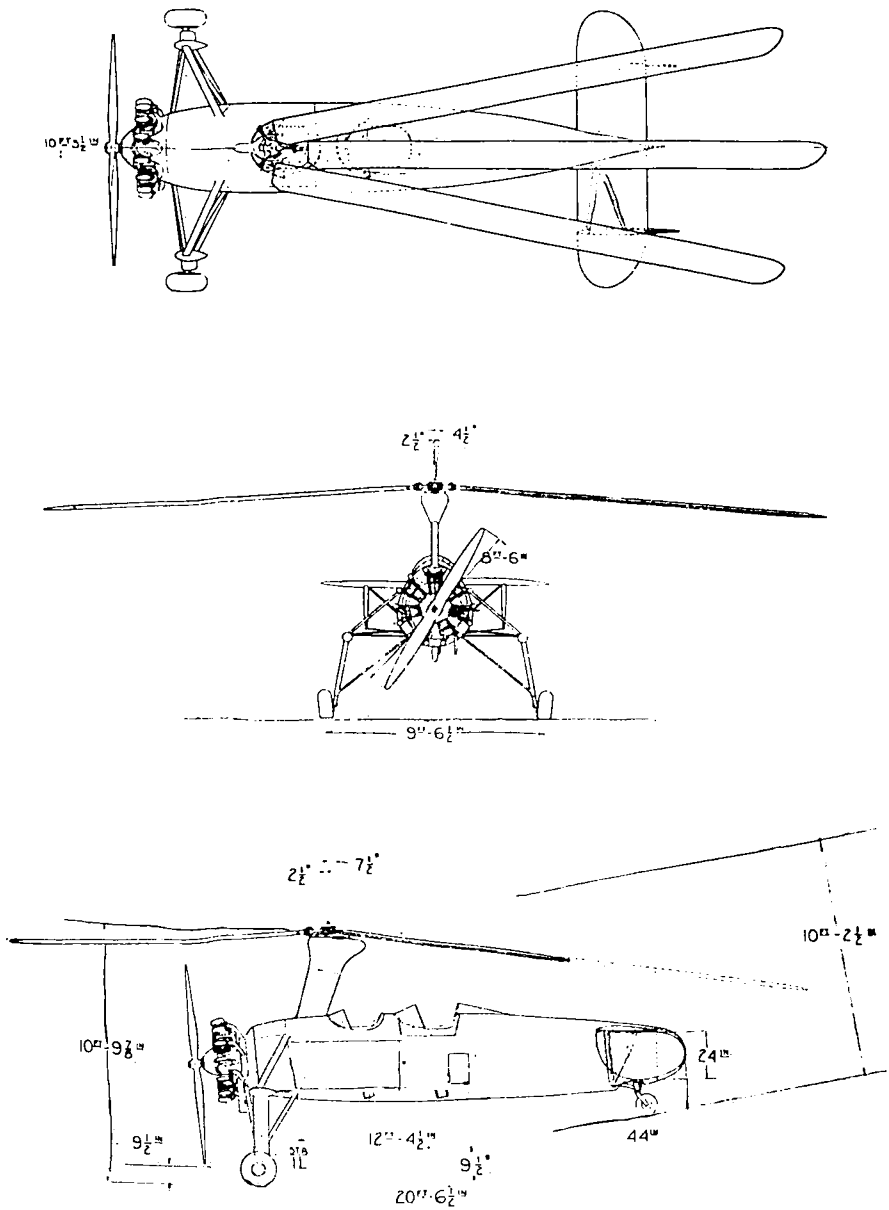
DOUGLAS AIRCRAFT COMPANY, INC.
Santa Monica, Calif.
MODEL: DOLPHIN AMPHIBION —— 6 PLACE
ENGINE: PRATT & WHITNEY WASP



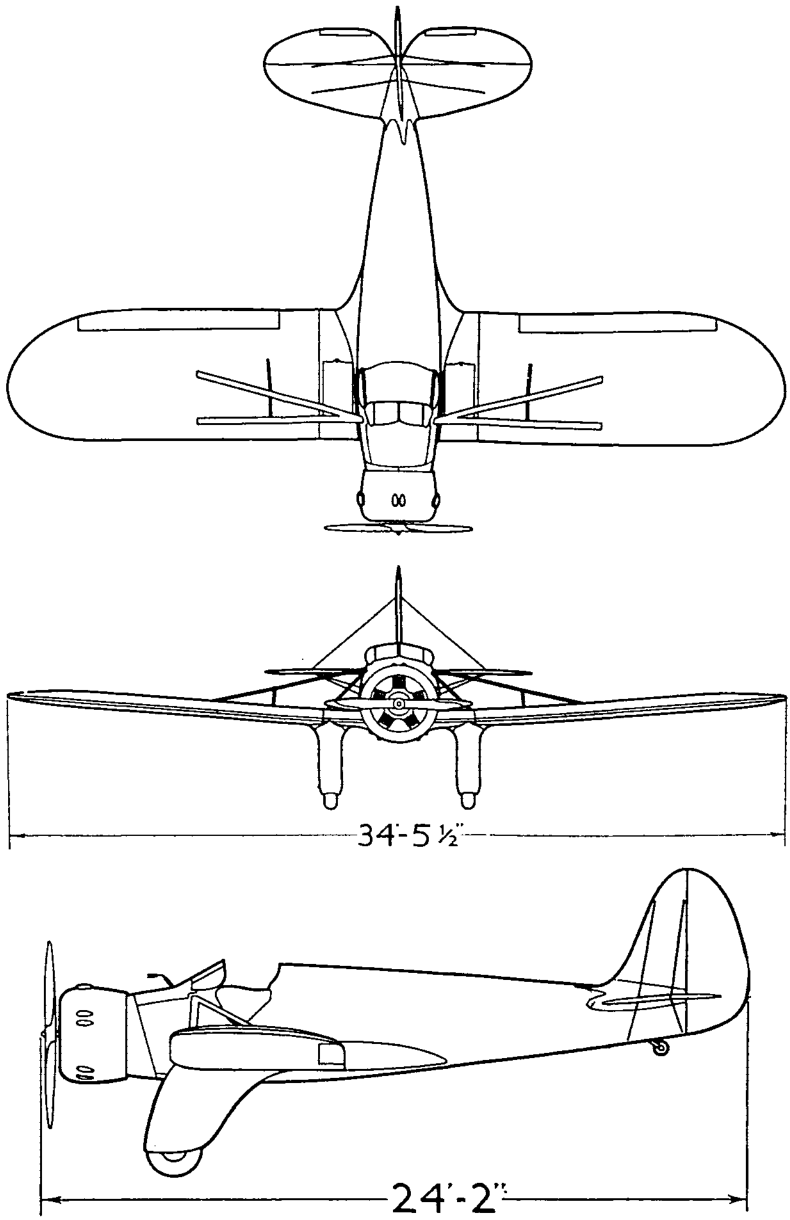
FLEETWINGS, INC.
Bristol, Pa.
Model F401 Amphibion —— 4 Place
Engine: Jacobs 225 H.P.



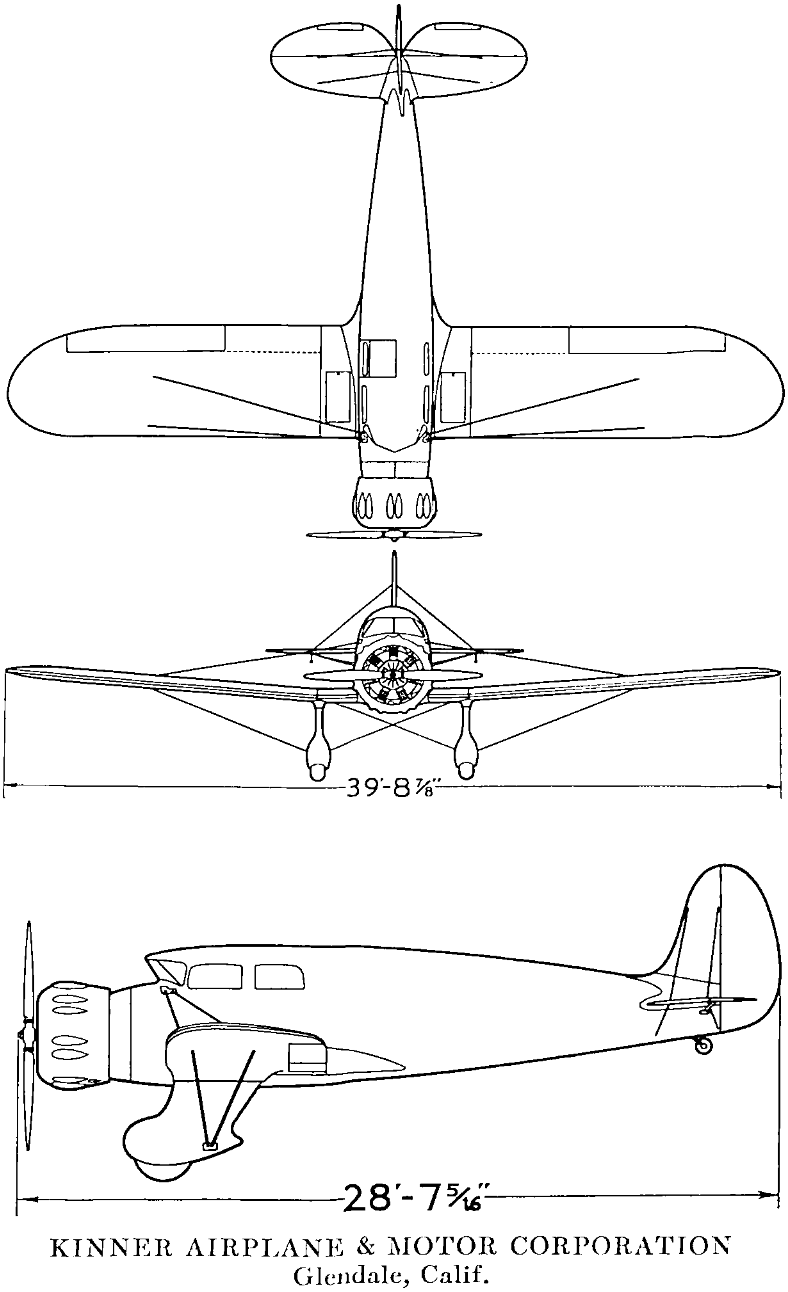
GREAT LAKES AIRCRAFT CORPORATION
Cleveland, Ohio
MODEL 2S-W —— 2 PLACE
ENGINE: WARNER SUPER SCARAB



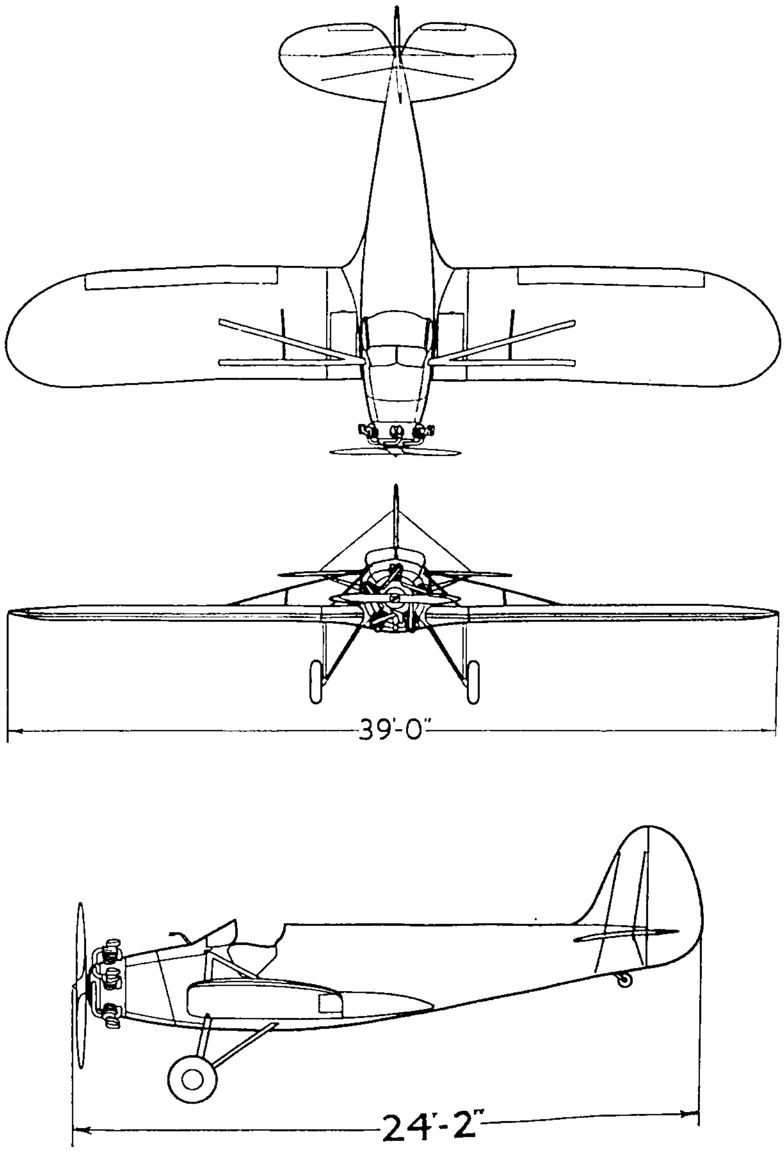
KELLETT AUTOGIRO CORPORATION
Philadelphia, Pa.
MODEL KD-1 —— 2 PLACE
ENGINE: JACOBS L-4



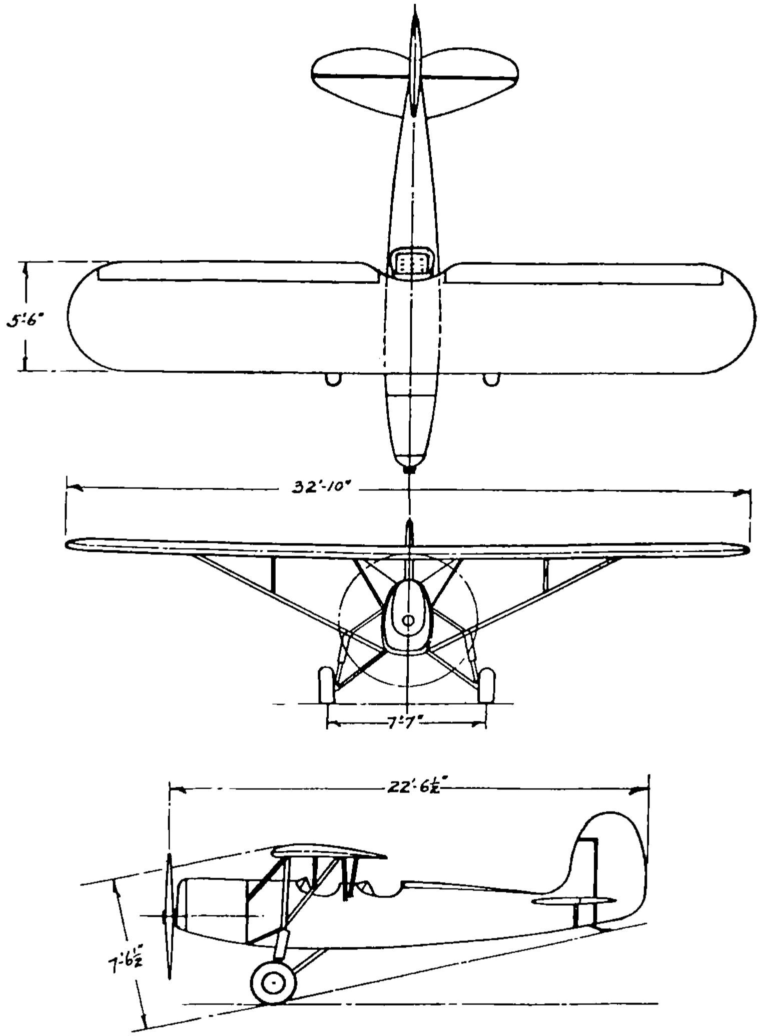
KINNER AIRPLANE & MOTOR CORPORATION
Glendale, Calif.
SPORTSTER B-2 —— 2 PLACE
ENGINE: KINNER B-5



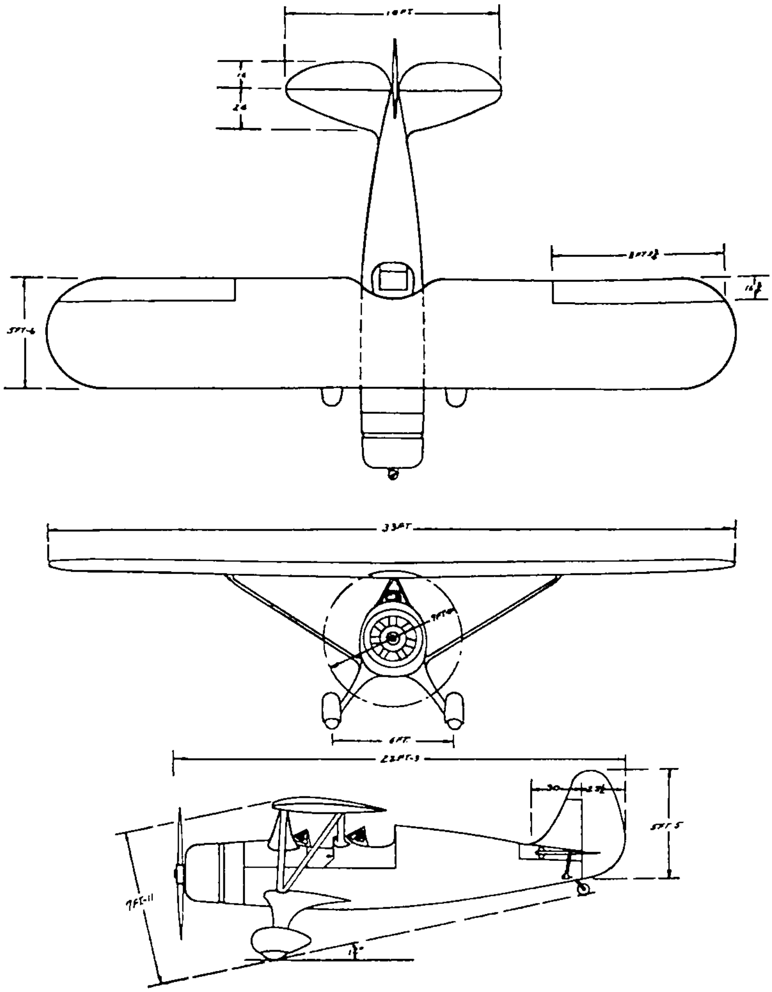
KINNER AIRPLANE & MOTOR CORPORATION
Glendale, Calif.
ENVOY —— 4 PLACE
ENGINE: KINNER C-7



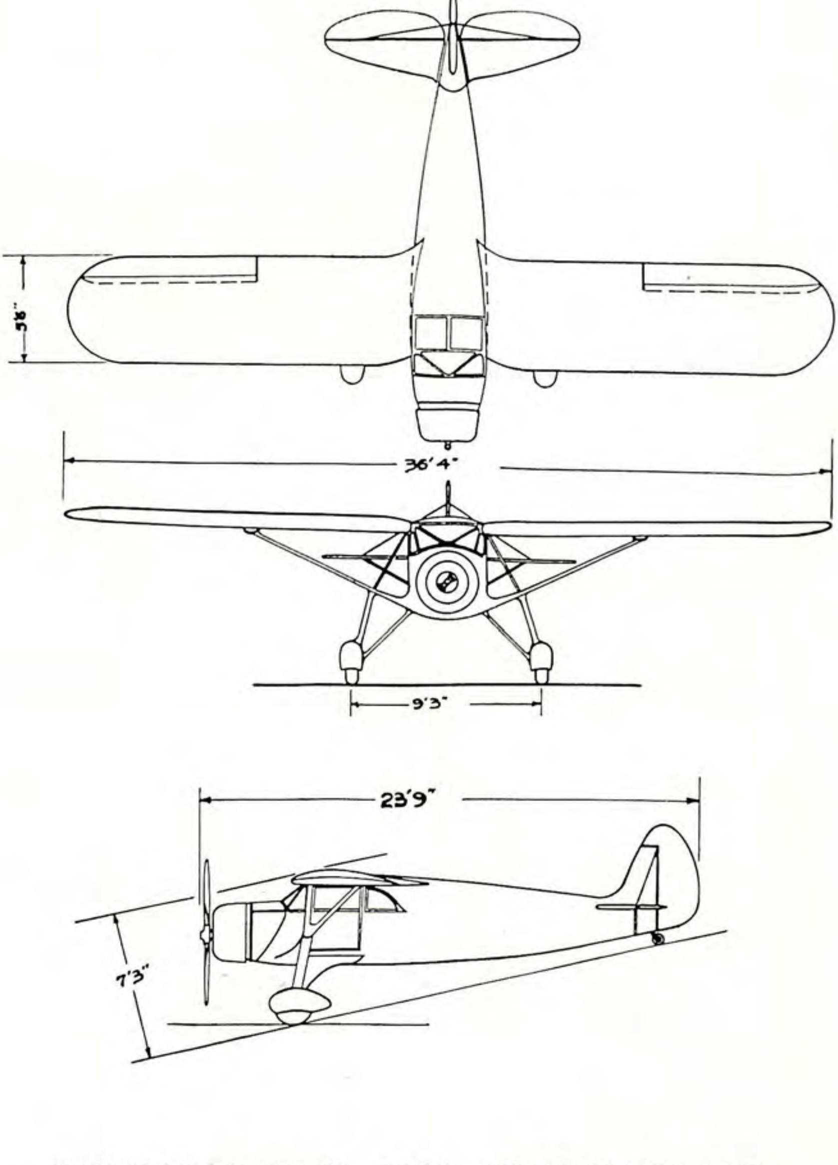
KINNER AIRPLANE & MOTOR CORPORATION
Glendale, Calif.
SPORTSTER —— 2 PLACE
ENGINE: KINNER K-5
KINNER B-5



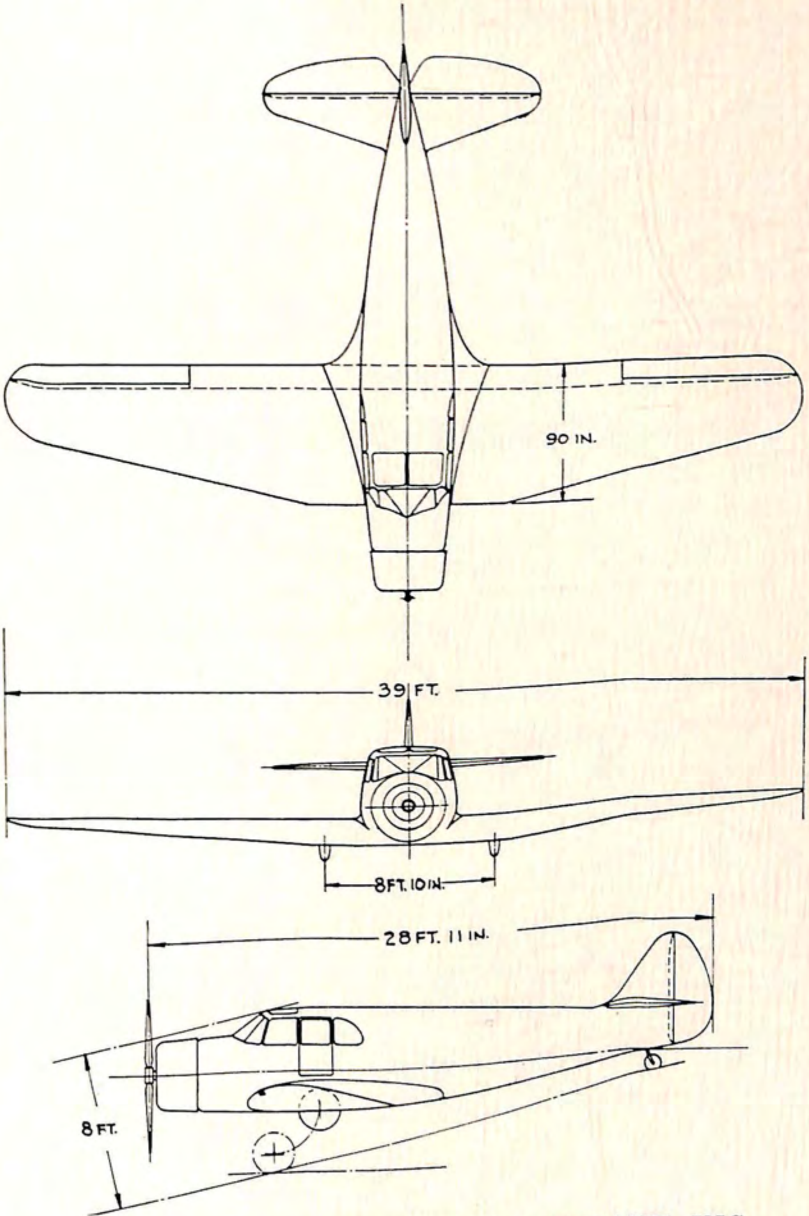
KREIDER-REISNER AIRCRAFT COMPANY, INC.
Hagerstown, Md.
FAIRCHILD 22 MODEL C7-D —— 2 PLACE
ENGINE: WRIGHT GIPSY



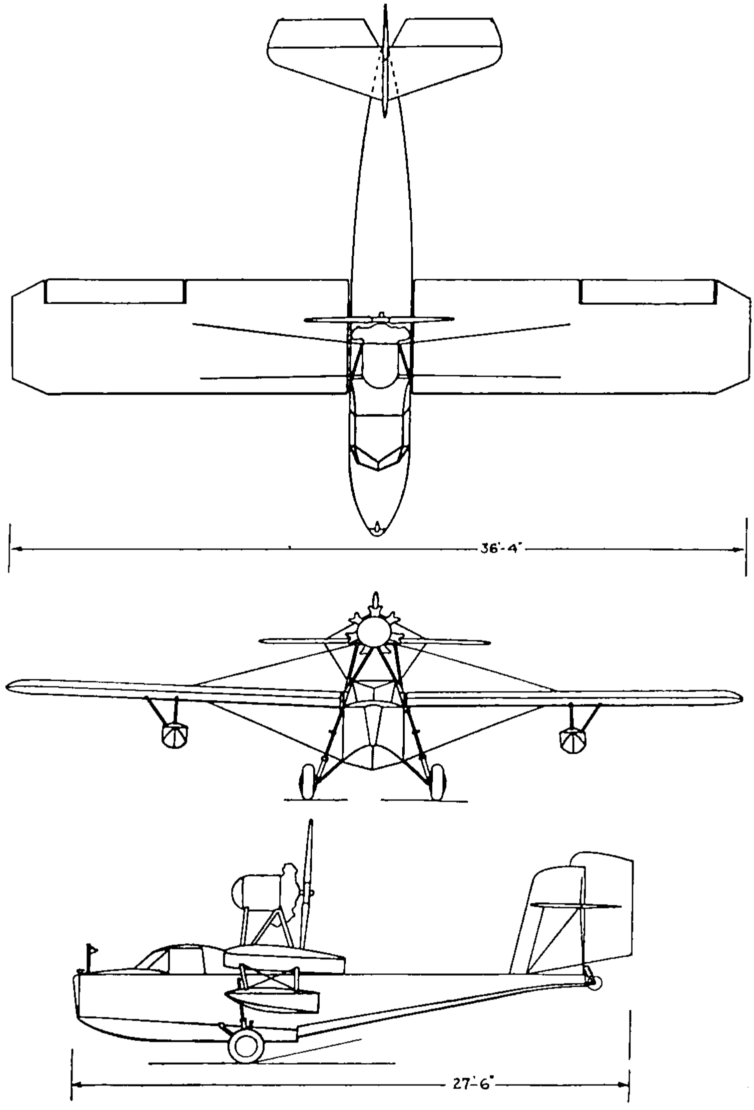
KREIDER-REISNER AIRCRAFT COMPANY, INC.
Hagerstown, Md.
Fairchild 22 Model C7-G —— 2 Place
Engine: Warner Super Scarab



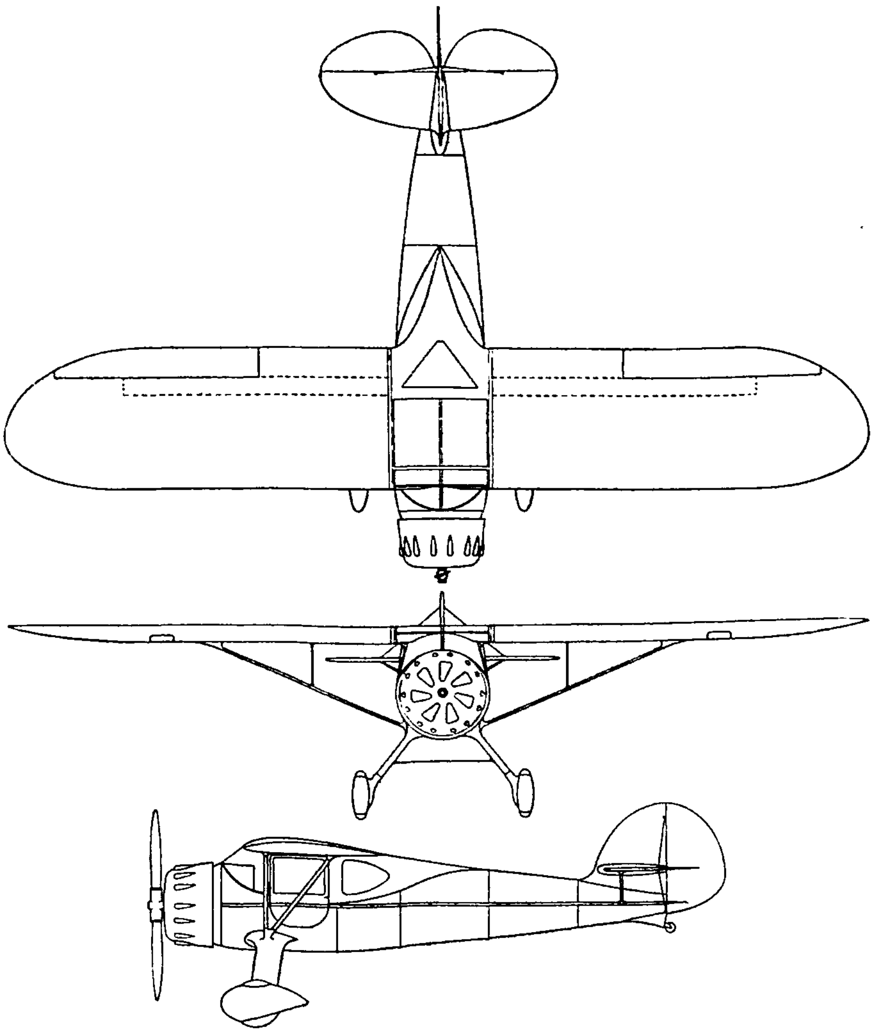
KREIDER-REISNER AIRCRAFT COMPANY, INC.
Hagerstown, Md.
FAIRCHILD 24 MODEL C8-C —— 2 PLACE
ENGINE: WARNER SUPER SCARAB



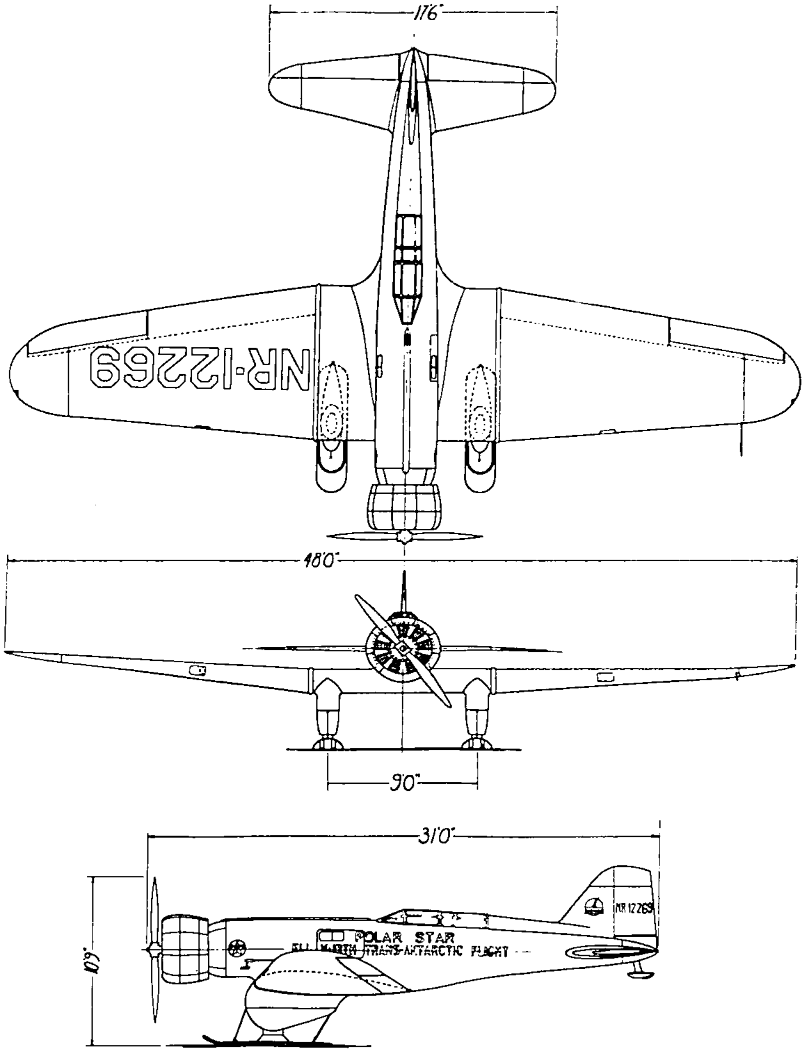
KREIDER-REISNER AIRCRAFT COMPANY, INC.
Hagerstown, Md.
FAIRCHILD 45 —— 4-5 PLACE
ENGINE: JACOBS



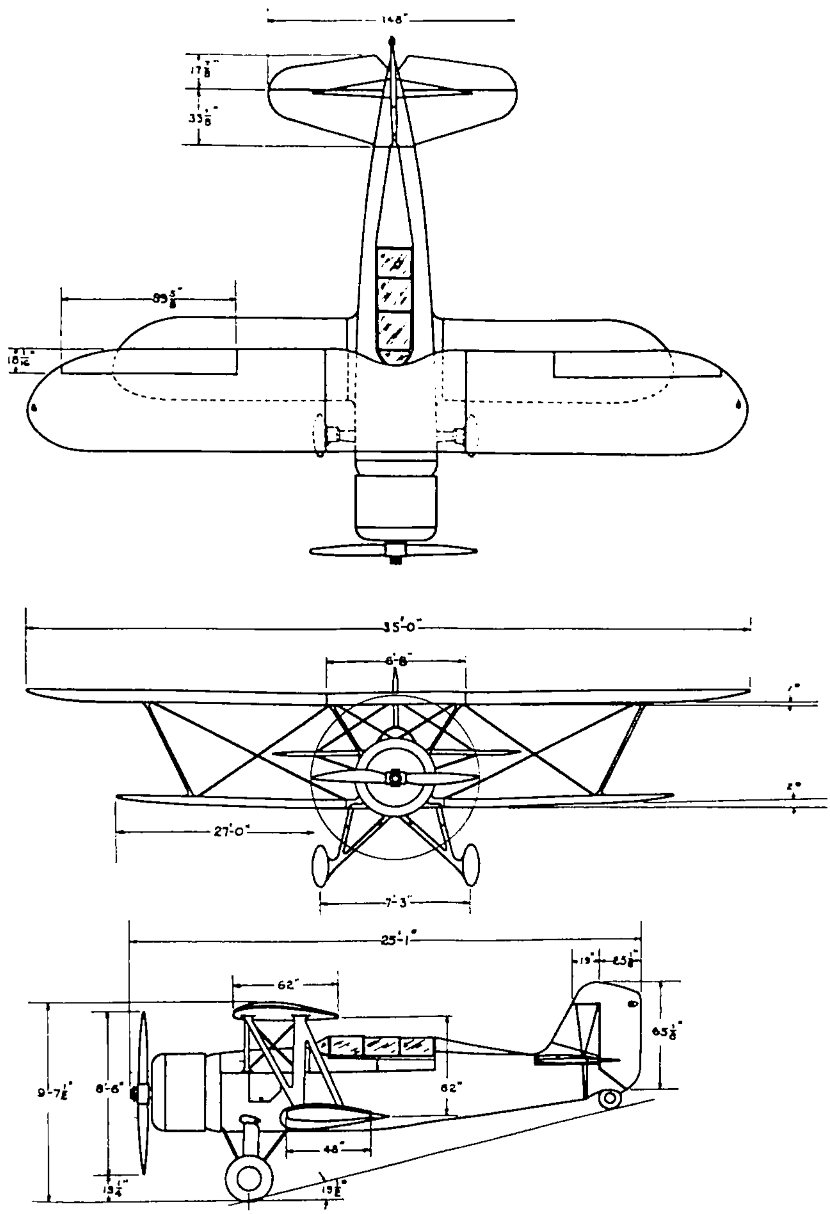
GROVER LOENING AIRCRAFT COMPANY, INC.
Garden City, L. I., N. Y.
DUCKLING —— 2 PLACE
ENGINE: WARNER SCARAB



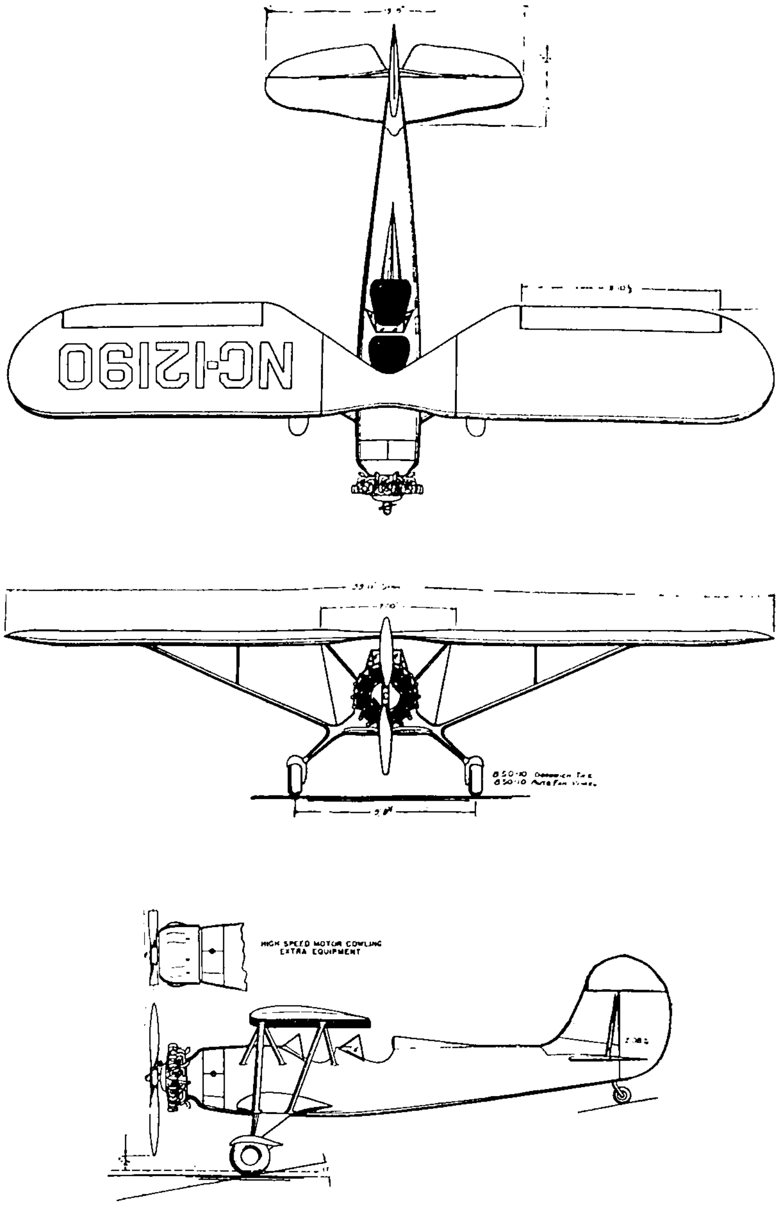
D. A. LUSCOMBE
Trenton, N. J.
PHANTOM —— 2 PLACE
ENGINE: WARNER SUPER SCARAB



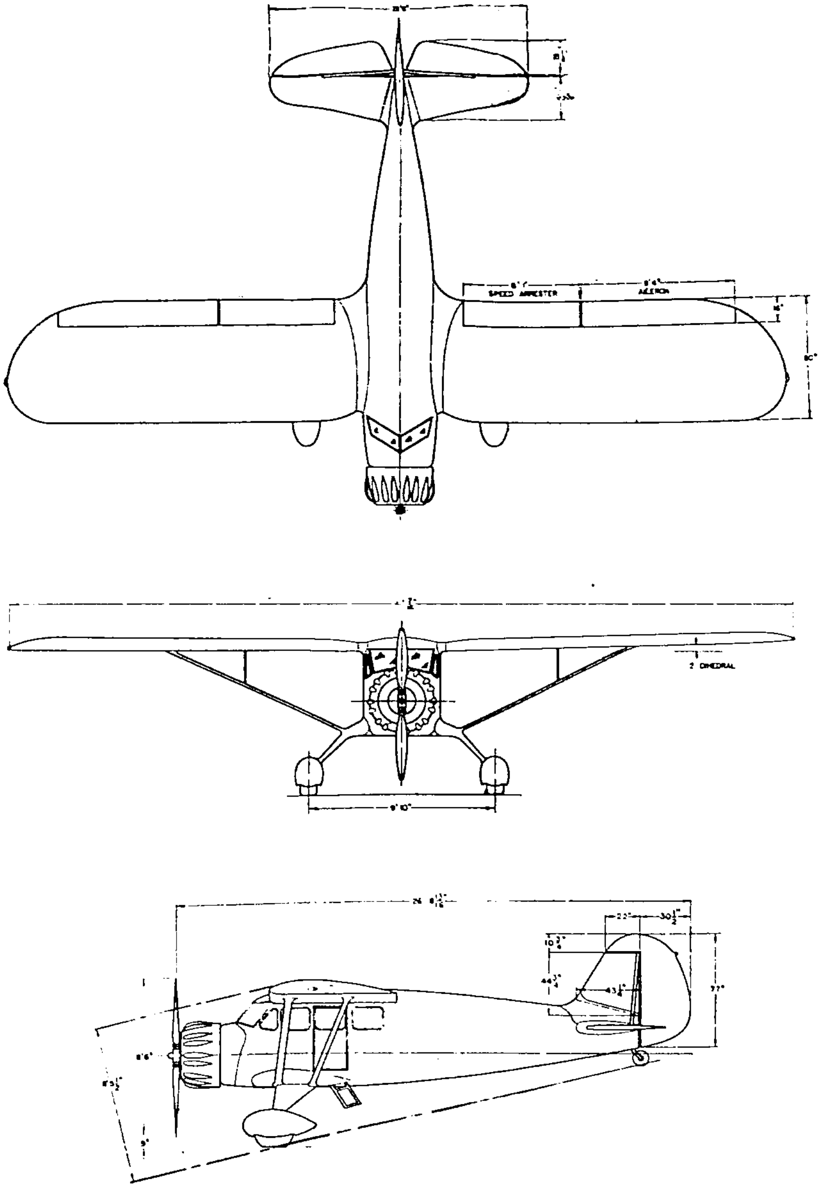
THE NORTHROP CORPORATION
Inglewood, Calif.
GAMMA—LONG RANGE —— 1-2 PLACE
ENGINE: PRATT & WHITNEY WASP



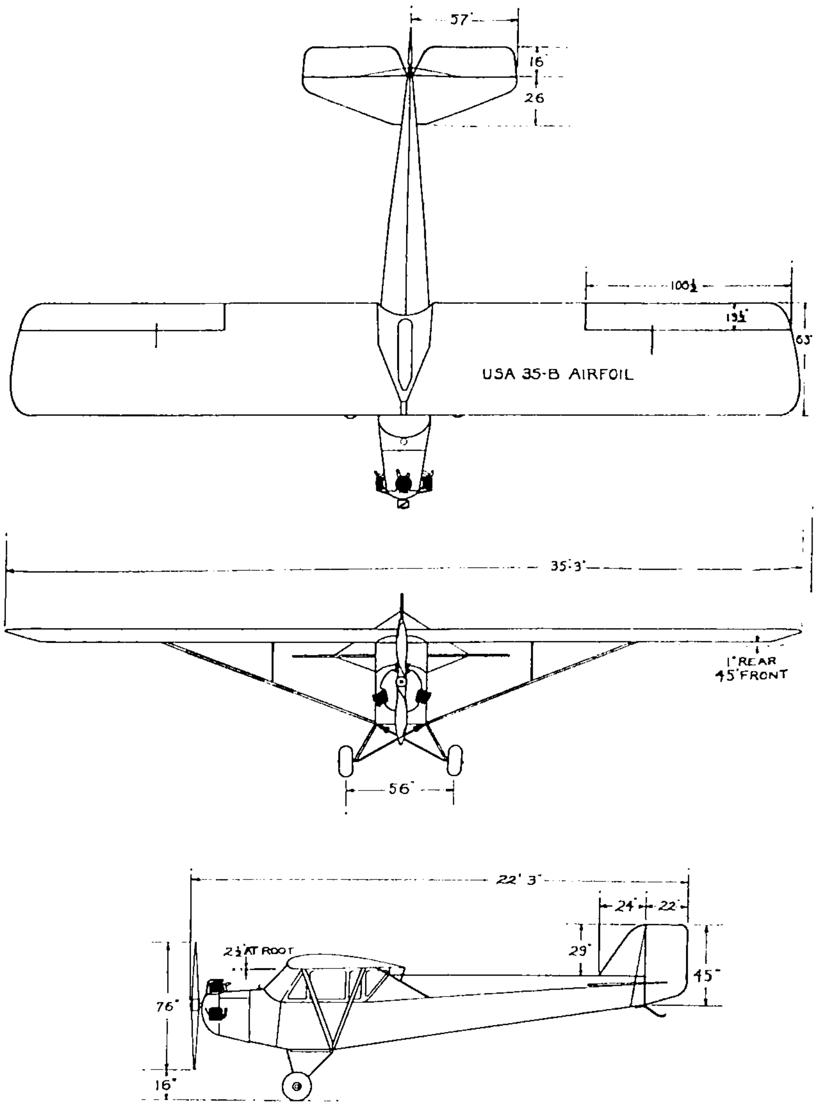
STEARMAN AIRCRAFT COMPANY
Wichita, Kans.
MODEL 81 —— 2 PLACE
ENGINE: PRATT & WHITNEY WASP JUNIOR



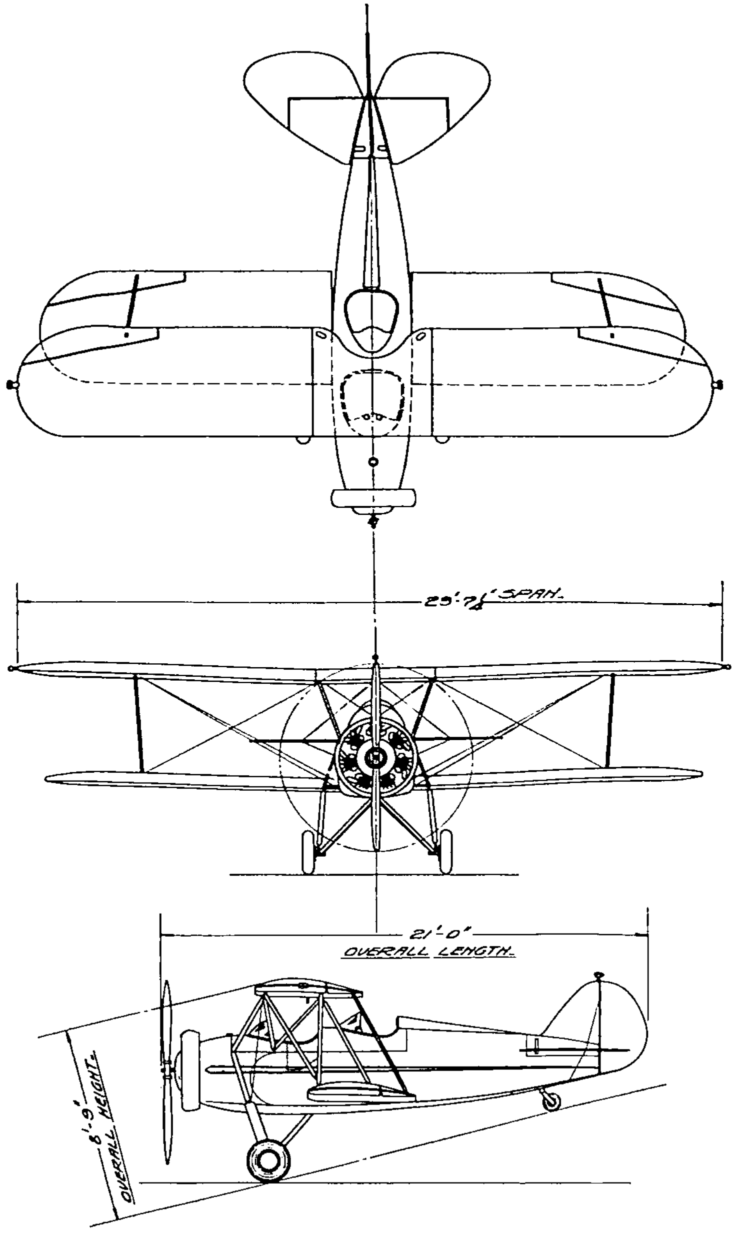
STINSON AIRCRAFT CORPORATION
Wayne, Mich.
Senior Trainer —— 2 Place
Engine: Lycoming



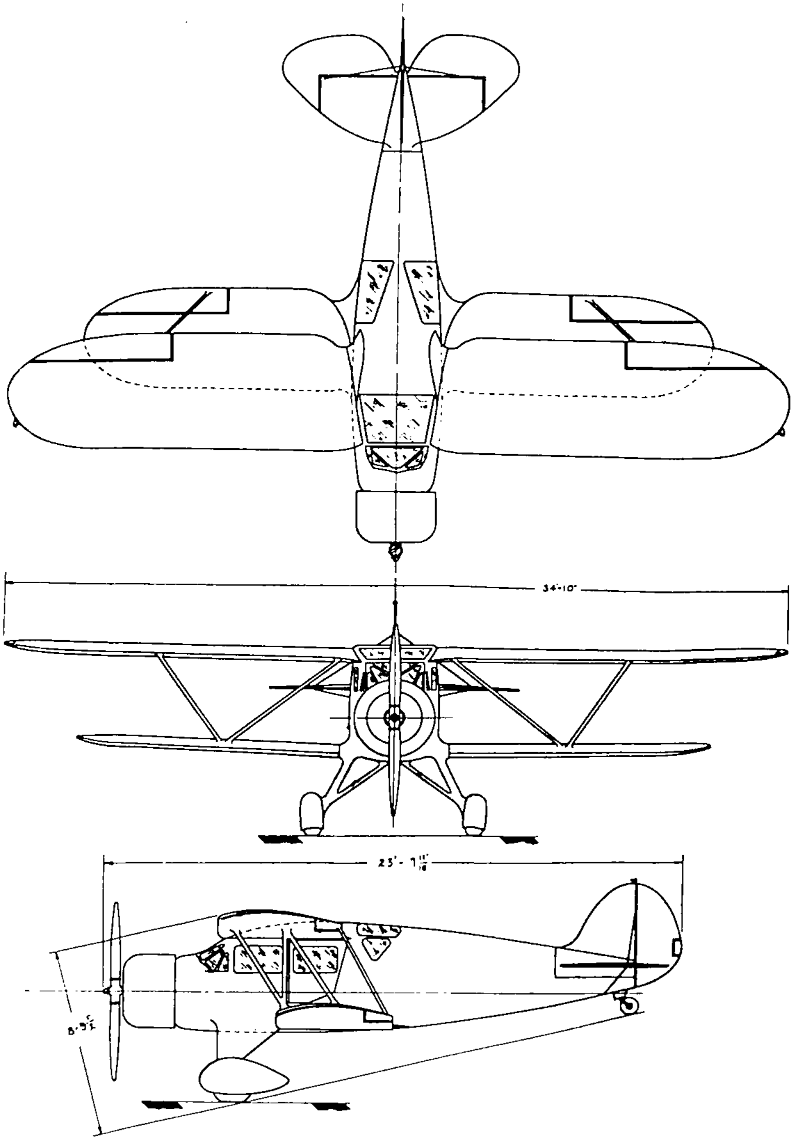
STINSON AIRCRAFT CORPORATION
Wayne, Mich.
RELIANT MODEL SR-5E —— 4 PLACE
ENGINE: LYCOMING



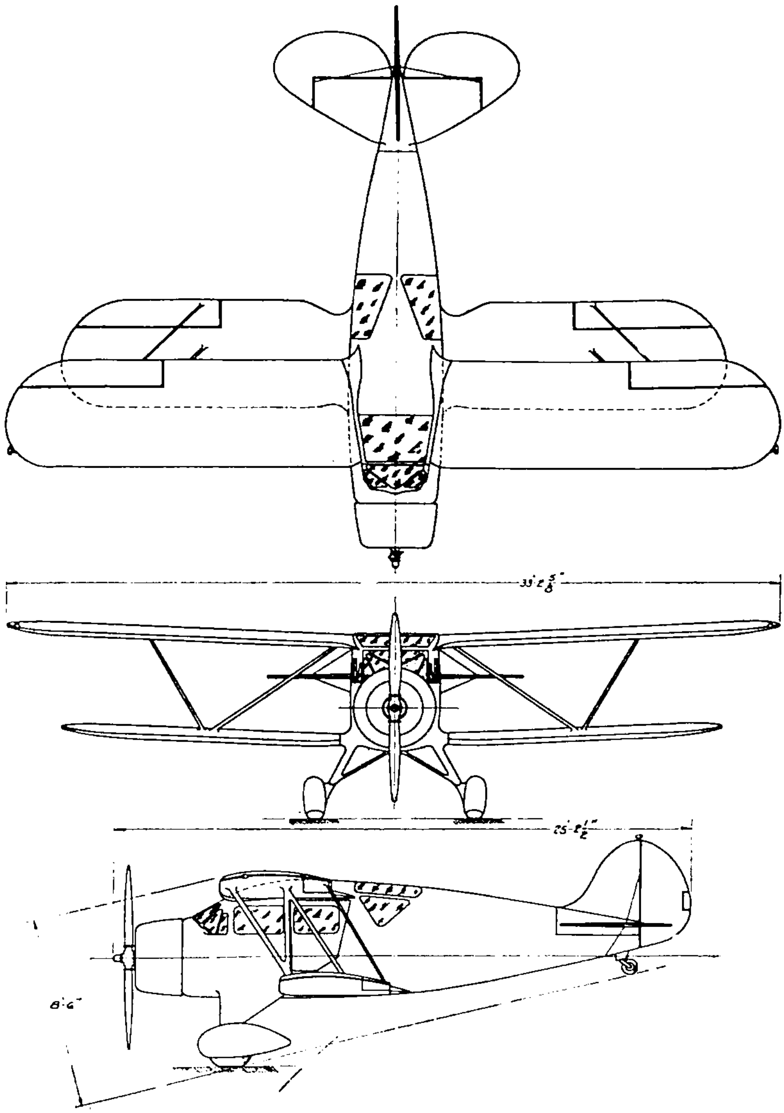
TAYLOR AIRCRAFT COMPANY
Bradford, Pa.
Taylor Cub F-2 —— 2 Place
Engine: Aeromarine AR3-40



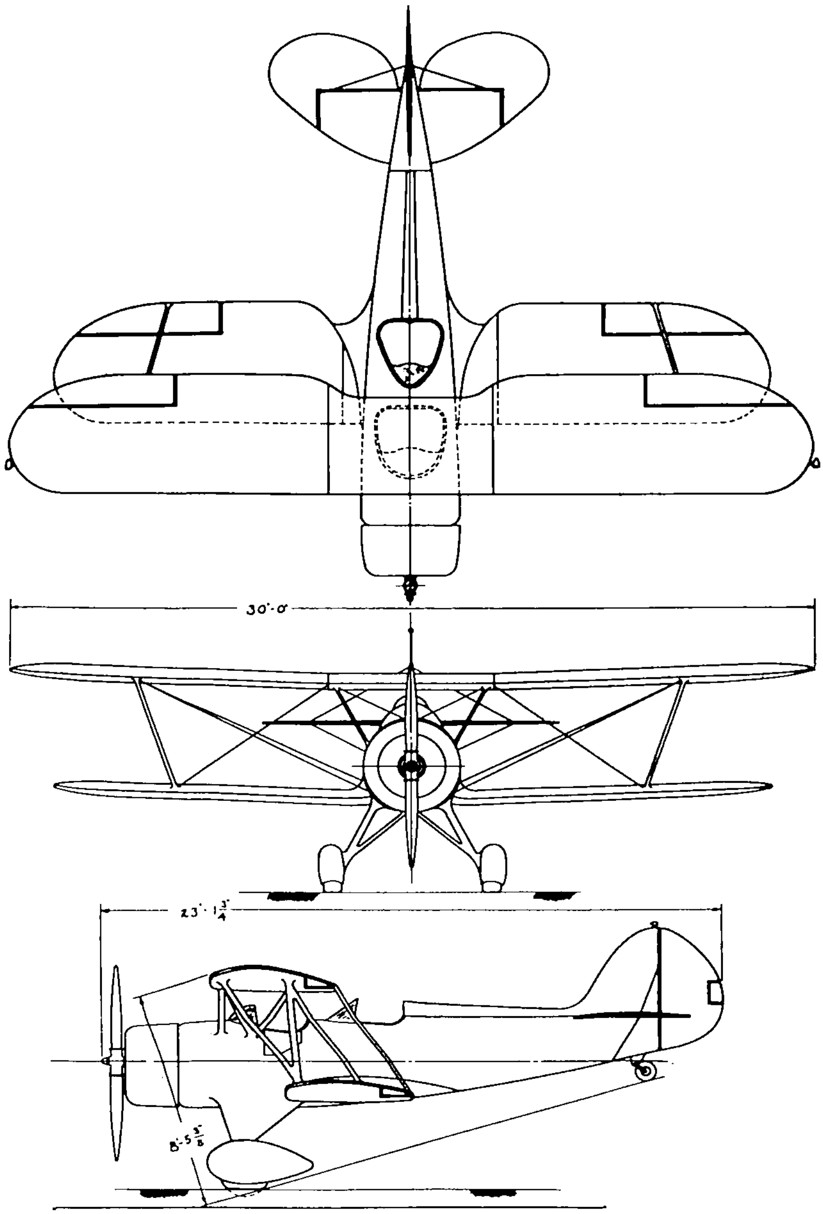
WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL RNF —— 3 PLACE
ENGINE: WARNER SCARAB



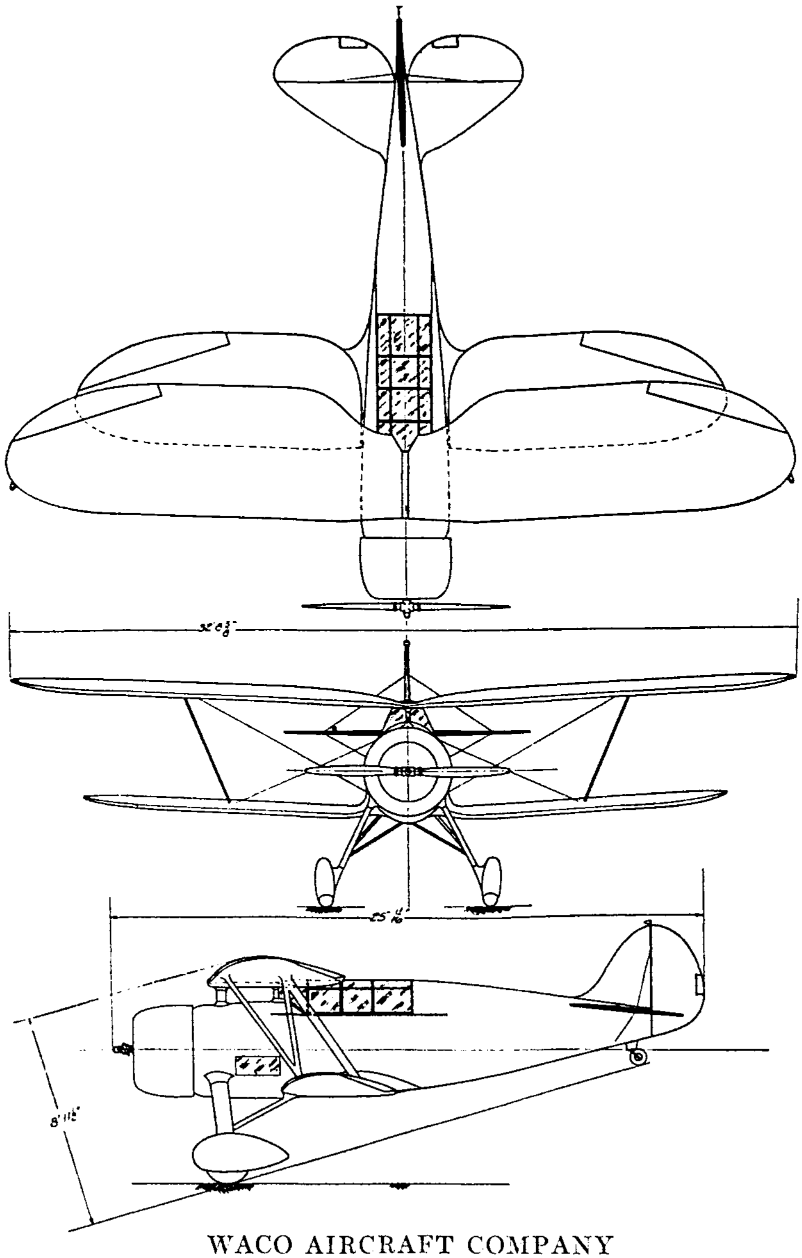
WACO AIRCRAFT COMPANY
Troy, Ohio
Model CJC —— 4 Place
Engine: Wright Whirlwind



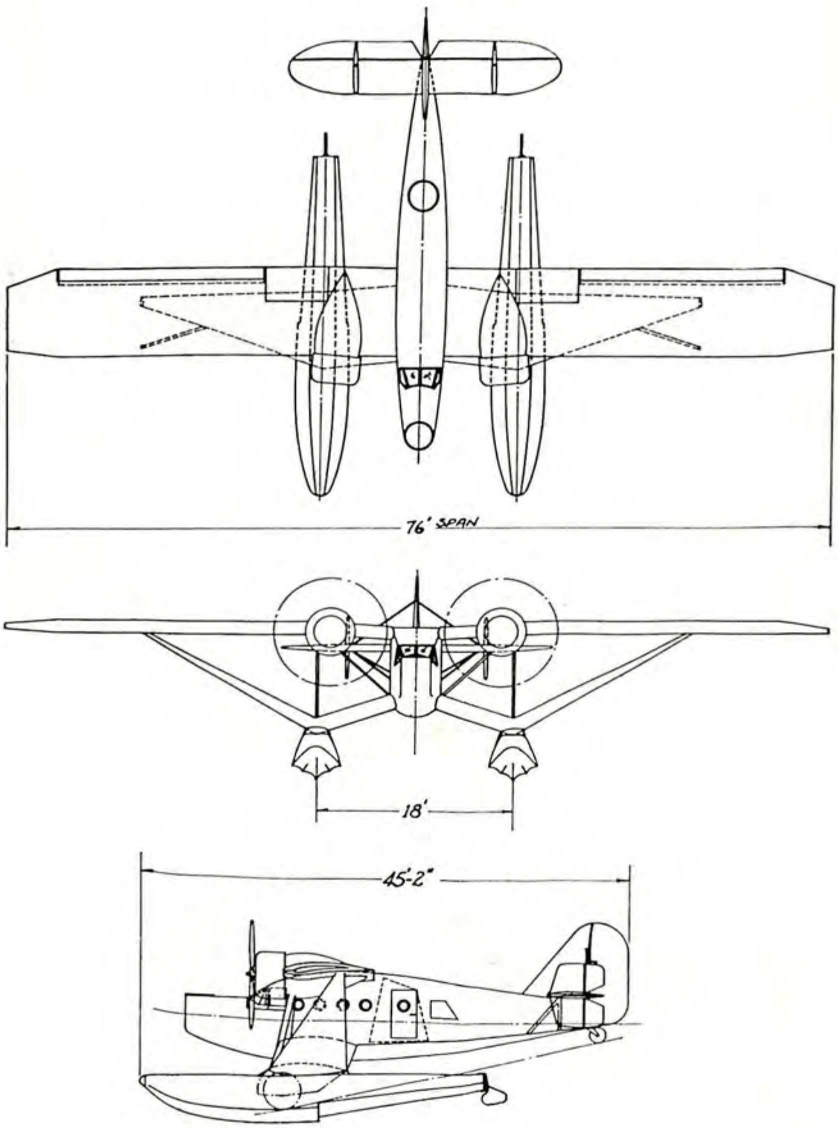
WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL UKC —— 4 PLACE
ENGINE: CONTINENTAL
MODEL YKC
ENGINE: JACOBS-L4



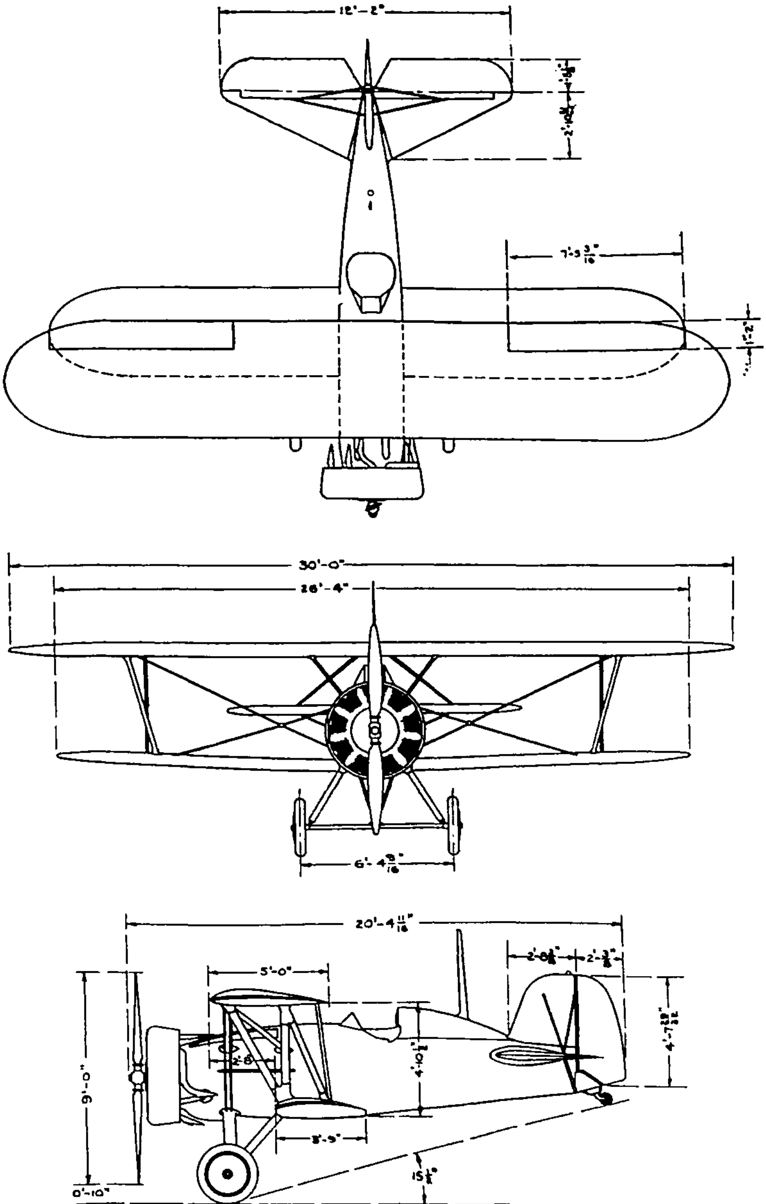
WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL UMF —— 2 PLACE
ENGINE: CONTINENTAL
MODEL YMF
ENGINE: JACOBS-L4



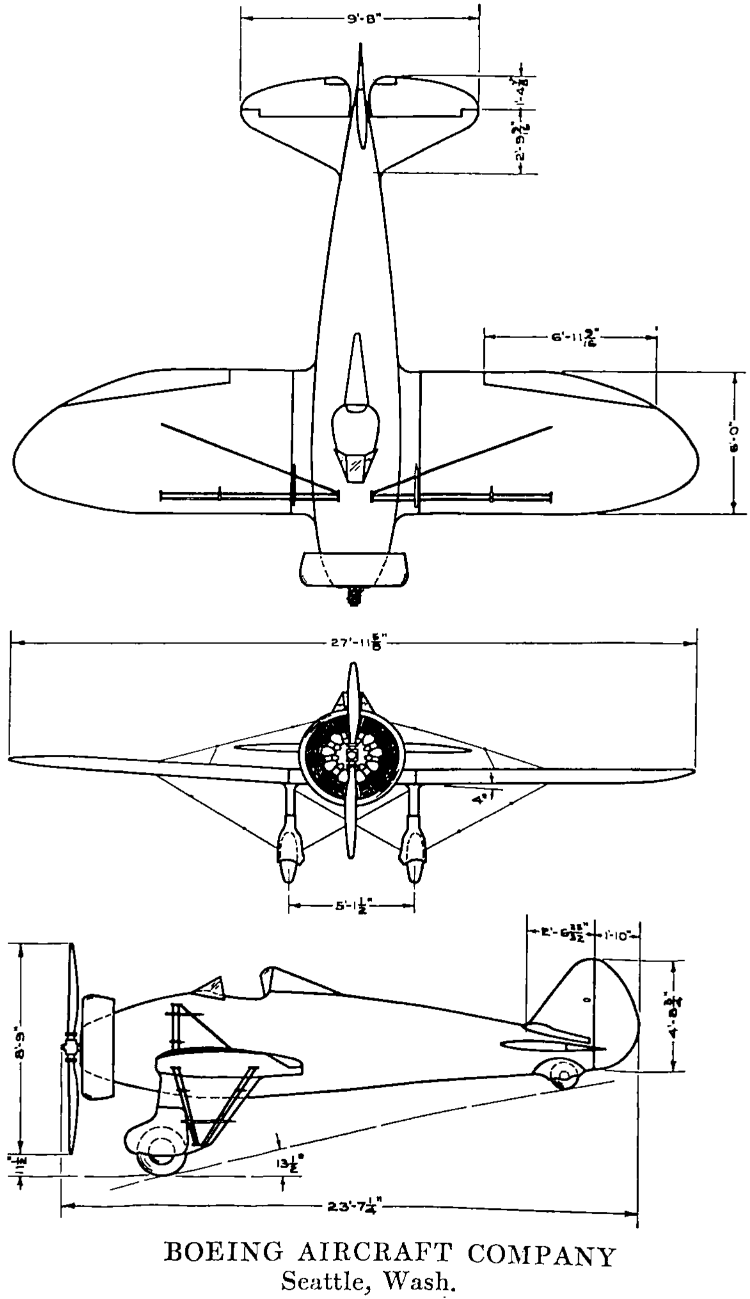
WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL WHD —— 2 PLACE
ENGINE: PRATT & WHITNEY WASP JUNIOR
WRIGHT WHIRLWIND



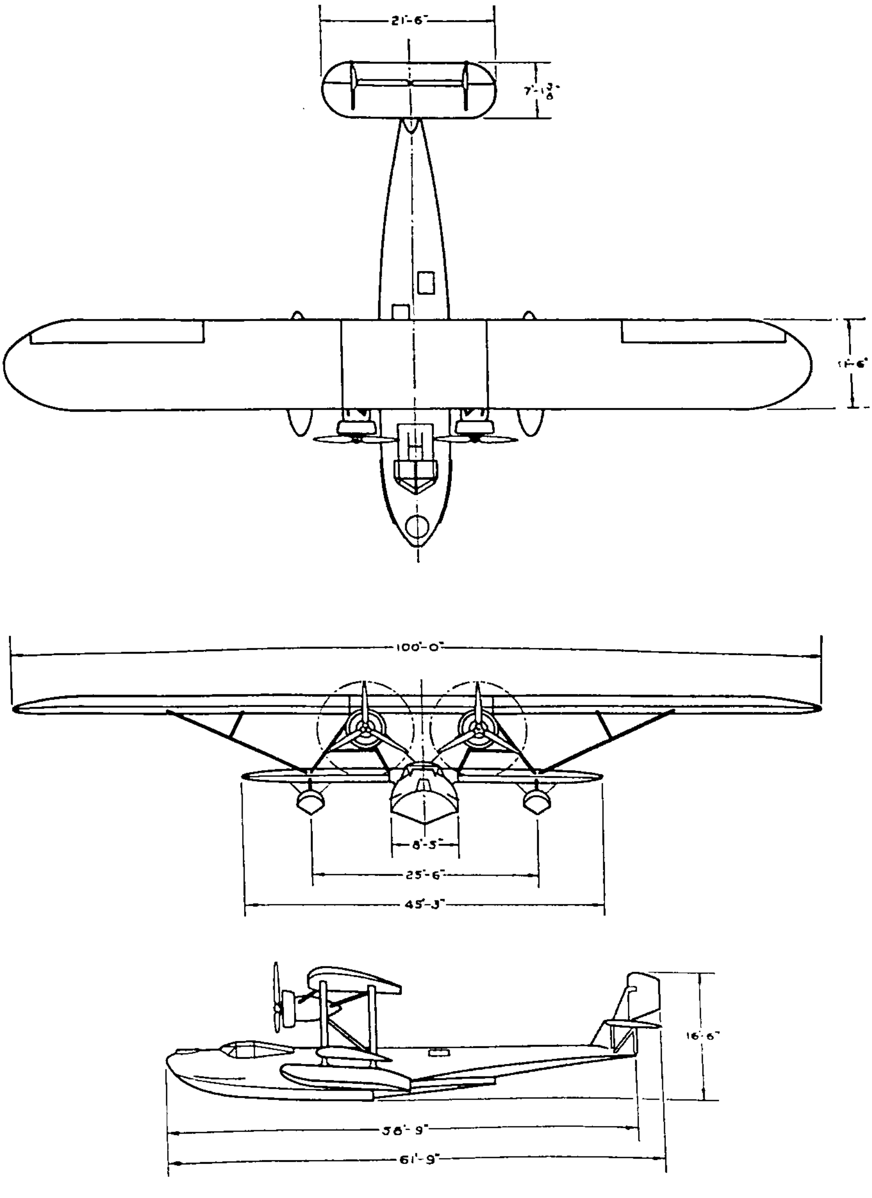
BELLANCA AIRCRAFT CORPORATION
Newcastle, Del.
Bombardment Land or Seaplane
Engines: Two Wright Cyclones



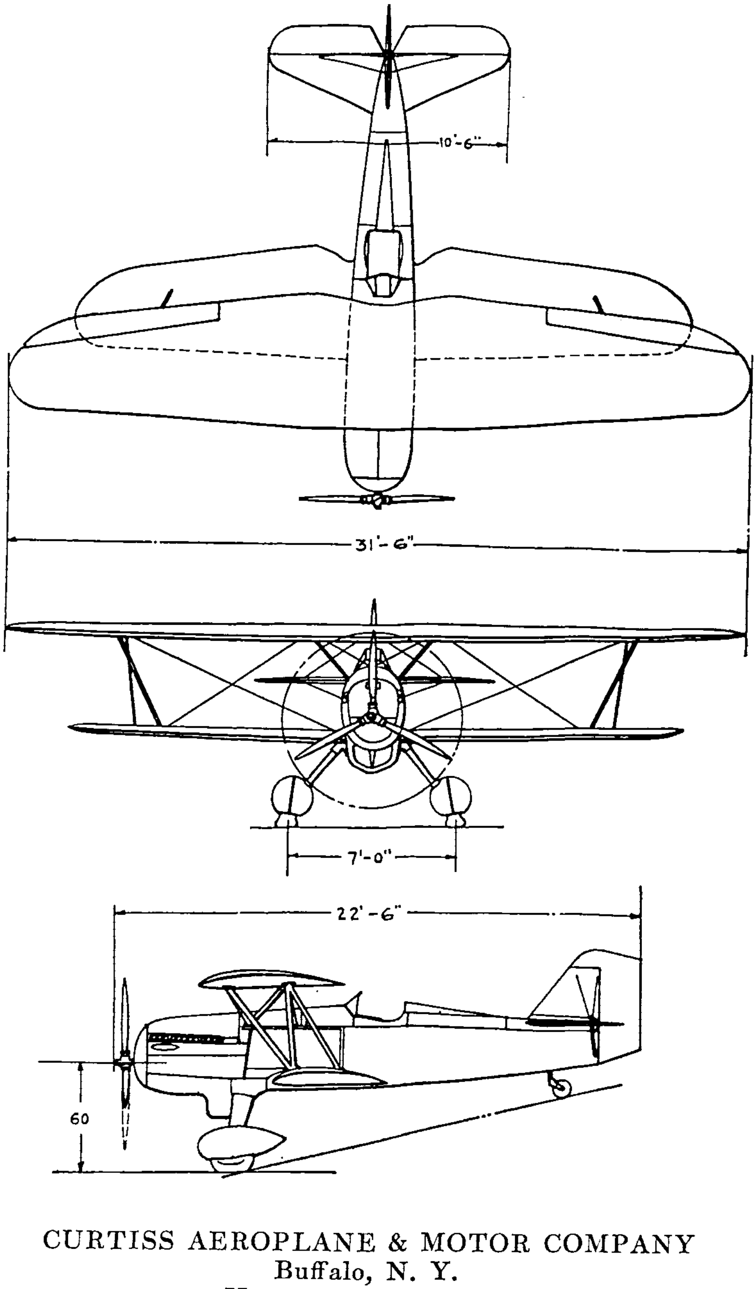
BOEING AIRCRAFT COMPANY
Seattle, Wash.
FIGHTER F4B-4
ENGINE: PRATT & WHITNEY WASP



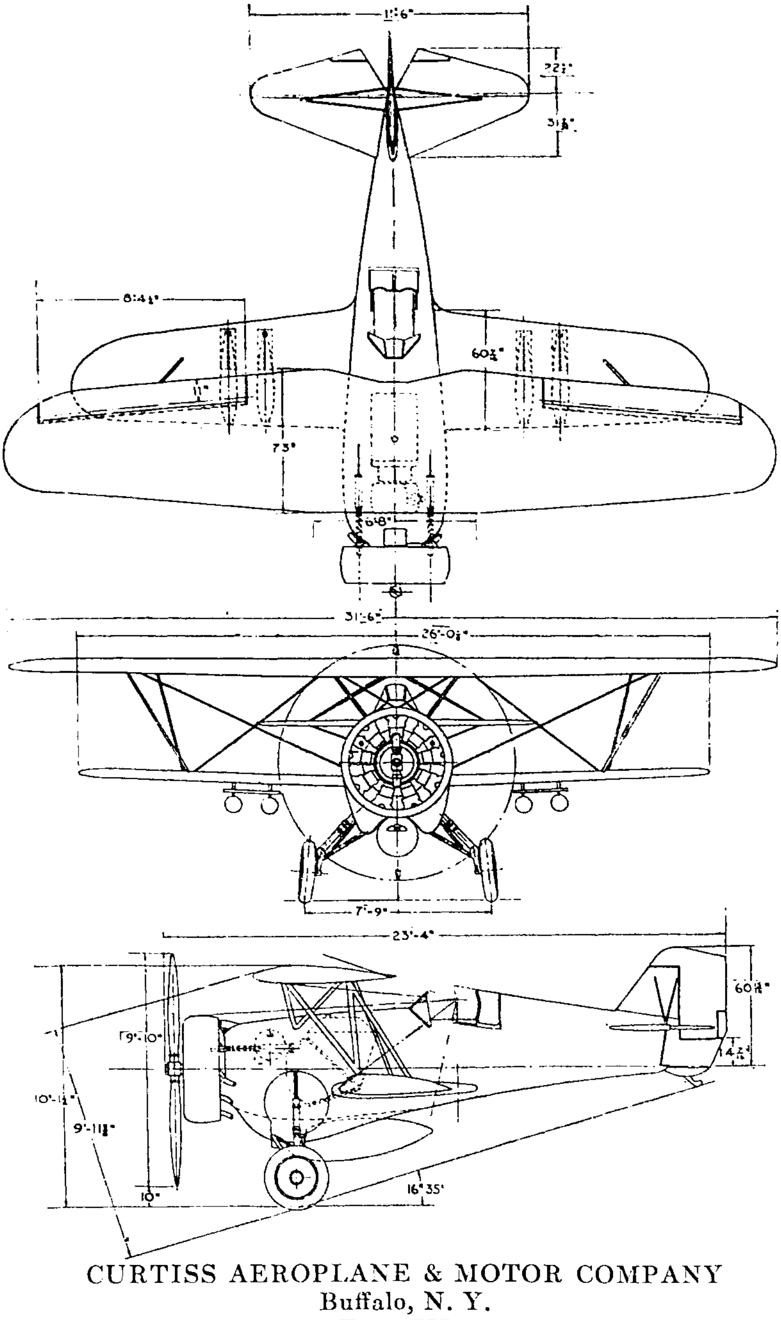
BOEING AIRCRAFT COMPANY
Seattle, Wash.
Pursuit P-26A —— Model 281
Engine: Pratt & Whitney Wasp



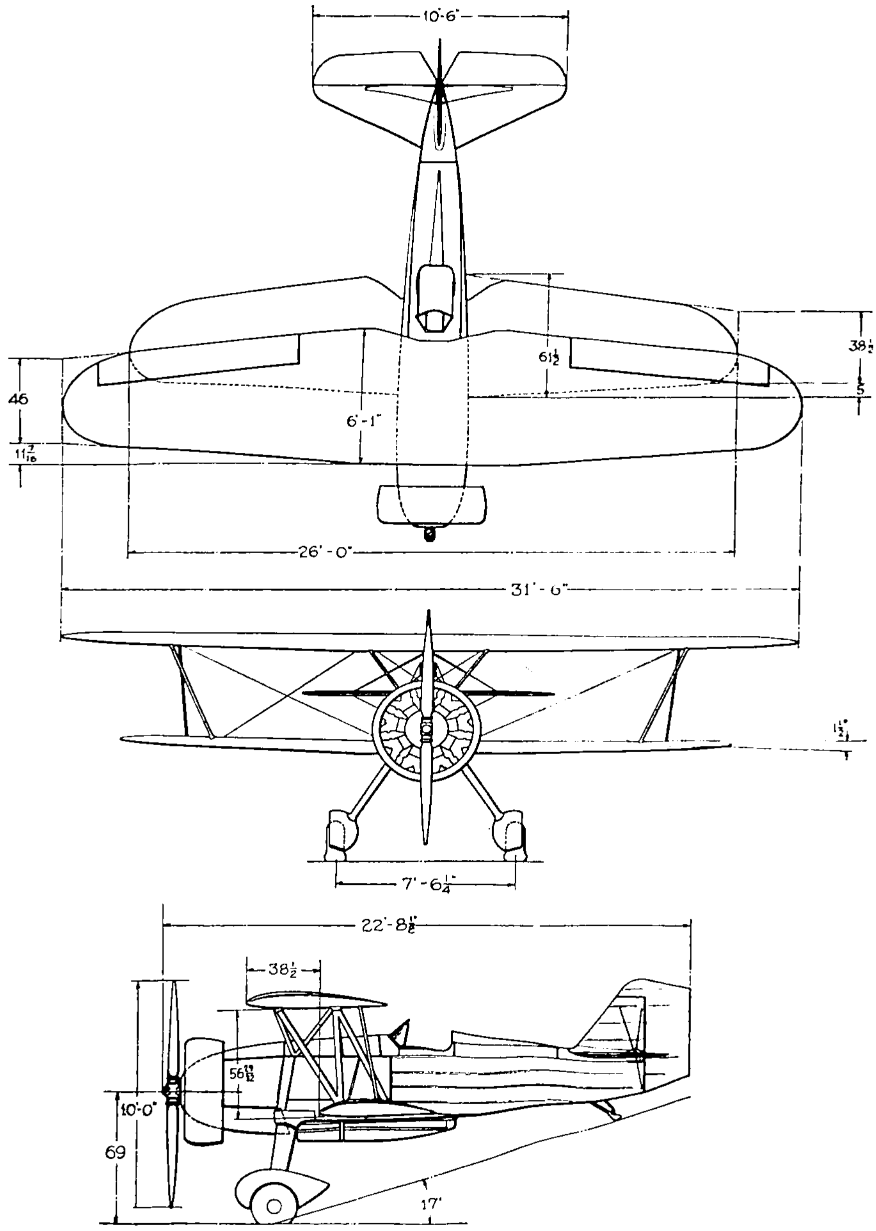
CONSOLIDATED AIRCRAFT CORPORATION
Buffalo, N. Y.
PATROL FLYING BOAT P2Y-1
ENGINES: TWO GEARED WRIGHT CYCLONES



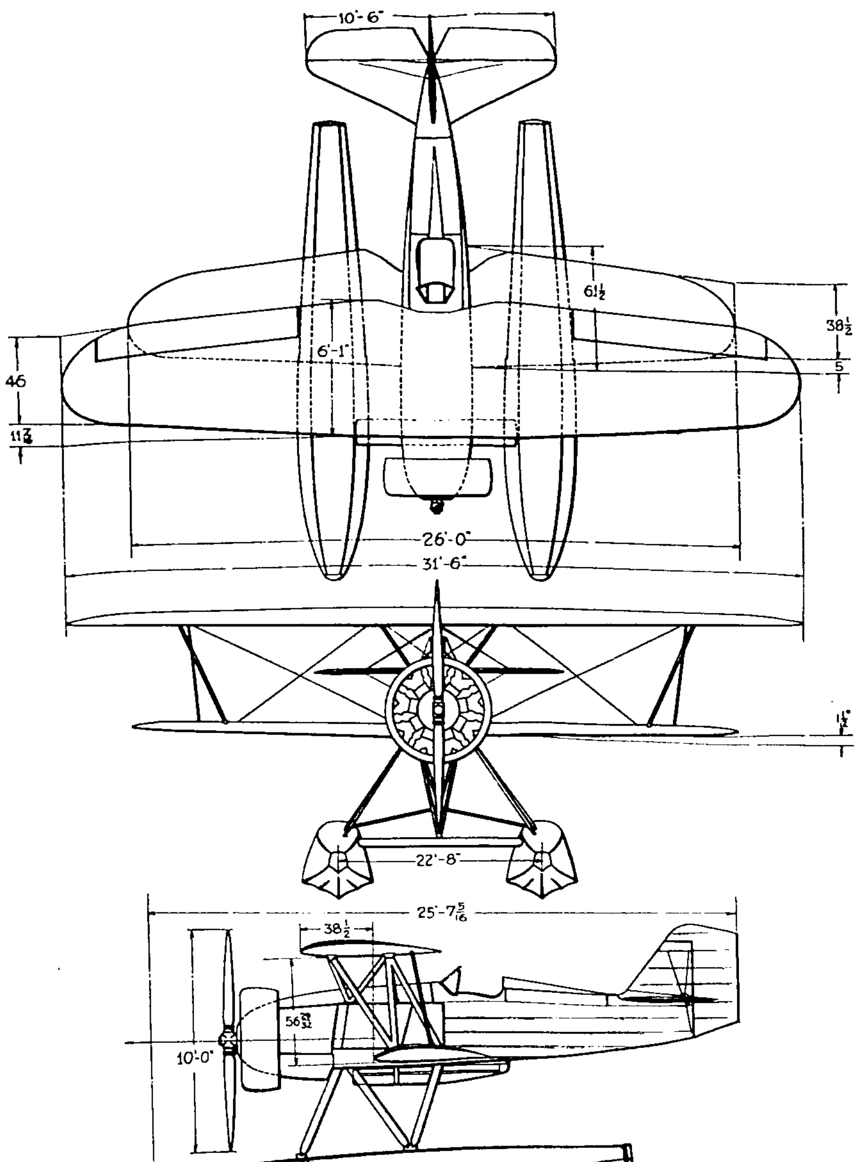
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
HAWK PURSUIT P 6-E
ENGINE: CURTISS CONQUEROR 675 H.P.



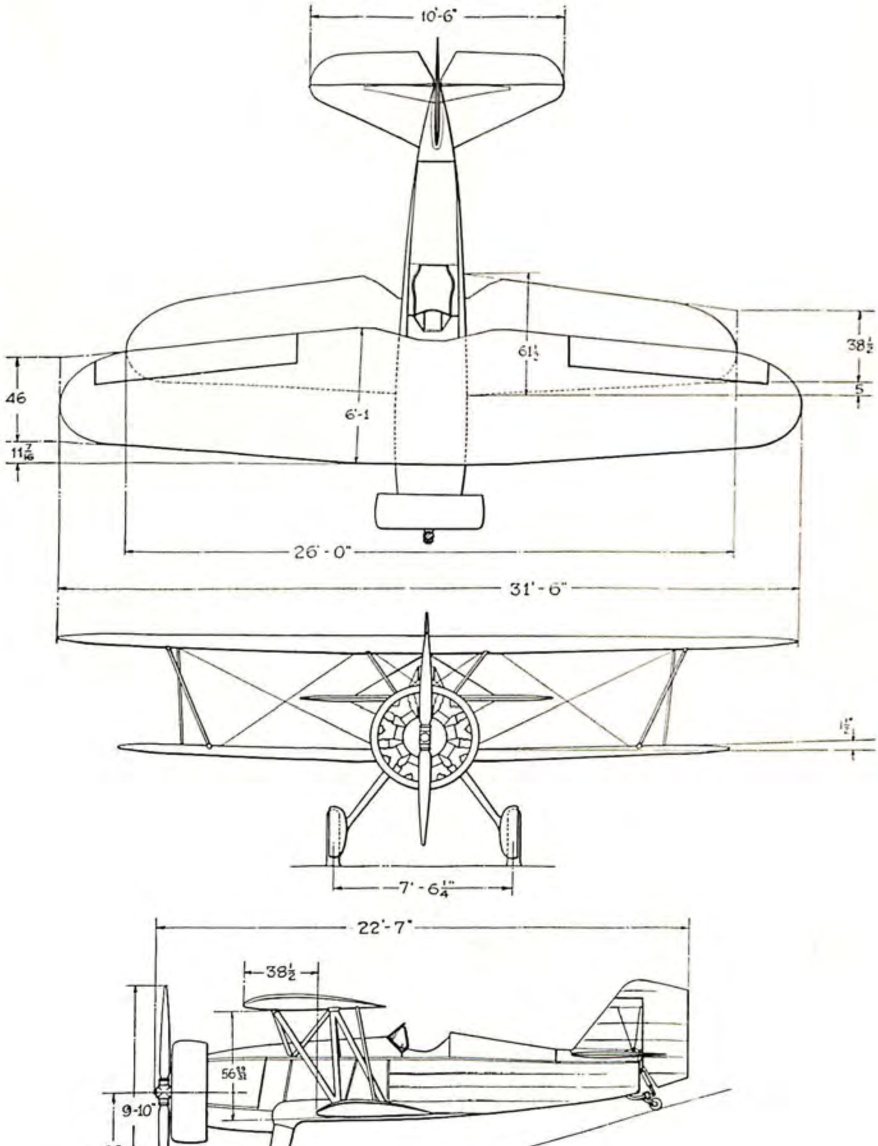
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
HAWK PURSUIT TYPE III —— 1 PLACE
ENGINE: WRIGHT F CYCLONE 715 H.P.



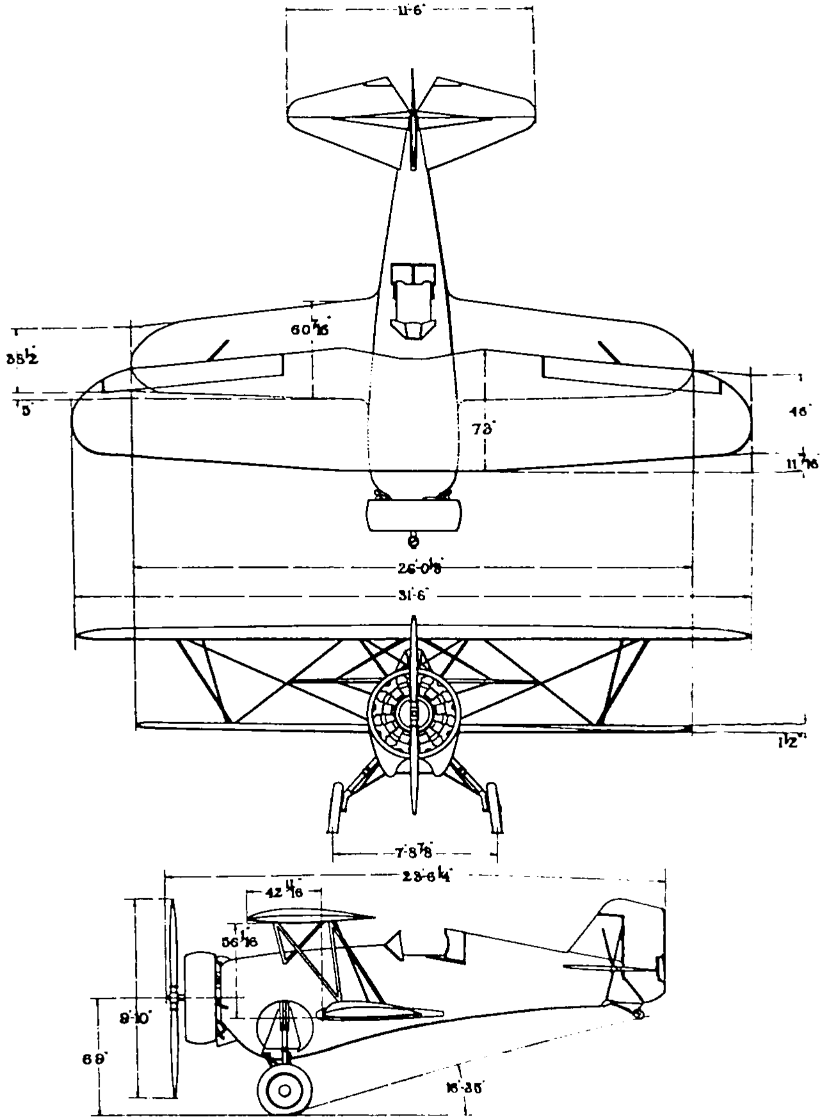
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
HAWK PURSUIT LAND PLANE
ENGINE: WRIGHT CYCLONE F —— 715 H.P.



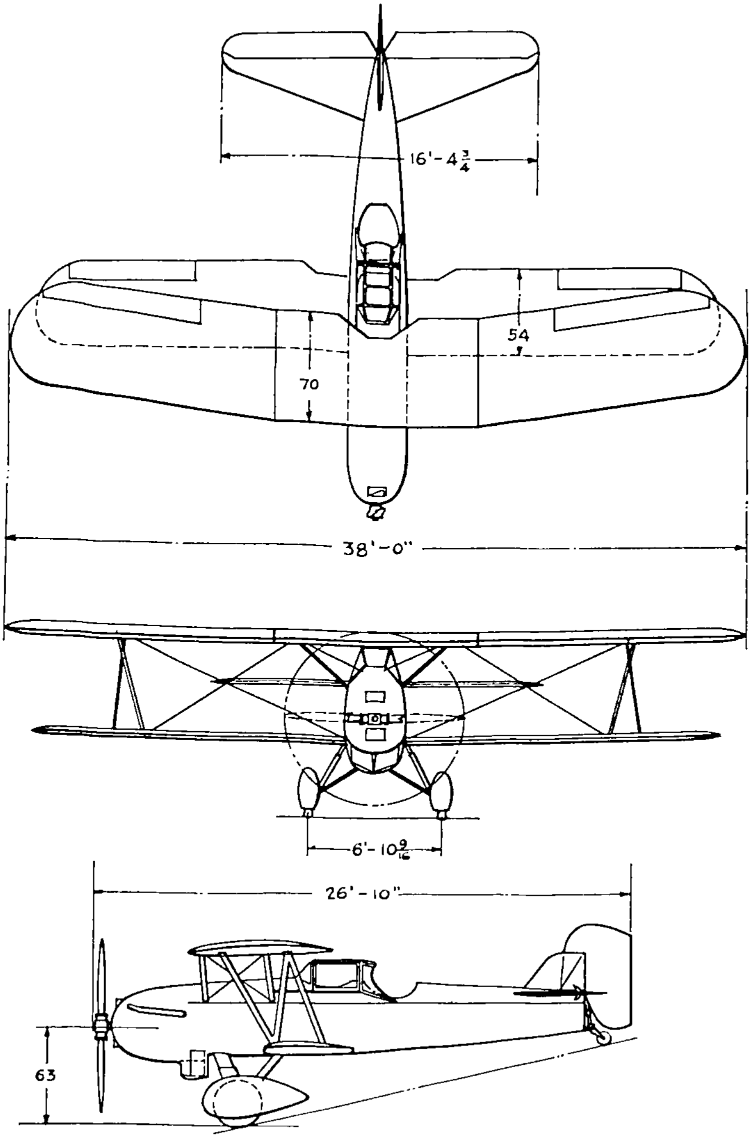
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
Hawk Pursuit Seaplane
Engine: Wright Cyclone F —— 715 H.P.



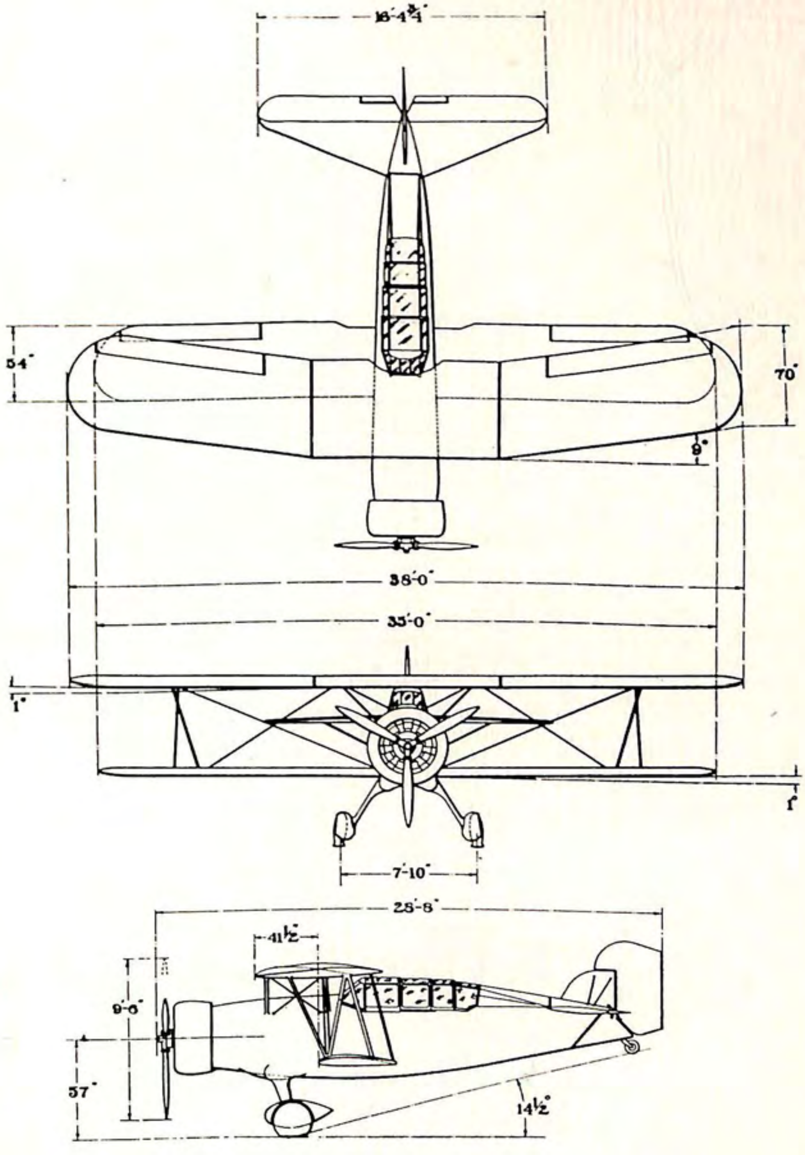
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
FIGHTER F11C-2 —— HAWK
ENGINE: WRIGHT CYCLONE F —— 715 H.P.



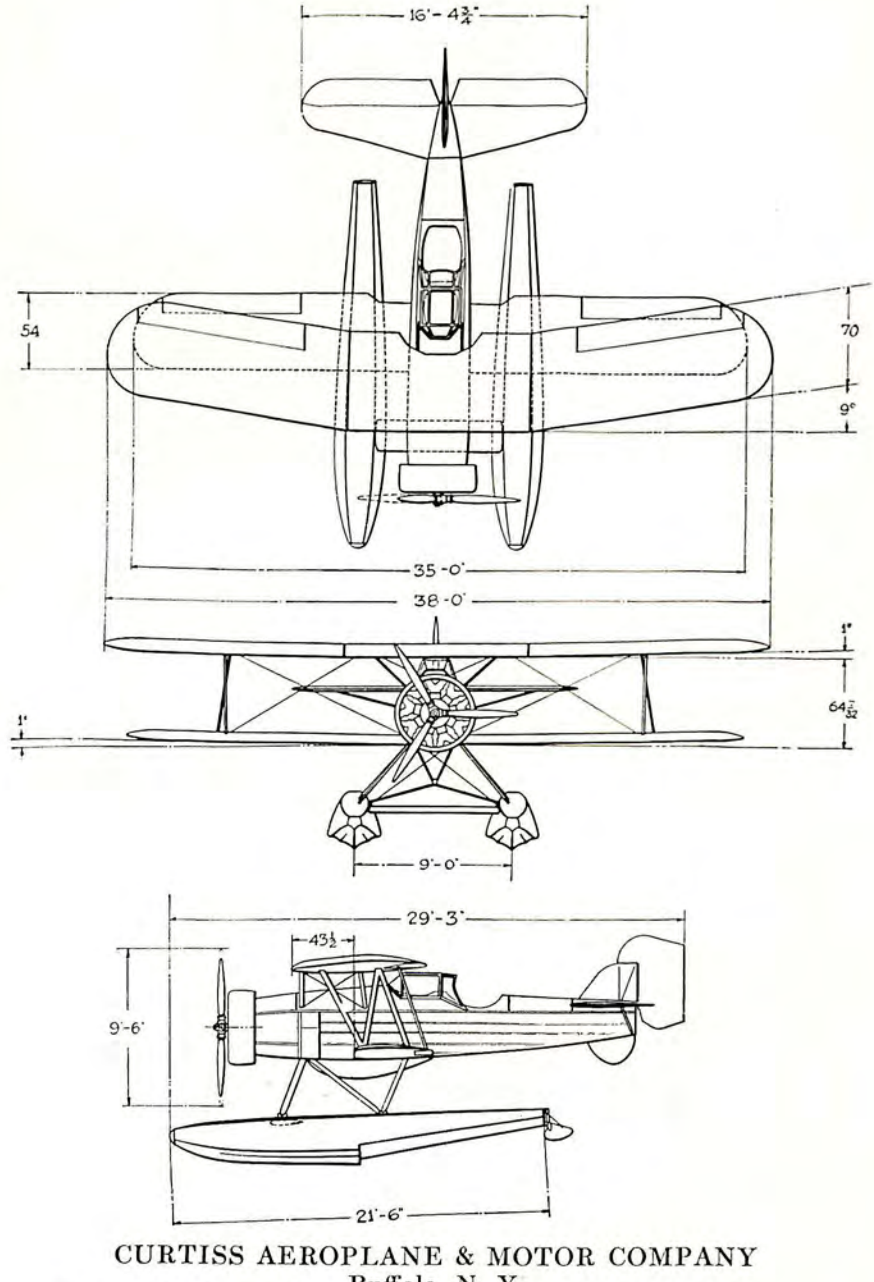
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
NAVY HAWK FIGHTER BF2C-1 —— 1 PLACE
ENGINE: WRIGHT CYCLONE



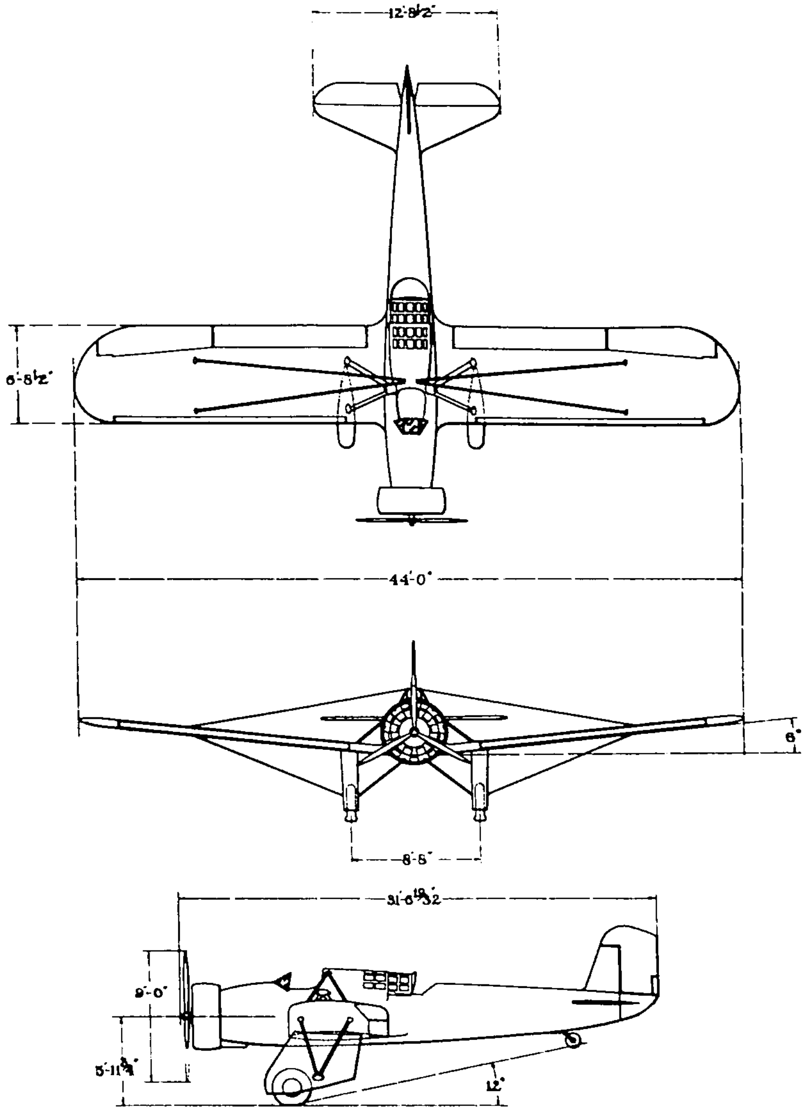
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
Falcon Observation O-39
Engine: Curtiss Conqueror 675 H.P.



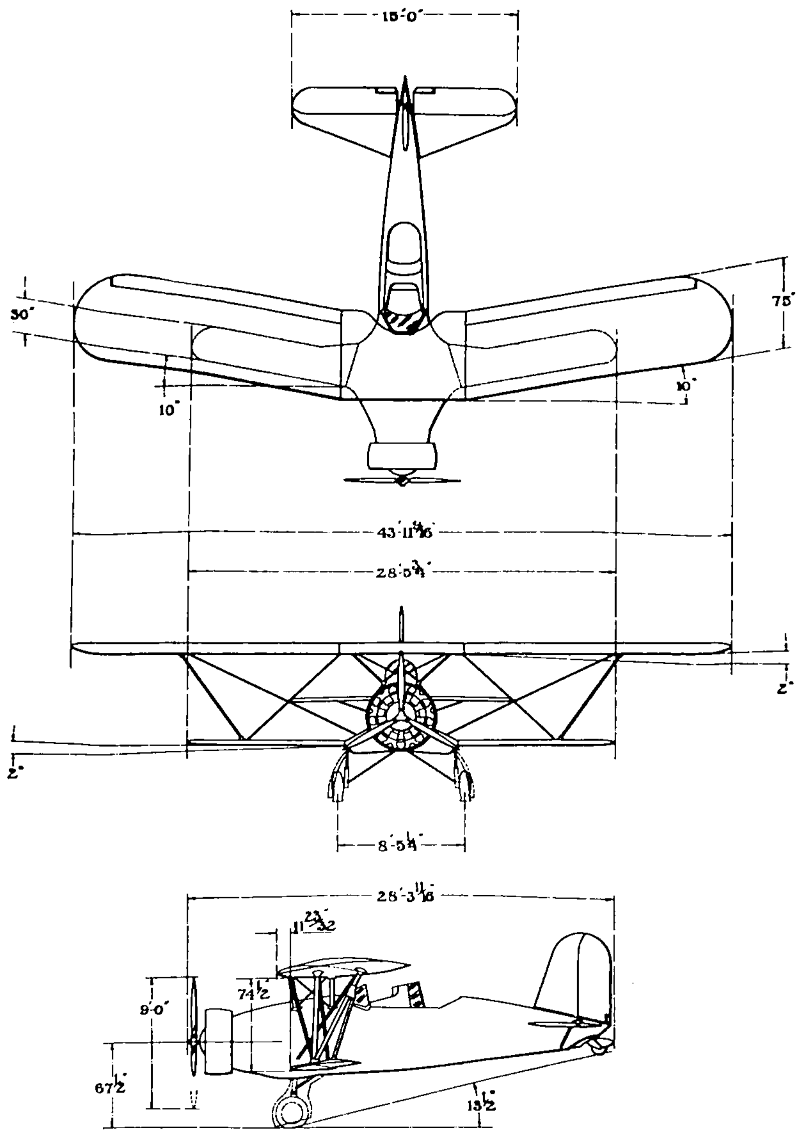
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
FALCON OBSERVATION & ATTACK
ENGINE: WRIGHT F CYCLONE 715 H.P.



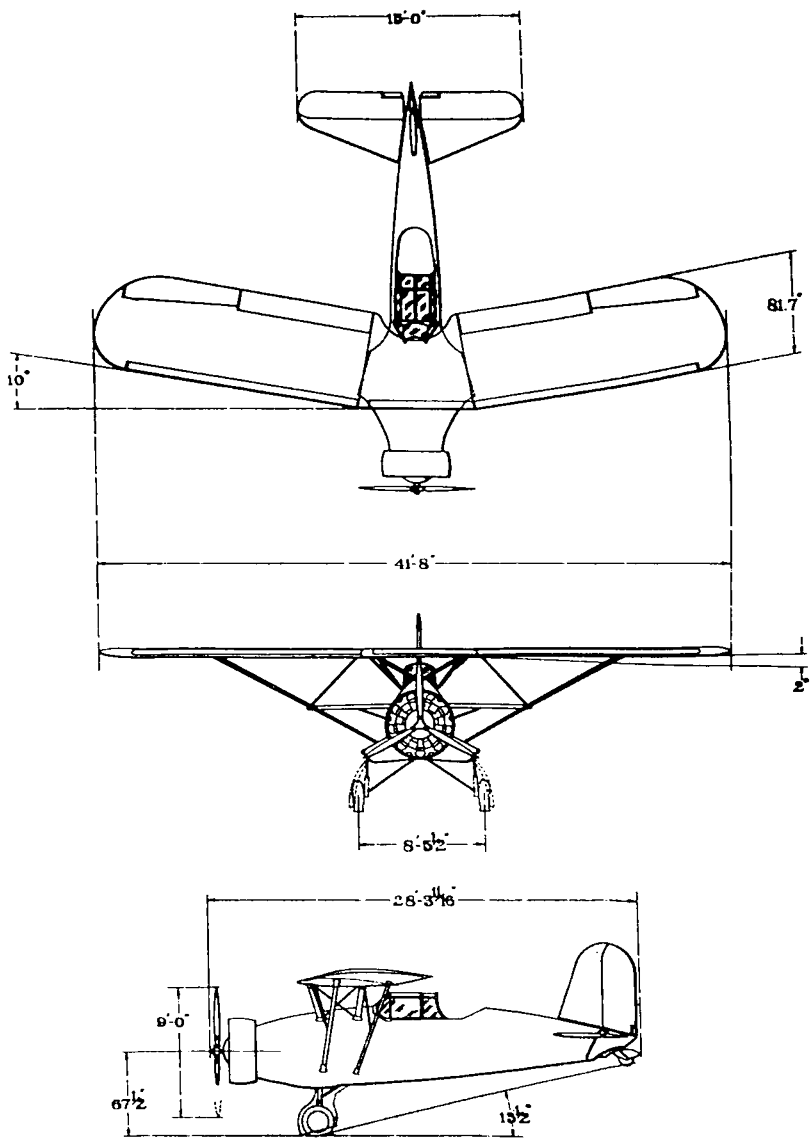
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
OBSERVATION & ATTACK —— FALCON SEAPLANE 2 PLACE
ENGINE: WRIGHT CYCLONE F —— 715 H.P.



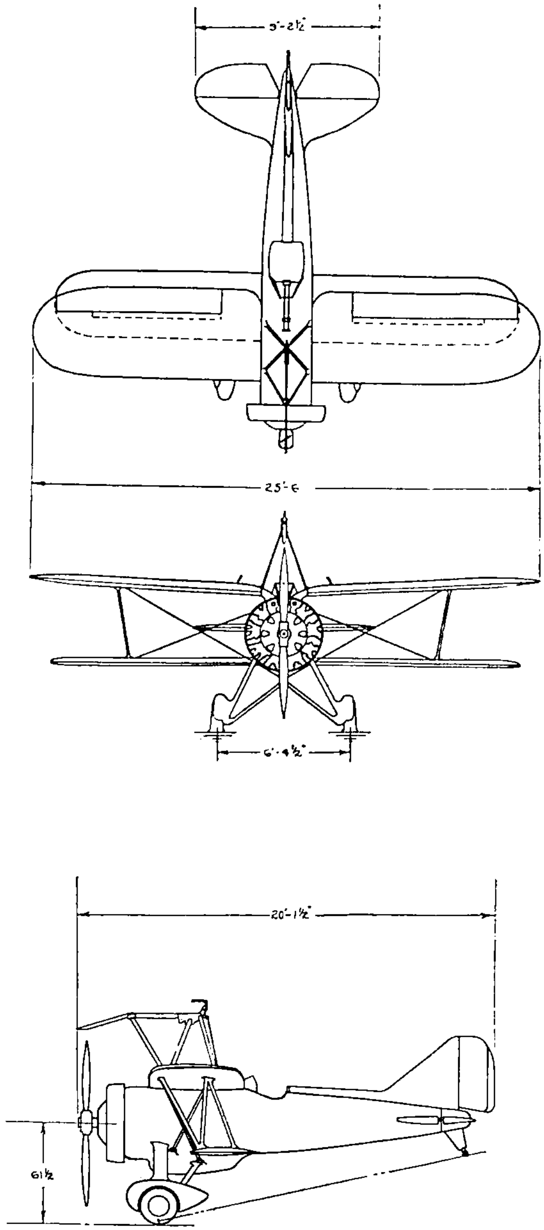
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
ATTACK A-12 —— SHRIKE
ENGINE: WRIGHT F CYCLONE 715 H.P.



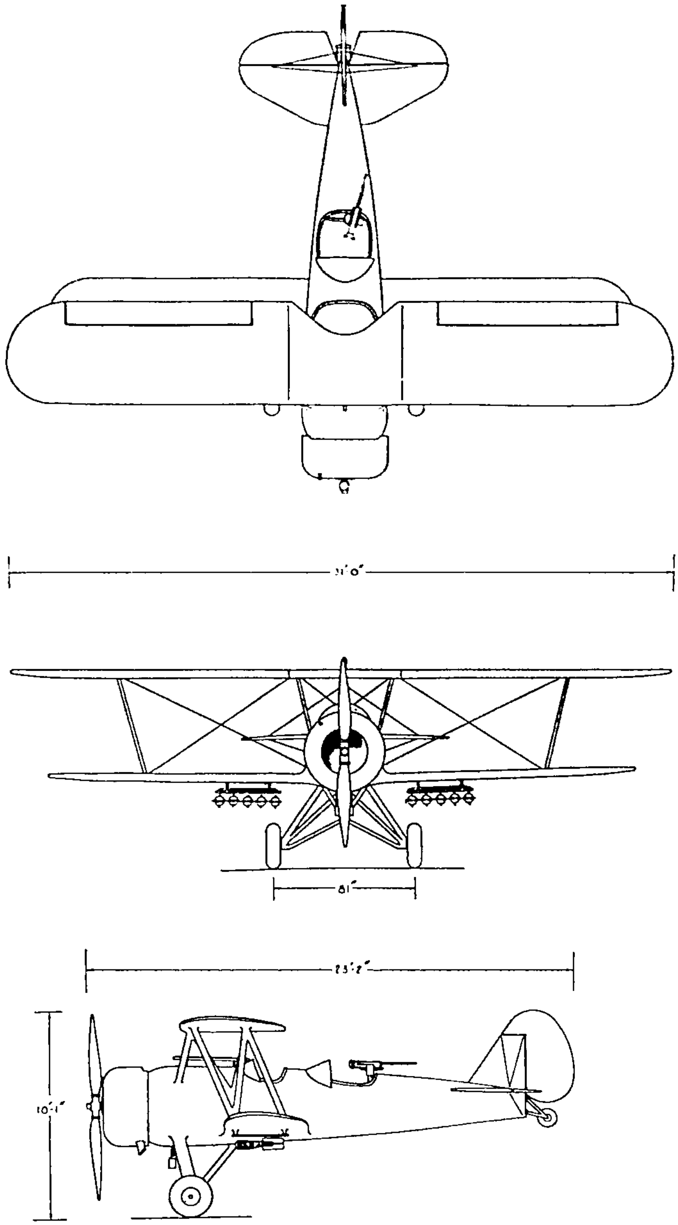
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
OBSERVATION Y1O-40A —— 2 PLACE
ENGINE: WRIGHT F CYCLONE 715 H.P.



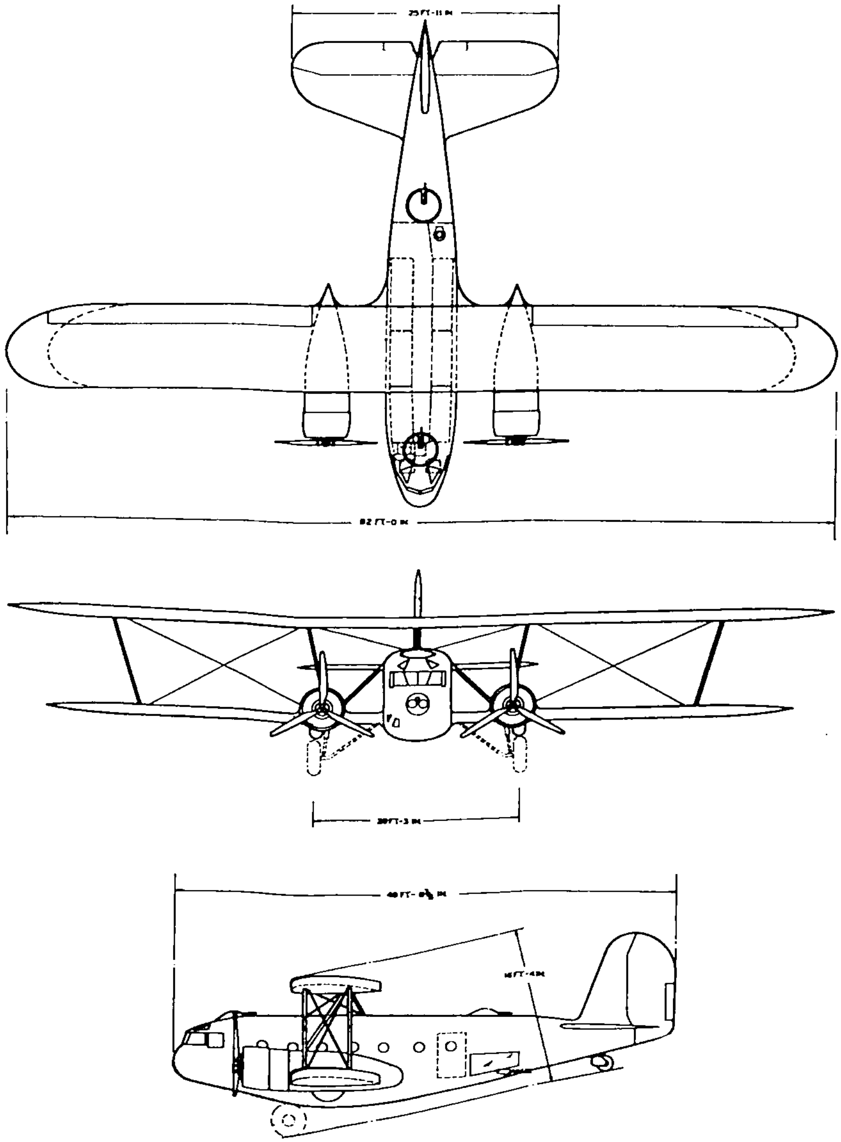
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
Observation Y10-40B —— 2 Place
Engine: Wright F Cyclone 715 H.P.



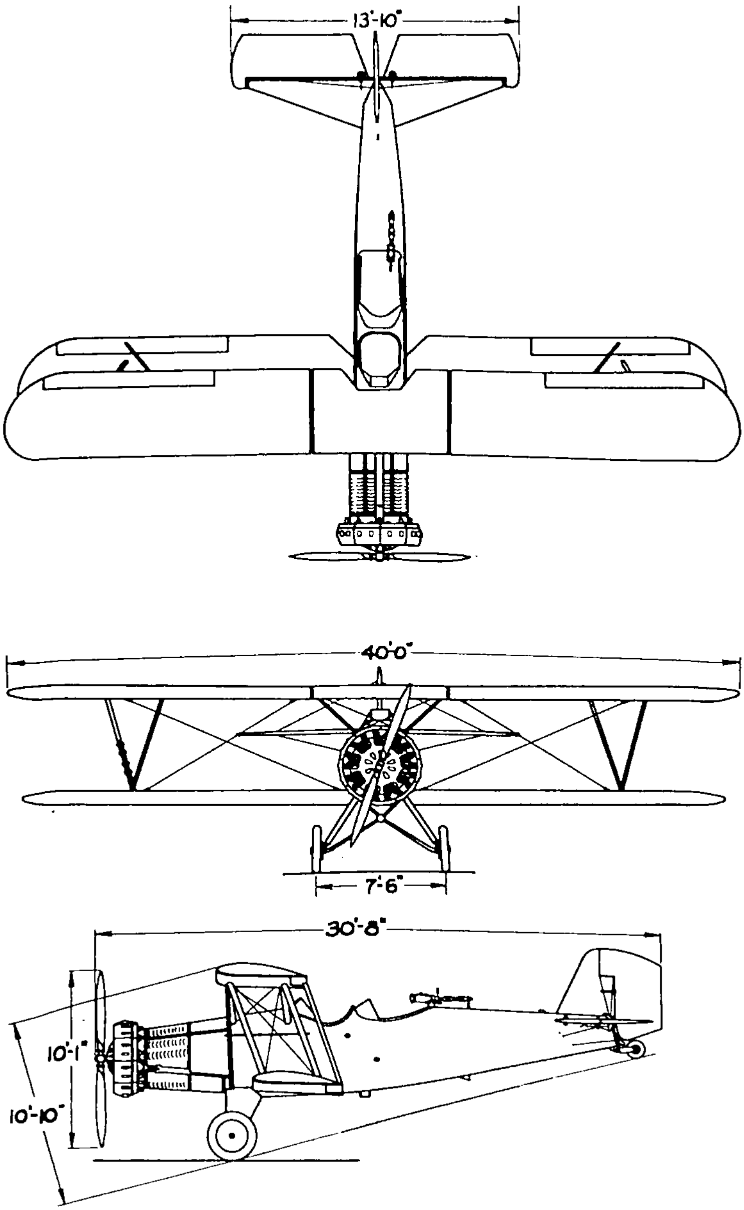
CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
Airship Fighter F9C-2
Engine: Wright Whirlwind 420 H.P.



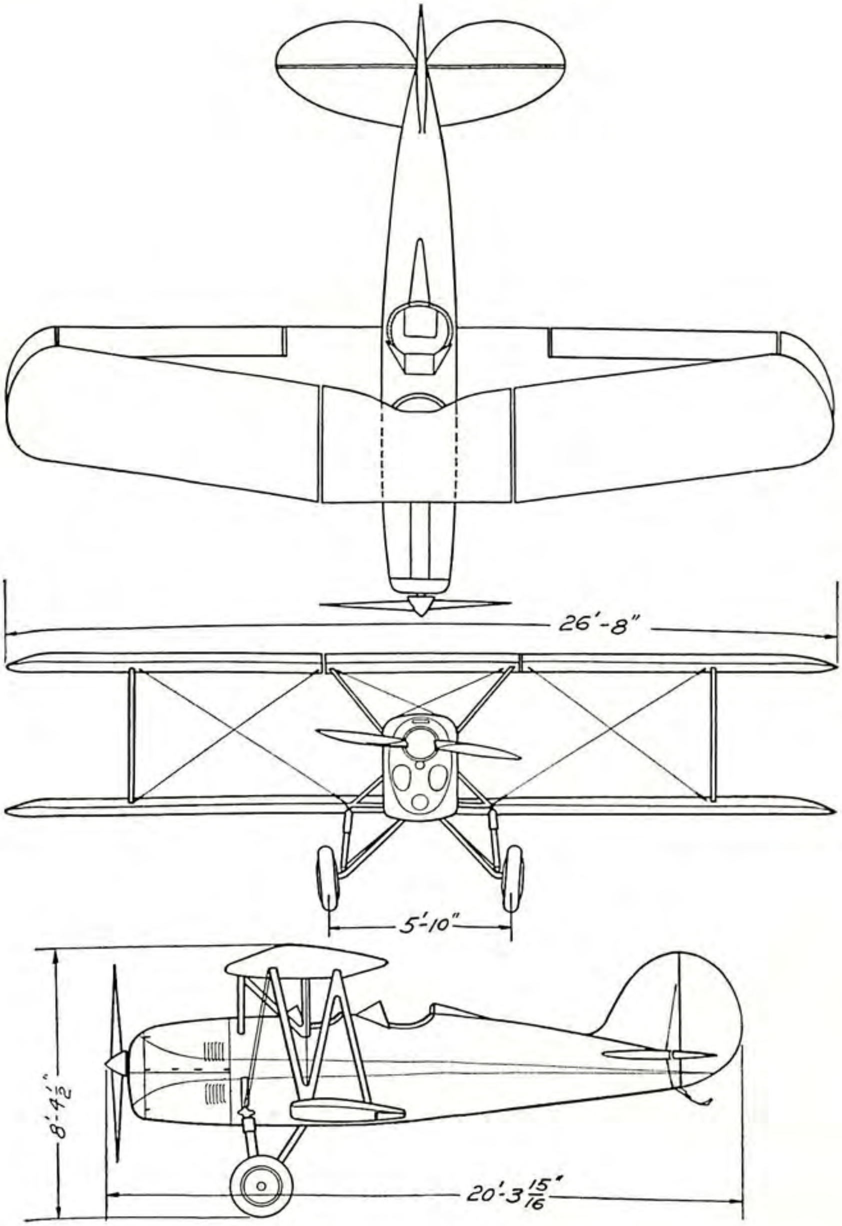
CURTISS-WRIGHT AIRPLANE COMPANY
St. Louis, Mo.
OSPREY —— 2 PLACE
ENGINE: WRIGHT WHIRLWIND 420 H.P.



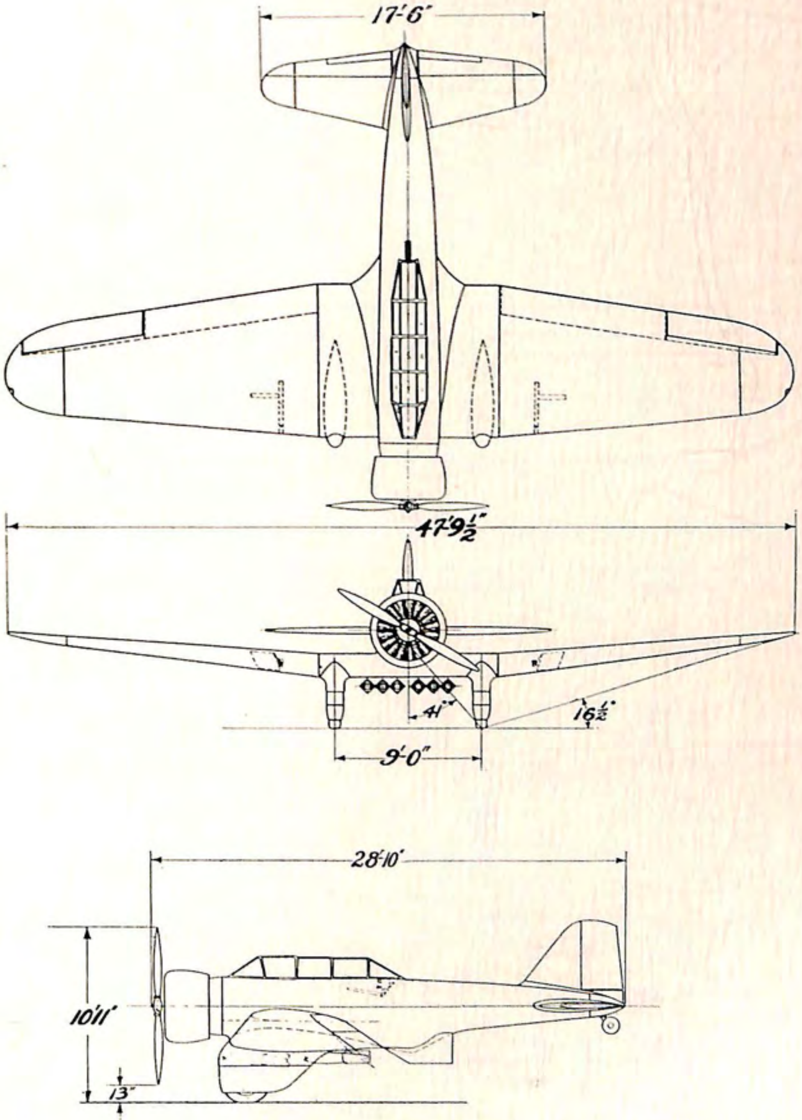
CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Mo.
Condor Bomber BT-32
Engines: Two Wright Cyclones 715 H.P.



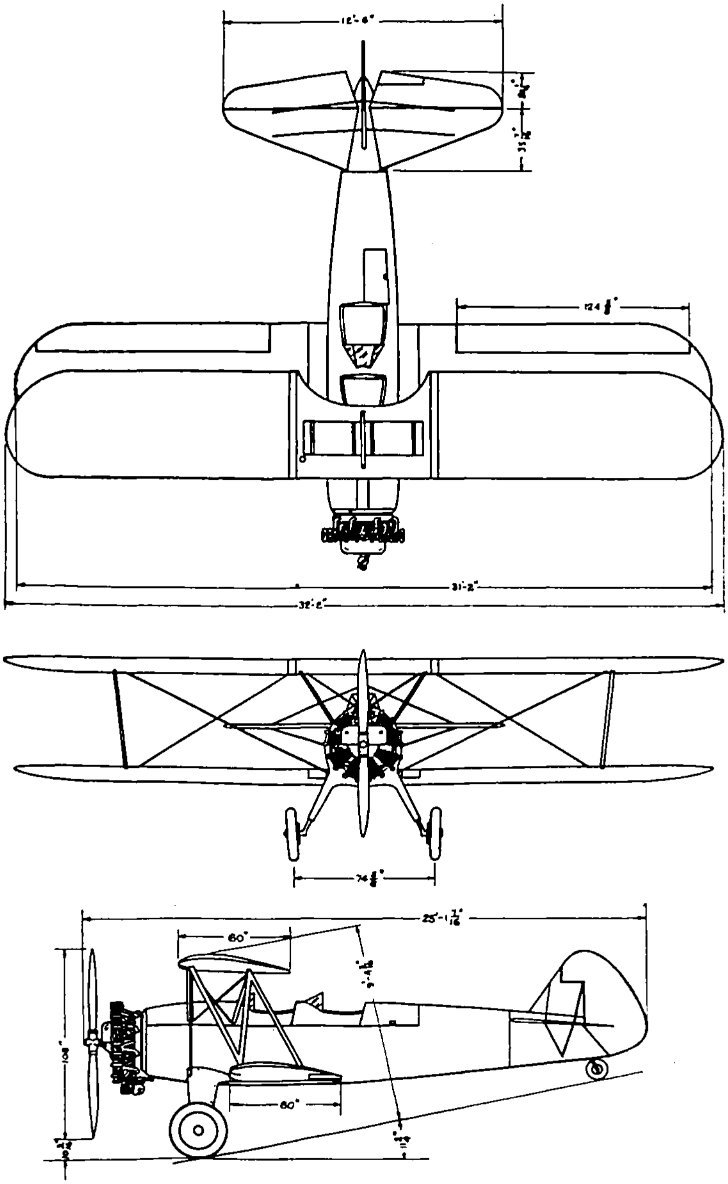
DOUGLAS AIRCRAFT COMPANY, INC.
Santa Monica, Calif.
Army Observation O-38B —— 2 Place
Engine: Pratt & Whitney Hornet



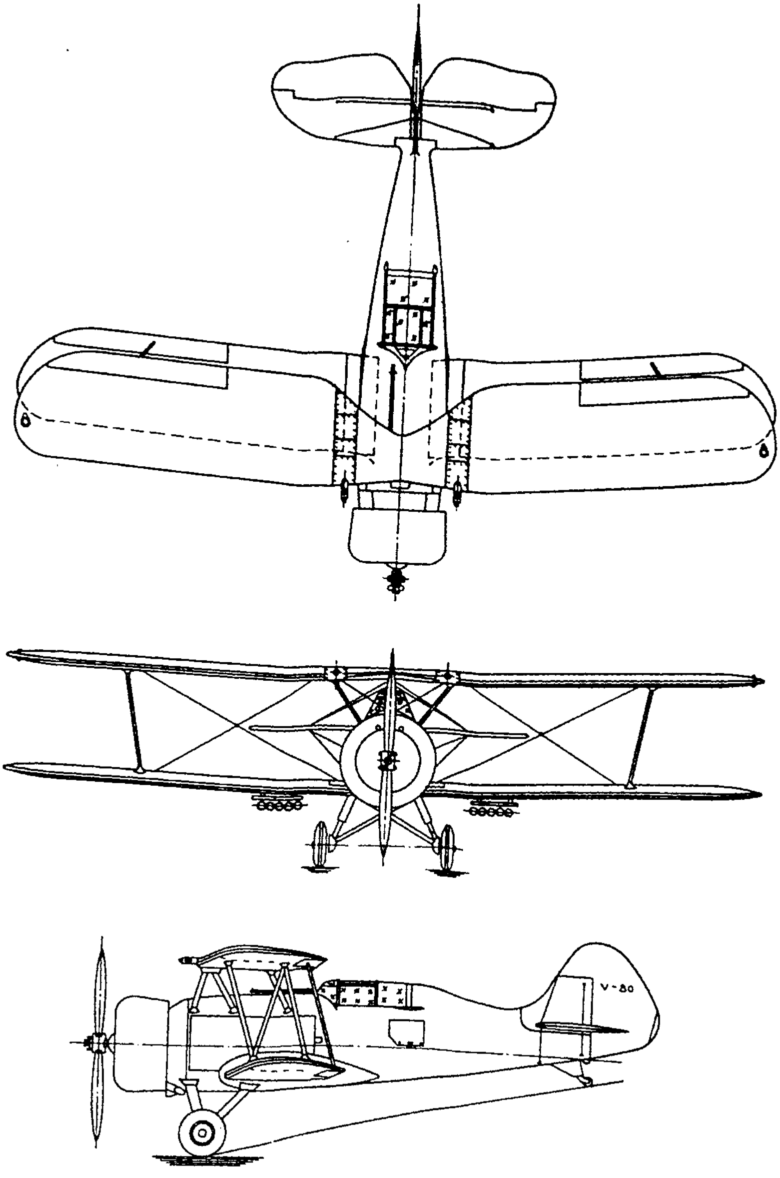
GREAT LAKES AIRCRAFT CORPORATION
Cleveland, Ohio
Model 2T-1A —— 2 Place
Engine: American Cirrus



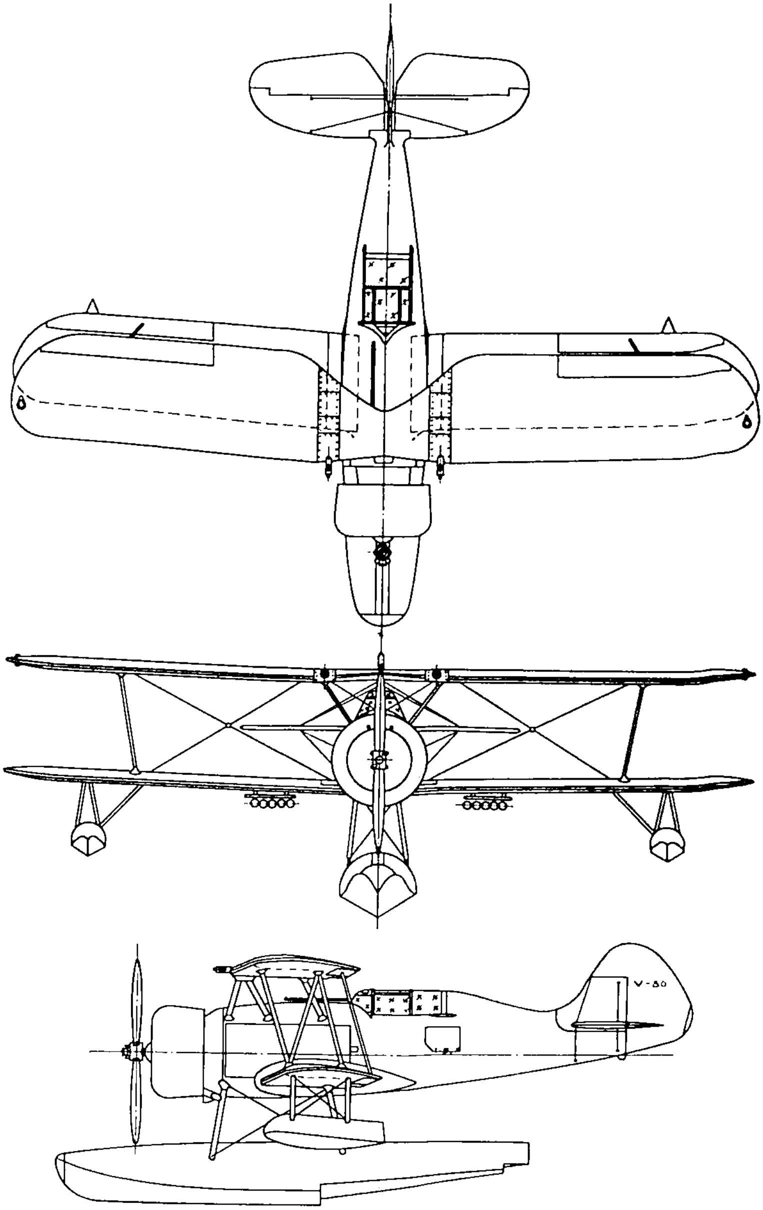
THE NORTHROP CORPORATION
Inglewood, Calif.
LONG RANGE BOMBER
ENGINE: WRIGHT CYCLONE



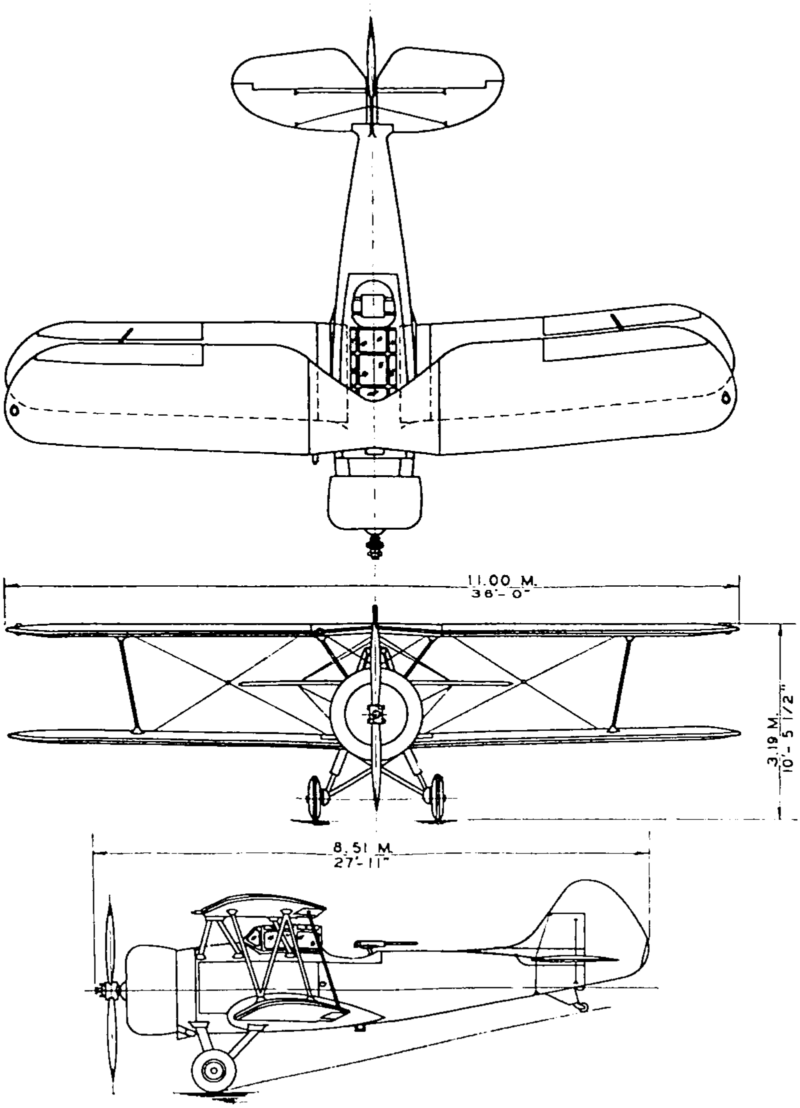
STEARMAN AIRCRAFT COMPANY
Wichita, Kans.
MODEL 73 NAVY TRAINER NS-1 —— 2 PLACE
ENGINE: WRIGHT WHIRLWIND



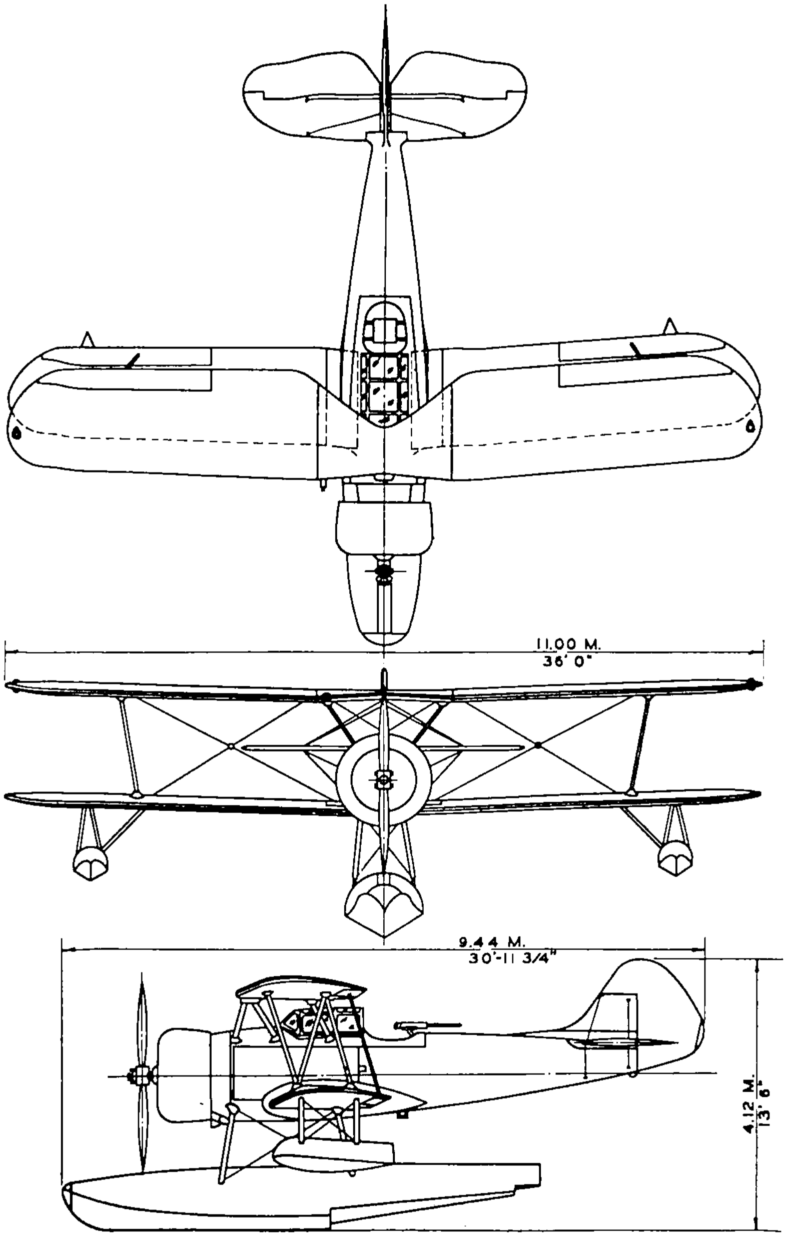
CHANCE VOUGHT CORPORATION
East Hartford, Conn.
Corsair V-80 —— 1 Place
Engine: Pratt & Whitney Hornet



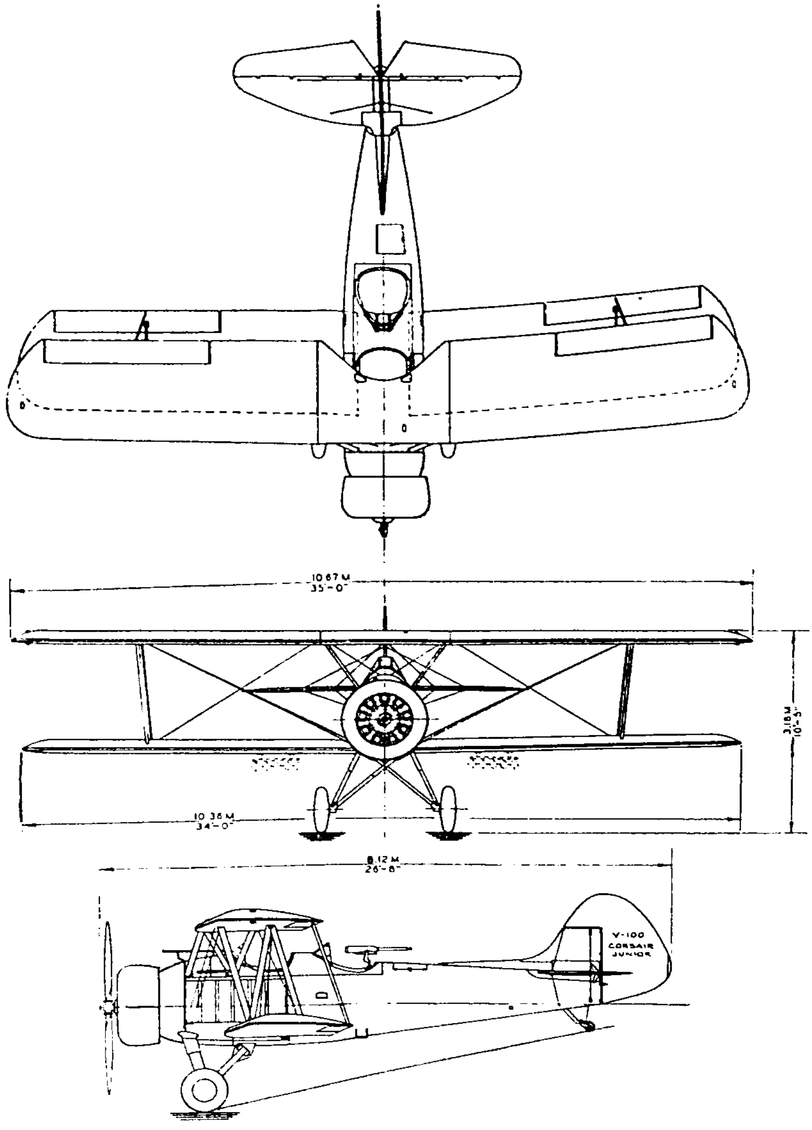
CHANCE VOUGHT CORPORATION
East Hartford, Conn.
Corsair V-80 Seaplane —— 1 Place
Engine: Pratt & Whitney Hornet



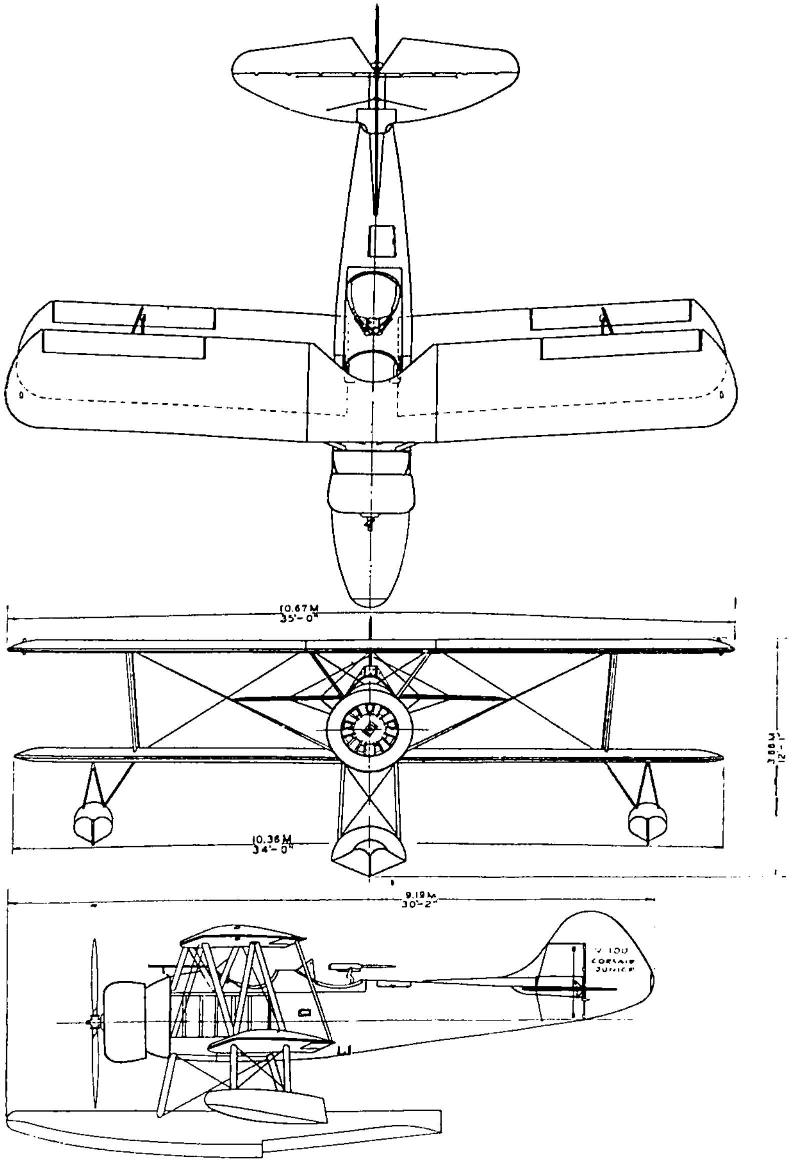
CHANCE VOUGHT CORPORATION
East Hartford, Conn.
CORSAIR SUPER V-90 —— 2 PLACE
ENGINE: PRATT & WHITNEY HORNET



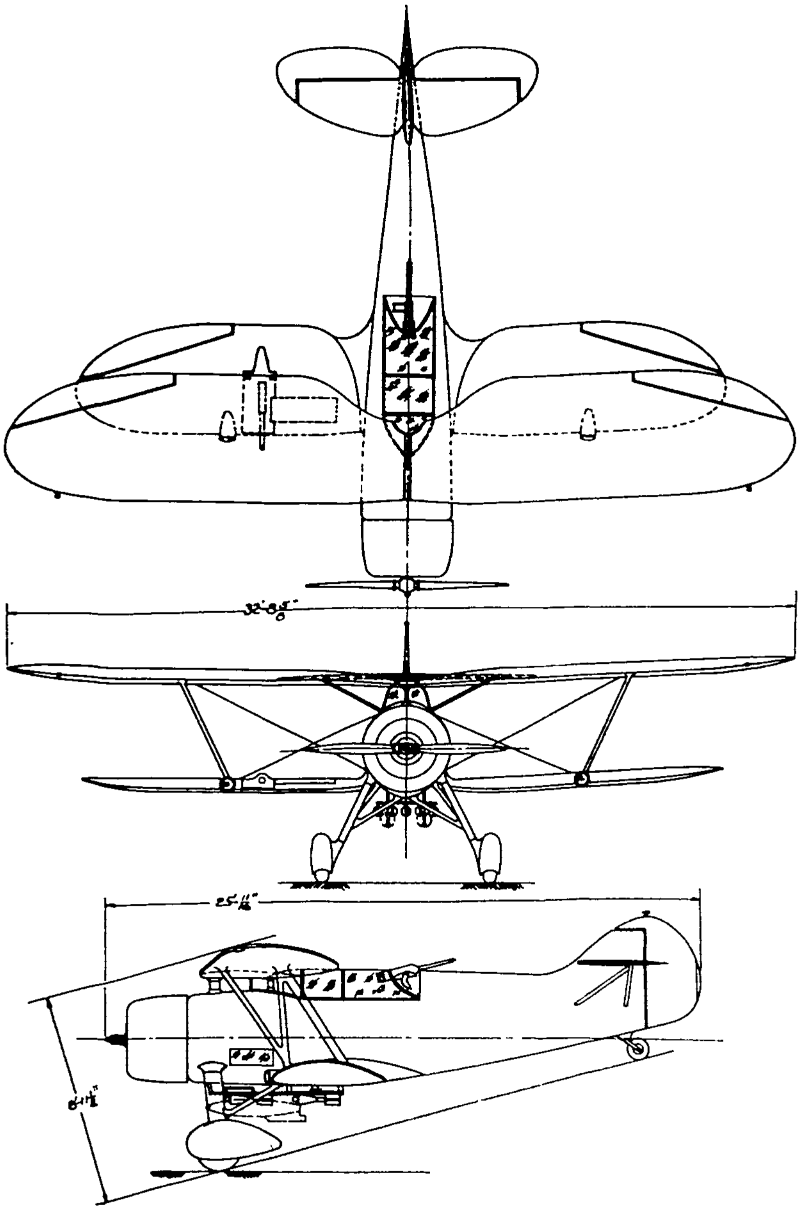
CHANCE VOUGHT CORPORATION
East Hartford, Conn.
CORSAIR SUPER V-90—SEAPLANE —— 2 PLACE
ENGINE: PRATT & WHITNEY HORNET



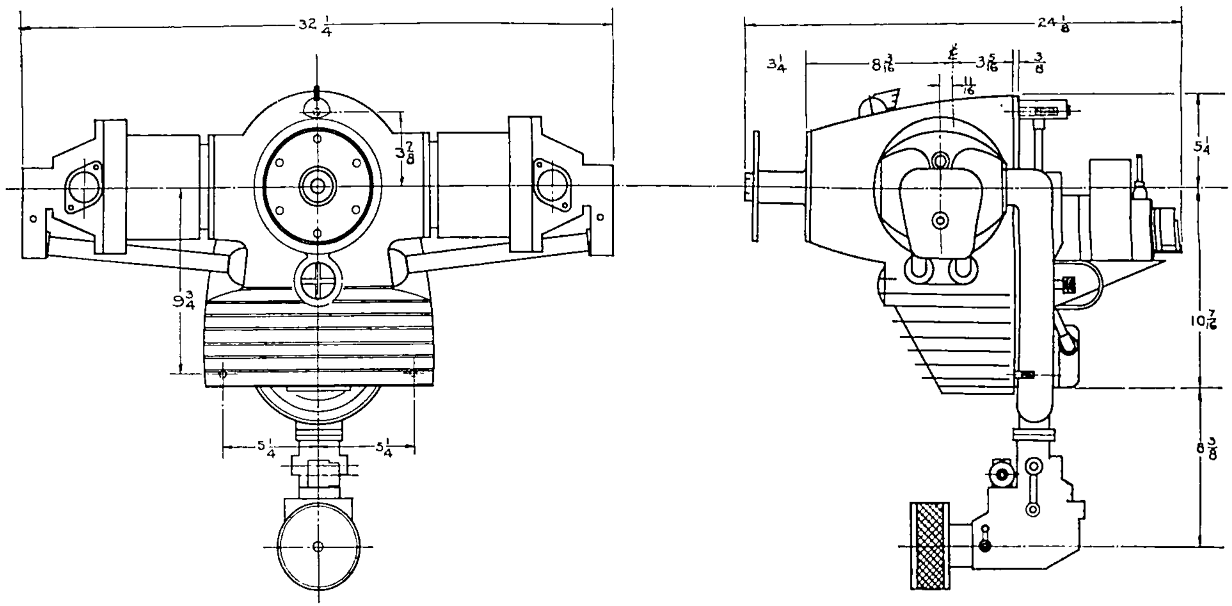
CHANCE VOUGHT CORPORATION
East Hartford, Conn.
Corsair Junior V-100 —— 2 Place
Engine: Pratt & Whitney Wasp Junior



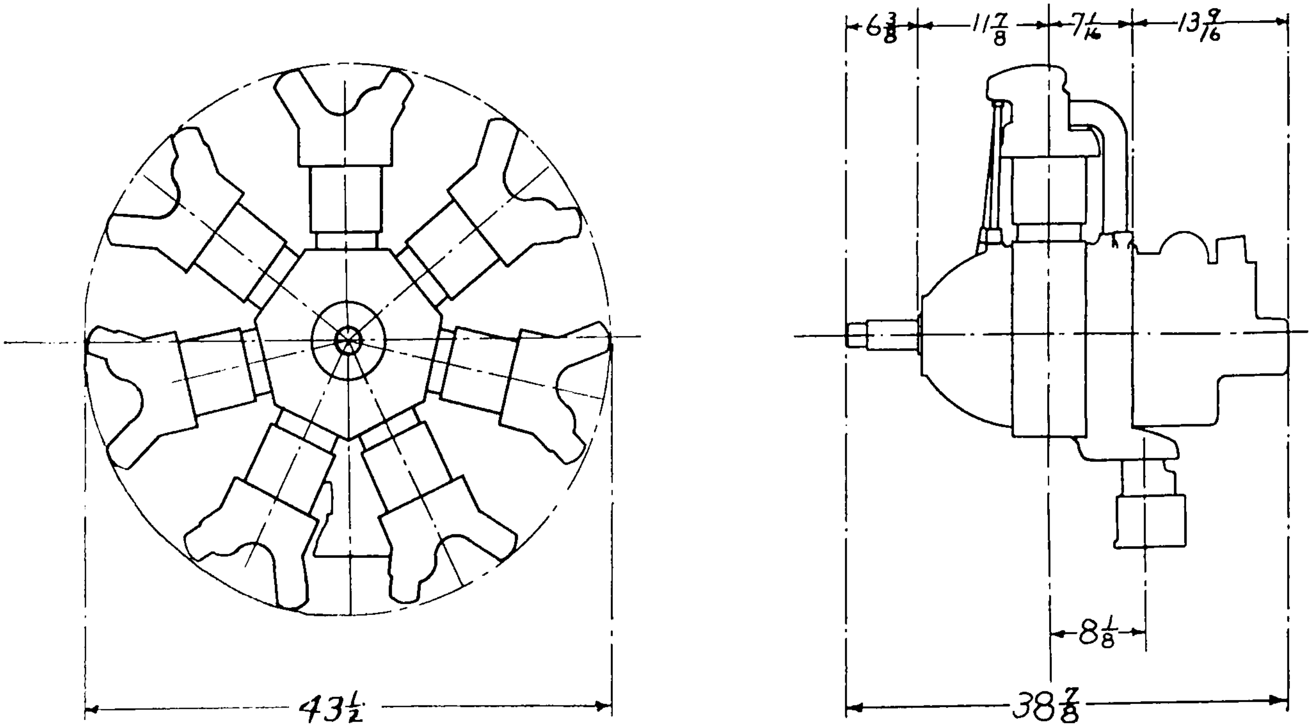
CHANCE VOUGHT CORPORATION
East Hartford, Conn.
Corsair Junior V-100—Seaplane —— 2 Place
Engine: Pratt & Whitney Wasp Junior



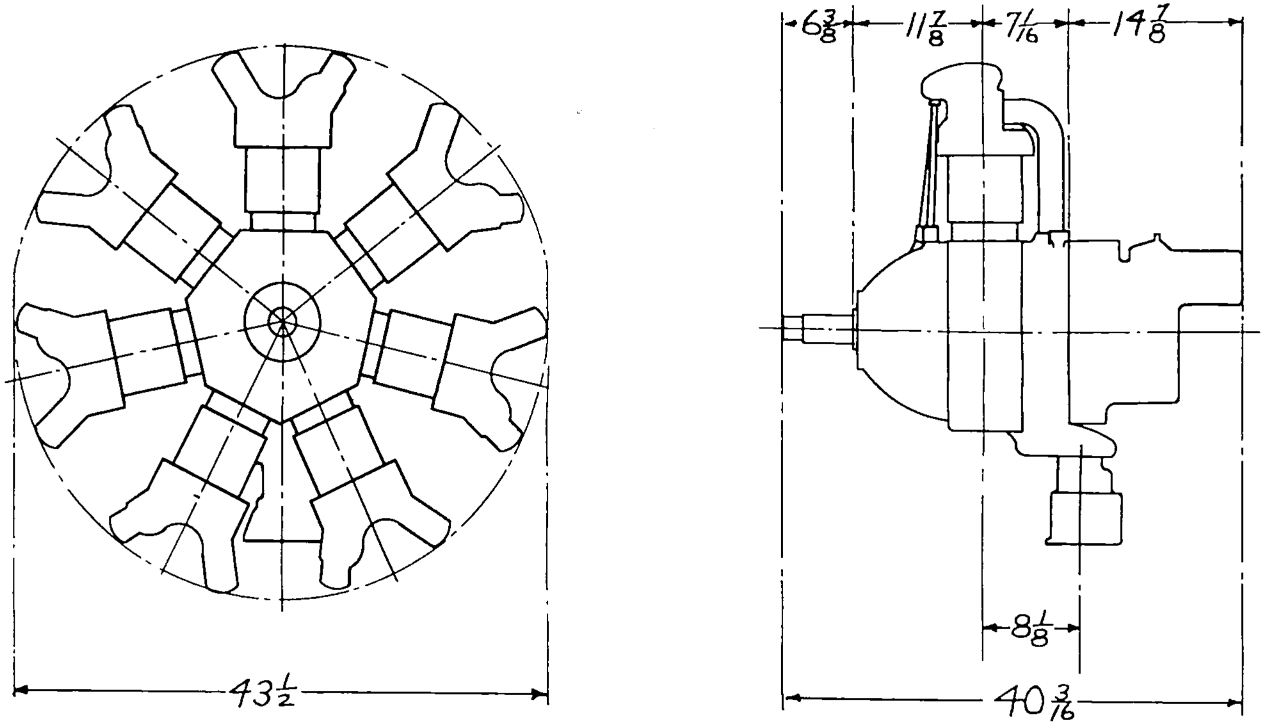
WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL WHD-A —— 2 PLACE
ENGINE: WRIGHT WHIRLWIND



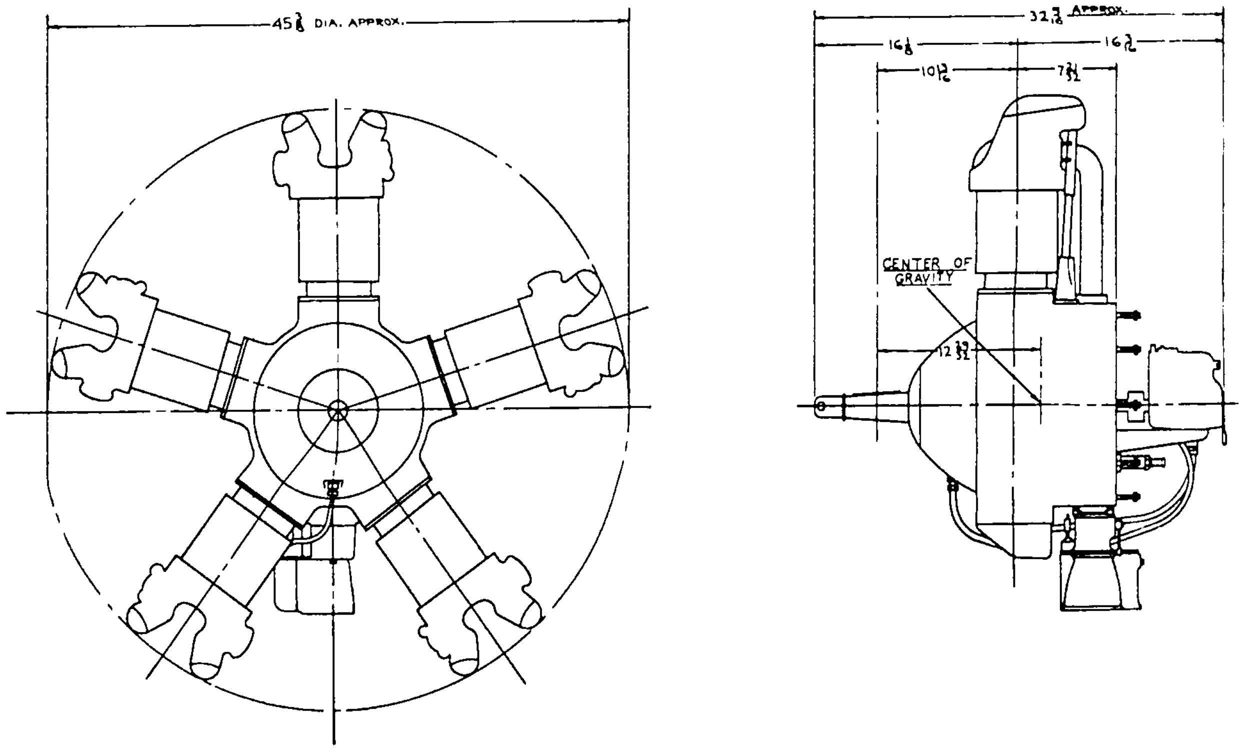
AERONAUTICAL CORPORATION OF AMERICA
Cincinnati, Ohio
AERONCA E-113B —— 36 H.P.
2 CYLINDER OPPOSED AIRCOOLED



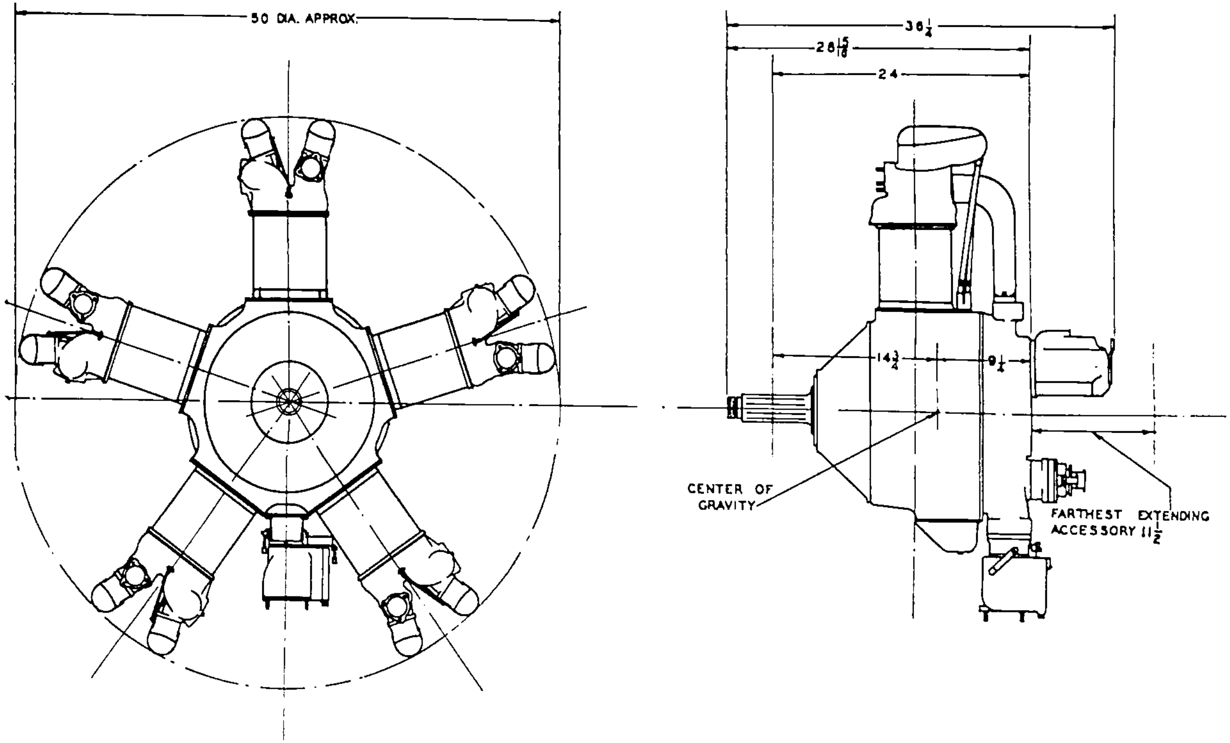
JACOBS AIRCRAFT ENGINE COMPANY
Pottstown, Penna.
Jacobs Model L-4 —— 225 H.P.
7 Cylinder Radial Aircooled



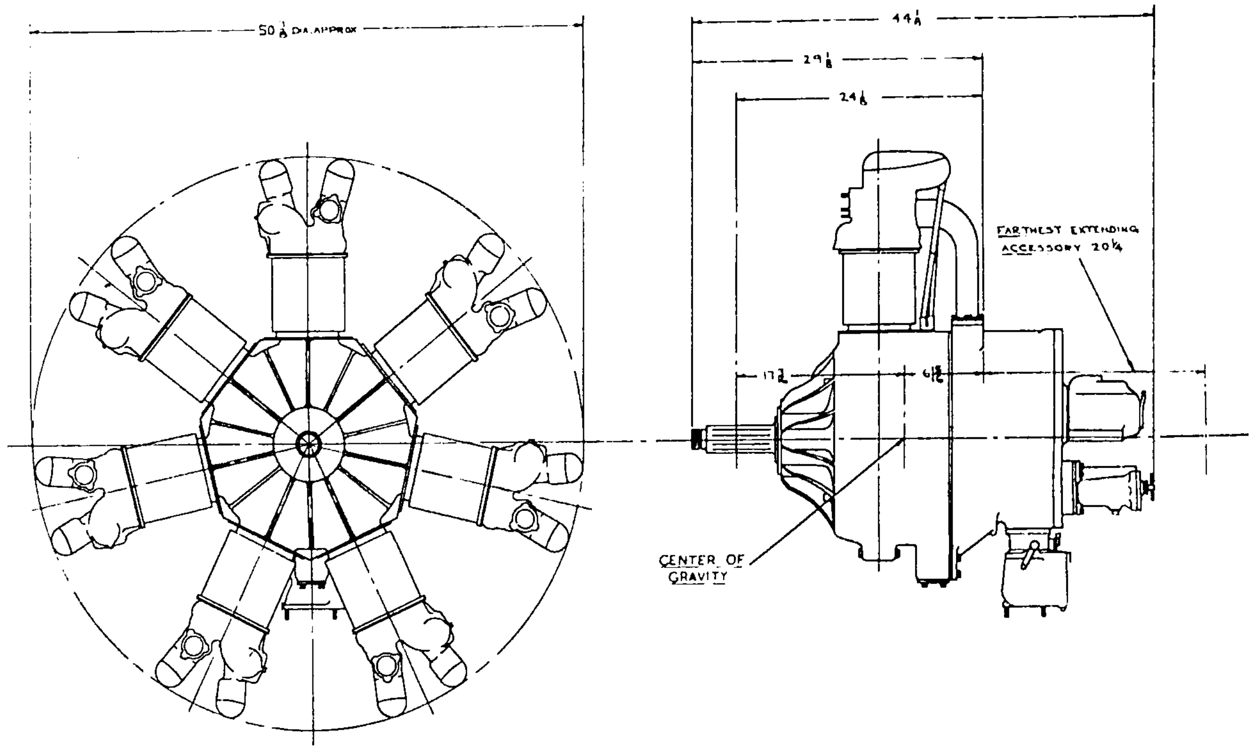
JACOBS AIRCRAFT ENGINE COMPANY
Pottstown, Penna.
Jacobs Model L-4M — 225 H.P.
7 Cylinder Radial Aircooled



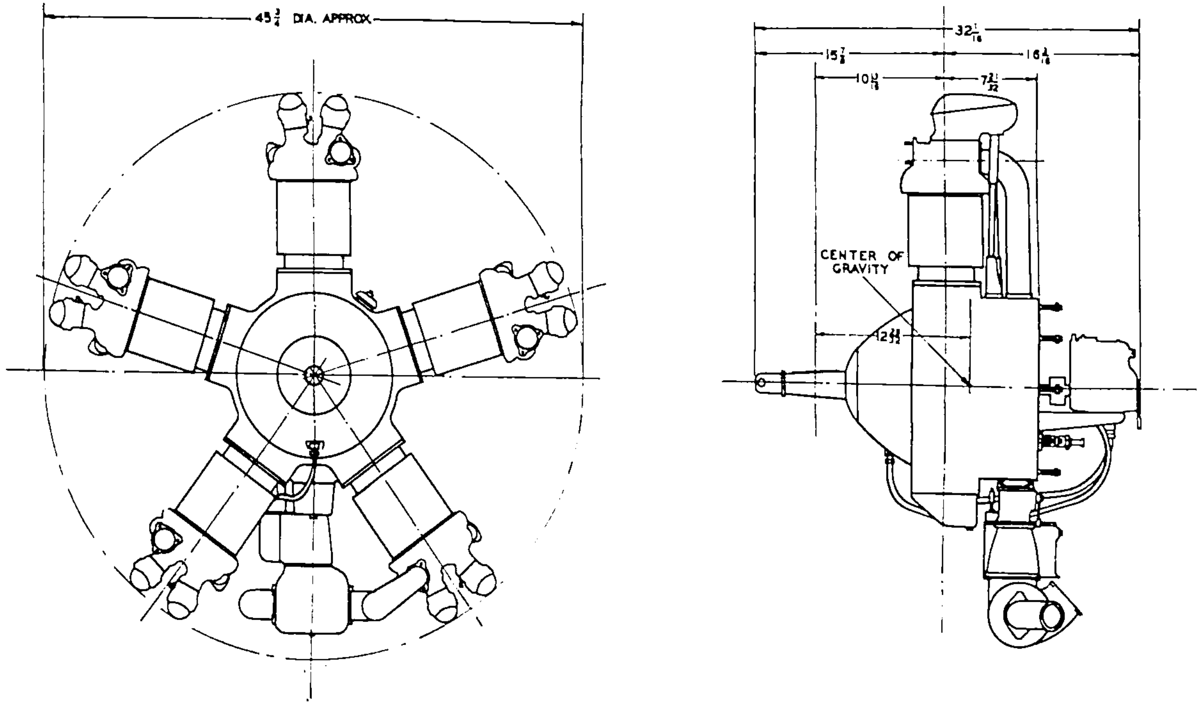
KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
MODEL B-5 —— 125 H.P.
5 CYLINDER RADIAL AIRCOOLED



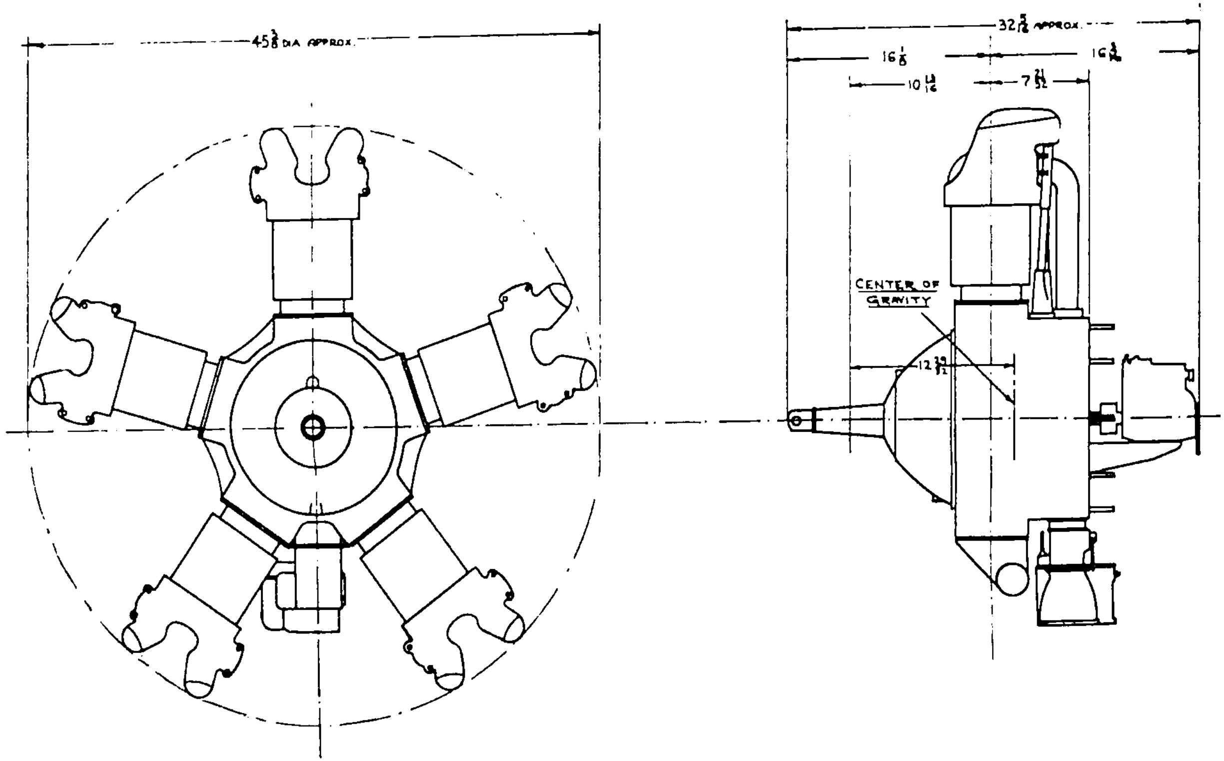
KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
MODEL C-5 —— 210 H.P.
5 CYLINDER RADIAL AIRCOOLED



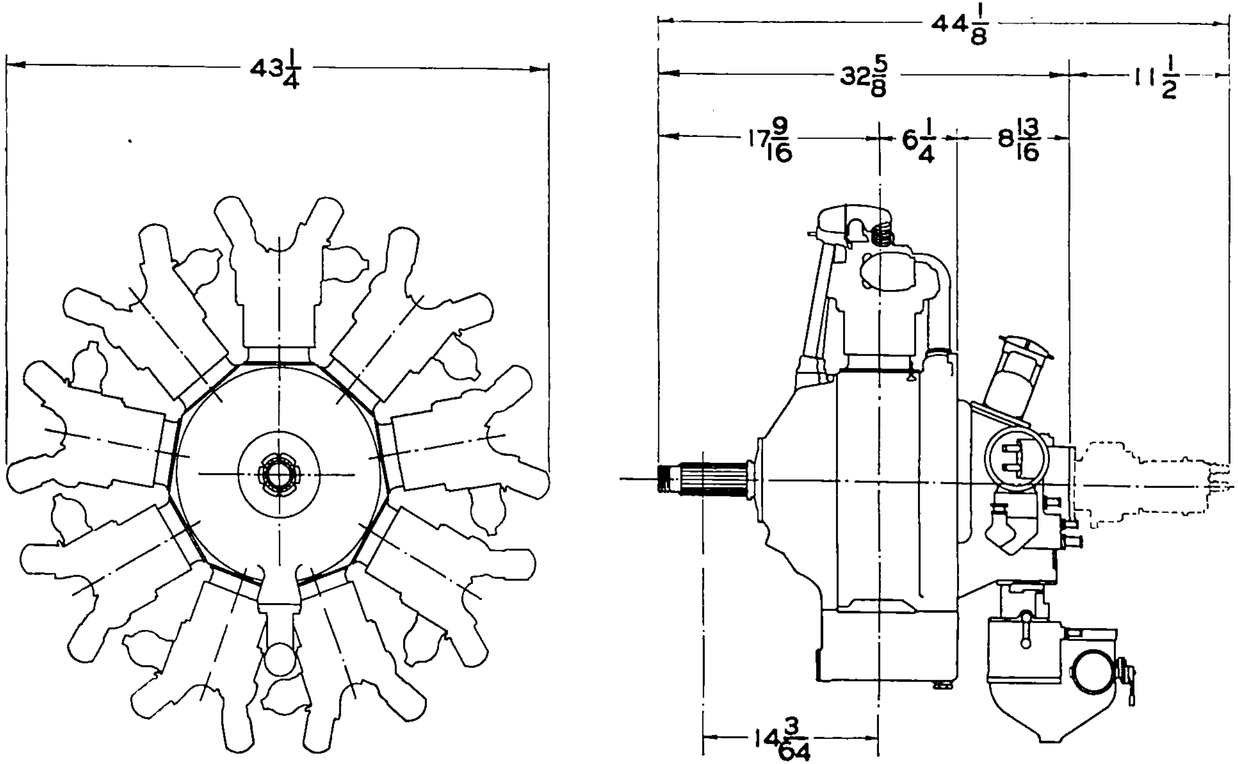
KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
Model C-7 —— 300 H.P.
7 Cylinder Radial Aircooled



KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
MODEL K-5 —— 100 H.P.
5 CYLINDER RADIAL AIRCOOLED

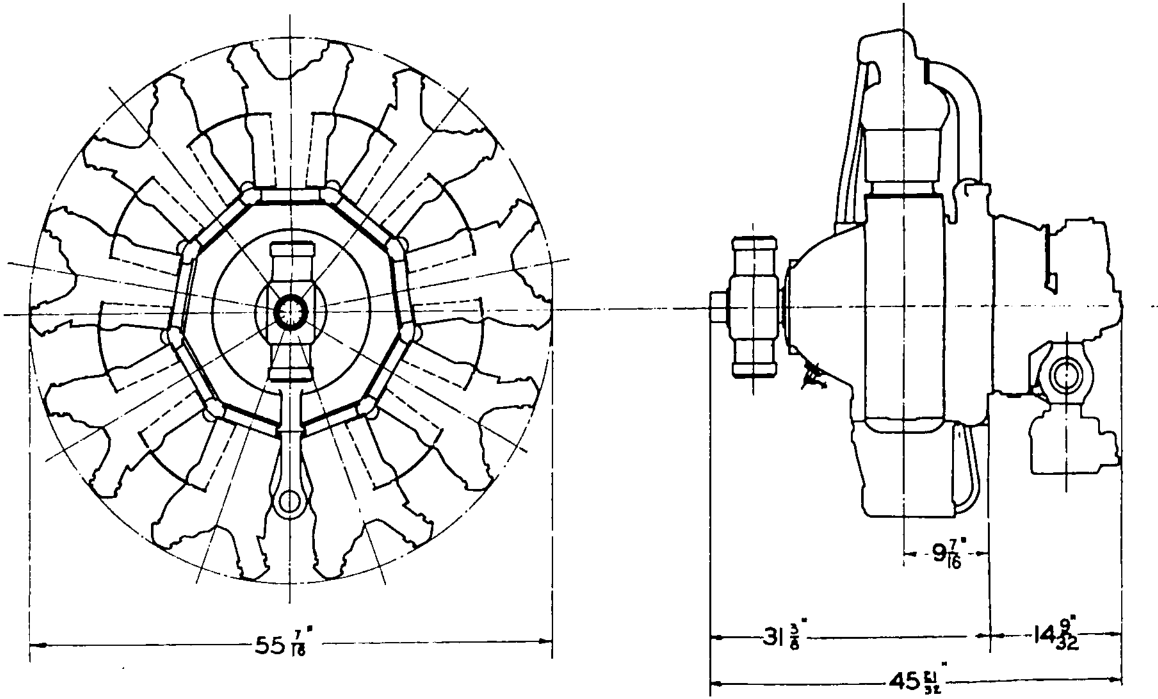


KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
MODEL R-5 —— 160 H.P.
5 CYLINDER RADIAL AIRCOOLED

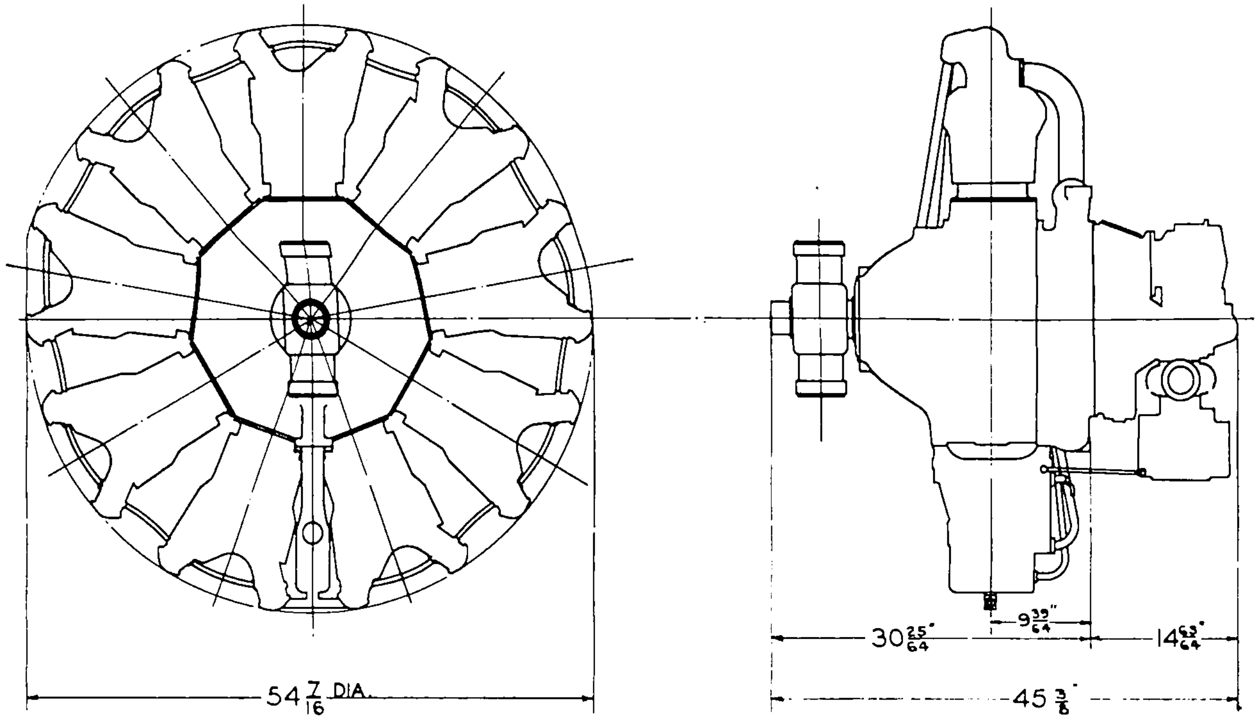


LYCOMING MANUFACTURING COMPANY
Williamsport, Pa.

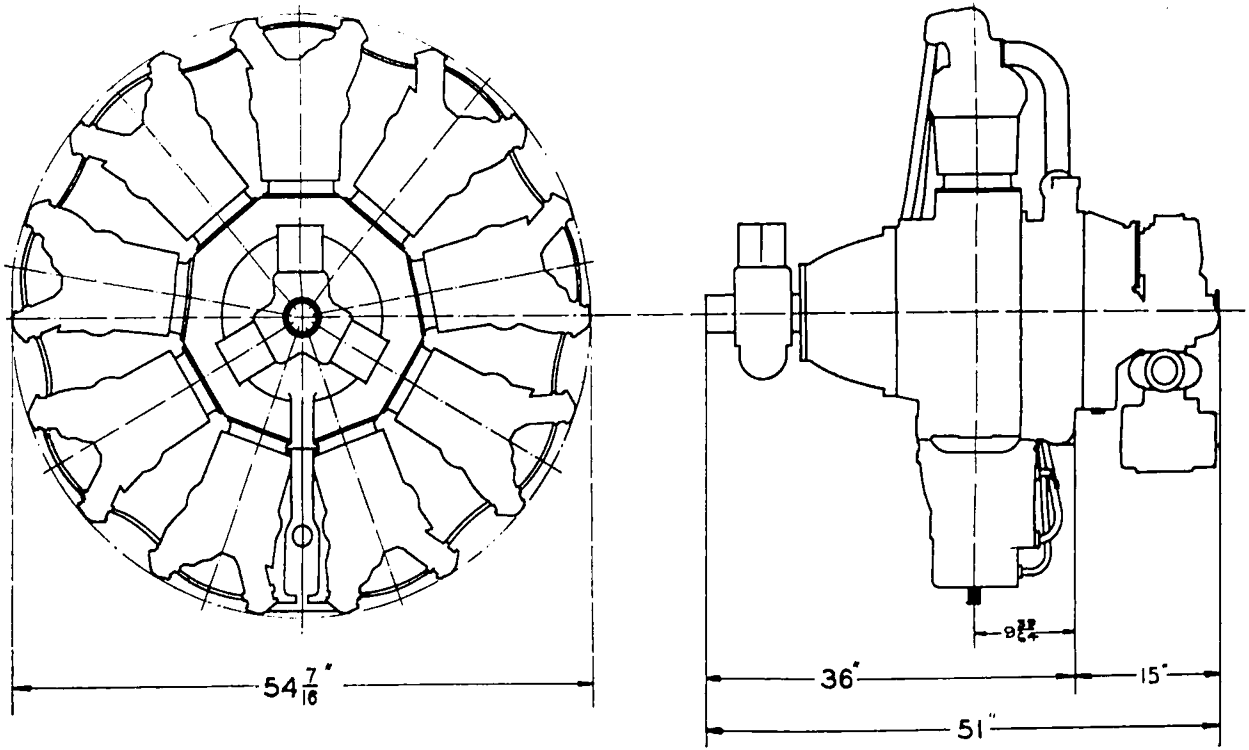
Model	R-680-4	——	225 H.P.
	R-680-2	——	240 H.P.
	R-680-6	——	245 H.P.
	R-680-5	——	260 H.P.



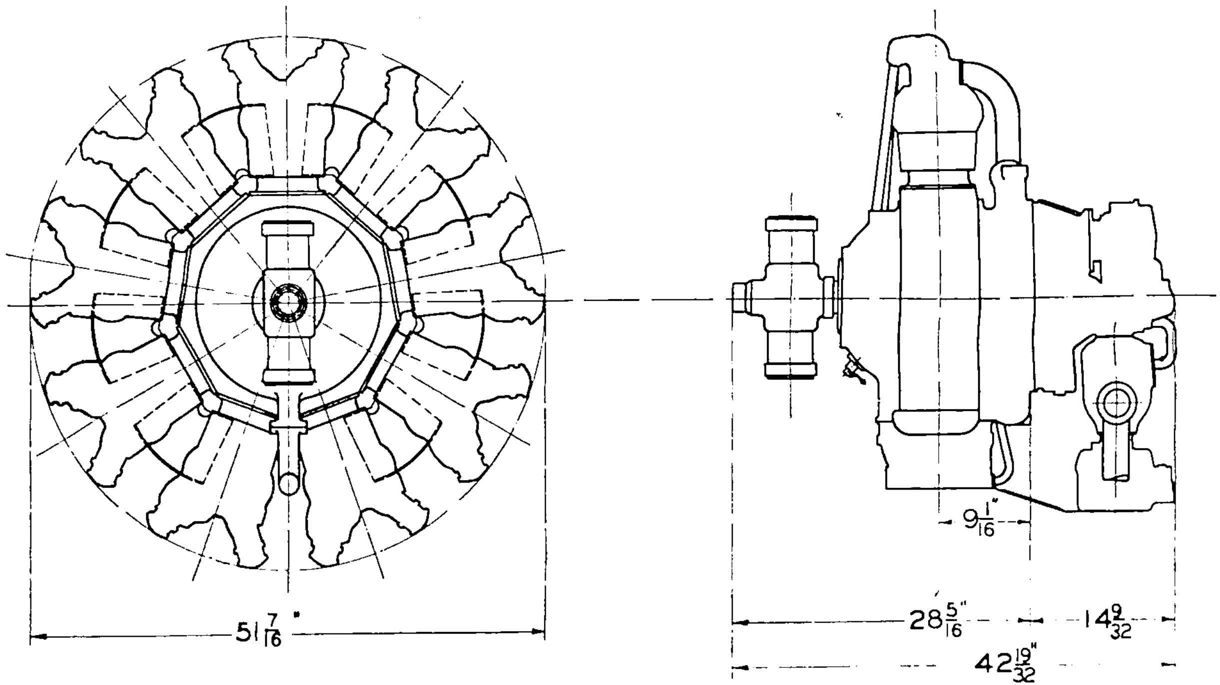
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
HORNET D1 —— 625-700 H.P.
9 CYLINDER RADIAL AIRCOOLED



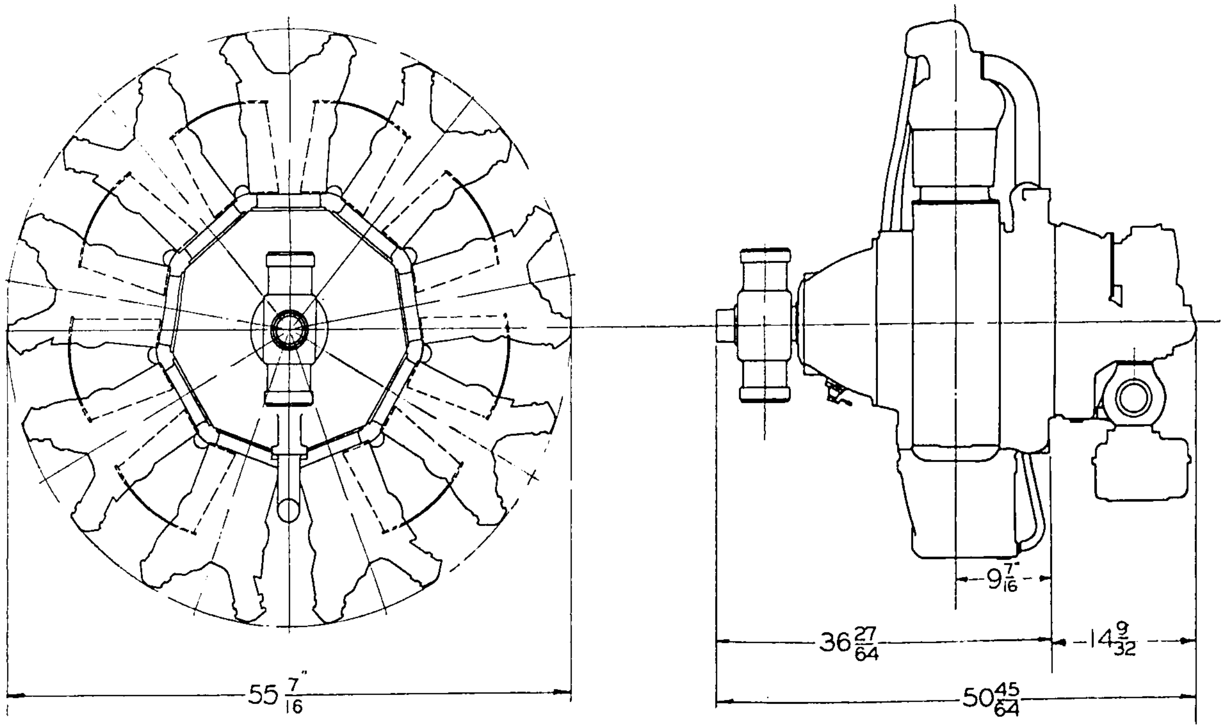
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
Hornet E —— 650-725 H.P.
9 Cylinder Radial Aircooled



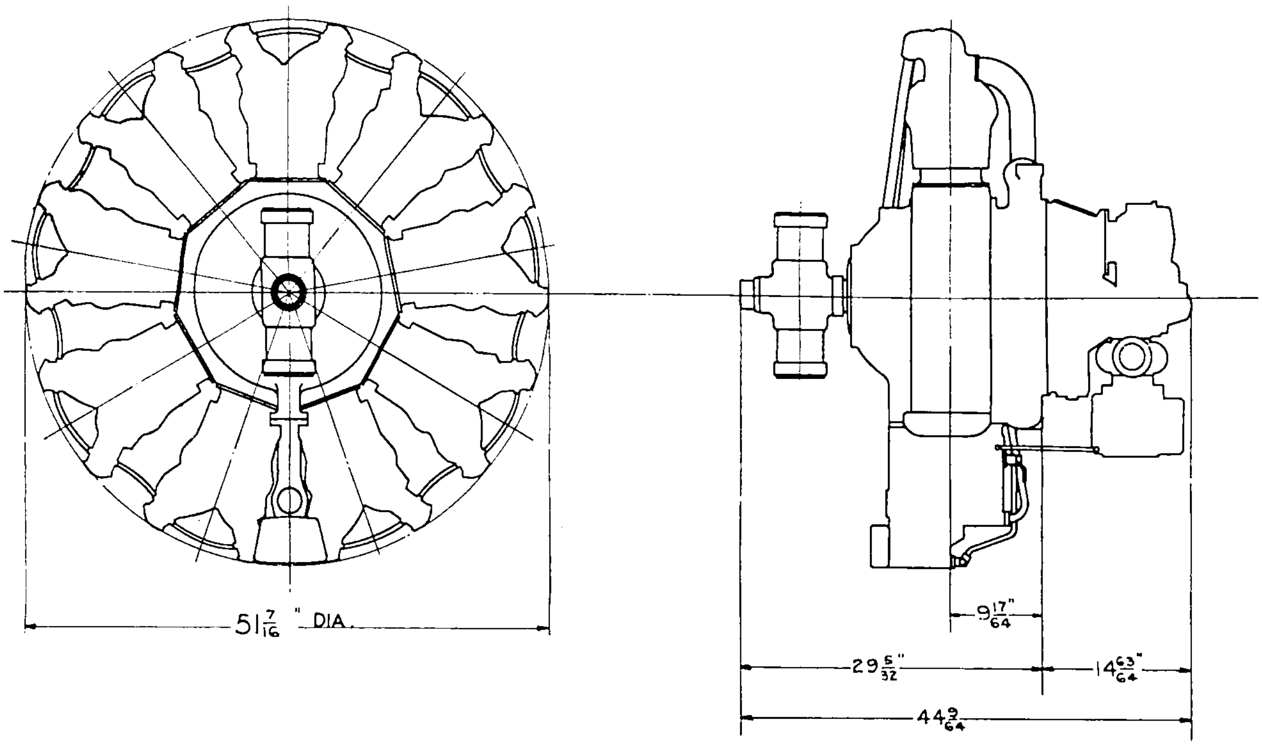
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
HORNET E (GEARED 3:2) —— 675-750 H.P.
9 CYLINDER RADIAL AIRCOOLED



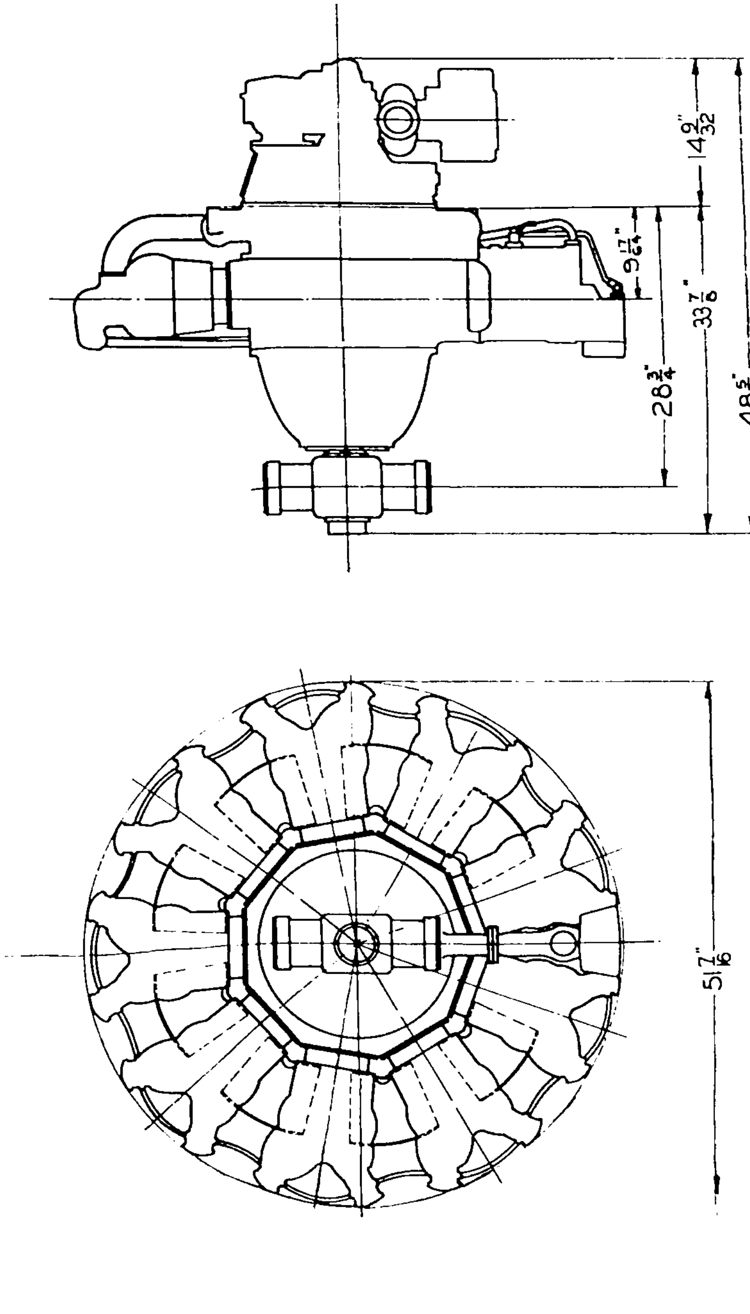
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
WASP D1 —— 500-550 H.P.
9 CYLINDER RADIAL AIRCOOLED



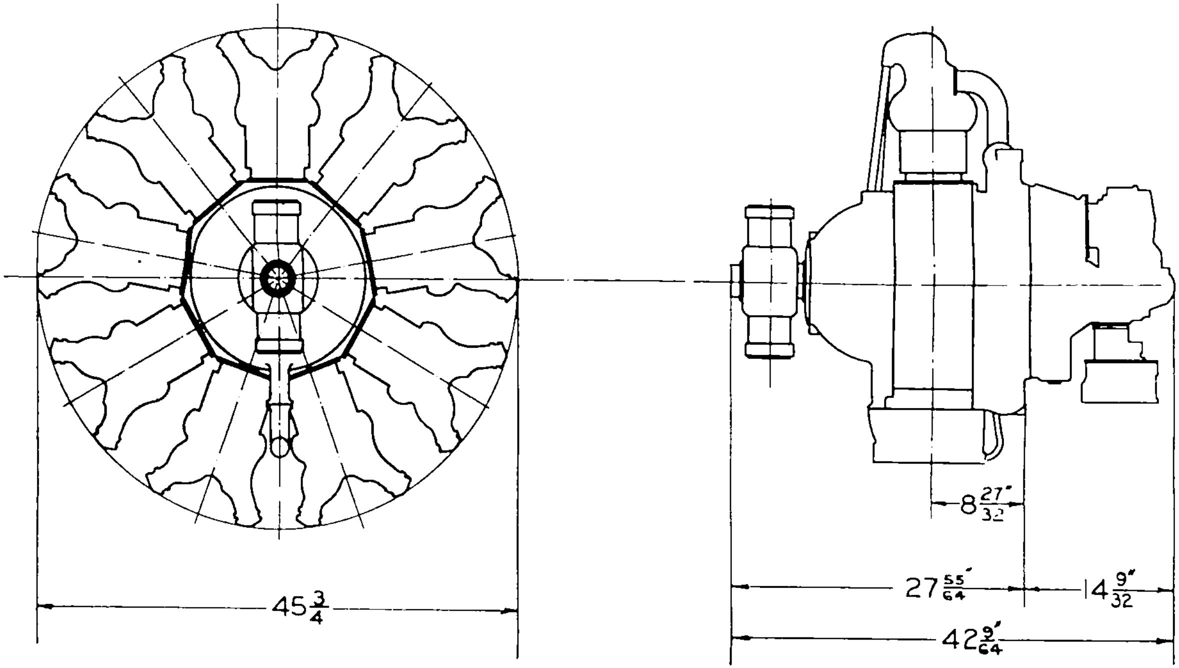
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
Hornet D1 (Geared 3:2) —— 650-700 H.P.
9 Cylinder Radial Aircooled



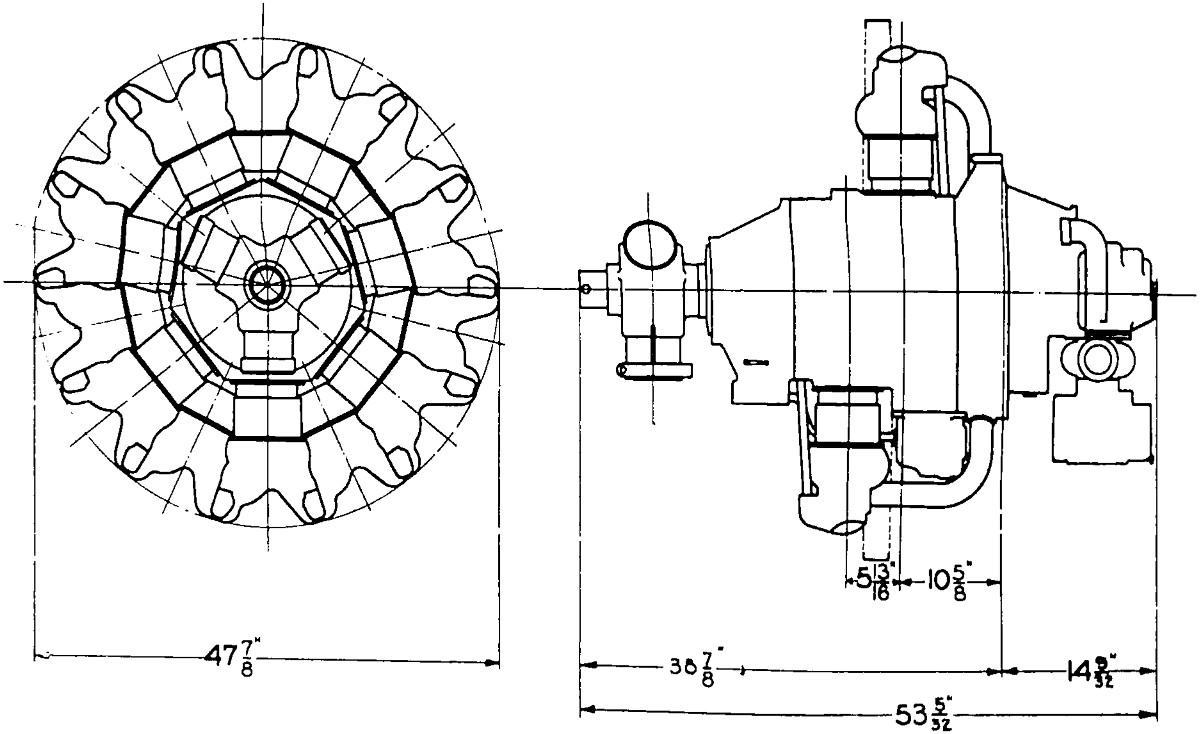
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
Wasp H1 —— 500-550 H.P.
9 Cylinder Radial Aircooled



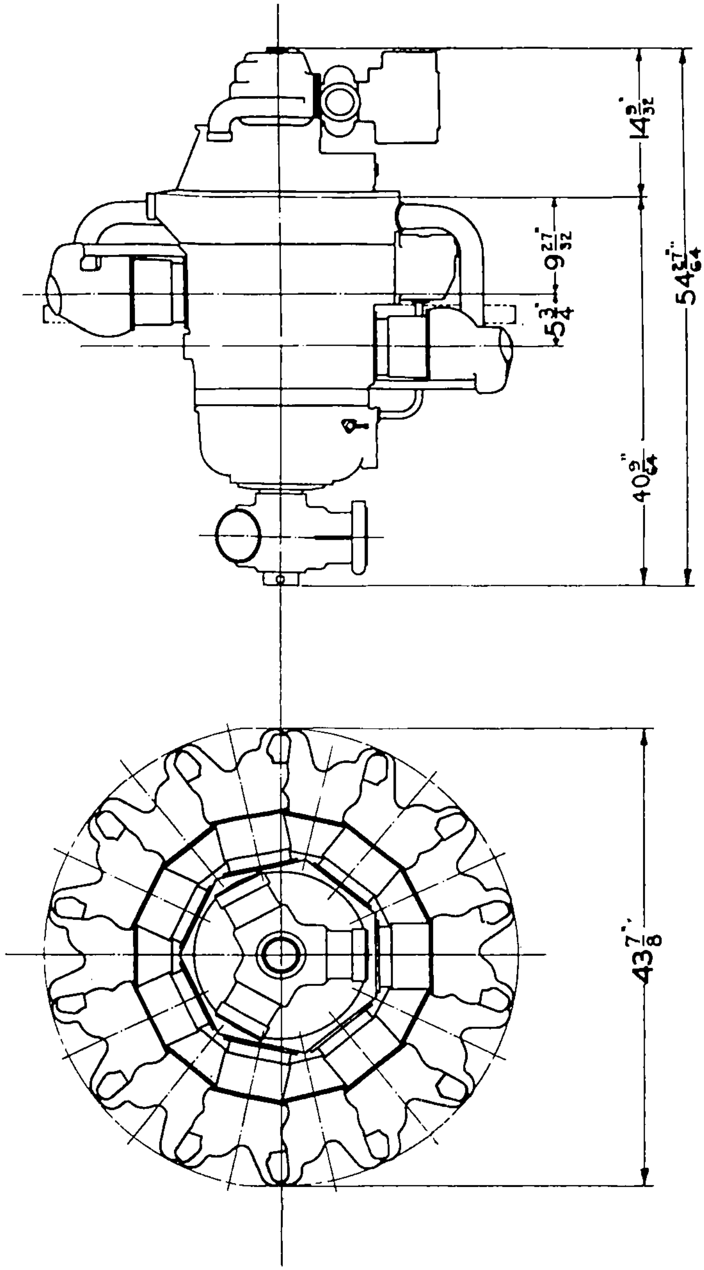
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
Wasp H1 (Geared 3:2 and 4:3) — 500-550 H.P.
9 Cylinder Radial Aircooled



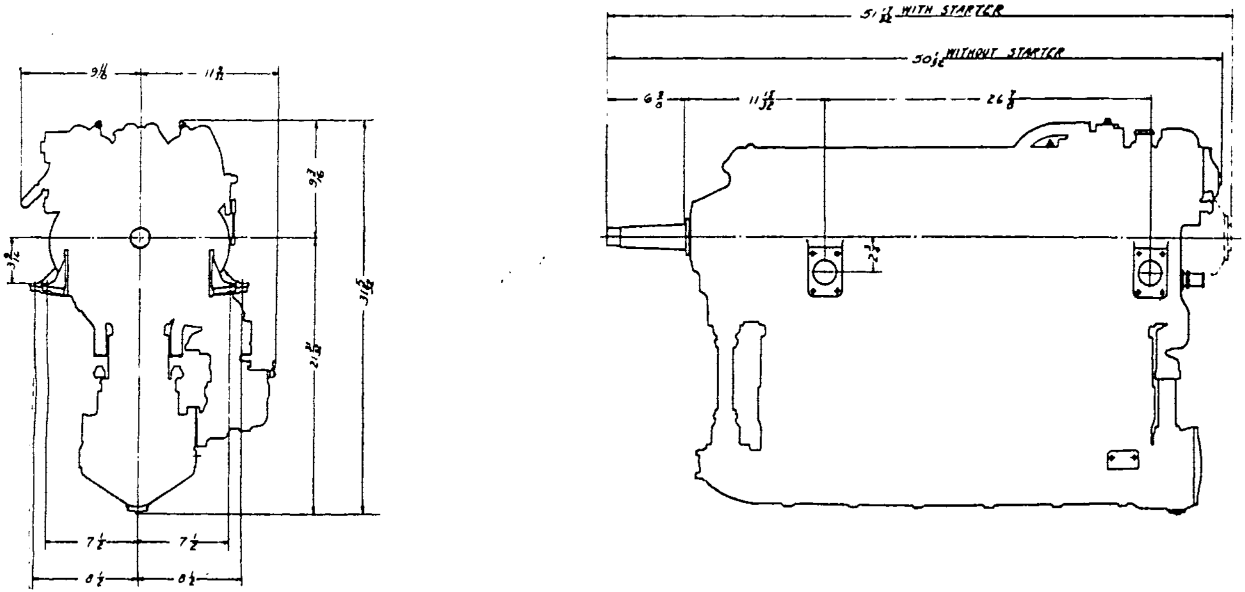
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
WASP JUNIOR B —— 320-420 H.P.
9 CYLINDER RADIAL AIRCOOLED



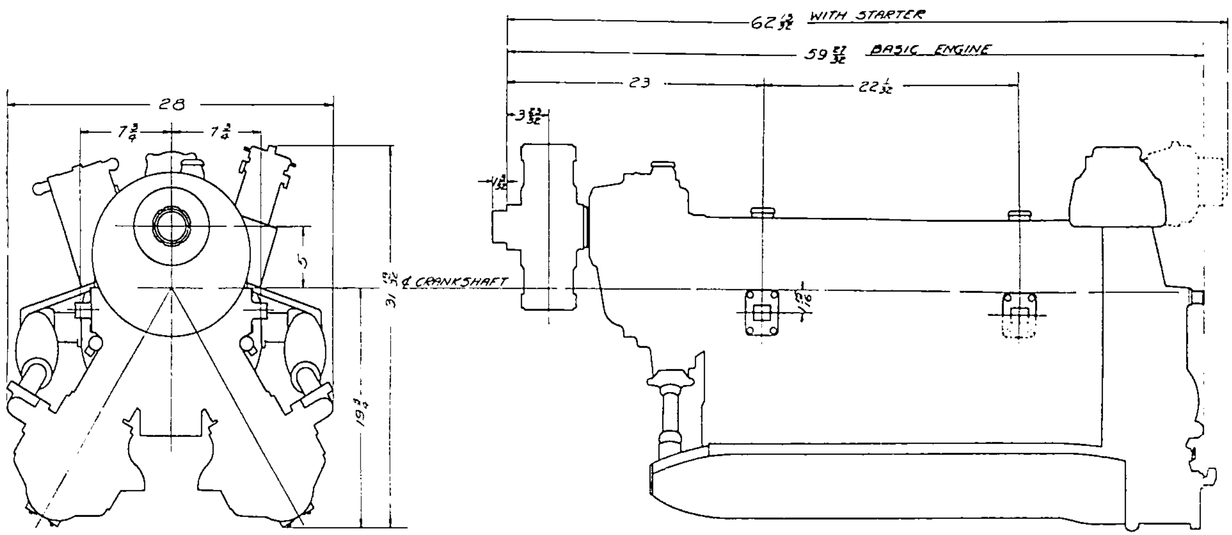
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
TWIN WASP A (GEARED 3:2 AND 4:3) —— 750-800 H.P.
14 CYLINDER RADIAL AIRCOOLED



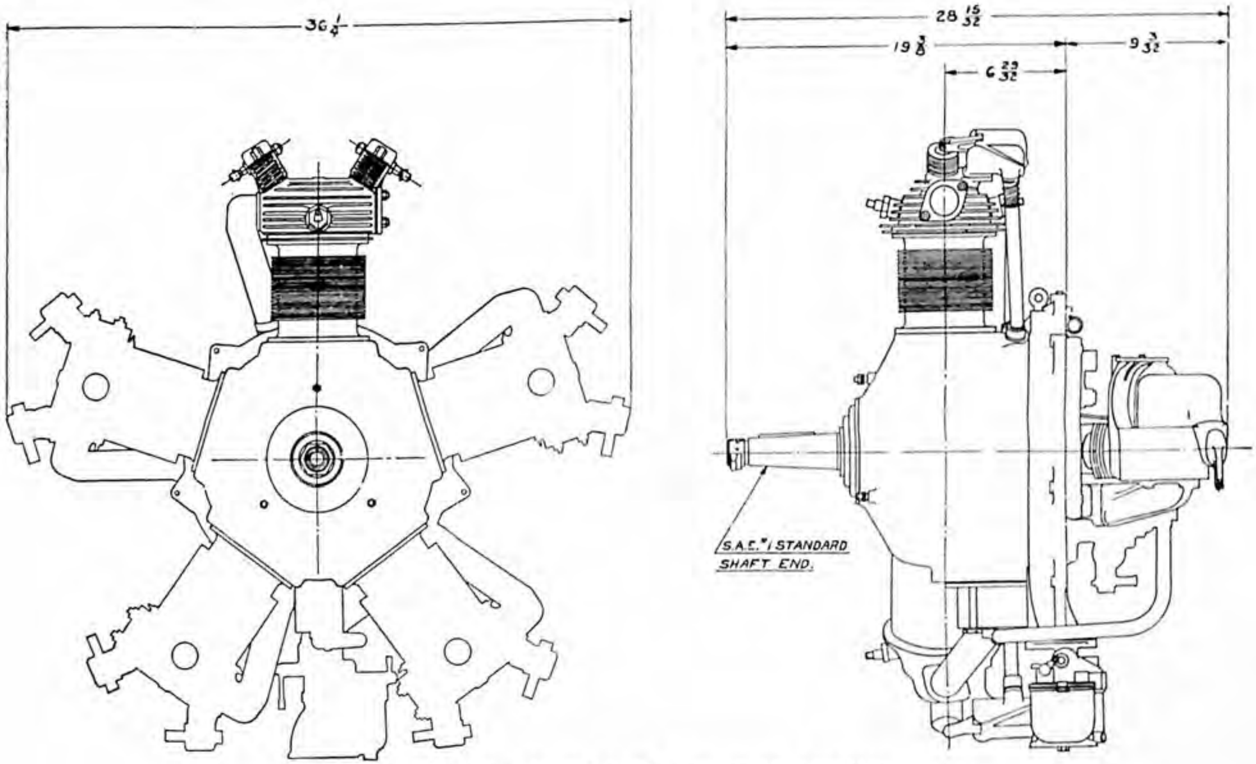
PRATT & WHITNEY AIRCRAFT COMPANY
East Hartford, Conn.
TWIN WASP JUNIOR A (GEARED 3:2 AND 4:3) — 650-700 H.P.
14 CYLINDER RADIAL AIRCOOLED



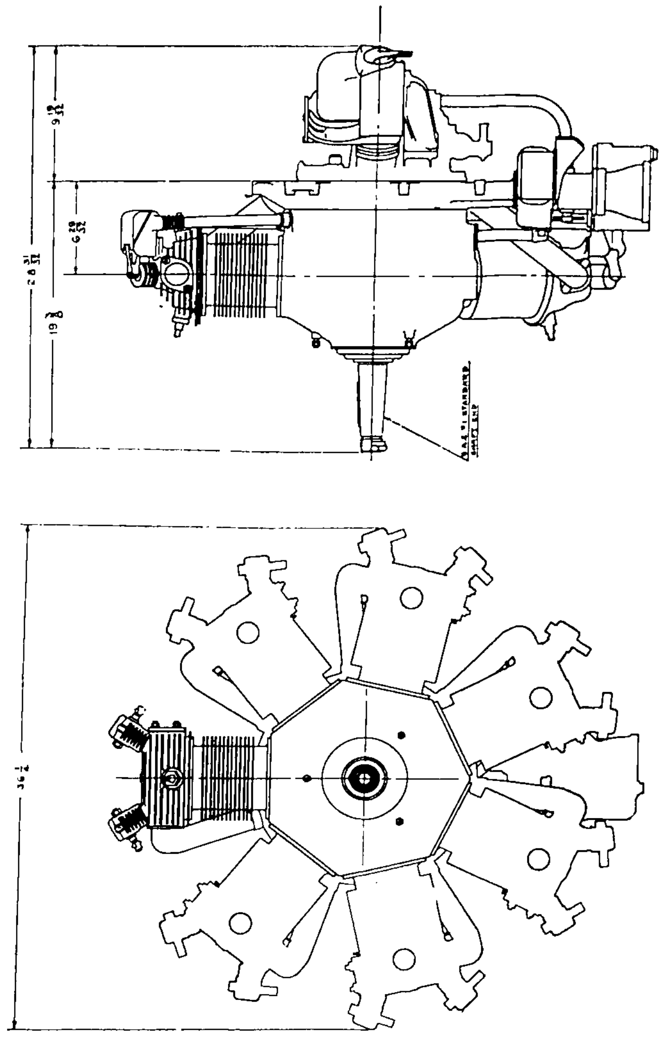
RANGER ENGINEERING CORPORATION
Farmingdale, N. Y.
Model 6-390 —— 120 H.P.
6 Cylinder Inverted In Line Aircooled



RANGER ENGINEERING CORPORATION
Farmingdale, N. Y.
MODEL V-770 SG —— 420 H.P.
12 CYLINDER INVERTED IN LINE AIRCOOLED

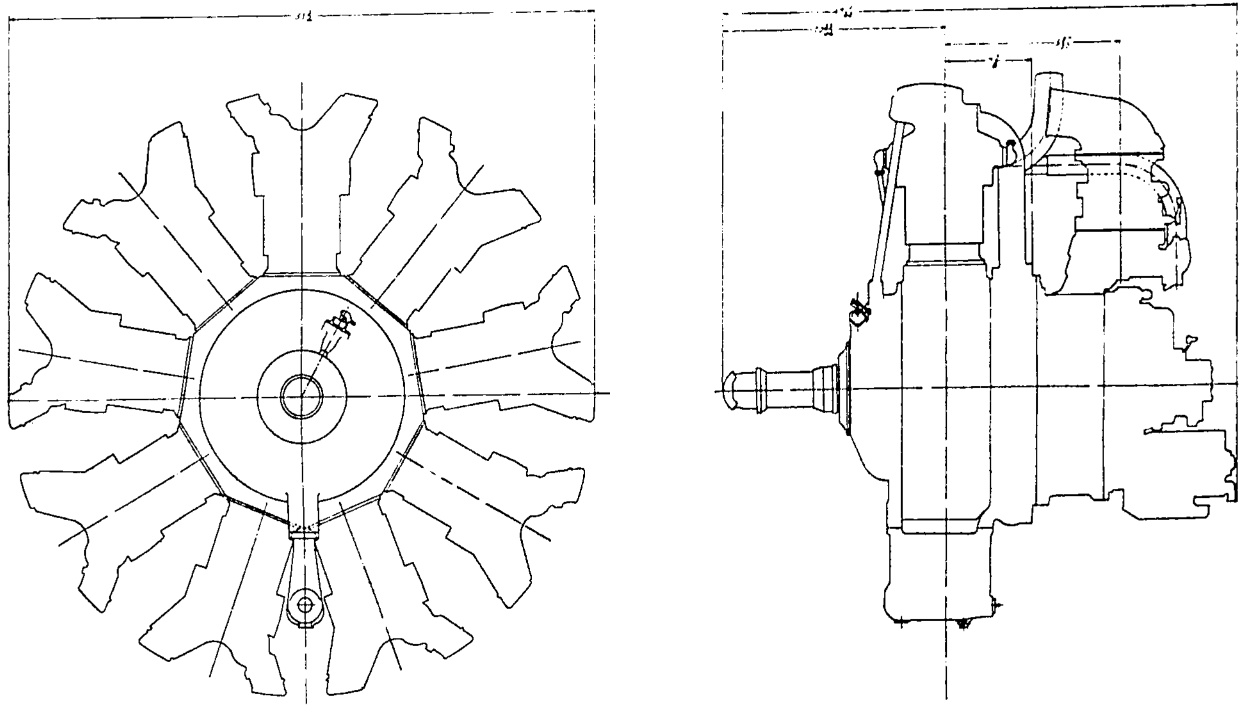


WARNER AIRCRAFT CORPORATION
Detroit, Mich.
SCARAB, JR. —— 90 H.P.
5 CYLINDER RADIAL AIRCOOLED

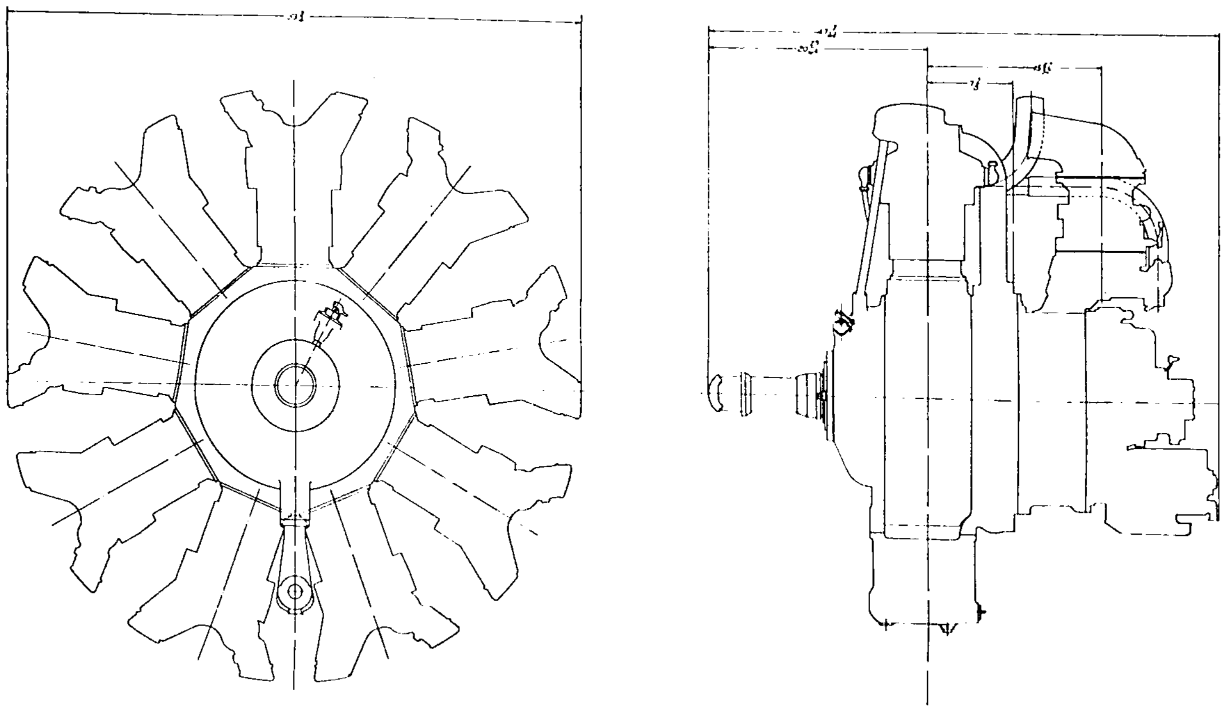


WARNER AIRCRAFT CORPORATION
Detroit, Mich.

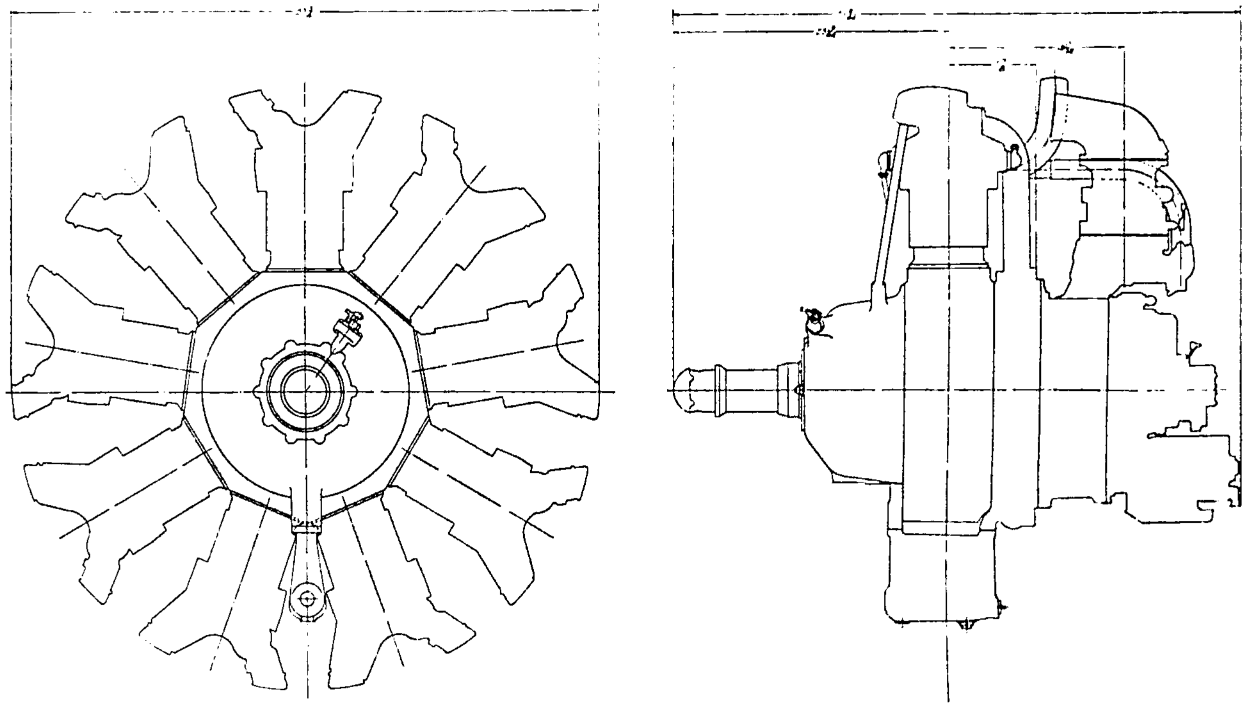
Scarab —— 125 H.P.
Super-Scarab —— 145 H.P.
7 Cylinder Radial Aircooled



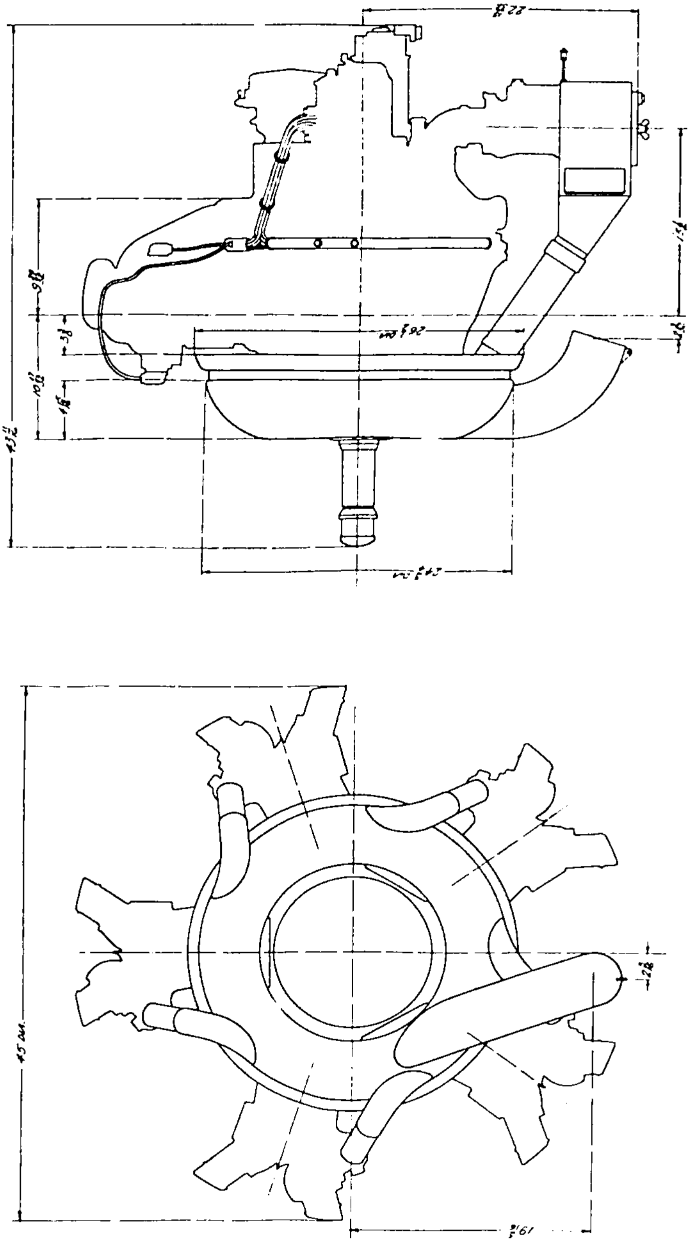
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT CYCLONE —— 715 H.P.
9 CYLINDER FIXED RADIAL AIRCOOLED
(This engine also has ratings of 645 and 675 H.P. at sea level. 735 H.P. at 4,000 feet altitude and 710 H.P. at 7,000 feet altitude.)



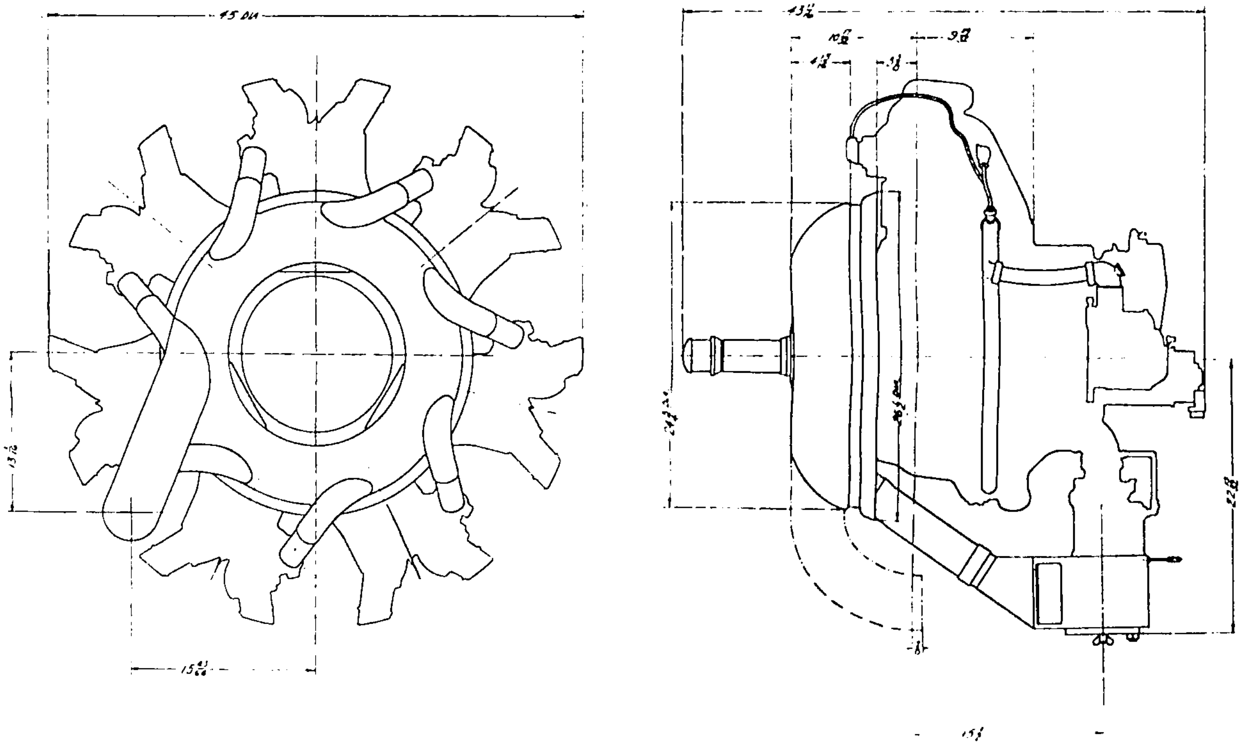
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT CYCLONE R-1820-F——715 H. P.
9 CYLINDER RADIAL AIRCOOLED
(This engine also has ratings of 660 and 690 H.P. at sea level, 735 H.P. at 4,000 feet and 710 H.P. at 7,000 feet.)



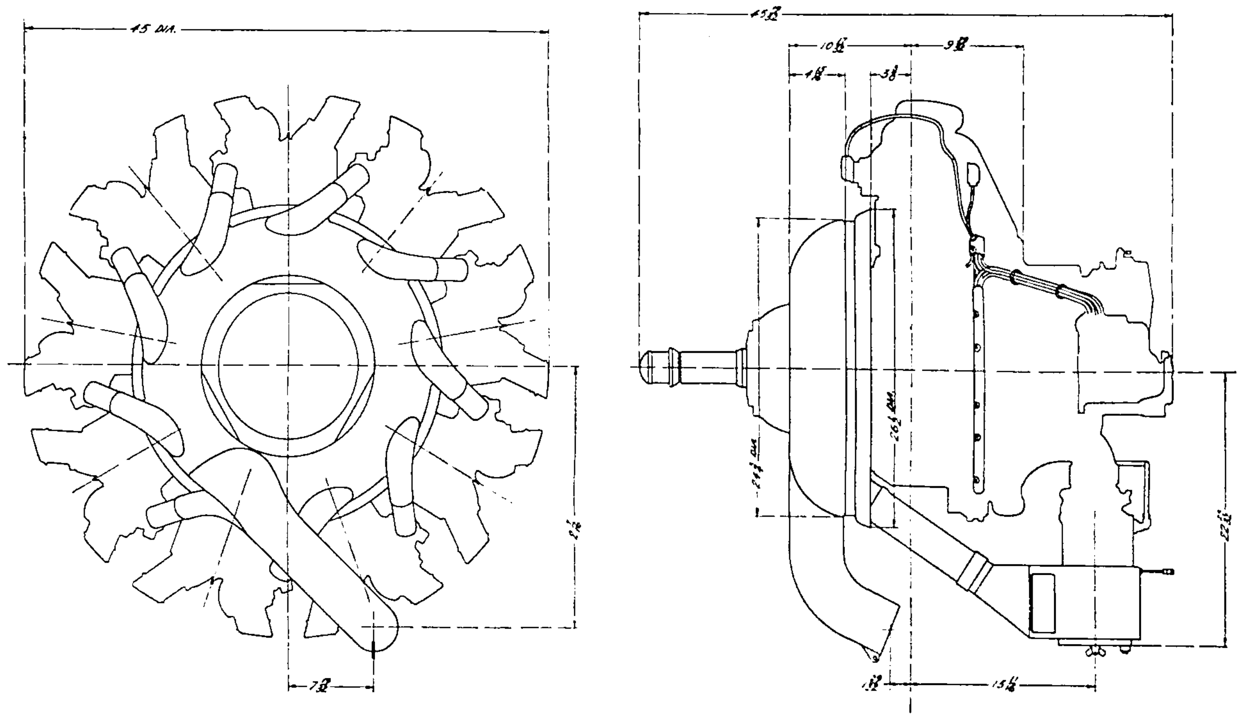
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT CYCLONE (GEARED 8:5) —— 715 H.P.
9 CYLINDER FIXED RADIAL AIRCOOLED



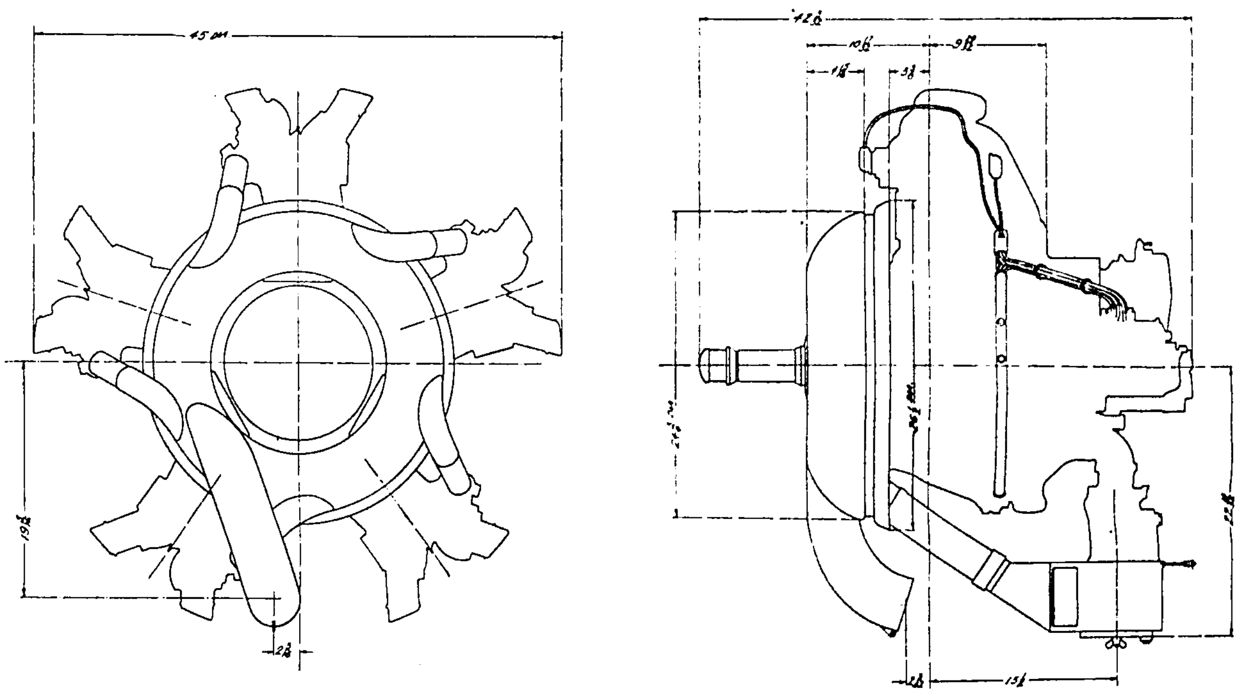
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
Wright Whirlwind —— 175 H.P.
5 Cylinder Radial Aircooled



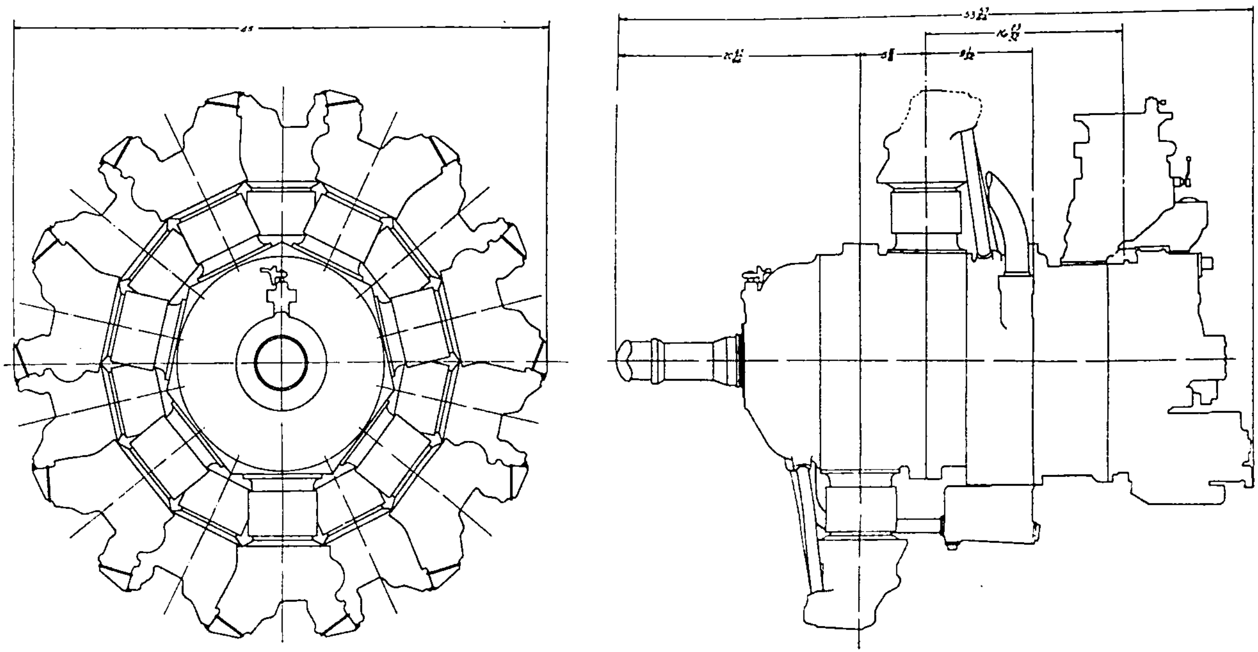
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT WHIRLWIND —— 250-285 H.P.
7 CYLINDER RADIAL AIRCOOLED



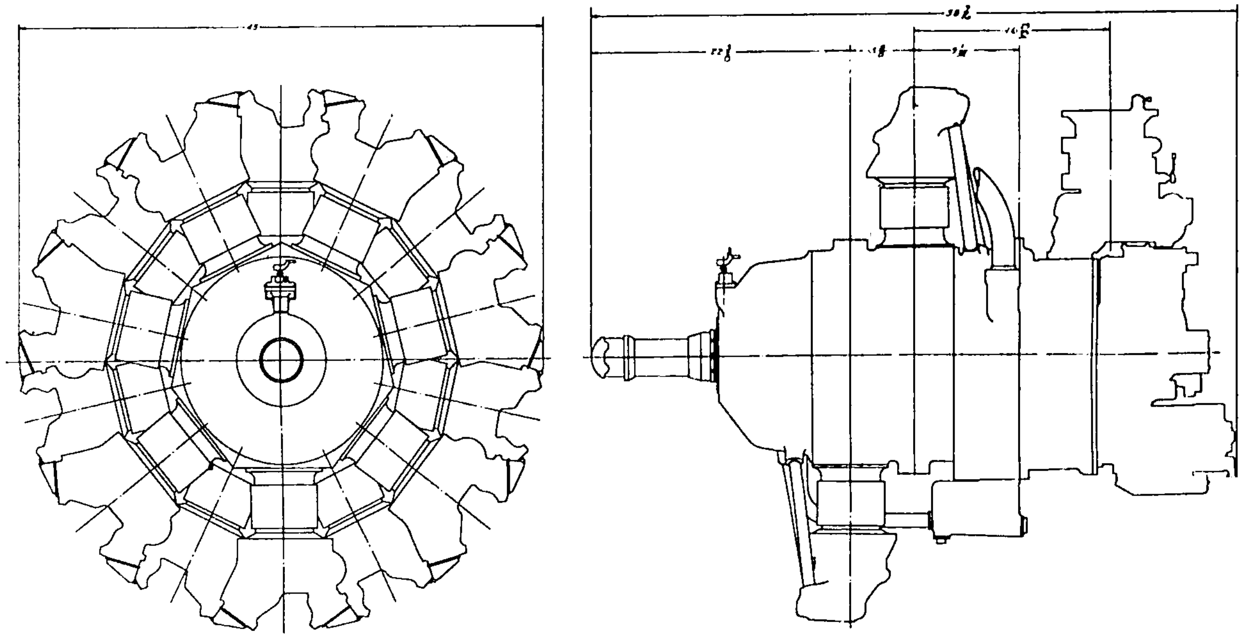
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT WHIRLWIND —— 330-365-420-440 H.P.
9 CYLINDER FIXED RADIAL AIRCOOLED



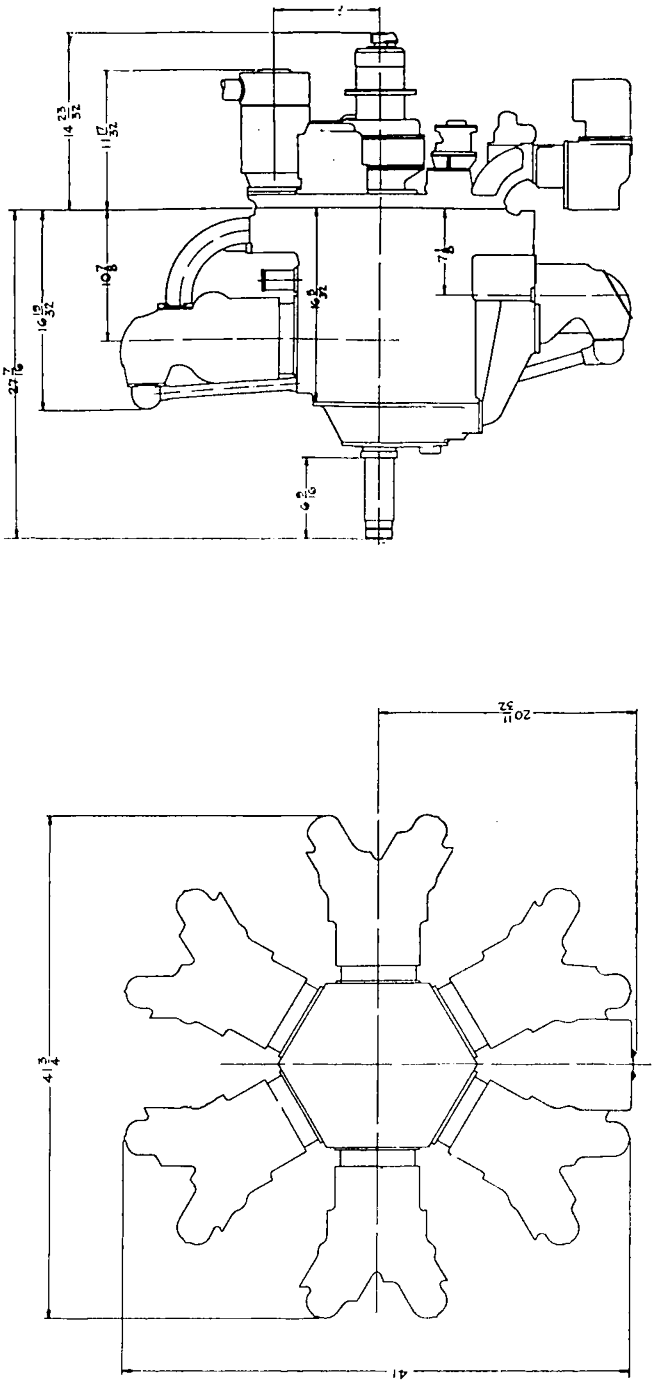
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT WHIRLWIND (GEARED) —— 330-365-420 H.P.
9 CYLINDER FIXED RADIAL AIRCOOLED



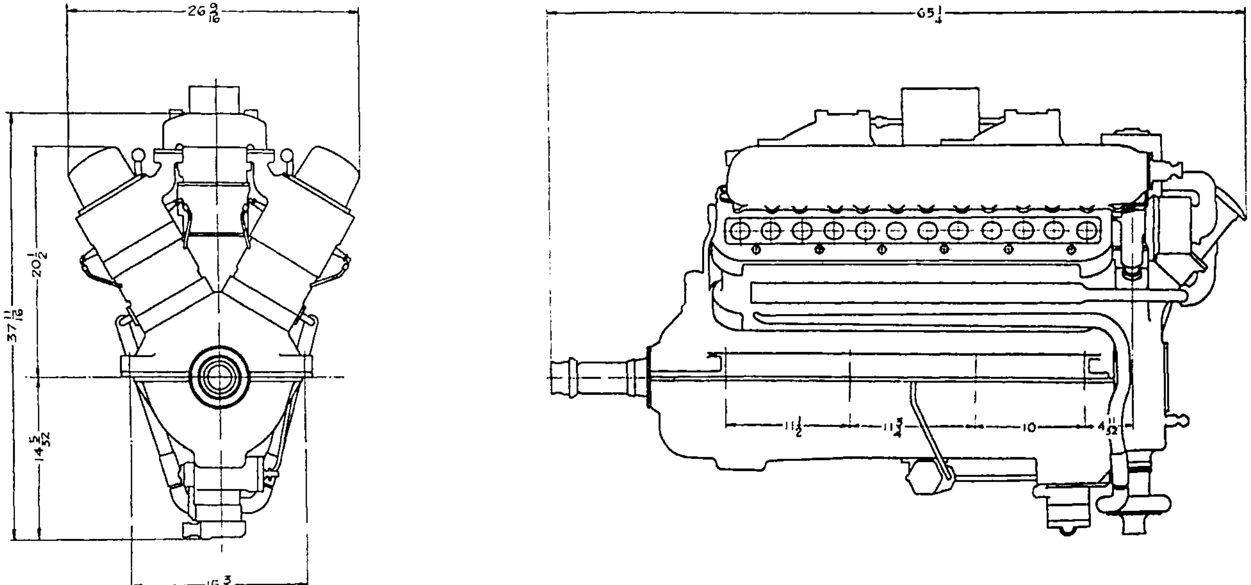
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT DOUBLE ROW WHIRLWIND —— 700 H.P.
14 CYLINDER 2 ROW RADIAL AIRCOOLED



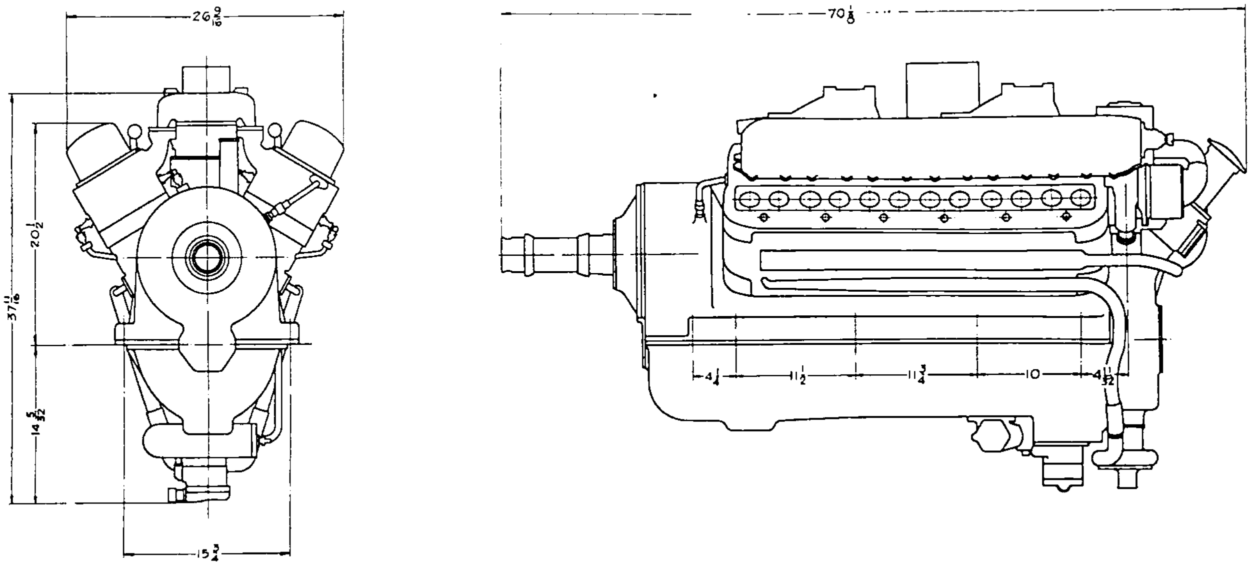
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
Wright Double Row Whirlwind (Geared 4:3) —— 700 H.P.
14 Cylinder 2 Row Radial Aircooled



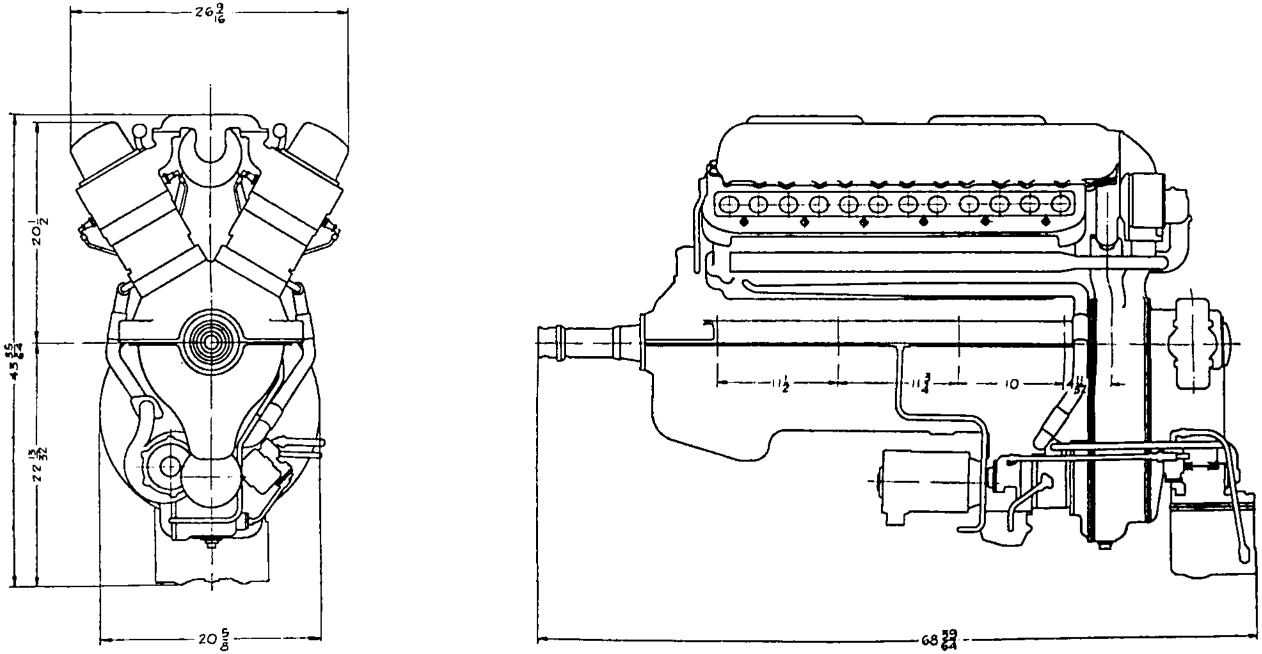
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
CURTISS CHALLENGER — 185 H.P.
6 CYLINDER RADIAL AIRCOOLED



WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
Curtiss Conqueror —— 675 H.P.
12 Cylinder V Type Liquid Cooled



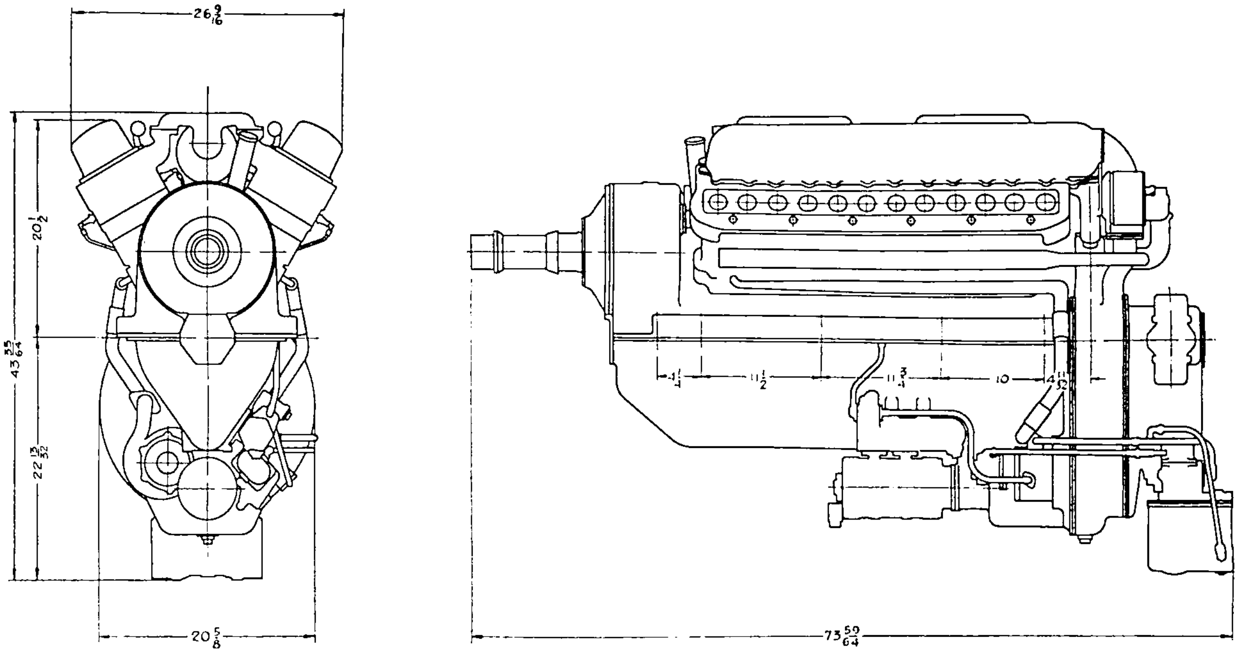
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
CURTISS CONQUEROR (GEARED) —— 675 H.P.
12 CYLINDER V TYPE LIQUID COOLED



WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.

Curtiss Super Conqueror —— 750 H.P. at Sea Level
740 H.P. at 6,000 Ft.

12 Cylinder V Type Liquid Cooled



WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
Curtiss Super Conqueror (Geared) 750 H.P. at Sea Level
705 H.P. at 7,000 Ft.
12 Cylinder V Type Liquid Cooled

Aviation Chronology and Records

CHRONOLOGY FOR 1934

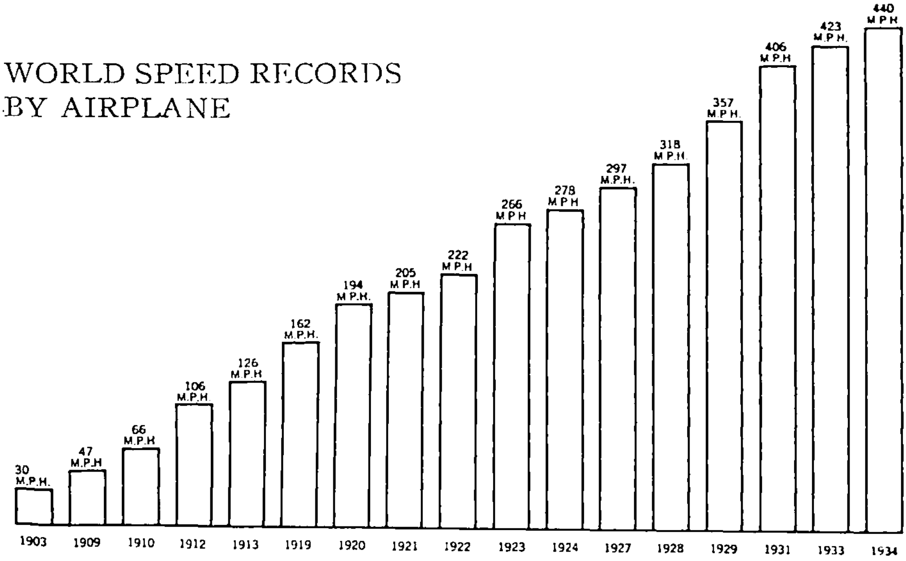
Jan. 1	Capt. de Corvette Bonnot and Lieut. de Vaisseau Jeanpierre make seaplane distance record of 2,286 miles in Air France test flight, begun December 31, from St. Louis, Senegal, Africa, to Natal, Brazil. (Latécoère 300, 4 Hispano-Suiza motors.)
Jan. 10-11	Six flying boats of Navy Patrol Squadron 10-F fly non-stop from San Francisco, Calif., to Pearl Harbor, Hawaii, making a seaplane distance record of 2,399 miles in 24 hrs. 56 min. (Consolidated P2Y-1, 2 Wright Cyclone motors.)
Jan. 11-14	Sixth Annual All-American Air Races held at Miami, Fla.
Jan. 13	John H. Wright makes American speed record for 100 kms. for light airplanes in the first category of 167.484 m.p.h. at Miami, Fla. (Lambert Monocoupe, Warner Scarab motor.)
Jan. 17	Leland S. Miles makes American speed record for 100 kms. for light airplanes in the second category of 209.109 m.p.h. at Miami, Fla. (Miles Special, Menasco C4S motor.)
Jan. 18	Herbert Schiff Memorial Trophy for 1933 presented to U. S. Marine Corps Observation Plane Squadron VO-7-M.
Jan. 25	Manley Memorial Medal presented to A. H. R. Fedden by the Society of Automotive Engineers.
Jan. 25	Wright Brothers Medal awarded to E. N. Jacobs by the Society of Automotive Engineers.
Jan. 26-Apr. 28	Maryse Hilsz flies from Paris, France, to Tokyo, Japan, and return. (Breguet 330, Hispano-Suiza motor.)
Jan. 30	Paul F. Fedoseyenko, Andrey B. Vasenko, and Ilya Usyskin, in the Soviet balloon Osaviakhim I, make unofficial altitude record of about 70,000 feet near Moscow, Russia, but later crash and are killed.
Feb. 3	Deutsche Luft Hansa starts regular air mail service between Germany and South America.
Feb. 14	S. J. Wittman makes speed record for 100 kms. for light airplanes in the fourth category of 137.513 m.p.h. at New Orleans, La. (Wittman Special, Pobjoy R motor.)
Feb. 14-19	Pan American Air Races held at Shushan Airport, New Orleans, La.
Feb. 17	James R. Wedell makes American speed record for 100 kms. without pay load of 266.032 m.p.h. at New Orleans, La. (Wedell-Williams, Pratt & Whitney Wasp motor.)
Feb. 18-19	Capt. E. V. Rickenbacker and Jack Frye, of Transcontinental and Western Air, Inc., fly from Los Angeles, Calif., to Newark, N. J., in 13 hrs. 2 min., making new record for passenger transport. (Douglas DC1, 2 Wright Cyclone motors.)
Feb. 19	All domestic air mail contracts having been annulled by order of President Roosevelt on Feb. 9, U. S. Army Air Corps starts to fly the mail.
Feb. 28-Apr. 25	Laura H. Ingalls flies from Glenn Curtiss Airport, North Beach, New York, on 17,000-mile tour of South America, including a solo flight across the Andes, and returns to Floyd Bennett Field, Brooklyn, New York, on April 25. (Lockheed Air Express, Pratt & Whitney Wasp motor.)
Mar. 31	Hubbard Gold Medal awarded by National Geographic Society to Mrs. Charles A. Lindbergh for her achievements as radio operator and co-pilot on 29,000-mile survey flight.
Apr. 11	Commander Renato Donati makes altitude record of 47,352.219 feet at Rome, Italy. (Caproni, Bristol Pegasus motor.)
Apr. 20-22	"U. S. S. Macon" flies from Sunnyvale, Calif., to Miami, Fla., to participate in Navy maneuvers, returning to California on May 18.

Apr. 23-May 1	Bernard Rubin and Kenneth H. F. Waller fly from Australia to Lympne, England, in 8 days, 12 hrs., making new record. (De Havilland Leopard Moth, De Havilland Gipsy Major motor.)
Apr. 26	Boris Sergievsky makes seaplane record for greatest load carried to an altitude of 2,000 meters by carrying 16,608 lbs. at Bridgeport, Conn. (Sikorsky S-42, 4 Pratt & Whitney Hornet motors.)
Apr. 26	Cheney Award presented to Lieut. William L. Bogen, Doy D. Dodd, and Thomas J. Rogers.
Apr. 27-May 6	International Show of Sport and Touring Aviation held at Geneva, Switzerland.
May 8-23	Jean Batten flies from Lympe, England, to Darwin, Australia, in 14 days, 23 hrs. 25 min., making new record for women. (De Havilland Moth, De Havilland Gipsy motor.)
May 13	Jack Frye of Transcontinental and Western Air, Inc., flies from Los Angeles, Calif., to Newark, N. J., in 11 hrs. 31 min., making new record for air mail. (Northrop Gamma, Wright Cyclone motor.)
May 14-15	George R. Pond and Cesare Sabelli fly from Floyd Bennett Field, Brooklyn, New York, to Lahinch, Ireland, in 32 hrs., later flying to Rome, Italy. (Bellanca Pacemaker, Wright Whirlwind motor.)
May 17	Boris Sergievsky and Raymond B. Quick make seaplane altitude record of 20,406.762 feet carrying a pay load of 5,000 kgs. at Bridgeport, Conn. (Sikorsky S-42, 4 Pratt & Whitney Hornet motors.)
May 24	Empire Air Day celebrated at Royal Air Force stations in England.
May 26	"Graf Zeppelin" resumes its regular mail and passenger service between Germany and Brazil.
May 27	Second annual Deutsch de la Meurthe Cup Race won by Maurice Arnoux at 241.7 m.p.h. (Caudron 450, Renault motor.)
May 27-28	Paul Codos and Maurice Rossi fly from Paris, France, to Floyd Bennett Field, Brooklyn, New York, in 38 hrs. 27 min. (Bleriot 110, Hispano-Suiza motor.)
May 29	Collier Trophy for 1933 presented to Hamilton Standard Propeller Company, with particular credit to Frank W. Caldwell, for the development of a controllable pitch propeller.
June 1	Last of air mail routes returned to private contractors.
June 12	Air Mail Act of 1934, including provision for the appointment of a Federal Aviation Commission to survey all phases of aviation, signed by President Roosevelt.
June 14	Mackay Trophy for 1933 presented to Capt. Westside T. Larson for his contribution to aerial defense.
June 20	Daniel Guggenheim Medal presented to William E. Boeing for his achievements in air transportation and aircraft manufacture.
June 23-July 8	Fifth Annual National Soaring Contest held at Elmira, N. Y., under auspices of the Soaring Society of America, Inc.
June 24	Third annual Annette Gipson All-Women Air Race held at Roosevelt Field, Mineola, N. Y.
June 25	Richard C. duPont makes glider distance record of 158.299 miles from Elmira, N. Y., to Basking Ridge, N. J. (duPont-Bowlus sailplane.)
June 29-30	Benjamin and Joseph Adamowicz fly from Harbor Grace, Newfoundland, to St. André de Messei, France, later continuing to Warsaw, Poland. (Bellanca Pacemaker, Wright Whirlwind motor.)
June 30	Fifteenth Royal Air Force Display held at Hendon, England.
June 30	Richard C. duPont makes American glider altitude record of 6,223.734 feet at Elmira, N. Y. (duPont-Bowlus sailplane.)

July 1	Aeronautics Branch, Department of Commerce, renamed Bureau of Air Commerce.
July 13-14	King's Cup Race won by Flight Lt. H. M. Schofield at Hatfield, England. (Monsopar S.T. 10, 2 Pobjoy Niagara motors.)
July 17-Sept. 4	Twelve Navy patrol flying boats make 5,000-mile flight from San Diego, Calif., to Alaska and return. (Martin PM-1, 2 Wright Cyclone motors.)
July 19-Aug. 20	Ten Army bombers make flight of approximately 7,360 miles from Bolling Field, Washington, D. C., to Alaska and return. (Martin B-10, 2 Wright Cyclone motors.)
July 21-Sept. 10	John Grierson flies from Rochester, England, to New York, by way of Iceland, Greenland and Canada. (De Havilland Fox Moth, De Havilland Gipsy motor.)
July 22-Aug. 5	Fifteenth Rhoen Soaring Contest held at Wasserkuppe, Germany.
July 28	Maj. William E. Kepner, Capt. Albert W. Stevens, and Capt. Orvil A. Anderson, taking off from Rapid City, S. D., ascend to an altitude of 60,613 feet in a balloon, but are forced down near Loomis, Neb., by a tear in the bag.
July 31-Aug. 1	National Balloon Race won by Lieut. Charles H. Kendall and Lieut. H. T. Orville in the Navy balloon, flying 206.4 miles from Birmingham, Ala., to Commerce, Ga.
Aug. 1	Edwin Musick, Boris Sergievsky, and Charles A. Lindbergh make eight seaplane load records at Stratford, Conn. (See Official air records.) (Sikorsky S-42, 4 Pratt & Whitney Hornet motors.)
Aug. 4-5	Women's National Air Meet held at Dayton, O.
Aug. 8-9	James R. Ayling and Leonard G. Reid fly from Wasaga Beach, Ontario, Canada, to Heston, England, in 30 hrs. 50 min. (De Havilland Dragon, 2 De Havilland Gipsy Major motors.)
Aug. 11	Helene Boucher makes women's speed record of 276.527 m.p.h. at Istres, France. (Caudron C. 450, Renault-Bengali motor.)
Aug. 17-Sept. 2	Second International Aero Exhibition held at Copenhagen, Denmark.
Aug. 18	Max Cosyns and Nérée van der Elst ascend to a height of 52,952 feet in a balloon, taking off at Hour-Havenne, Belgium, and landing near Senaulje, Yugoslavia.
Aug. 27-Sept. 6	Dr. Richard U. Light and Robert F. Wilson fly from Cartwright, Labrador, to Kirkwall Bay, Orkney Islands, by way of Greenland, Iceland, and the Faroe Islands. (Bellanca Skyrocket, Pratt & Whitney Wasp motor.)
Aug. 28-Sept. 16	International Touring Competition won by Jerzy Bajan. (R.W.D.9, Skoda motor.)
Aug. 31-Sept. 3	National Air Races held at Cleveland, O.
Sept. 1	Col. Roscoe Turner flies from Burbank, Calif., to Floyd Bennett Field, Brooklyn, New York, in 10 hrs. 2 min. 57 sec., making new transcontinental record. (Wedell-Williams, Pratt & Whitney Hornet motor.)
Sept. 20-28	C. J. Melrose flies from Darwin, Australia, to Croydon, England, in 8 days, 9 hrs., making new record. (De Havilland Puss Moth, De Havilland Gipsy Major motor.)
Sept. 20-30	Soaring Society of America holds gliding meet at Big Meadows, Va.
Sept. 23-25	Gordon Bennett Balloon Race won by F. Hynek and W. Pomaski of Poland, traveling 826.77 miles from Warsaw to Anna, Russia.
Oct. 2	General Headquarters Air Force, directly under command of the Chief of Staff, U. S. Army, is established.

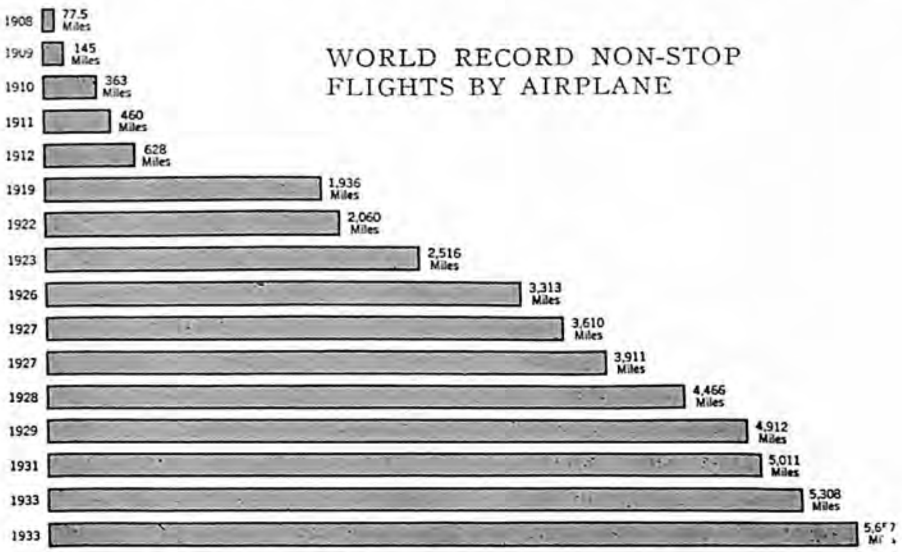
Oct. 9	Gold Medal of the Fédération Aéronautique Internationale presented to Wiley Post.
Oct. 9-11	Thirty-fourth annual congress of the Fédération Aéronautique Internationale held in Washington, D. C.
Oct. 18-19	Mario Stoppani, Corradina Corrado, and Amadeo Suraion make seaplane distance record of 2,566.808 miles, from Monfalcone, Italy, to Massaua, Africa. (Cant Z-501, Isotta-Fraschini-Asso motor.)
Oct. 20-22	C. W. A. Scott and T. Campbell Black fly from Mildenhall, England, to Darwin, Australia, in 52 hrs. 30 min., making new record. (De Havilland Comet, 2 De Havilland Gipsy Six R motors.)
Oct. 20-23	MacRobertson International Air Race won by C. W. A. Scott and T. Campbell Black, flying from Mildenhall, England, to Melbourne, Australia, in 70 hrs. 54 min. 18 sec. (De Havilland Comet, 2 De Havilland Gipsy Six R motors.)
Oct. 20-Nov. 4	Sir Charles Kingsford-Smith and Capt. P. G. Taylor fly from Brisbane, Australia, to Oakland, Calif. (Lockheed Altair, Pratt & Whitney Wasp motor.)
Oct. 23	Dr. and Mrs. Jean Piccard ascend to a height of 57,979 feet in a stratosphere balloon, taking off from Dearborn, Mich., and landing near Cadiz, O.
Oct. 23	Lieut. Francesco Agello makes seaplane speed record of 440.681 m.p.h. at Desenzano, Italy. (Macchi-Castoldi 72, Fiat AS-6V motor.)
Oct. 27-Nov. 2	Lieut. Owen Cathcart-Jones and Kenneth H. F. Waller fly from Darwin, Australia, to Lympne, England, in 5 days, 15 hrs. 23 min., making new record. (De Havilland Comet, 2 De Havilland Gipsy Six R motors.)
Nov. 8	Capt. E. V. Rickenbacker, Silas Morehouse and Capt. Charles W. France fly from Los Angeles, Calif., to Newark, N. J., in 12 hrs. 3 min. 50 sec., making new record for passenger transport. (Douglas DC2, 2 Wright Cyclone motors.)
Nov. 15	Kansas City Trophy and Kansas City Chamber of Commerce Trophy presented to Dr. John D. Brock in recognition of five years of consecutive daily flights.
Nov. 16-Dec. 2	Fourteenth International Aviation Exhibition held at Paris, France.
Nov. 17	Mitchell Trophy Race won by Capt. Fred C. Nelson, U. S. Air Corps, at an average speed of 216.832 m.p.h. at Selfridge Field, Mich.
Dec. 3	Charles T. P. Ulm, George Littejohn, and J. S. Skilling leave Oakland, Calif., on attempted transpacific flight to Australia in British landplane, and are lost at sea. (Airspeed Envoy, 2 Linx motors.)
Dec. 8	Grover Loening Intercollegiate Flying Club Trophy presented to University of Minnesota Flying Club.
Dec. 21	Lt. Comdr. E. F. Stone, U. S. Coast Guard, makes speed record for amphibions of 191.734 m.p.h. at Hampton Roads, Va. (Grumman JF-2, Wright Cyclone motor.)
Dec. 25	Raymond Delmotte makes landplane speed record of 314.319 m.p.h. at Istres, France. (Caudron C. 460, Renault motor.)
Dec. 26	Lt. Col. Frank M. Andrews appointed commander of the General Headquarters Air Force.

WORLD SPEED RECORDS
BY AIRPLANE



SPEED RECORDS
by airplane

Date	*Place*	*Airplane*	*Pilot*	*Speed*
1903	United States (First Flight)	Wright (US)	O. Wright	30 m.p.h.
1909	France	Curtiss (US)	Curtiss	47 m.p.h.
1910	United States	Bleriot (Fr)	LeBlanc	66 m.p.h.
1912	France	Deperdussin (Fr)	Vedrines	106 m.p.h.
1913	France	Deperdussin (Fr)	Prevost	126 m.p.h.
1919	United States	Curtiss (US)	Rohlfs	162 m.p.h.
1920	France	Nieuport (Fr)	Lecointe	194 m.p.h.
1921	France	Nieuport (Fr)	Lecointe	205 m.p.h.
1922	United States	Curtiss (US)	Mitchell	222 m.p.h.
1923	United States	Curtiss (US)	Williams	266 m.p.h.
1924	France	Ferbois (Fr)	Bonnett	278 m.p.h.
1927	Italy	Macchi (It)	de Bernardi	297 m.p.h.
1928	Italy	Macchi (It)	de Bernardi	318 m.p.h.
1929	England	Supermarine (Br)	Orlebar	357 m.p.h.
1931	England	Supermarine (Br)	Stainforth	406 m.p.h.
1933	Italy	Macchi (It)	Agello	423 m.p.h.
1934	Italy	Macchi (It)	Agello	440 m.p.h.



The record flight of today is a commonplace tomorrow.

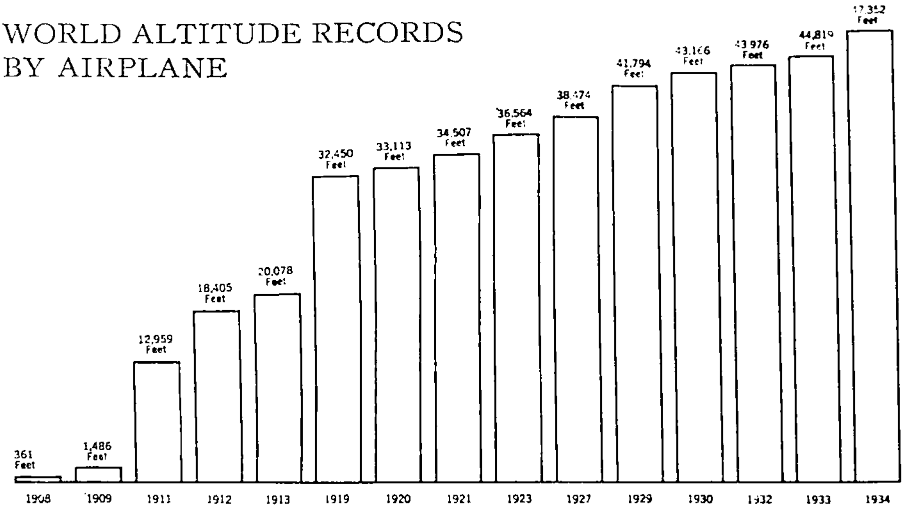
RECORD NON-STOP FLIGHTS

by airplane

Date	*Place*	*Airplane*	*Pilot*	*Distance*
1908	France	Wright (US)	W. Wright	77.5 mi.
1909	France	Farman (Fr)	Farman	145 mi.
1910	France	Farman (Fr)	Tabuteau	363 mi.
1911	France	Nieuport (Fr)	Gobe	460 mi.
1912	France	Farman (Fr)	Fourny	628 mi.
1919	St. Johns, Newf. to Ireland	Vickers (Br)	Alcock and Brown	1,936 mi.
1922	San Diego, Cal. to Indianapolis, Ind.	Fokker (US)	Kelley and Macready	2,060 mi.
1923	New York to San Diego, Cal.	Fokker (US)	Kelley and Macready	2,516 mi.
1926	Paris to Djask, Persia	Breguet (Fr)	Coste and Rignot	3,313 mi.
1927	New York to Paris, France	Ryan (US)	Lindbergh	3,610 mi.
1927	New York to Germany	Bellanca (US)	Chamberlin	3,911 mi.
1928	Rome to Brazil	Savoia (It)	Ferrarin and del Prete	4,466 mi.
1929	Paris to Coulart, China	Breguet (Fr)	Coste and Bellonte	4,912 mi.
1931	New York to Istanbul, Turkey	Bellanca (US)	Boardman and Polando	5,011 mi.
1933	Cranwell, Eng. to Walvis Bay, South Africa	Fairey (Br)	Gayford and Nicholetts	5,308 mi.
1933	New York to Rayak, Syria	Bleriot (Fr)	Codos and Rossi	5,653 mi.

The record was not broken in 1934.

WORLD ALTITUDE RECORDS BY AIRPLANE



ALTITUDE RECORDS
by Airplane

Date	*Place*	*Airplane*	*Pilot*	*Altitude*
1908	France	Wright (US)	W. Wright	361 ft.
1909	France	Antoinette (Fr)	Latham	1,486 ft.
1911	France	Bleriot (Fr)	Garros	12,959 ft.
1912	Algeria	Morane (Fr)	Garros	18,405 ft.
1913	France	Nieuport (Fr)	Legagneux	20,078 ft.
1919	United States	Curtiss (US)	Rohlfs	32,450 ft.
1920	United States	Lepere (US)	Schroeder	33,113 ft.
1921	United States	Lepere (US)	Macready	34,507 ft.
1923	France	Nieuport (Fr)	Lecointe	36,564 ft.
1927	United States	Wright (US)	Champion	38,474 ft.
1929	Germany	Junkers (Ger)	Neuenhofen	41,794 ft.
1930	United States	Wright (US)	Soucek	43,166 ft.
1932	England	Vickers (Br)	Uwins	43,976 ft.
1933	France	Potez (Fr)	Lemoine	44,819 ft.
1934	Italy	Caproni (It)	Donati	47,352 ft.

OFFICIAL AIR RECORDS

Established under Rules and Regulations of the

FEDERATION AERONAUTIQUE INTERNATIONALE

Translated and Compiled by the Contest Committee, The National Aeronautic Association, Washington, D. C.
December 31, 1934

OFFICIAL WORLD AIR RECORDS

World records are defined as maximum performance regardless of the class or type of aircraft used.

MAXIMUM SPEED OVER A 3 KILOMETER COURSE
709.209 km.p.h. (440.681 m.p.h.)
Francesco Agello, Italy, October 23, 1934.

AIRLINE DISTANCE..........................9,104,700 kilometers (5,657.387 miles)
M. Rossi and P. Codos, France, August 5, 6, and 7, 1933.

ALTITUDE..18,665 meters (61,236.691 feet)
Lt. Comdr. T. G. W. Settle, USN, and Major Chester L. Fordney, USMC, United States, November 20, 1933.

CIRCUIT OF WORLD ....(No record established)

AIRLINE DISTANCE WITH REFUELING....................(No record established)

OFFICIAL INTERNATIONAL AND NATIONAL "CLASS" RECORDS

AIRPLANES—CLASS C

DISTANCE, AIRLINE
International Record............................9,104.700 kilometers (5,657.387 miles)
M. Rossi and P. Codos, France, Bleriot-Zapata monoplane, "Joseph Le Brix," Hispano-Suiza 500 HP engine, from Floyd Bennett Field, Brooklyn, New York, U. S. A., to Rayack, Syria, August 5, 6, and 7, 1933.
National (U.S.) Record............................8,065.736 kilometers (5,011.800 miles)
Russell N. Boardman and John Polando, Bellanca monoplane, Wright J-6 300 HP engine, from Brooklyn, New York, to Istanbul, Turkey, July 28, 29, and 30, 1931.

DISTANCE, BROKEN LINE
International Record............................9,106.330 kilometers (5,658.400 miles)
M. Rossi and P. Codos, France, Bleriot-Zapata monoplane, "Joseph Le Brix," Hispano-Suiza 500 HP engine, from Floyd Bennett Field, Brooklyn, New York, U. S. A., to Rayack, Syria, August 5, 6, and 7, 1933.
National (U.S.) Record..None established.

ALTITUDE
International Record ....14,433 meters (47,352.219 feet)
Commander Renato Donati, Italy, Caproni airplane, Pegasus 600 HP engine, Rome-Montecelio airport, April 11, 1934.
National (U.S.) Record..............................13,157 meters (43,165.880 feet)
Lt. Apollo Soucek, Wright "Apache," Pratt and Whitney 450 HP engine, at Anacostia, D. C., June 4, 1930.

MAXIMUM SPEED
International Record ....Speed, 505.848 km.p.h. (314.319 m.p.h.)
Raymond Delmotte, France, Caudron C. 460 monoplane, Renault 6 cylinder 380 HP engine at Istres, December 25, 1934.
National (U.S.) Record..........................Speed, 490.80 km.p.h. (304.98 m.p.h.)
James R. Wedell, Wedell-Williams monoplane, Pratt and Whitney Wasp Senior engine, supercharged, at Glenview, Illinois, September 4, 1933.

SPEEDS FOR SPECIFIED DISTANCES WITHOUT PAY LOAD

SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record..........................Speed, 431.654 km.p.h. (268.217 m.p.h.)
R. Delmotte, France, Caudron 450 monoplane, Renault 300 HP engine, Villesauvage-la-Marmogne course, May 24, 1934.
National (U.S.) Record..........................Speed, 428.138 km.p.h. (266.032 m.p.h.)
J. R. Wedell, Wedell-Williams monoplane, Pratt & Whitney Wasp 800 HP engine, New Orleans, Louisiana, February 17, 1934.

SPEED FOR 1000 KILOMETERS (621.369 MILES)
International Record..........................Speed, 409.184 km.p.h. (254.255 m.p.h.)
Miss Helene Boucher, France, Caudron C. 450 airplane, Renault 300 HP engine, at Istres, August 8, 1934.
National (U.S.) Record..........................Speed, 205.06 km.p.h. (127.418 m.p.h.)
Lieut. Harold R. Harris, U.S.A., and Ralph Lockwood, DH-4L, Liberty 400 HP engine, at Wright Field, Dayton, Ohio, March 29, 1923.

SPEED FOR 2000 KILOMETERS (1242.739 MILES)
International Record..........................Speed, 345.310 km.p.h. (214.565 m.p.h.)
Flight Captain Robert Untucht, Germany, Heinkel 70 monoplane, BMW 630 HP engine, Berlin-Staaken, March 24, 1933.
National (U.S.) Record..........................Speed, 183.83 km.p.h. (114.226 m.p.h.)
Lieut. Harold R. Harris, U.S.A., DH-4L, Liberty 375 HP engine, Wright Field, Dayton, Ohio, April 17, 1923.

SPEED FOR 5000 KILOMETERS (3106.849 MILES)
International Record..........................Speed, 208.152 km.p.h. (130.189 m.p.h.)
Carlos de Haya Gonzales and Cipriano Rodriguez Diaz, Spain, Breguet airplane, Hispano-Suiza 600 HP engine, Seville-Utrera-Carmona course, October 7 and 8, 1930.
National (U.S.) Record.. None established.

SPEED FOR 10,000 KILOMETERS (6213.698 MILES)
International Record..........................Speed, 149.853 km.p.h. (93.114 m.p.h.)
J. Le Brix and M. Doret, France, Dewoitine airplane, Hispano-Suiza 650 HP engine, Istres, June 7, 8, 9, and 10, 1931.
National (U.S.) Record..None established.

CLASS C—WITH PAY LOAD OF 500 KILOGRAMS
(1102.311 lbs.)

ALTITUDE
International Record....................................10,285 meters (33,743.334 feet)
M. Signerin, France, Breguet 198 airplane, Gnome-Rhone 620 HP engine, Villacoublay, September 21, 1932.
National (U.S.) Record....................................8,578 meters (28,143 feet)
Lieut. H. R. Harris, U.S.A.S., USA-TP-1, Liberty 400 HP engine, at Wright Field, Dayton, Ohio, May 21, 1924.
SPEED FOR 1000 KILOMETERS
International Record..........................Speed, 347.477 km.p.h. (215.912 m.p.h.)
Flight Captain Robert Untucht, Germany, Heinkel 70 monoplane, BMW V1 630 HP engine, at Berlin, March 22, 1933.
National (U.S.) Record..None established.
SPEED FOR 2000 KILOMETERS
International Record..........................Speed, 255.253 km.p.h. (158.606 m.p.h.)
M. Doret, Captain Terrasson and Lieutenant Lecarme, France, Dewoitine monoplane, 3 Hispano-Suiza 575 HP engines, Villacoublay—Orleans—Le Boullay course, September 7, 1933.
National (U.S.) Record..None established.
SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C—WITH PAY LOAD OF 1000 KILOGRAMS
(2204.622 lbs.)

ALTITUDE
International Record....................................8,980 meters (29,461.853 feet)
M. Signerin, France, Breguet 198 airplane, Gnome-Rhone 620 HP engine, Villacoublay, September 23, 1932.
National (U.S.) Record....................................6,346 meters (20,820 feet)
Waldo Waterman, Bach airplane, Wright J-6 engine, Los Angeles Airport, Los Angeles, California, July 26, 1929.
SPEED FOR 1000 KILOMETERS
International Record..........................Speed, 281.250 km.p.h. (174.760 m.p.h.)
M. Lemoine, France, Potez 50 airplane, Gnome-Rhone 700 HP engine, Villacoublay-Angers, March 8, 1933.
National (U.S.) Record..........................Speed, 245.750 km.p.h. (152.700 m.p.h.)
Leland F. Schoenhair, Lockheed Vega "Executive" monoplane, Pratt and Whitney 450 HP engine, supercharged, Jacksonville, Florida, February 20, 1930.
SPEED FOR 2000 KILOMETERS
International Record..........................Speed, 255.253 km.p.h. (158.606 m.p.h.)
M. Doret, Captain Terrasson and Lieutenant Lecarme, France, Dewoitine monoplane, 3 Hispano-Suiza 575 HP engines, Villacoublay—Orleans—Le Boullay course, September 7, 1933.
National (U.S.) Record..None established.
SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C—WITH PAY LOAD OF 2000 KILOGRAMS
(4409.244 lbs.)

ALTITUDE
International Record....................................8,438 meters (27,683.643 feet)
Nicola di Mauro and Giorgio Olivari, Italy, Savoia-Marchetti S. 72 airplane powered with 3 Pegasus S. 2 engines, Montecelio airport, Rome, May 12, 1934.
National (U.S.) Record....................................2,049 meters (6,722.420 feet)
Lieut. H. R. Harris, U.S.A.S., Barling Bomber, 6 Liberty 400 HP engines, Wright Field, Dayton, Ohio, October 25, 1923.
SPEED FOR 1000 KILOMETERS
International Record..........................Speed, 259.556 km.p.h. (161.280 m.p.h.)
M. Doret, Captain Terrasson and Lieutenant Lecarme, France, Dewoitine monoplane, 3 Hispano-Suiza 575 HP engines, Villacoublay—Orleans—Le Boullay course, September 7, 1933.
National (U.S.) Record..None established.
SPEED FOR 2000 KILOMETERS
International Record..........................Speed, 255.253 km.p.h. (158.606 m.p.h.)
M. Doret, Captain Terrasson and Lieutenant Lecarme, France, Dewoitine monoplane, 3 Hispano-Suiza 575 HP engines, Villacoublay—Orleans—Le Boullay course, September 7, 1933.
National (U.S.) Record..None established.
SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C—WITH PAY LOAD OF 5000 KILOGRAMS (11,023 lbs.)

ALTITUDE
International Record....................................6,649 meters (21,814.239 feet)
Lucien Coupet, France, Farman type F. 221, 4 Gnome-Rhone type K. 14 RSD motors, at Toussus le Noble, June 16, 1934.
National (U.S.) Record..None established.
SPEED FOR 1000 KILOMETERS
Neither International nor National (U.S.) Record has been established.
SPEED FOR 2000 KILOMETERS
Neither International nor National (U.S.) Record has been established.
SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C—WITH PAY LOAD OF 10,000 KILOGRAMS (22,046 lbs.)

ALTITUDE
International Record....................................3,231 meters (10,597 feet)
Cav. Domenico Antonini, Italy, Caproni "Ca 90" airplane, 6 Isotta-Fraschini Asso engines, 1000 HP each, Cascina Malpensa, February 22, 1930.
National (U.S.) Record..None established.
SPEED FOR 1000 KILOMETERS
Neither International nor National (U.S.) Record has been established.
SPEED FOR 2000 KILOMETERS
Neither International nor National (U.S.) Record has been established.
SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C—GREATEST PAY LOAD CARRIED TO AN ALTITUDE OF 2000 METERS (6,561.66 feet)

International Record..................................10,000 kilograms (22,046.222 lbs.)
Cav. Domenico Antonini, Italy, Caproni "Ca 90" airplane, 6 Isotta-Fraschini Asso engines, 1000 HP each, Cascina Malpensa, February 22, 1930.
National (U.S.) Record..................................2,000 kilograms (4,409.244 lbs.)
Lt. H. R. Harris, U.S.A.S., Barling Bomber, 6 Liberty 400 HP engines, at Wright Field, Dayton, Ohio, October 25, 1923.

CLASS C—REFUELING IN FLIGHT

AIRLINE DISTANCE WITH REFUELING
Neither International nor National (U.S.) Record has been established.
BROKEN LINE DISTANCE WITH REFUELING
Neither International nor National (U.S.) Record has been established.

LIGHT AIRPLANES—CLASS C—FIRST CATEGORY

Multi-seaters weight empty less than 560 kgs. (1,234.576 lbs.)

AIRLINE DISTANCE
International Record..................................2,912 kilometers (1,809.429 miles)
Lalouette and de Permangle, France, Farman 231 airplane, Renault 95 HP engine, from Istres airport to Ville-Cisneros, January 11 and 12, 1931.
National (U.S.) Record..None established.
ALTITUDE
International Record....................................9,282 meters (30,453 feet)
Comm. Renato Donati, pilot, M. Lanciani, passenger, Italy, Fiat A.S.I.c.n.a. airplane, C.N.A.c. 7 engine, Littorio airport, December 30, 1932.
National (U.S.) Record....................................5,652 meters (18,543 feet)
Willfred G. Moore, Inland Sport monoplane, Warner 110 HP engine, Kansas City, Missouri, September 30, 1929.
SPEED FOR 100 KILOMETERS
International Record..........................Speed, 292.160 km.p.h. (181.539 m.p.h.)
Maurice Arnoux, France, Caudron 560 airplane, Renault-Bengali engine, Etampes La Marmogne course, August 25, 1934.
National Record..................................Speed, 269.541 km.p.h. (167.484 m.p.h.)
John H. Wright, pilot; Karl E. Voelter, passenger; Monocoupe monoplane, Warner Scarab 110 HP engine, Miami, Florida, January 13, 1934.

SPEED FOR 1000 KILOMETERS
International Record............................Speed, 279.018 km.p.h. (173.373 m.p.h.)
Capt. Puget and Lt. Moulignat, France, Caudron "Rafale" airplane, Renault 140 HP engine, at Istres, August 18, 1934.
National (U.S.) Record..None established.
SPEED FOR 2000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

LIGHT AIRPLANES—CLASS C—SECOND CATEGORY

Single-seaters weight empty less than 450 kgs. (992.070 lbs.)

AIRLINE DISTANCE
International Record..................................3,582 kilometers (2,225.747 miles)
Captain Skerzinski, Poland, R. W. D. 5-2 monoplane, Gipsy Major 130 HP engine, from St. Louis, Senegal, to Maceio, Brazil, May 7, 1933.
National (U.S.) Record..................................2,655 kilometers (1,650 miles)
D. S. Zimmerly, Barling NB-3 airplane, 60 HP LeBlond engine, Brownsville, Texas, to Winnipeg, Canada, July 17, 1929.
ALTITUDE
International Record..................................10,008 meters (32,834.546 feet)
Furio Niclot, Italy, E.T.A., C.N.A. airplane, C.N.A.C. 7, 160 HP engine, Littorio Airport, December 24, 1933.
National (U.S.) Record..................................7,338 meters (24,074.730 feet)
D. S. Zimmerly, Barling NB-3 monoplane, Lambert R266 90 HP engine, Forest Park Flying Field, St. Louis, Missouri, February 16, 1930.
SPEED FOR 100 KILOMETERS
International Record............................Speed, 345.622 km.p.h. (214.759 m.p.h.)
Raymond Delmotte, France, Caudron C. 362 monoplane, Renault-Bengali 152 HP engine, Villesauvage la Marmogne course, May 2, 1934.
National (U.S.) Record..... ....Speed, 336.530 km.p.h. (209.109 m.p.h.)
Leland S. Miles, "Miles Special" monoplane, Menasco C 4 S 185 HP engine at Miami, Florida, January 17, 1934.
SPEED FOR 1000 KILOMETERS
International Record............................Speed, 332.883 km.p.h. (206.843 m.p.h.)
R. Delmotte, France, Caudron monoplane, type 362, Renault-Bengali 150 HP engine, at Istres, December 26, 1933.
National (U.S.) Record..None established.
SPEED FOR 2000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

LIGHT AIRPLANES—CLASS C—THIRD CATEGORY

Multi-seaters weight empty less than 280 kgs. (617.288 lbs.)

AIRLINE DISTANCE
International Record..................................886.677 kilometers (550.954 miles)
Sebastiano Bedendo and P. Nuvoli, Italy, N. S. airplane, Pobjoy 75 HP engine, from Cinisello-Milano to San Vito dei Normanni-Brindisi, April 24, 1933.
National (U.S.) Record..None established.
ALTITUDE
International Record..................................6,951 meters (22,805.049 feet)
Giovanni Zappetta, pilot; Ragusa Francesco, passenger, Italy, N5 monoplane, Pobjoy 75 HP engine, Montecelio, December, 1933.
National (U.S.) Record..................................4,244 meters (13,923.843 feet)
Edna Rudolph, pilot, Thornton Waggoner, passenger, Curtiss Wright Junior airplane, Szekely 43 HP engine, East St. Louis, Illinois, May 31, 1931.
SPEED FOR 100 KILOMETERS
International Record............................Speed, 212.139 km.p.h. (131.816 m.p.h.)
Bailly and Reginensi, France, Farman 239 airplane, Pobjoy 75 HP engine, Villesauvage-La Marmogne course, October 4, 1933.
National (U.S.) Record..None established.
SPEED FOR 500 KILOMETERS
International Record............................Speed, 200,271 km.p.h. (124.442 m.p.h.)
Bailly and Reginensi, France, Farman 239 airplane, Pobjoy 75 HP engine, Villesauvage-La Marmogne course, October 6, 1933.
National (U.S.) Record..None established.
SPEED FOR 1000 KILOMETERS
International Record............................Speed, 195.760 km.p.h. (121.639 m.p.h.)
Bailly and Reginensi, France, Farman 239 airplane, Pobjoy 75 HP engine, Villesauvage-La Marmogne course, October 6, 1933.
National (U.S.) Record..None established.

LIGHT AIRPLANES—CLASS C—FOURTH CATEGORY

Single-seaters weight empty less than 200 kgs. (440.920 lbs.)

AIRLINE DISTANCE
International Record..............................852.100 kilometers (529.469 miles)
G. Fauvel, France, Maubaussin Peyret Type 10, No. 1 airplane, A.B.C. Scorpion engine. Saint-Inglebert to Pau, September 10, 1929.
National (U.S.) Record..None established.
ALTITUDE
International Record.....................................5,193 meters (17,037 feet)
G. Fauvel, France, Maubaussin Peyret Type 10, No. 1 airplane, A.B.C. Scorpion engine, Le Bourget, September 5, 1929.
National (U.S.) Record...................................5,324 meters (17,467 feet)
Kenneth W. Scholter, Aeronca airplane, Aeronca 38 HP engine, Detroit, Michigan, April 12, 1931.
(Note: F.A.I. requirement that previous record be beaten by 200 meters (656.166 feet) in order to establish a new international mark prevents international recognition of the above national record.)
SPEED FOR 100 KILOMETERS
International Record..........................Speed, 221.307 km.p.h. (137.513 m.p.h.)
S. J. Wittman, United States, "Wittman Special," Pobjoy "R" 95 HP engine, New Orleans, Louisiana, February 14, 1934.
National (U.S.) Record..Same as above.
SPEED FOR 500 KILOMETERS
Neither International nor National (U.S.) Record has been established.
SPEED FOR 1000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

SEAPLANES—CLASS C2

AIRLINE DISTANCE
International Record ....4,130.885 kilometers (2,566.808 miles)
Mario Stoppani and Corradino Corrado, Italy, Cant Z 501 I-Agil seaplane, Isotta-Fraschini-Asso 750 R. engine, from Monfalcone to Massaua, Oct. 18-19, 1934.
National (U.S.) Record..........................3,860.823 kilometers (2,398.999 miles)
Lt. Comdr. Knefler McGinnis, U.S.N., and Comm. Marc A. Mitscher, U.S.N., 10-P-1 Navy Patrol Seaplane, 2 Wright "Cyclone" 650 HP engines, Paradise Cove, San Francisco Bay, California, to Isle of Oahu, Pearl Harbor, Hawaii, January 10 and 11, 1934.
BROKEN LINE DISTANCE
International Record............................3,793.200 kilometers (2,356.980 miles)
Capt. de Corvette Bonnot and Lieut. de Vaisseau Jeanpierre, France, Latecoere 300 seaplane, 4 Hispano-Suiza 650 HP engines, Berre-Port Etienne-St. Louis, Senegal, December 31, 1933, and January 1, 1934.
National (U.S.) Record..None established.
ALTITUDE
International Record.................................11,753 meters (38,559.594 feet)
Lieut. Apollo Soucek, U.S.N., United States, "Apache," Pratt and Whitney 425 HP engine, supercharged, at Washington, D. C., June 4, 1929.
National (U.S.) Record..Same as above.
MAXIMUM SPEED
International Record..........................Speed, 709.209 km.p.h. (440.681 m.p.h.)
Francesco Agello, Italy, MC 72 seaplane, Fiat A.S. 6 engine at de Desenzano-Garda, October 23, 1934.
National (U.S.) Record........................Speed, 395.439 km.p.h. (245.713 m.p.h.)
Lieut. James H. Doolittle, U.S.A.S., Curtiss R3C-2 Curtiss V-1400, 600 HP engine, Bay Shore, Baltimore, Maryland, October 27, 1925.

SPEEDS FOR SPECIFIED DISTANCES WITHOUT PAY LOAD

SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record..........................Speed, 629.370 km.p.h. (391.072 m.p.h.)
Guglielmo Cassinelli, Italy, Macchi C.72 seaplane, 2400 HP Fiat AS 6 engine, Falconara-Pesaro permanent course, October 8, 1933.
National (U.S.) Record......................Speed, 338.944 km.p.h. (241.679 m.p.h.)
Lieut. G. T. Cuddihy, U.S.N., Curtiss R3C-2 Curtiss V-1500, 700 HP, at Norfolk, Virginia, November 13, 1926.
SPEED FOR 1000 KILOMETERS (621.369 MILES)
International Record..........................Speed, 253.601 km.p.h. (157.580 m.p.h.)
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 HP "Hornet" engines, supercharged, at Stratford, Connecticut, August 1, 1934.
National (U.S.) Record..Same as above.

SPEED FOR 2000 KILOMETERS (1242.739 MILES)
International Record............................Speed, 253.182 km.p.h. (157.319 m.p.h.)
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 HP "Hornet" engines, supercharged, at Stratford, Connecticut, August 1, 1934.
National (U.S.) Record..Same as above.
SPEED FOR 5000 KILOMETERS (3106.849 MILES)
International Record............................Speed, 139.567 km.p.h. (86.723 m.p.h.)
Lieut. de Vaisseau Paris, and M. Gonord, France, Latecoere 28-3 seaplane, Hispano-Suiza 600 HP engine, at Arcachon, June 4 and 5, 1931.
National (U.S.) Record..None established
SPEED FOR 10,000 KILOMETERS (6213.698 MILES)
Neither International nor National (U.S.) Record has been established.

CLASS C2—WITH PAY LOAD OF 500 KILOGRAMS (1102.311 lbs.)

ALTITUDE
International Record....................................9,532 meters (31,272.871 feet)
M. Bourdin, France, Liore and Olivier seaplane, 2 Hispano Suiza 500 HP engines, at Antibes, January 26, 1934.
National (U.S.) Record..................................8,208 meters (26,929.080 feet)
Boris Sergievsky, Sikorsky S-38 seaplane, 2 Pratt and Whitney "Wasp" 420 HP engines, supercharged, Bridgeport, Connecticut, July 21, 1930.
SPEED FOR 1000 KILOMETERS
International Record............................Speed, 253.601 km.p.h. (157.580 m.p.h.)
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 HP "Hornet" engines, supercharged, at Stratford, Connecticut, August 1, 1934.
National (U.S.) Record..Same as above
SPEED FOR 2000 KILOMETERS
International Record............................Speed, 253.182 km.p.h. (157.319 m.p.h.)
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 HP "Hornet" engines, supercharged, at Stratford, Connecticut, August 1, 1934.
National (U.S.) Record..Same as above.
SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C2—WITH PAY LOAD OF 1000 KILOGRAMS (2204.622 lbs.)

ALTITUDE
International Record....................................8,864 meters (29,081.277 feet)
M. Bourdin, France, Liore and Olivier seaplane, 2 Hispano-Suiza 690 HP engines, at Antibes, December 26, 1933.
National (U.S.) Record..................................8,208 meters (26,929.080 feet)
Boris Sergievsky, Sikorsky S-38 seaplane, 2 Pratt and Whitney Hornets, 575 HP each, at Bridgeport, Connecticut, July 21, 1930.
SPEED FOR 1000 KILOMETERS
International Record............................Speed, 253.601 km.p.h. (157.580 m.p.h.)
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 HP "Hornet" engines, supercharged, at Stratford, Connecticut, August 1, 1934.
National (U.S.) Record..Same as above.
SPEED FOR 2000 KILOMETERS
International Record............................Speed, 253.182 km.p.h. (157.319 m.p.h.)
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 HP "Hornet" engines, supercharged, at Stratford, Connecticut, August 1, 1934.
National (U.S.) Record..Same as above.
SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C2—WITH PAY LOAD OF 2000 KILOGRAMS (4409.244 lbs.)

ALTITUDE
International Record....................................7,507 meters (24,629.190 feet)
M. Bourdin, France, Liore and Olivier seaplane, 2 Hispano-Suiza 690 HP engines, at Antibes, January 3, 1934.

National (U.S.) Record................................6,074 meters (19,709.258 feet)
Boris Sergievsky, Sikorsky S-38 seaplane, 2 Pratt and Whitney 425 HP "Wasp" engines, at Stratford, Connecticut, August 11, 1930.

SPEED FOR 1000 KILOMETERS
International Record..........................Speed, 253.601 km.p.h. (157.580 m.p.h.)
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 HP "Hornet" engines, supercharged, at Stratford, Connecticut, August 1, 1934.
National (U.S.) Record..Same as above.

SPEED FOR 2000 KILOMETERS
International Record..........................Speed, 253.182 km.p.h. (157.319 m.p.h.)
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 HP "Hornet" engines, supercharged, at Stratford, Connecticut, August 1, 1934.
National (U.S.) Record..Same as above.

SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C2—WITH PAY LOAD OF 5000 KILOGRAMS (11,023.11 lbs.)

ALTITUDE
International Record....................................6,220 meters (20,406.762 feet)
Boris Sergievsky and Raymond B. Quick, United States, Sikorsky S-42 seaplane powered with 4 Pratt and Whitney "Hornet" 670 HP engines at Bridgeport, Connecticut, May 17, 1934.
National (U.S.) Record...Same as above.

SPEED FOR 1000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

SPEED FOR 2000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C2—WITH PAY LOAD OF 10,000 KILOGRAMS (22,046.22 lbs.)

ALTITUDE
Neither International nor National (U.S.) Record has been established.

SPEED FOR 1000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

SPEED FOR 2000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

SPEED FOR 5000 KILOMETERS
Neither International nor National (U.S.) Record has been established.

CLASS C2—GREATEST PAY LOAD CARRIED TO AN ALTITUDE OF 2000 METERS (6,561.660 feet)

International Record...............................Weight, 7,533 kgs. (16,608 lbs.)
Boris Sergievsky, United States, Sikorsky S-42 seaplane, 4 Pratt and Whitney "Hornet" 650 HP engines, Bridgeport, Connecticut, April 26, 1934.
National (U.S.) Record...Same as above.

LIGHT SEAPLANES—CLASS C2—FIRST CATEGORY

Multi-seaters weight empty less than 680 kgs. (1,499.128 lbs.)

AIRLINE DISTANCE
International Record..............................122.560 kilometers (76.155 miles)
Lallouette and Albert, France, Farman 231 seaplane, Renault 95 HP engine, from Le Pecq to Caudebec-en-Caux, May 13, 1931.
National (U.S.) Record...None established.

ALTITUDE
International Record...............................7,362 meters (24,153.470 feet)
Ingenieur Furio Niclot, pilot; Mariano Lanciani, passenger; Italy, Fiat A.S.I.C.N.A. seaplane, C.N.A. C-7 engine, Littorio airport, December 28, 1932.
National (U.S.) Record...None established.

SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record....................Speed, 189.433 km.p.h. (117.708 m.p.h.)
Lallouette and Boulanger, France, Farman 231 seaplane, Renault 95 HP engine, Draveil-Montereau course, March 28, 1931.
National (U.S.) Record....................None established.
SPEED FOR 1000 KILOMETERS (621.369 MILES)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 2000 KILOMETERS (1242.739 MILES)
Neither International nor National (U.S.) Record has been established.

LIGHT SEAPLANES—CLASS C2—SECOND CATEGORY

Single-seaters weight empty less than 570 kgs. (1,256.622 lbs.)

AIRLINE DISTANCE
Neither International nor National (U.S.) Record has been established.
ALTITUDE
International Record....................8,411 meters (27,595.061 feet)
Furio Niclot, Italy, ETA-CNA seaplane, CNA C7 160 HP engine, Littorio airport, Rome, Italy, November 6, 1933.
National (U.S.) Record....................None established.
SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record....................Speed, 165.004 km.p.h. (102.554 m.p.h.)
Alfred Grundke, Germany, Junkers J 50-W seaplane, Armstrong Sideley Genet 85 HP engine, at Dessau, June 13, 1930.
National (U.S.) Record....................None established.
SPEED FOR 1000 KILOMETERS (621.369 MILES)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 2000 KILOMETERS (1242.739 MILES)
Neither International nor National (U.S.) Record has been established.

LIGHT SEAPLANES—CLASS C2—THIRD CATEGORY

Multi-seaters weight empty less than 350 kgs. (771.610 lbs.)

AIRLINE DISTANCE
Neither International nor National (U.S.) Record has been established.
ALTITUDE
International Record....................3,231 meters (10,600.361 feet)
Jean de Viscaya and Forestier, France, Farman F-231 seaplane, Salmson 40 HP engine, Farman-Le Pecq course, June 11, 1931.
National (U.S.) Record....................None established.
SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record....................Speed, 143.540 km.p.h. (89.191 m.p.h.)
De Viscaya and Chaudet, France, Farman 230 seaplane, Salmson 40 HP engine, Le Pecq-Bonnieres-Le Rhoule, June 26, 1931.
National (U.S.) Record....................None established.
SPEED FOR 500 KILOMETERS (310.685 MILES)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 1000 KILOMETERS (621.369 MILES)
Neither International nor National (U.S.) Record has been established.

LIGHT SEAPLANES—CLASS C2—FOURTH CATEGORY

Single-seaters weight empty less than 250 kgs. (551.150 lbs.)

AIRLINE DISTANCE
Neither International nor National (U.S.) Record has been established.
ALTITUDE
International Record....................3,461 meters (11,354.964 feet)
Vercruysse, France, Mayboussin-Peyret seaplane, A.B.C. Scorpion 34 HP engine, at Argenteuil, December 10, 1930.
National (U.S.) Record....................None established.
SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record....................Speed, 122.783 km.p.h. (76,293 m.p.h.)
Vercruysse, France, Mayboussin-Peyret seaplane, A.B.C. Scorpion 34 HP engine, Chatou-Epinay course, December 22, 1930.
National (U.S.) Record....................None established.
SPEED FOR 500 KILOMETERS (310.685 MILES)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 1000 KILOMETERS (621.369 MILES)
Neither International nor National (U.S.) Record has been established.

AMPHIBIONS—CLASS C3

AIRLINE DISTANCE
Neither International nor National (U.S.) Record has been established.
BROKEN LINE DISTANCE
Neither International nor National (U.S.) Record has been established.
ALTITUDE
Neither International nor National (U.S.) Record has been established.
MAXIMUM SPEED
International Record..........................Speed, 308.567 km.p.h. (191.734 m.p.h.)
Lt. Comdr. Elmer F. Stone, United States, U. S. Coast Guard Amphibian No. 167, (Grumman Amphibian), at Hampton Roads, Virginia, December 20, 1934.
National (U.S.) Record..Same as above.
SPEED FOR 100 KILOMETERS (62.137 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.
SPEED FOR 1000 KILOMETERS (621.369 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.
SPEED FOR 2000 KILOMETERS (1242.739 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.
SPEED FOR 5000 KILOMETERS (3106.849 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.
SPEED FOR 10,000 KILOMETERS (6213.698 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.

LIGHT AMPHIBIONS—CLASS C3

Multi-seaters weight empty less than 750 kgs. (1,653.450 lbs.)

AIRLINE DISTANCE
Neither International nor National (U.S.) Record has been established.
ALTITUDE
Neither International nor National (U.S.) Record has been established.
SPEED FOR 100 KILOMETERS (62.137 MILES)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 1000 KILOMETERS (621.369 MILES)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 2000 KILOMETERS (1242.739 MILES)
Neither International nor National (U.S.) Record has been established.

BALLOONS—CLASS A

FIRST CATEGORY (600 *cubic meters*)

DURATION
International Record..22 hrs. 34 min.
Georges Cormier, France, August 10 and 11, 1924.
National (U.S.) Record....................................None has been established.
DISTANCE
International Record.................................804.173 kilometers (499.69 miles)
Georges Cormier, France, July 1, 1922.
National (U.S.) Record....................................None has been established.
ALTITUDE
Neither International nor National (U.S.) Record has been established.

SECOND CATEGORY (601-900 *cubic meters*)

DURATION
International Record..23 hrs. 28 min.
Jules Dubois, France, May 14 and 15, 1922.
National (U.S.) Record..19 hours.
W. C. Naylor and K. W. Warren, "Skylark," Little Rock, Arkansas, to Crawford, Tennessee, April 29-30, 1926.
DISTANCE
International Record.................................804.173 kilometers (499.69 miles)
Georges Cormier, France, July 1, 1922.
National (U.S.) Record.................................660 kilometers (410 miles)
W. C. Naylor and K. W. Warren, "Skylark," Little Rock, Arkansas, to Crawford, Tennessee, April 29-30, 1926.
ALTITUDE
Neither International nor National (U.S.) Record has been established.

THIRD CATEGORY (901-1200 *cubic meters*)

DURATION
International Record..26 hrs. 46 min.
E. J. Hill and A. G. Schlosser, United States, Ford Airport to Montvale, Virginia, July 4-5, 1927.
National (U.S.) Record..Same as above.

DISTANCE
International Record....................................1,238 kilometers (769.256 miles)
Georges Ravaine, France, from Basle, Switzerland, to Tokary, Poland, September 25 and 26, 1932.
National (U.S.) Record.............................920.348 kilometers (571.877 miles)
S. A. U. Rasmussen, Ford Airport to Hookerton, North Carolina, July 4-5, 1927.
ALTITUDE
Neither International nor National (U.S.) Record has been established.

FOURTH CATEGORY (1201-1600 *cubic meters*)

DURATION
International Record...26 hrs. 46 min.
E. J. Hill and A. G. Schlosser, United States, Ford Airport to Montvale, Virginia, July 4-5, 1927.
DISTANCE
International Record....................................1,238 kilometers (769.256 miles)
Georges Ravaine, France, from Basle, Switzerland, to Tokary, Poland, September 25 and 26, 1932.
National (U.S.) Record.............................920.348 kilometers (571.877 miles)
S. A. U. Rasmussen, Ford Airport to Hookerton, North Carolina, July 4-5, 1927.
ALTITUDE
Neither International nor National (U.S.) Record has been established.

FIFTH CATEGORY (1601-2200 *cubic meters*)

DURATION
International Record...51 hours.
Lt. Comdr. T. G. W. Settle and Lt. Charles H. Kendall, United States, Gordon-Bennett Balloon Race, Chicago, Illinois, September 2, 3, and 4, 1933.
National (U.S.) Record..Same as above.
DISTANCE
International Record....................................1,550 kilometers (963.123 miles)
Lt. Comdr. T. G. W. Settle, USN, and Lieutenant Wilfred Bushnell, USN, United States, from Basle, Switzerland, to Daugieliski, Poland, September 25, 26, and 27, 1932. (Gordon-Bennett)
National (U.S.) Record..Same as above.
ALTITUDE
Neither International nor National (U.S.) Record has been established.

SIXTH CATEGORY (2201-3000 *cubic meters*)

DURATION
International Record...51 hours.
Lt. Comdr. T. G. W. Settle and Lt. Charles H. Kendall, United States, Gordon-Bennett Balloon Race, Chicago, Illinois, September 2, 3, and 4, 1933.
National (U.S.) Record..Same as above.
DISTANCE
International Record....................................1,550 kilometers (963.123 miles)
Lt. Comdr. T. G. W. Settle and Lt. Wilfred Bushnell, United States, from Basle, Switzerland, to Daugieliski, Poland, September 25, 26, and 27, 1932. (Gordon-Bennett)
National (U.S.) Record..Same as above.
ALTITUDE
International Record....................................8,690 meters (28,508.413 feet)
Capt. Hawthorne C. Gray, United States, Scott Field, Belleville, Illinois, March 9, 1927.
National (U.S.) Record..Same as above.

SEVENTH CATEGORY (3001-4000 *cubic meters*)

DURATION
International Record...51 hours.
Lt. Comdr. T. G. W. Settle and Lt. Charles H. Kendall, United States, Gordon-Bennett Balloon Race, Chicago, Illinois, September 2, 3, and 4, 1933.
National (U.S.) Record..Same as above.
DISTANCE
International Record.................................1,550 kilometers (963.123 miles)
Lt. Comdr. T. G. W. Settle, USN, and Lieutenant Wilfred Bushnell, USN, United States, from Basle, Switzerland, to Daugieliski, Poland, September 25, 26, and 27, 1932. (Gordon-Bennett)
National (U.S.) Record..Same as above.
ALTITUDE
International Record....................................8,690 meters (28,508.413 feet)
Capt. Hawthorne C. Gray, United States, Scott Field, Belleville, Illinois, March 9, 1927.
National (U.S.) Record..Same as above.

EIGHTH CATEGORY (4001 *cubic meters or more*)

DURATION
International Record....................87 hours.
H. Kaulen, Germany, December 13 to 17, 1913.
National (U.S.) Record....................51 hours.
Lt. Comdr. T. G. W. Settle and Lt. Charles H. Kendall, Gordon-Bennett Balloon Race, Chicago, Illinois, September 2, 3, and 4, 1933.
DISTANCE
International Record....................3,052.7 kilometers (1,896.856 miles)
Berliner, Germany, February 8, 9, and 10, 1914.
National (U.S.) Record....................1,887.6 kilometers (1,172.898 miles)
A. R. Hawley, St. Louis, Missouri, to Lake Tschotogama, Canada, October 17-19, 1910.
ALTITUDE
International Record....................18,665 meters (61,236.691 feet)
Lt. Comdr. T. G. W. Settle, USN, and Major C. L. Fordney, USMC, United States, take-off from Akron, Ohio, landing near Bay Side, New Jersey, November 20, 1933.
National (U.S.) Record....................Same as above.

AIRSHIPS—CLASS B

AIRLINE DISTANCE
International Record....................6,384.500 kilometers (3,967.137 miles)
Dr. Hugo Eckener, Germany, L.Z. 127, "Graf Zeppelin," 5 Maybach 450-550 HP engines, from Lakehurst, N. J., U.S.A., to Friedrichshafen, Germany, October 29, 30, 31, and November 1, 1928.
National (U.S.) Record....................None established.

GLIDERS—CLASS D

AIRLINE DISTANCE
International Record....................375 kilometers (233.014 miles)
Heinrich Dittmar, Germany, Fafnir II glider "D-Sao Paulo," from the Wasserkuppe to Liban, Czechoslovakia, September 27, 1934.
National (U.S.) Record....................254.759 kilometers (158.299 miles)
Richard C. du Pont, United States, du Pont-Bowlus sailplane, "Albatross II" from Elmira, New York to Basking Ridge, New Jersey, June 25, 1934.
DISTANCE WITH RETURN TO POINT OF DEPARTURE
Neither International nor National (U.S.) Record has been established.
DURATION WITH RETURN TO POINT OF DEPARTURE
International Record....................36 hrs., 35 min.
Kurt Schmidt, Germany, Grunau Baby glider, "D-Loerzer" at Korschenruh, Prusse Orientale, August 3 and 4, 1933.
National (U.S.) Record....................21 hrs., 34 min.
Lieut. William A. Cocke, Jr., Cocke "Nighthawk" glider, Honolulu, Hawaii, December 17 and 18, 1931.
ALTITUDE
International Record....................2,589 meters (8,493.869 feet)
Robert Kronfeld, Austria, Wien glider, Rhon-Rossiter, Lienlas, July 30, 1929.
National (U.S.) Record....................1,897 meters (6,223.734 feet)
Richard C. du Pont, du Pont-Bowlus sailplane, Albatross I, Elmira, New York, June 30, 1934.

AUTOGIROS—CLASS E

AIRLINE DISTANCE
Neither International nor National (U.S.) Record has been established.
BROKEN LINE DISTANCE
Neither International nor National (U.S.) Record has been established.
ALTITUDE
Neither International nor National (U.S.) Record has been established.
MAXIMUM SPEED
Neither International nor National (U.S.) Record has been established.
SPEED FOR 100 KILOMETERS (62.137 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.
SPEED FOR 1000 KILOMETERS (621.369 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.
SPEED FOR 2000 KILOMETERS (1242.739 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.
SPEED FOR 5000 KILOMETERS (3106.849 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.
SPEED FOR 10,000 KILOMETERS (6213.698 MILES) WITHOUT PAY LOAD
Neither International nor National (U.S.) Record has been established.

HELICOPTERS—CLASS G

DURATION, CLOSED CIRCUIT
International Record..8 min., 45 sec.
Marinello Nelli, Italy, Ascanio helicopter, Fiat A 50 engine, October 8, 1930, at Rome.
National (U.S.) Record....................................None has been established.
AIRLINE DISTANCE
International Record.......................................1,078.60 meters (3538.706 feet)
Marinello Nelli, Italy, Ascanio helicopter, Fiat A 50 engine, October 10, 1930, at Rome.
National (U.S.) Record....................................None has been established.
ALTITUDE
International Record...18 meters (59,055 feet)
Marinello Nelli, Italy, Ascanio helicopter, Fiat A 50 engine, October 13, 1930, at Rome.
National (U.S.) Record....................................None has been established.

FEMININE RECORDS

AIRPLANES—CLASS C

AIRLINE DISTANCE
International Record...........................3,939.245 kilometers (2,447.728 miles)
Miss Amelia Earhart, United States, Lockheed Vega monoplane, Wasp 450 HP engine, from Los Angeles, Calif., to Newark, New Jersey, August 24 and 25, 1932.
National (U.S.) Record..Same as above.
ALTITUDE
International Record..................................9,791 meters (32,122.606 feet)
Miss Mary Hilsz, France, Morane-Saulnier airplane, Gnome and Rhone 420 HP engine, Villacoublay, August 19, 1932.
National (U.S.) Record...............................8,761 meters (28,743.352 feet)
Miss Ruth Nichols, Lockheed Vega monoplane, Pratt and Whitney 420 HP "Wasp" engine, at Jersey City Airport, New Jersey, March 6, 1931.
MAXIMUM SPEED
International Record..........................Speed, 445.028 km.p.h. (276.527 m.p.h.)
Miss Helene Boucher, France, Caudron C. 450 airplane, Renault-Bengali 315 HP engine, at Istres, August 11, 1934.
National (U.S.) Record..........................Speed, 405.92 km.p.h. (252.226 m.p.h.)
Mrs. May Haizlip, Wedell-Williams monoplane, Pratt and Whitney 540 HP supercharged "Wasp Jr." engine, Cleveland, Ohio, September 5, 1932.
SPEED FOR 100 KILOMETERS (62.137 MILES) WITHOUT PAY LOAD
International Record..........................Speed, 412.371 km.p.h. (256.235 m.p.h.)
Miss Helene Boucher, France, Caudron C. 450 airplane, Renault 300 HP engine, at Istres, August 8, 1934.
National (U.S.) Record..........................Speed, 281.470 km.p.h. (174.897 m.p.h.)
Amelia Earhart, Lockheed Vega monoplane, Pratt and Whitney "Wasp" 420 HP engine, Detroit, Michigan, June 25, 1930.
SPEED FOR 1000 KILOMETERS (621.369 MILES) WITHOUT PAY LOAD
International Record..........................Speed, 409.184 km.p.h. (254.255 m.p.h.)
Miss Helene Boucher, France, Caudron C. 450 airplane, Renault 300 HP engine, at Istres, August 8, 1934.
National (U.S.) Record..None established.

LIGHT AIRPLANES—CLASS C

First Category—Multi-seaters weight empty less than 560 kgs. (1,234.576 lbs.)

AIRLINE DISTANCE (FIRST CATEGORY)
Neither International nor National (U.S.) Record has been established.
ALTITUDE (FIRST CATEGORY)
International Record..................................5,632 meters (18,477.634 feet)
Mrs. de la Combe and Miss Aube, France, Morane 341 monoplane, Renault-Bengali 140 HP engine, at Villacoublay, November 22, 1934.
National (U.S.) Record ....None established.
SPEED FOR 100 KILOMETERS (62.137 MILES) (FIRST CATEGORY)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 1000 KILOMETERS (621.369 MILES) (FIRST CATEGORY)
International Record ....Speed, 250.086 km.p.h. (155.396 m.p.h.)
Miss Helene Boucher, France, Caudron "Rafale" airplane, Renault-Bengali 145 HP engine, Istres, July 8, 1934.
National (U.S.) Record ....None established.
SPEED FOR 2000 KILOMETERS (1,242.739 MILES) (FIRST CATEGORY)
Neither International nor National (U.S.) Record has been established.

LIGHT AIRPLANES—CLASS C

Second Category—Single-seaters weight empty less than 450 kgs. (992.070 lbs.)

AIRLINE DISTANCE
International Record............................2,976.910 kilometers (1,849.763 miles)
Madame Mary Bastie, France, Klemm monoplane, Salmson 40 HP engine, from Le Bourget to Urino, Russia, June 28 and 29, 1931.
National (U.S.) Record..None established.
ALTITUDE
International Record..................................5,900 meters (19,356.897 feet)
Miss Helene Boucher, France, Mauboussin-Peyret monoplane, Zodiac type, Salmson 60 HP engine, at d'Orly airport, August 2, 1933.
National (U.S.) Record...............................5,516 meters (18,097.058 feet)
Mrs. May Haizlip, Buhl "Bull Pup" monoplane, Szekely 85 HP engine, at St. Clair, Michigan, June 13, 1931.

SEAPLANES—CLASS C2

AIRLINE DISTANCE
Neither International nor National (U.S.) Record has been established.
BROKEN LINE DISTANCE
Neither International nor National (U.S.) Record has been established.
ALTITUDE
International Record..................................5,554 meters (18,221.729 feet)
Marquise Carina Negrone, Italy, Breda 15 seaplane, Isotta-Fraschini-Asso 80 engine, at Genes, May 5, 1934.
National (U.S.) Record.........................4,103 meters (13,461.259 feet)
Mrs. Marion Eddy Conrad, Savoia-Marchetti seaplane, Kinner 125 HP engine, Port Washington, Long Island, New York, October 20, 1930.
MAXIMUM SPEED
Neither International nor National (U.S.) Record has been established.

LIGHT SEAPLANES—CLASS C2

Second Category—Single-seaters weight empty less than 570 kgs. (1,256.622 lbs.)

AIRLINE DISTANCE (SECOND CATEGORY)
Neither International nor National (U.S.) Record has been established.
ALTITUDE (SECOND CATEGORY)
International Record..................................5,554 meters (18,221.729 feet)
Marquise Carina Negrone, Italy, Breda 15 seaplane, Isotta-Fraschini-Asso 80 engine, at Genes, May 5, 1934.
National (U.S.) Record..None established.
SPEED FOR 100 KILOMETERS (62.137 MILES) (SECOND CATEGORY)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 1000 KILOMETERS (621.369 MILES) (SECOND CATEGORY)
Neither International nor National (U.S.) Record has been established.
SPEED FOR 2000 KILOMETERS (1242.739 MILES) (SECOND CATEGORY)
Neither International nor National (U.S.) Record has been established.

NATIONAL AIR RACES

Cleveland, Ohio — Aug. 31—Sept. 3, 1934

OFFICIAL STANDING OF CONTESTANTS

BENDIX TRANSCONTINENTAL SPEED DASH

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Speed*	*Money*
1	Douglas Davis	Wedell-Williams Racer	Wasp	9:26:41	216.237	$4500.00
2	J. A. Worthen	Wedell-Williams Racer	Wasp	10:03:00	203.213	2500.00
3	Lee Gehlbach	Granville, Miller, & De Lackner	Hornet	Did not finish within specified time limit		

EVENT NO. 1—375 CU. IN. DISPLACEMENT

1	Lee Miles	Miles & Atwood Special	Menasco	14:52:11	201.767	630.00
2	Arthur C. Chester	Chester Special	Menasco	14:55:40	201.027	350.00
3	Earl Ortman	Keith-Ryder	Menasco	18:51:62	159.063	210.00
4	Joe Jacobson	Howard Racer	Wright Gipsy	19:02:55	157.542	140.00
5	S. J. Wittman	Wittman Special	Cirrus Hermies	19:06:73	156.968	70.00

EVENT NO. 2—SHELL SPEED DASH, 375 CU. IN. DISPLACEMENT OR LESS

	Lee Miles	Miles & Atwood Special	Menasco		227.947	100.00 Bonus Prize

EVENT NO. 3—550 CU. IN. DISPLACEMENT

1	Lee Miles	Miles & Atwood Special	Menasco	8:43:66	206.241	765.00
2	Roger Don Rae	Keith-Ryder	Menasco	8:47:36	204.770	425.00
3	Arthur C. Chester	Chester Special	Menasco	8:51:02	203.382	255.00
4	Harold Neuman	Howard Racer	Menasco	9:20:11	192.819	170.00
5	Roy Hunt	Howard Racer	Menasco	9:55:66	181.311	85.00

EVENT NO. 4—200 CU. IN. DISPLACEMENT

1	S. J. Wittman	Popjoy	Popjoy	6:57:18	129.440	180.00
2	Willis Kysor	Rasmussen Special	Rasmussen	7:59:90	112.523	100.00
3	Arthur Davis	Houser Special	Continental	8:06:73	110.944	60.00
4	Clarence McArthur	Tillbury Flash	Church	8:46:18	102.626	40.00

EVENT NO. 5—375 CU. IN. DISPLACEMENT

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Speed*	*Money*
1	Lee Miles	Miles & Atwood Special	Menasco	8:54:17	202.183	$630.00
2	Arthur C. Chester	Chester Special	Menasco	9:01:91	199.295	350.00
3	S. J. Wittman	Wittman Special	Cirrus Hermies	9:38:77	186.603	210.00
4	Earl Ortman	Keith-Ryder	Menasco	9:56:04	181.196	140.00
5	Joe Jacobson	Howard Racer	Wright Gipsy	11:36:93	159.965	70.00

EVENT NO. 6—SHELL SPEED DASH, 550 CU. IN. DISPLACEMENT OR LESS

	Harold Neuman	Howard Racer	Menasco		222.859	150.00 Bonus Prize

EVENT NO. 7—550 CU. IN. DISPLACEMENT

1	Harold Neuman	Howard Racer	Menasco	8:30:51	211.553	765.00
2	Roger Don Rae	Keith-Ryder	Menasco	8:31:84	211.003	425.00
3	Lee Miles	Miles & Atwood Special	Menasco	8:51:56	203.176	255.00
4	Arthur C. Chester	Chester Special	Menasco	8:55:03	201.857	170.00
5	S. J. Wittman	Wittman Special	Cirrus Hermies	9:44:74	184.697	85.00

EVENT NO. 8—200 CU. IN. DISPLACEMENT

1	S. J. Wittman	Popjoy Special	Popjoy	7:55:78	113.498	180.00
2	Arthur Davis	Houser Special	Continental	8:03:83	111.588	100.00
3	Willis Kysor	Rasmussen Special	Rasmussen	10:35:43	84.982	60.00
	Clarence McArthur	Tillbury Flash	Church	Out second lap		

EVENT NO. 9—550 CU. IN. DISPLACEMENT

1	Roy T. Minor	Brown Special	Menasco	8:26:43	213.257	765.00
2	Lee Miles	Miles & Atwood Special	Menasco	8:40:84	203.451	425.00
3	Arthur C. Chester	Chester Special	Menasco	8:51:94	203.030	255.00
4	S. J. Wittman	Wittman Special	Cirrus Hermies	9:50:04	180.288	170.00
5	Roy Hunt	Howard Racer	Menasco	10:28:45	171.851	85.00

EVENT NO. 10—SHELL SPEED DASH, UNLIMITED CU IN. DISPLACEMENT

	J. A. Worthen	Wedell-Williams Racer	Wasp		302.036	

EVENT NO. 11—1000 CU. IN. DISPLACEMENT

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Speed*	*Money*
1	Douglas Davis	Wedell-Williams Racer	Wasp	13:34:68	220.946	$765.00
2	Walter Wedell	Wedell-Williams Racer	Wasp	13:40:05	219.498	425.00
3	Harold Neuman	Howard Racer	Menasco	14:48:72	202.538	255.00
4	Roy T. Minor	Brown Special	Menasco	15:04:95	198.906	170.00
5	Roger Don Rae	Keith-Ryder	Menasco	15:06:71	198.519	85.00

EVENT NO. 12—375 CU. IN. DISPLACEMENT

1	Lee Miles	Miles & Atwood Special	Menasco	9:00:67	199.752	630.00
2	Arthur C. Chester	Chester Special	Menasco	9:05:14	198.114	350.00
3	S. J. Wittman	Wittman Special	Cirrus Hermies	10:12:80	176.240	210.00
4	Earl Ortman	Keith-Ryder	Menasco	11:19:12	159.029	140.00
5	Joe Jacobson	Howard Racer	Wright Gipsy	11:35:22	155.347	70.00

EVENT NO. 13—SHELL SPEED DASH, UNLIMITED CU. IN. DISPLACEMENT

	Douglas Davis	Wedell-Williams Racer	Wasp		264.794	250.00 Bonus Prize

EVENT NO. 14—THOMPSON TROPHY RACE

1	Roscoe Turner	Modified Wedell-Wms. Special	Hornet	24:10:36	248.129	4500.00
2	Roy T. Minor	Brown Special	Menasco	27:54:58	214.920	2500.00
3	J. A. Worthen	Wedell-Williams Special	Wasp	28:47:65	208.376	1500.00
4	Harold Neuman	Howard Racer	Menasco	28:58:59	207.064	1000.00
5	Roger Don Rae	Keith-Ryder	Menasco	29:13:04	205.358	500.00
	Arthur C. Chester	Chester Special	Menasco	31:18:94	191.597	
	Douglas Davis	Wedell-Williams Racer	Wasp	Out Lap Eight		
	Lee Miles	Miles & Atwood Special	Menasco	Out Lap Twelve		

SHELL QUALIFICATION SPEEDS—GROUP 1—375 CU. IN. DISPLACEMENT

1	Lee Miles	Miles & Atwood Special	Menasco		233.44	350.00
2	Arthur C. Chester	Chester Special	Menasco		229.715	250.00
3	Earl Ortman	Keith-Ryder	Menasco		201.865	150.00
4	S. J. Wittman	Wittman Special	Cirrus Hermies		201.08	100.00
5	Joe Jacobson	Howard Racer	Wright Gipsy		172.21	50.00

SHELL QUALIFICATION SPEEDS—GROUP 2—550 CU. IN. DISPLACEMENT

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Speed*	*Money*
1	Roy T. Minor	Brown Special	Menasco		243.145	$525.00
2	Harold Neuman	Howard Racer	Menasco		239.623	375.00
3	Roger Don Rae	Keith-Ryder	Menasco		235.336	225.00
4	Lee Miles	Miles & Atwood Special	Menasco		233.44	150.00
5	Arthur C. Chester	Chester Special	Menasco		229.715	75.00

SHELL QUALIFICATION SPEEDS—GROUP 3—UNLIMITED CU. IN. DISPLACEMENT

1	Douglas Davis	Wedell-Williams Racer	Wasp	306.215	875.00
2	Roscoe Turner	Wedell-Williams Racer	Hornet	295.465	625.00
3	J. A. Worthen	Wedell-Williams Racer	Wasp	292.141	375.00
4	J. A. Worthen	Wedell-Williams Racer	Wasp	248.913	250.00
5	Roy T. Minor	Brown Special	Menasco	243.145	125.00

PARACHUTE JUMPING

EVENT NO. 20

Place	*Name of Jumper*	*Distance from Mark*	*Money*
1	Roger Don Rae	32 feet 10 inches	90.00
2	Shirley Rauner	62 feet 10 inches	50.00
3	Joseph Crane	85 feet 6 inches	30.00
4	Clement Sohm	187 feet 1 inch	20.00
5	George Brand	197 feet	10.00

EVENT NO. 21

1	Merrill West	91 feet 9 inches	90.00
2	Shirley Rauner	171 feet 11 inches	50.00
3	Clement Sohm	229 feet 5 inches	30.00
4	Irwin Davis	279 feet 8 inches	20.00
5	Tot Dryer	300 feet	10.00

EVENT NO. 22

Place	*Pilot*	*Distance from Mark*	*Money*
1	Shirley Rauner	9 feet	$90.00
2	Clement Sohm	34 feet 2 inches	50.00
3	Tot Dryer	121 feet 4 inches	30.00
4	E. Verne Stewart	147 feet 4 inches	20.00
5	Joseph Crane	228 feet 2 inches	10.00

EVENT NO. 23

Cancelled due to high winds—Prize money distributed among entrants.

TROPHIES AWARDED—1934 NATIONAL AIR RACES

Donor	*Trophy*	*Awarded To*	*Event*
Bendix Aviation Corporation	Vincent Bendix Trophy	Douglas Davis	Bendix Trophy Race
Charles E. Thompson	Charles E. Thompson Trophy	Roscoe Turner	Event No. 14
Louis William Greve	Louis William Greve Trophy	Lee Miles	Events Nos. 3, 7, 9
Shell Petroleum Corporation	Shell Perpetual Trophy	Douglas Davis	Event No. 13
Shell Petroleum Corporation	Shell 550 Cu. In. Speed Dash Trophy	Roy T. Minor	
Shell Petroleum Corporation	Shell 375 Cu. In. Speed Dash Trophy	Arthur Davis	
Clifford W. Henderson	Clifford W. Henderson Trophy	Douglas Davis	

INTERNATIONAL GORDON-BENNETT BALLOON RACE

Starting from Warsaw, Poland

September 23, 1934

Place	*Nationality*	*Pilot and Aide*	*Landing Place (nearest city)*	*Distance*
1	Poland	F. Hynek W. Pomaski	Russia—Anna (Woronez)	826.77 mi.
2	Poland	Z. Burzynski J. Zakrzewski	Russia—Bykowa (Riazan)	808.95
3	Belgium	E. Demuyter L. Coeckelbergh	Russia—Bieloje (Biezeck)	726.90
4	Poland	A. Janusz J. Wawszczak	Finland—Lohikoski (Savonlinna)	705.89
5	Switzerland	W. Gerber E. Tilgenkamp	Russia—Woronowa (Schlusselburg)	651.66
6	Switzerland	A. V. Baerle E. Dietschi	Russia—Azarowa (Wiazima)	564.55
7	France	A. Boitard Ch. Dupont	Russia—Wierduga (Luga)	551.80
8	Germany	C. Goetze E. Burghard	Russia—Stawitino (St. Russa)	543.11
9	France	Ch. Dollfus P. Jacquet	Russia—Plussa (Luga)	537.97
10	Italy	M. Caputo A. Pirazzoli	Russia—Mazowier (Peipus jez)	530.90
11	United States	G. Hineman M. Vanik	Russia—Spitsina (Peipus jez)	509.21
12	United States	Ch. Kendall H. Orville	Russia—Berdjajewa (Wieliz)	507.85
13	Germany	W. Zinner E. Deku	Esthonia—Kulmawere (M. Magdalena)	495.63
14	Germany	H. Kaulen H. Probsting	Esthonia—Olustwere (Suure Jaani)	471.09
15	Belgium	Ph. Quersin M. van Schelle	Russia—Woliewa (Witebsk)	434.09
16	Czechoslovakia	G. Peter	Lithuania—Eustachowo (Kibarty)	183.96

Flying Facts and Figures

AMERICAN FLYING ACTIVITIES

Calendar Years

Summary of Air Transport Operations

Air Lines of the United States

Year	*Operators*	*Planes in Service*	*Miles Scheduled*	*Miles Flown*	*Passengers*	*Passenger Miles*	*Express (pounds)*	*Mail (pounds)*
1926	19	95	....	4,608,880 (a)	5,782	....	6,467(c)	433,649
1927	24	144	....	5,242,839 (b)	12,594	....	12,495(c)	1,222,843(d)
1928	32	294	....	10,472,024	52,934	....	35,376(c)	3,632,059(e)
1929	27	619	....	20,242,891	165,263	....	197,538(c)	7,772,014(f)
1930	35	685	30,703,119	28,833,967	385,910	94,545,784	286,798(c)	8,513,675(g)
1931	41	720	47,463,673	43,395,478	457,753	116,232,153	885,164(c)	9,351,195(h)
1932	33	655	51,932,868	48,344,358	504,575	143,169,682	1,324,428(c)	7,658,332(i)
1933	28	615	54,072,467	50,800,705	546,235	183,695,784	1,884,545(c)	7,644,646(j)
1934	25	550	45,941,494	42,622,619	537,637	217,096,507	2,946,460(c)	7,155,281(k)

Note: The total of 7,155,281 pounds listed for 1934 includes only mail flown by air transport lines of the United States on domestic and foreign routes. To determine the total mail flown there should be added the operations of the U. S. Army Air Corps which from Feb. 10 to June 1, 1934, flew 1,707,559 miles with mail and carried 768,215 pounds of mail, according to War Department reports.

(a) Includes 2,583,056 miles flown on Government operated mail routes.
(b) Includes 1,320,535 miles flown on Government operated mail routes.
(c) Includes only express poundage carried on regular schedules and not freight flown by special order.
(d) Includes 121,439 pounds mail flown on Government operated routes.
(e) Includes 631,541 pounds mail flown on F.A.M. routes.
(f) Includes 675,084 pounds mail flown on F.A.M. routes.
(g) Includes 508,474 pounds mail flown on F.A.M. routes.
(h) Includes 346,116 pounds mail flown on F.A.M. routes.
(i) Includes 286,162 pounds mail flown on F.A.M. routes.
(j) Includes 277,293 pounds mail flown on F.A.M. routes.
(k) Includes 343,404 pounds mail flown on F.A.M. routes. See *Note* above.

Government Flying Operations

Miles Flown

Fiscal Year	*U. S. Army*	*U. S. Navy*	*U. S. Coast Guard*	*U. S. Dept. Commerce*
1926	16,764,540	8,352,800	16,300	....
1927	14,871,870	10,452,720	28,960	....
1928	19,546,450(a)	14,135,490(b)	83,083	900,000
1929	27,405,790(a)	19,513,095(b)	48,254	1,000,000
1930	32,500,000	26,478,700(b)	67,655	1,427,000
1931	44,000,000	28,889,835(b)	53,440	969,000
1932	42,914,655(a)	26,508,715(b)	93,750	975,500
1933	56,077,344(a)	22,989,300(b)	184,965	1,364,200
1934	51,506,888(a)	28,001,250(b)	219,572	932,420

(a) Includes National Guard.
(b) Includes Marine Corps and Naval Reserve.

MONTHLY AIR TRANSPORT OPERATIONS

Air Transport Lines of the United States

1933	*Miles Scheduled*	*Miles Flown*	*Passengers*	*Passenger Miles*	*Mail (pounds)*	*Express (pounds)*
January	4,337,546	3,868,951	30,440	9,830,404	548,883	102,600
February	3,904,259	3,556,410	30,298	9,919,976	516,085	117,436
March	4,336,849	3,856,810	30,696	10,120,556	611,362	151,840
April	4,273,394	3,957,263	36,835	10,850,026	590,799	133,715
May	4,463,894	4,228,803	45,061	14,311,801	635,662	159,619
June	4,522,485	4,456,869	55,151	17,903,363	666,133	164,245
July	4,993,433	4,957,868	63,034	20,839,713	667,058	165,772
August	5,024,986	4,919,119	64,147	21,366,935	713,415	169,397
September	4,833,918	4,672,076	60,842	20,375,170	666,465	174,601
October	4,803,648	4,706,806	55,409	19,648,340	688,936	171,857
November	4,348,347	4,009,806	40,643	15,773,854	654,348	179,012
December	4,189,708	3,609,924	33,679	12,755,646	685,500	194,451
Total	54,072,467	50,800,705	546,235	183,695,784	7,644,646	1,884,545
1934						
January	4,054,089	3,627,214	32,901	12,971,534	680,912	174,123
February	3,535,142	3,127,726	33,435	12,986,176	450,659	158,358
March	2,990,407	2,491,868	29,458	11,403,774	35,902	202,092
April	2,755,093	2,613,473	36,798	14,441,670	34,785	215,032
May	2,882,028	2,905,235	41,847	17,362,562	321,409	222,745
June	3,798,516	3,696,377	47,757	19,706,032	568,656	257,407
July	4,326,561	4,229,353	50,413	20,256,814	724,773	233,046
August	4,267,061	4,159,708	56,019	23,672,974	786,541	300,969
September	4,082,737	3,792,071	49,061	20,890,560	756,874	293,888
October	4,580,980	4,448,958	69,540	24,342,551	949,273	305,737
November	4,309,091	3,849,691	47,981	20,265,840	874,595	282,680
December	4,359,789	3,680,945	42,427	18,796,020	970,902	300,383
Total	45,941,494	42,622,619	537,637	217,096,507	7,155,281	2,946,460

REVIEW OF ANNUAL MILITARY AND COMMERCIAL PRODUCTION IN THE UNITED STATES

AIRPLANE PRODUCTION

Annual Totals

Year	*Military* Units	*Military* Value	*Commercial* Units	*Commercial* Value
1925	447(1)	$ 5,174,025(1)	268(1)	$ 1,499,634(1)
1926	532(1)	6,154,708(1)	604(1)	2,716,319(1)
1927	621(1)	7,528,383(1)	1,565	6,976,616
1928	1,219(1)	19,066,379(1)	3,542	17,194,298
1929	677	10,832,544	5,357	33,624,756
1930	747	10,723,720	1,937	10,746,042
1931	812	12,971,028	1,582	6,655,738
1932	593	10,389,316	549	2,337,899
1933	466	9,784,643	591	6,180,900
1934	437	8,836,509	772	9,957,602

(1) Source: Derived from U. S. Census Reports.

AIRPLANE ENGINE PRODUCTION

Annual Totals

Year	Military Units	Military Value	Commercial Units	Commercial Value
1926	842(1)	$ 4,080,571(2)	*	*
1927	1,397(1)	6,550,533(3)	*	*
1928	2,620(2)	12,407,920(2)	632(2)	$ 979,600(2)
1929	1,861	8,600,530	5,517	17,895,300
1930	1,841	10,823,423	1,925	6,255,493
1931	1,800	10,417,718	1,976	4,148,131
1932	1,085	6,370,678	813	2,898,371
1933	860	4,986,181	1,120	4,724,441
1934	688	5,162,710	2,048	10,270,500

(1) This total does not include an indeterminate number of Liberty and OX engines that were reconditioned and put into service.
(2) Department of Commerce.
(3) Derived from U. S. Census Reports.
* Liberty and OX war surplus used.

MONTHLY PRODUCTION AND SALES STATISTICS

Military and Salable Commercial Aircraft

PRODUCTION

	1933				1934			
	Military		*Commercial*		*Military*		*Commercial*	
	Units	*Value*	*Units*	*Value*	*Units*	*Value*	*Units*	*Value*
January	50	$ 873,048	31	$ 109,366	63	$1,124,727	19	$ 31,437
February	55	1,309,931	26	85,533	31	607,512	14	168,534
March	44	828,618	36	258,232	30	458,095	48	386,680
April	40	787,212	51	893,843	14	221,617	40	350,826
May	42	1,037,623	60	953,090	53	740,282	93	631,925
June	45	1,083,394	73	1,004,950	50	780,454	89	1,102,215
July	51	932,569	80	1,046,013	48	966,716	93	1,256,309
August	25	498,021	70	866,398	23	515,605	116	1,426,534
September	32	802,300	51	406,759	24	447,355	95	1,016,748
October	30	426,423	50	241,380	34	947,469	64	1,175,829
November	19	365,237	34	195,439	47	1,445,674	50	1,197,787
December	33	840,267	29	119,897	20	581,003	51	1,212,778
Total	466	$9,784,643	591	$6,180,900	437	$8,836,509	772	$9,957,602

DELIVERIES

January	63	$ 971,948	41	$ 120,826	62	$1,119,727	29	$ 105,195
February	55	1,309,931	27	85,380	32	617,512	14	165,711
March	44	828,618	39	285,471	30	458,095	49	375,828
April	40	787,212	53	900,091	14	221,617	36	324,281
May	42	1,037,623	58	953,424	53	740,282	91	635,045
June	34	670,368	71	987,465	50	780,454	84	1,067,130
July	51	932,569	81	1,048,545	48	966,716	97	1,278,887
August	25	498,021	71	871,608	23	515,605	119	1,448,177
September	31	727,300	51	413,482	24	447,355	96	1,031,732
October	31	501,423	43	227,115	32	936,469	63	1,183,561
November	19	365,237	39	209,224	46	1,439,674	49	463,107
December	33	840,267	30	132,788	20	581,003	48	1,203,255
Total	468	$9,470,517	604	$6,235,419	434	$8,824,509	775	$9,281,909

All values represent planes less motors.

MONTHLY PRODUCTION AND SALES STATISTICS

Military and Commercial Aircraft Engines

PRODUCTION

	1933				1934			
	Military		*Commercial*		*Military*		*Commercial*	
	Units	*Value*	*Units*	*Value*	*Units*	*Value*	*Units*	*Value*
January.......	55	$314,710	68	$299,790	46	$314,820	108	$431,691
February......	61	326,101	79	363,234	38	229,140	188	928,016
March........	64	353,050	73	361,365	41	350,700	191	1,133,758
April..........	91	596,400	74	323,774	26	236,900	164	855,999
May..........	132	787,800	120	422,920	65	452,800	150	586,825
June..........	121	700,350	146	636,078	124	887,900	206	847,498
July..........	69	348,700	102	394,275	64	390,700	203	1,054,615
August........	42	236,700	150	656,575	61	421,250	226	1,148,058
September.....	75	419,220	72	276,945	52	361,700	164	787,475
October.......	55	335,250	65	242,375	55	466,500	178	903,765
November.....	19	90,300	79	300,360	30	240,000	172	1,045,095
December.....	76	477,600	92	446,750	86	810,300	98	547,705
Total.....	860	$4,986,181	1,120	$4,724,441	688	$5,162,710	2,048	$10,270,500

DELIVERIES

	1933 Military Units	1933 Military Value	1933 Commercial Units	1933 Commercial Value	1934 Military Units	1934 Military Value	1934 Commercial Units	1934 Commercial Value
January.......	55	$314,710	103	$459,450	46	$314,820	100	$394,441
February......	67	358,301	81	368,734	38	229,140	182	938,291
March........	65	359,050	83	386,135	41	350,700	183	1,060,698
April..........	91	596,400	67	282,769	26	236,900	169	885,124
May..........	132	787,700	109	312,810	65	452,800	178	755,375
June..........	121	700,350	138	595,473	124	887,900	189	753,023
July..........	69	348,700	138	524,125	64	390,700	221	1,112,190
August........	42	236,700	105	459,535	61	421,250	198	1,049,623
September.....	75	419,220	101	363,060	52	361,700	157	817,225
October.......	55	335,250	62	236,150	55	466,500	157	830,815
November.....	19	90,300	74	287,385	30	240,000	118	625,570
December.....	76	477,600	74	348,940	85	805,800	87	494,355
Total.....	867	$5,024,281	1,135	$4,624,566	687	$5,158,210	1,939	$9,716,730

PRODUCTION AND DELIVERIES OF SALABLE AIRCRAFT IN THE UNITED STATES

COMMERCIAL AND MILITARY

Type	*Places*	*Production—1933*		*Deliveries—1933*		*Production—1934*		*Deliveries—1934*	
		Number	*Value**	*Number*	*Value**	*Number*	*Value**	*Number*	*Value**
Biplanes									
Open Cockpit	1	1	$2,000	1	$2,000		....	...	....
	2	76	316,807	85	330,852	103	$441,858	106	$445,433
	3	56	190,099	58	195,376	26	97,145	24	91,785
	Up	0	....	0	....	27	126,405	33	155,595
Sub-total	....	133	$508,906	144	$528,228	156	$665,408	163	$692,813
Cabin Single Engine	All	87	363,790	90	374,585	112	480,950	105	448,095
Cabin Multi-Engine	All	21	1,150,000	21	1,150,000	16	885,000	16	885,000
Total Biplanes	....	241	$2,022,696	255	$2,052,813	284	$2,031,358	284	$2,025,908
Monoplanes									
Open Cockpit	1	2	1,750	3	2,500	1	825	2	1,525
	2	72	109,375	65	102,761	62	162,015	67	173,345
	3	0	....	0	....	0	....	0	....
	Up	0	....	1	1,350	0	....	0	....
Sub-total	....	74	$111,125	69	$106,611	63	$162,840	69	$174,870
Cabin Single Engine	1	0	....	0	....	1	17,000	1	17,000
	2	64	118,048	61	105,413	134	389,455	135	381,446
	3	0	....	0	....	60	180,028	57	183,335
	4	96	234,525	101	240,270	93	246,218	95	255,755
	5	8	130,800	9	143,550	3	48,700	2	32,750
	6	10	116,100	11	123,700	12	192,654	16	237,351
	7	1	12,950	1	12,950	2	62,532	3	74,532
	8 and Up	2	45,000	2	45,000	28	1,211,208	28	1,211,208
Sub-total	....	181	$657,423	185	$670,883	333	$2,347,795	337	$2,393,377
Cabin Multi-Engine	All	69	3,181,787	71	3,211,193	77	4,827,874	66	4,085,374
Total Monoplanes	....	324	$3,950,335	325	$3,988,687	473	7,338,509	472	6,653,621
Seaplanes	All	2	4,314	1	1,314	6	408,978	7	410,873
Amphibions	All	13	139,755	13	139,755	8	167,007	9	167,257
Autogiros	....	11	63,800	10	52,850	1	11,750	3	24,250
Sub-total	....	26	$207,869	24	$193,919	15	$587,735	19	$602,380
Commercial Total	....	591	$6,180,900	604	$6,235,419	772	$9,957,602	775	$9,281,909
Military Total	....	466	$9,784,643	468	$9,470,517	437	$8,836,509	434	$8,824,509
Grand Total	....	1,057	$15,965,543	1,072	$15,705,936	1,209	$18,794,111	1,209	$18,106,418

* Values represent planes less engines.

PRODUCTION AND DELIVERIES OF COMMERCIAL AND MILITARY AIRPLANE ENGINES IN THE UNITED STATES

Commercial	*1933 Production*		*1933 Deliveries*		*1934 Production*		*1934 Deliveries*	
Horsepower	*Units*	*Value*	*Units*	*Value*	*Units*	*Value*	*Units*	*Value*
Under 75	67	$43,958	73	$46,638	99	$60,735	98	$60,060
76–125	102	124,230	99	119,640	129	164,775	111	150,875
126–175	30	56,695	44	83,395	134	193,155	127	186,105
176–225	152	364,135	183	433,070	317	690,249	308	662,754
226–300	95	255,705	104	286,405	64	209,986	63	208,436
301–400	36	145,330	28	112,130	80	337,400	61	258,000
401–500	67	325,788	64	307,788	65	334,500	77	394,700
501–600	232	1,224,500	249	1,337,700	100	595,700	79	453,000
601–Up	339	2,184,100	291	1,897,800	1,060	7,684,000	1,015	7,342,800
Commercial Totals	1,120	$4,724,441	1,135	$4,624,566	2,048	$10,270,500	1,939	$9,716,730
Military								
Horsepower								
126–175	0	....	0	....	0	....	0	....
176–225	13	$27,234	13	$27,234	10	$35,000	10	$35,000
226–300	9	27,000	9	27,000	15	45,000	15	45,000
301–400	30	120,000	30	120,000	10	42,000	10	42,000
401–500	181	812,217	181	812,217	71	322,200	71	322,200
501–600	153	745,400	160	782,500	21	98,000	20	93,500
601–Up	474	3,254,330	474	3,255,330	561	4,620,510	561	4,620,510
Military Totals	860	$4,986,181	867	$5,024,281	688	$5,162,710	687	$5,158,210
GRAND TOTAL	1,980	$9,710,622	2,002	$9,648,847	2,736	$15,433,210	2,626	$14,874,940

SUMMARY OF SPARE PART SALES

Aircraft

	Military	*Commercial*	*Miscellaneous*	*Total*
1930	$4,108,167	$3,442,573	$475,002	$8,025,742
1931	4,627,594	1,912,481	499,857	7,039,932
1932	3,701,838	974,439	348,770	5,025,047
1933	3,127,255	945,336	140,340	4,212,931
1934	2,168,856	1,540,564	436,425	4,145,845

Aircraft Engine

	Military	*Commercial*	*Miscellaneous*	*Total*
1930	$2,231,370	$2,487,576	$494,216	$5,213,162
1931	3,904,739	1,747,654	267,400	5,919,793
1932	3,699,848	1,241,878	73,644	5,015,370
1933	1,961,033	1,567,604	67,843	3,596,480
1934	1,543,730	2,517,592	299,377	4,360,699

UNITED STATES AERONAUTIC EXPORTS

TOTAL VALUE FOR CALENDAR YEARS

Source—U. S. Bureau of Foreign and Domestic Commerce

Country of Destination	*1934 Value*	*1933 Value*	*1932 Value*
China	$ 3,778,262	$ 1,762,247	$ 157,515
Russia	3,276,490	380,222	406,677
Germany	1,761,607	349,090	192,501
Colombia	1,615,778	636,081	290,388
Peru	1,018,426	384,141	337,664
Mexico	598,133	297,058	233,800
Brazil	528,668	1,459,745	2,680,418
Siam	522,745	108,714	2,135
Argentina	519,961	677,437	271,087
Netherlands	410,431	319,803	179,628
Turkey	327,143	11,498	672,378
Japan	320,562	338,908	366,950
Bolivia	303,609	259,840	362,046
Sweden	262,085	45,617	113,954
Switzerland	259,063	2,669	1,629
France	196,935	16,952	54,305
Canada	188,928	64,088	178,108
Poland and Danzig	172,904	147,711	2,227
Panama	145,967	232,616	42,866
United Kingdom	137,361	84,913	57,972
Italy	107,245	21,003	3,696
Australia	105,447	43,625	24,237
Rumania	101,092	24,726	5,735
Netherland West Indies	76,497	20,654	5,039
Austria	74,844	83	30
Hong Kong	64,248	484,115	210,410
Union of South Africa	58,238	30,707	15,092
Portugal	56,797	25,304	2,037
Czechoslovakia	55,735	10,876	16,458
Philippine Islands	47,135	95,176	208,115
Chile	45,214	59,284	21,065
Belgium	37,517	37,588	466,962
Guatemala	37,140	21,164	9,902
Honduras	36,694	80,189	33,252
Trinidad and Tobago	27,104	34,046	56,709
Finland	25,888	4,482	2,218
Uruguay	23,094	70	5,645
Norway	22,797	4,620	159
Arabia	21,106	1,800	....

Country of Destination	1934 Value	1933 Value	1932 Value
Netherland East Indies	19,028	51,113	29,152
Yugoslavia	16,468	15,171	2,550
Irish Free State	15,195	....	....
Spain	14,382	7,438	39,572
Costa Rica	14,091	11,692	74
Dominican Republic	13,926	22,145	7,632
Cuba	13,898	25,404	37,854
Venezuela	13,559	6,748	56,673
Salvador	11,624	65,078	1,647
Nicaragua	7,660	14,781	854
Morocco	6,330	....	15
British East Africa	6,173	510	62
Egypt	5,384	5,636	4,409
Lithuania	5,205	490	868
Haiti	4,528	1,392	3,811
New Zealand	4,449	6,876	6,032
Kwantung	2,143	3,965	....
British Malaya	1,157	....	450
Iraq	1,054	63	....
Other Asia	1,035	826	....
Other British West Indies	873	1,932	5,848
Jamaica	330	429	590
Denmark	238	100	431
Bulgaria	200	1,140	....
British Guiana	100	71	1,343
Mozambique	64	1,697	749
Greece	50	65	53
Bermuda	40	....	....
French Guiana	36	164	217
British India	25	75	466
Palestine	22	....	5,082
Hungary	14	....	....
Virgin Islands	8	560	110
Newfoundland and Labrador	3	....	60
Greenland	....	30,000	....
Ecuador	....	18,971	32,608
Paraguay	....	2,111	....
Surinam	....	198	986
French Oceania	....	149	....
Syria	....	50	4,000
Latvia	....	....	10,400
British Oceania	....	....	358
French West Indies	....	....	263
Barbados	....	....	165
Canary Islands	....	....	56
Algeria and Tunisia	....	....	34
Belgian Congo	....	....	30
British Honduras	....	....	11
Albania	....	....	7
Totals	$17,548,181	$ 9,155,882	$ 7,946,533

AIRPLANES, SEAPLANES AND AMPHIBIONS

Country of Destination	1934 Units	1934 Value	1933 Units	1933 Value	1932 Units	1932 Value
China	132	$3,236,742	74	$1,456,580	16	$ 88,110
Colombia	78	1,064,633	30	656,593	9	191,500
Peru	19	714,480	16	188,475	9	176,816
Siam	24	498,678	...	....	...	....
Mexico	46	498,312	49	249,467	21	133,571
Germany	8	337,110	1	4,000	3	55,000
Switzerland	3	214,158	...	....	...	....
Brazil	28	193,345	73	1,104,531	111	2,282,245
Bolivia	9	180,469	7	133,000	15	344,501
Japan	6	160,228	6	61,350	1	20,400
Argentina	9	134,448	38	417,962	9	67,210
France	3	102,567	1	5,915	1	6,097
Turkey	18	93,189	...	....	26	432,459

Country of Destination	1934 Units	1934 Value	1933 Units	1933 Value	1932 Units	1932 Value
Rumania	22	83,450	...	....	...	....
United Kingdom	4	76,296	1	29,069	1	10,000
Austria	1	74,579	...	....	...	....
Sweden	2	70,500	...	....	...	....
Netherland West Indies	1	70,000	3	20,500	2	4,600
Netherlands	2	66,683	2	12,042	...	....
Hong Kong	12	41,298	36	474,508	6	189,793
Portugal	6	37,995	5	21,600	...	....
Union of South Africa	5	33,391	3	30,300	3	14,470
Panama	5	31,200	9	146,363	...	....
Canada	5	26,921	2	10,301	19	80,583
Guatemala	5	26,860	2	12,500	1	4,600
Philippine Islands	5	25,128	6	74,603	2	61,657
Australia	1	20,410	...	....	1	20,000
Arabia	1	19,000	...	....	...	....
Uruguay	2	16,080	...	....	1	4,245
Honduras	4	15,000	12	70,227	5	22,100
Irish Free State	1	14,950	...	....	...	....
Dominican Republic	1	11,000	1	16,000	...	....
Norway	3	10,594	...	....	...	....
Costa Rica	2	8,000	3	9,800	...	....
Morocco	1	6,330	...	....	...	....
Spain	4	6,267	1	4,204	2	10,800
Belgium	1	6,010	...	....	2	48,850
Nicaragua	2	6,000	4	13,775	...	....
British East Africa	1	5,241	...	....	...	....
Salvador	1	5,000	4	59,641	...	....
Egypt	1	3,758	2	5,400	1	2,500
New Zealand	1	3,479	1	5,833	5	5,839
Italy	1	3,355	...	....	...	....
Czechoslovakia	2	2,600	...	....	...	....
Chile	1	1,650	2	50,000	...	....
British Malaya	1	1,100	...	....	...	....
Greenland	..	....	1	30,000	...	....
Ecuador	..	....	1	15,200	3	31,201
Venezuela	..	....	...	....	3	41,000
Palestine	..	....	...	....	1	4,820
Syria	..	....	...	....	1	4,000
Totals	490	$8,258,484	396	$5,389,739	280	$4,358,967

AIRCRAFT ENGINES

Country of Destination	1934 Units	1934 Value	1933 Units	1933 Value	1932 Units	1932 Value
Russia	405	$1,650,591	2,576	$ 255,400	2,010	$ 261,334
Germany	213	1,166,774	48	200,446	23	96,193
Argentina	32	219,163	17	57,869	3	12,027
Brazil	42	191,201	8	22,395	4	27,234
Netherlands	34	137,859	40	221,750	29	138,802
Sweden	21	134,550	4	25,200	15	98,386
Poland and Danzig	24	103,718	24	112,980	....	....
Colombia	18	102,840	20	94,139	12	64,855
China	14	79,137	13	70,084	5	4,195
Peru	13	78,732	3	14,198	10	34,155
Italy	12	68,439	2	12,986	....	....
Mexico	53	58,913	21	27,546	61	63,500
Czechoslovakia	8	46,835	....	....	....	....
Turkey	8	45,600	....	....	12	72,400
Bolivia	5	36,818	11	57,688	4	10,900
Japan	5	36,161	2	1,800	....	....
Panama	17	35,927	20	37,800	14	28,540
Switzerland	4	23,662	....	....	....	....
Siam	3	21,620	15	102,195	....	....
Trinidad and Tobago	11	21,551	12	31,282	14	49,820
Australia	9	12,965	9	31,103	....	....
Venezuela	4	11,500	....	....	2	4,350
Canada	6	11,440	12	8,255	19	8,361
France	2	11,200	....	....	4	26,441
Yugoslavia	1	9,500	....	....	....	....
Union of South Africa	1	6,822	....	....	....	....
Netherland West Indies	2	6,440	....	....	....	....

Country of Destination	1934 Units	1934 Value	1933 Units	1933 Value	1932 Units	1932 Value
Chile	1	6,277	....	....	1	8,000
Salvador	1	6,277	....	....	1	1,500
Honduras	10	6,243	6	2,519	3	4,541
Uruguay	1	5,750	....	....	....	....
Spain	5	5,160	1	2,097	7	21,000
Guatemala	5	5,017	1	1,000	2	985
Costa Rica	3	4,264	1	1,000	....	....
Finland	2	3,550	....	....	1	300
Philippine Islands	1	2,819	3	10,070	36	55,003
Cuba	2	2,500	20	11,047	5	8,052
Norway	2	1,760	....	....	....	....
Egypt	1	1,500	....	....	1	850
Rumania	2	881	....	....	....	....
New Zealand	1	310	....	....	....	....
Other Br. W. Indies	1	300	3	950	1	5,000
Kwantung	1	300	....	....	....	....
Nicaragua	1	175	1	500	....	....
United Kingdom	...	....	1	9,000	1	5,000
Hong Kong	...	....	2	3,000	4	17,600
Dominican Republic	...	....	3	2,238	....	....
Arabia	...	....	1	1,800	....	....
Mozambique	...	....	1	450	....	....
Belgium	...	....	....	....	41	357,792
Netherland India	...	....	....	....	2	10,996
Latvia	...	....	....	....	5	10,400
Haiti	...	....	....	....	2	3,034
Portugal	...	....	....	....	1	1,136
Totals	1,007	$4,383,101	2,901	$1,430,787	2,356	$1,517,682

PARACHUTES AND PARTS

Country of Destination	1934 Value	1933 Value	1932 Value
Turkey	$28,253	$ 3,417	$ 94,845
Brazil	24,107	16,052	84,460
Portugal	14,517	3,704	......
Netherland India	7,472	311	8,361
Colombia	6,902	14,089	1,998
Hong Kong	4,320	......	......
Argentina	4,000	13,102	......
Bolivia	1,900	6,098	......
Peru	1,580	3,756	......
Netherlands	1,354	......	......
Yugoslavia	1,100	15,171	2,533
Arabia	1,000	......	......
Other Asia	625	......	......
China	550	5,600	6,450
Belgium	300	......	......
Sweden	252	......	......
Rumania	150	910	520
Mexico	84	200	5,166
Paraguay	......	2,100	......
Salvador	......	2,100	......
United Kingdom	......	452	1,416
Trinidad and Tobago	......	200	......
Cuba	......	150	......
Panama	......	110	284
Russia	......	......	105,000
Ecuador	......	......	1,300
Venezuela	......	......	600
France	......	......	200
Canada	......	......	145
Australia	......	......	130
Japan	......	......	55
Totals	$98,466	$87,522	$313,463

AIRCRAFT PARTS AND ACCESSORIES (EXCEPT TIRES)

Country of Destination	*1934 Value*	*1933 Value*	*1932 Value*
Russia	$1,625,899	$ 124,822	$ 40,343
China	461,833	229,983	58,760
Colombia	441,403	171,260	32,035
Germany	257,723	144,644	41,308
Peru	223,634	157,712	126,693
Netherlands	204,535	86,011	40,826
Argentina	162,350	188,504	191,850
Turkey	160,100	8,081	72,674
Canada	150,567	45,532	89,019
Japan	124,173	275,758	346,495
Brazil	120,015	316,767	286,479
Bolivia	84,362	63,054	6,645
France	83,168	11,037	21,567
Panama	78,840	48,343	14,042
Australia	72,072	12,522	4,107
Poland and Danzig	69,186	34,731	2,227
United Kingdom	61,065	46,392	41,556
Sweden	56,783	20,417	15,568
Mexico	40,824	19,845	31,563
Chile	37,287	9,284	13,065
Italy	35,451	8,017	3,696
Belgium	31,207	37,588	60,320
Finland	22,338	4,482	1,918
Switzerland	21,243	2,669	1,629
Philippine Islands	19,188	10,503	91,455
Hong Kong	18,630	6,607	3,017
Union of South Africa	18,015	407	622
Rumania	16,611	23,816	5,215
Honduras	15,451	7,443	6,611
Netherland East Indies	11,556	50,802	9,795
Cuba	11,398	14,207	29,802
Norway	10,443	4,620	159
Czechoslovakia	6,300	10,876	16,458
Yugoslavia	5,868	......	17
Trinidad and Tobago	5,553	2,564	6,889
Guatemala	5,263	7,664	4,317
Lithuania	5,205	490	868
Haiti	4,528	1,392	777
Portugal	4,285	......	901
Spain	2,955	1,137	7,772
Dominican Republic	2,926	3,907	2,632
Siam	2,447	6,519	2,135
Venezuela	2,059	6,748	10,723
Kwantung	1,843	3,965	......
Costa Rica	1,827	892	74
Nicaragua	1,485	506	854
Uruguay	1,264	70	1,400
Iraq	1,054	63	......
British East Africa	932	510	62
New Zealand	660	1,045	193
Arabia	589	......	......
Other British West Indies	573	982	848
Albania	517	......	7
Other Asia	410	826	......
Salvador	347	3,337	147
Jamaica	330	429	590
Austria	265	83	30
Irish Free State	245	......	......
Denmark	238	100	431
Bulgaria	200	......	......
Egypt	136	236	1,059
British Guiana	100	71	1,343
Mozambique	64	1,247	749
British Malaya	57	75	450
Netherland West Indies	57	134	439
Greece	50	65	53
Bermudas	40	......	......
French Guiana	36	164	217
British India	25	......	466
Palestine	22	......	262
Hungary	14	......	......

Country of Destination	1934 Value	1933 Value	1932 Value
Virgin Islands	8	560	110
Newfoundland and Labrador	3	......	60
Ecuador	......	3,771	107
Bulgaria	......	1,140	......
Surinam	......	198	986
French Oceania	......	149	......
Syria	......	50	......
Paraguay	......	11	......
British Oceania	......	......	358
French West Indies	......	......	265
Barbados	......	......	165
Canary Islands	......	......	56
Algeria and Trinidad	......	......	34
Belgian Congo	......	......	30
Morocco	......	......	15
British Honduras	......	......	11
Totals	$4,808,130	$2,247,834	$1,756,421

AERONAUTICAL PURCHASES BY MILITARY SERVICES FISCAL YEAR 1934

The following is a compilation of major purchases and deliveries of aircraft and engines by the United States Army and Navy aviation services during the fiscal year 1934, prepared with the aid of the Army Air Corps and the Bureau of Aeronautics of the Navy Department.

ARMY AIR CORPS AERONAUTICAL CONTRACTS

Contract No.	Contractor	Quantity	Type
W 535 ac-5911	Douglas Aircraft Co., Inc., Santa Monica, Calif.	22	O-38E Airplanes
W 535 ac-6809	Boeing Airplane Company, Seattle, Wash.	1	YP-29 Airplane
		1	YP-29A Airplane
		1	YP-29B Airplane
W 535 ac-6810	Kreider-Reisner Aircraft Co., Hagerstown, Md.	1	XC-31 Airplane
W 535 ac-6811	The Northrop Corp., Inglewood, Calif.	1	1 YA-13 Airplane
W 535 ac-6861	The Glenn L. Martin Co., Baltimore, Md.	81	139-A Airplanes
	Total	108	

AIRPLANES DELIVERED TO ARMY AIR CORPS

Type	Contractor	Quantity
P-26A	Boeing Airplane Co., Seattle, Wash.	109
P-30	Consolidated Aircraft Co., Buffalo, N. Y.	4
B-10	Glenn L. Martin Co., Baltimore, Md.	14
B-10A	Glenn L. Martin Co., Baltimore, Md.	1
B-12	Glenn L. Martin Co., Baltimore, Md.	7
B-12A	Glenn L. Martin Co., Baltimore, Md.	15
B-14	Glenn L. Martin Co., Baltimore, Md.	1
A-12	Curtiss Aeroplane & Motor Co., Inc., Buffalo, N. Y.	46
O-38B	Douglas Aircraft Co., Inc., Santa Monica, Calif.	*3
O-38E	Douglas Aircraft Co., Inc., Santa Monica, Calif.	*3
O-38E	Douglas Aircraft Co., Inc., Santa Monica, Calif.	*21
O-40B	Curtiss Aeroplane & Motor Co., Inc., Buffalo, N. Y.	3
OA-4B	Douglas Aircraft Co., Inc., Santa Monica, Calif.	4
C-27A	Bellanca Aircraft Co., New Castle, Del.	9
C-27B	Bellanca Aircraft Co., New Castle, Del.	1
C-29	Douglas Aircraft Co., Inc., Santa Monica, Calif.	2
		243

* Transferred to National Guard.

ENGINES DELIVERED TO ARMY AIR CORPS

Type	*Contractor*	*Quantity*
985	Pratt & Whitney Aircraft Co., E. Hartford, Conn.	16
1340	Pratt & Whitney Aircraft Co., E. Hartford, Conn.	91
1510	Wright Aeronautical Corp., Paterson, N. J.	1
1535	Pratt & Whitney Aircraft Co., E. Hartford, Conn.	1
1570	Curtiss Aeroplane & Motor Co., Inc., Buffalo, N. Y.	18
1690	Pratt & Whitney Aircraft Co., E. Hartford, Conn.	*160
1710	Allison Engineering Co., Indianapolis, Ind.	1
1820	Wright Aeronautical Corp., Paterson, N. J.	134
1830	Pratt & Whitney Aircraft Co., E. Hartford, Conn.	3
		425

* 52 delivered to National Guard.

NAVY PURCHASES OF AERONAUTICAL EQUIPMENT FISCAL YEAR 1934

Airplanes

Type	*Factory Name*	*Quantity*
F2F-1	Grumman Fighter with P&W R-1535-72 engine	54
BF2C-1	Curtiss Bomber-Fighter with Wright R-1820-O4 engine	27
OJ-2	B/J Observation with P&W R-985-46 engine	12
SF-1	Grumman Scout with Wright R-1820-84 engine	34
XSOE-1	Bellanca Scout-Observation with Wright R-1820-84 engine	1
XSOK-1	Kreider-Reisner Scout-Observation with Wright R-1510-C engine	1
P2Y-3	Consolidated Long Range Patrol with 2 Wright R-1820-90 engines	23
XPTBH-1	Hall Patrol-Torpedo-Bomber with 2 P&W R-1830-60 engines	1
XJW-1	Waco Utility with Continental R-670-98 engine	2
JF-1	Grumman Utility with P&W R-1830-62 engine	5
JF-2*	Grumman Utility with Wright R-1820-F2 engine	9
RD-3	Douglas Transport with 2 P&W R-1340-C engines	6
RD-4*	Douglas Transport with 2 P&W R-1340-C engines	10
R4C-1	Curtiss-Wright Transport with 2 Wright R-1820-12 engines	2
R2D-1	Douglas Transport with 2 Wright R-1820-F3 engines	3
XR3Q-1	Stinson Transport with Lycoming R-680-6 engine	1
XTBD-1	Douglas Horizontal Bomber with P&W XR-1830-60 engine	1
XTBG-1	Great Lakes Horizontal Bomber with P&W XR-1830-60 engine	1
BG-1	Great Lakes Dive Bomber with P&W R-1535-64 engine	44
XB2G-1	Great Lakes Dive Bomber with P&W R-1535-66 engine	1
XN3Y-1**	Consolidated Trainer with Lycoming R-680-6 engine	3
NS-1	Stearman Trainer with Wright R-790-8 engine	41
Gliders	Franklin Glider Corporation	4
	Total	286
	* These airplanes purchased for the Coast Guard	19
	Total for the Navy	267

** These airplanes procured from the Air Corps, U. S. Army.

Engines

Type	*Manufacturer*	*Quantity*
R-1830-62	Pratt & Whitney Aircraft Company	42
R-1535-66	Pratt & Whitney Aircraft Company	61
R-1830-58	Pratt & Whitney Aircraft Company	4
R-985-46	Pratt & Whitney Aircraft Company	16
R-1535-64	Pratt & Whitney Aircraft Company	2
XR-1340-32	Pratt & Whitney Aircraft Company	1
XR-1830-60	Pratt & Whitney Aircraft Company	7
XR-1830-58	Pratt & Whitney Aircraft Company	3
R-1535-72	Pratt & Whitney Aircraft Company	74
R-1535-B	Pratt & Whitney Aircraft Company	3
R-1340-C*	Pratt & Whitney Aircraft Company	20
R-1820-90	Wright Aeronautical Corporation	128
R-1820-84	Wright Aeronautical Corporation	46
R-1820-04	Wright Aeronautical Corporation	36
R-1820-F2*	Wright Aeronautical Corporation	12
XR-1510-30	Wright Aeronautical Corporation	1
XR-1820-10	Wright Aeronautical Corporation	1
R-1820-12	Curtiss-Wright (furnished with R4C-1 airplanes)	4
R-680-5**	Lycoming (furnished with XN3Y-1 airplanes)	3
R-680-6	Lycoming (furnished with XR3Q-1 airplane)	1
GV-660	Steel Products Engineering Company	4
R-670-98	Continental (furnished with XJW-1 airplanes)	2
R-670-98	Continental Aircraft Engine Company	1
2-Cylinder air cooled	(Diesel)-Lawrance Engineering & Research Co.	1
9-Cylinder air cooled	(Diesel)-Guiberson Diesel Engineering Co.	1
GC-14, R-1830	Kinner Airplane and Motor Company	1
E-6	Menasco Manufacturing Company	1
R-1820-F3	Douglas Aircraft Co. (furnished with R2D-1 airplanes)	6
	Total	482
	* Procured for the U. S. Coast Guard	32
	Total for the Navy	450

** Procured from the Air Corps, U. S. Army.

AIRPLANES DELIVERED TO U. S. NAVY

Type	*Factory Name*	*Quantity*
FF-1	Grumman Fighter	20
XF2J-1	B/J Fighter	1
XF3U-1	Chance Vought Fighter	1
XF2F-1	Grumman Fighter	1
XFD-1	Douglas Fighter	1
XF13C-1	Curtiss Fighter	1
O3U-3	Vought Observation	43
OJ-2	B/J Observation	9
XO3U-6	Vought Observation	1
XP2Y-2	Consolidated Long Range Patrol	1
XP2S-1	Sikorsky Patrol	1
SF-1	Grumman Scout	27
XSS-2	Sikorsky Scout	1
XSG-1	Great Lakes Scout	1
SU-4	Vought Scout	20
XBG-1	Great Lakes Dive Bomber	1
XB2Y-1	Consolidated Dive Bomber	1
XJW-1	Waco Utility	2
JF-1	Grumman Utility	3
R4C-1	Curtiss Transport (Condor)	2
XR3Q-1	Stinson Transport	1
XN3Y-1	Consolidated trainer (obtained from Army Air Corps)	3
PS-2	Franklin Glider	4
	Total	146

AIRCRAFT ENGINES DELIVERED TO U. S. NAVY

Type	*Manufacturer*	*Quantity*
R-1820-04	Wright Aeronautical Corp.	36
R-1820-84	Wright Aeronautical Corp.	43
R-1820-90	Wright Aeronautical Corp.	64
R-1820-08	Wright Aeronautical Corp.	1
R-1820-80	Wright Aeronautical Corp.	2
R-1830-62	Pratt & Whitney Aircraft Co.	17
R-1830-58	Pratt & Whitney Aircraft Co.	2
R-1690-42	Pratt & Whitney Aircraft Co.	30
R-985-38	Pratt & Whitney Aircraft Co.	14
R-670-98	Continental Aircraft Engine Co.	1
R-1820-F3*	Douglas Aircraft Co.	6
R-1820-12**	Curtiss-Wright Airplane Co.	4
R-680-6***	Stinson Aircraft Corp.	1
R-680-6****	Army Air Corps	3
R-670-98*****	Waco Aircraft Co.	1
	Total	225

* Received with R2D-1 airplanes.
** Received with R4C-1 airplanes.
*** Received with XR3Q-1 airplane.
**** Received with XN3Y-1 airplanes.
***** Received with XJW-1 airplane.

TREND OF AIRCRAFT ACCIDENT RATES

In the U. S. Army Air Corps

Fiscal years	*Aircraft hours*	*Fatal accidents*	*Rate per 1,000 hrs.*	*Hours flown per fatal accident*	*All accidents*	*Rate per 1,000 hrs.*	*Hrs. per accident*	*Ratio accidents to fatal accidents*
1922	65,214	24	.368	2,714	330	5.06	198	1 to 13.8
1923	65,750	33	.502	1,992	283	4.31	232	1 to 8.6
1924	97,834	23	.235	4,250	275	2.81	356	1 to 12.0
1925	150,319	29	.193	5,180	311	2.07	483	1 to 10.7
1926	158,402	27	.171	5,865	334	2.11	474	1 to 12.4
1927	140,402	28	.199	5,030	227	1.61	620	1 to 8.1
1928	182,903	25	.137	7,320	249	1.36	734	1 to 10.0
1929	263,381	42	.230	4,355	390	1.48	675	1 to 9.3
1930	325,224	37	.114	8,785	468	1.44	695	1 to 12.6
1931	396,961	21	.053	18,900	456	1.15	870	1 to 21.7
1932	371,254	33	.086	11,061	423	1.14	877	1 to 12.8
1933	432,966	28	.064	15,463	442	1.02	979	1 to 15.8
1934*	382,099*	35*	.091*	10,917*	418*	1.09*	914*	1 to 11.9*

* Includes 12 fatalities during Air Corps operations with mail between February 19 and June 1, 1934.

AIRCRAFT APPROPRIATIONS, UNITED STATES

Fiscal Year		*Department Appropriations*	*Total*	*Increase or Decrease*	*Net*
1924–25	Army........	$14,113,043.80		+$1,687,043.80	
	Navy........	15,150,000		+502,826	
	Air Mail.....	2,750,000		+1,250,000	
	N.A.C.A......	470,000	$32,483,043.80	+187,000	+$3,626,869.80
1925–26	Army........	14,700,000(1)		+586,956.20	
	Navy........	14,790,000(2)		−360,000	
	Air Mail.....	2,810,000(3)		−150,000	
	N.A.C.A......	534,000	32,624,000	+64,000	+350,956.20
1926–27	Army........	15,050,000†		+350,000	
	Navy........	18,505,288		+3,715,288	
	Air Mail.....	2,650,000(3)		−160,000	
	N.A.C.A......	513,000	36,718,288	−21,000	+3,844,288
1927–28	Army........	20,396,300		+5,346,300	
	Navy........	20,100,000		+1,594,712	
	Air Mail.....	4,150,000		+1,500,000	
	N.A.C.A......	513,000			
	Commerce....	3,791,500	48,950,800	+3,791,500	+12,232,512
1928–29	Army........	24,848,562(4)		+4,452,262	
	Navy........	32,189,560(5)		+12,089,560	
	Air Mail.....	6,430,000		+2,280,000	
	N.A.C.A......	600,000		+87,000	
	Commerce....	4,361,850	68,429,972	+570,350	+19,479,172
1929–30	Army........	34,690,785		+9,842,223	
	Navy........	31,430,000(5)		−759,560	
	Air Mail.....	13,300,000		+6,870,000	
	N.A.C.A......	1,292,200		+692,200	
	Commerce....	6,416,620	87,129,605	+2,054,770	+18,699,633
1930–31	Army........	35,823,473		+1,132,688	
	Navy........	32,033,211		+603,211	
	Air Mail.....	21,600,000(6)		+8,300,000	
	N.A.C.A......	1,321,000(7)		+29,000	
	Commerce....	9,207,430(8)	99,985,114	+2,790,810	+12,855,498
1931–32	Army........	31,479,635(9)		−4,343,838	
	Navy........	31,145,000		−888,211	
	Air Mail.....	27,000,000(10)		+5,400,000	
	N.A.C.A......	1,051,070(11)		−269,930	
	Commerce....	10,362,300(12)	101,038,005	+1,154,870	+1,052,891

(1) Plus $2,150,000 contract authorizations for additional purchases of aircraft.
(2) Plus $4,100,000 contract authorizations for additional purchases of aircraft.
(3) For the contract Air Mail Service $500,000 was appropriated for 1926 and $2,000,000 was allowed for 1927.
(4) And contract authorization of $5,000,000.
(5) And contract authorization of $10,000,000.
(6) Includes $6,600,000 for Foreign Air Mail.
(7) Includes $15,000 for printing.
(8) Includes $7,944,000 for new and improved air navigation facilities.
(9) Not less than $15,296,231 to be spent for the purchase of new airplanes, equipment, spare parts, and accessories.
(10) Includes $7,000,000 for Foreign Air Mail.
(11) Includes $23,000 for printing.
(12) Includes $9,000,000 for new and improved air navigation facilities.
+ Shows amount of increase. — Shows amount of decrease.
† Plus $6,250,000 contract authorization for additional purchases of aircraft.

AIRCRAFT APPROPRIATIONS, UNITED STATES (Cont.)

Fiscal Year		*Department Appropriations*	*Total*	*Increase or Decrease*	*Net*
1932–33	Army........	$25,439,131		−$6,040,504	
	Navy........	25,245,420		−5,899,580	
	Air Mail.....	26,460,000(13)		−540,000	
	N.A.C.A......	920,000		−131,070	
	Commerce....	8,553,500(14)	$86,618,051	−1,808,800	$−14,419,954
1933–34	Army........	23,324,185(16)		−2,114,946	
	Navy........	21,957,459		−3,287,961	
	Air Mail.....	21,000,000(13)		−5,460,000	
	N.A.C.A......	695,000		−225,000	
	Commerce....	7,660,780(15)	74,637,424	−892,720	−11,980,627
1934–35	Army........	27,396,453(20)		+4,072,268	
	Navy........	18,643,320		−3,314,139	
	Air Mail.....	19,000,000(17)		−2,000,000	
	N.A.C.A......	707,792		+12,792	
	Commerce....	5,511,800(18)	71,259,365	−2,148,980	−3,378,059
1935–36	*Army........	48,383,400		+20,986,947	
	*Navy........	39,500,000(21)		+20,856,680	
	*Air Mail.....	17,700,000(17)		−1,300,000	
	*N.A.C.A......	820,800		+113,008	
	*Commerce....	6,009,700(19)	112,413,900	+497,900	+41,154,535

(13) Includes $7,000,000 for Foreign Air Mail.
(14) Includes $1,000,000 for Aircraft in Commerce.
(15) Only $5,172,500 of the $7,660,780 appropriated for the fiscal year 1934 was available. It was divided as follows: $700,000 for Aircraft in Commerce and $4,472,500 for Air Navigation Facilities.
(16) Only $11,599,673 of the 23 million was available for the fiscal year 1934, the rest having been impounded. An additional sum of $7,500,000 was made available for the purchase of new airplanes through the P.W.A. (Public Works Administration) fund; plus $3,000,000 contract authorization for additional purchases prior to July 1,1934.
(17) Includes $7,000,000 for Foreign Air Mail.
(18) Divided as follows: Air Navigation Facilities, $4,867,800; Aircraft in Commerce, $644,000.
(19) Divided as follows: Air Navigation Facilities, $5,274,900; Aircraft in Commerce, $734,800.
(20) Plus $3,000,000 contract authorization for additional purchases of aircraft.
(21) Plus $12,500,000 for additional purchases of aircraft under the title "Emergency Construction—Increase in the Navy."
* Proposed expenditures. + Shows amount of increase. − Shows amount of decrease.

STRENGTH OF U. S. NAVAL AVIATION

Fiscal years 1924–1934

Officers Attached to Aviation

	June 30, 1924	*June 30, 1925*	*June 30, 1926*	*June 30, 1927*	*June 30, 1928*	*June 30, 1929*	*June 30, 1930*	*June 30, 1931*	*June 30, 1932*	*June 30, 1933*	*June 30, 1934*
Naval aviators	328	382	426	472	466	520	614	737	803	826	834
Student naval aviators	47	35	71	28	73	116	184	149	84	45	107
Line, ground	42	17	14	12	24	54*	69	254	230	444	489
Staff, ground	101	99	129	138	128	101*	98	120	111		
Naval observers	5	5	11	12	11	11	9	5	7	6	5
Student naval observers	....	....	....	....	2	....	....	....	....	....	....
Officers having flight orders	13	16	19	15	33	41	45	48	48	2	2
Total	536	554	670	677	737	843	1,019	1,313	1,283	1,323	1,437

* Approximate figures.

Enlisted Men on Duty

	June 30, 1924	*June 30, 1925*	*June 30, 1926*	*June 30, 1927*	*June 30, 1928*	*June 30, 1929*	*June 30, 1930*	*June 30, 1931*	*June 30, 1932*	*June 30, 1933*	*June 30, 1934*
Aviation ratings	1,788	1,711	1,722	2,092	2,785	3,067	2,895	3,136	3,313	1,633	1,878
General service ratings	1,814	1,597	2,155	2,333	8,636	8,575	7,874	9,503	9,045	10,653	10,095
Total	3,602	3,308	3,877	4,425	11,421	11,642	10,769	12,639	12,358	12,286	11,973

U. S. Marine Corps Aviation

Fiscal Year	*1932*			*1933*			*1934*		
	Officers	*Enlisted Men*	*Total*	*Officers*	*Enlisted Men*	*Total*	*Officers*	*Enlisted Men*	*Total*
Pilots	101	32	133	103	30	133	104	34	138
Student Pilots	12	0	12	0	7	7	8	0	8
Flight orders	7	157	164	5	155	160	5	157	162
Non-flyers	10	760	770	10	758	768	11	781	792
Total	130	949	1,079	118	950	1,068	128	972	1,100

COMPARATIVE TABULATIONS OF ACCIDENTS—CIVIL AERONAUTICS FOR THE YEARS 1931, 1932, 1933 AND THE FIRST SIX MONTHS OF 1934

(Compiled by Bureau of Air Commerce, U. S. Dept. of Commerce)

Mileage Flown Per Accident

	*January-June, 1931**	*July-December, 1931*	*January-June, 1932**	*July-December, 1932*	*January-June, 1933**	*July-December, 1933*	*January-June, 1934**
Miles flown in scheduled transport operations	20,190,925	27,195,062	24,668,414	26,264,553	25,862,120	28,780,425	21,517,658
Miles flown in miscellaneous operations including student instruction and experimental flying	43,282,595	51,060,520	33,722,685	44,456,015	32,748,485	38,474,360	36,780,157
Total	63,473,520	78,255,582	58,391,099	70,720,568	58,610,605	67,254,785	58,297,815
Accidents, all services	1,054	1,277	914	1,152	813	891	676
Miles flown per accident, all services	60,222	61,281	63,885	61,389	72,091	75,482	86,230
Accidents, scheduled transport operations	61	65	67	48	48	53	27
Miles flown per accident, scheduled transport operations	330,999	418,386	368,185	547,178	538,704	543,027	796,950
Accidents, miscellaneous operations	993	1,212	847	1,104	765	838	649
Miles flown per accident, miscellaneous operations	43,676	42,129	39,814	40,268	42,808	45,912	56,672
Fatal accidents, all services**	114	153	105	119	85	106	93
Miles flown per fatal accident in all services	556,785	511,474	556,106	594,290	689,536	634,478	626,858
Fatal accidents, scheduled transport operations**	5	9	11	6	5	4	6
Miles flown per fatal accident, scheduled operations	4,038,185	3,021,674	2,242,583	4,377,425	5,172,424	7,159,106	3,586,276
Fatal accidents, miscellaneous operations**	109	144	94	113	80	102	87
Miles flown per fatal accident, miscellaneous operations	397,088	354,587	358,752	393,416	409,356	377,200	422,760
Pilot fatalities, all services	95	125	82	99	72	90	74
Miles flown per pilot fatality, all services	668,142	626,045	712,086	714,349	814,036	747,275	787,808
Pilot fatalities, scheduled transport operations	5	6	10	5	4	4	6
Miles flown per pilot fatality, scheduled transport operations	4,038,185	4,532,510	2,466,841	5,252,911	6,465,530	7,159,106	3,586,276
Pilot fatalities, miscellaneous operations	90	119	72	94	68	86	68
Miles flown per pilot fatality, miscellaneous operations	480,918	429,080	468,371	472,936	481,595	447,376	540,885

* It should be borne in mind that weather conditions during the last 6 months of the calendar year are more favorable for flying than during the first 6 months, hence, in making comparisons, figures for corresponding periods should be used in each case.

** A fatal aircraft accident is one in which 1 or more persons (passenger, pilot, or crew) were killed or fatally injured.

CAUSES OF ACCIDENTS

Scheduled Air Transport Operations

Causes	*Percentages*						
	January-June, 1931	*July-December, 1931*	*January-June, 1932*	*July-December, 1932*	*January-June, 1933*	*July-December, 1933*	*January-June, 1934*
Number of accidents involved	61	65	67	48	48	53	27
PERSONNEL:							
Pilot:							
Error of judgment	8.85	6.15	3.73	5.85	1.04	5.28	14.45
Poor technique	3.44	4.92	3.88	1.06	3.12	1.89	15.74
Disobedience of orders	2.29	0	.37	0	0	.47	0
Carelessness or negligence	6.15	6.15	2.98	6.38	7.29	13.21	11.67
Miscellaneous	0	0	0	0	2.08	0	0
Total pilot errors	20.73	17.22	10.96	13.29	13.53	20.85	41.86
Other personnel:							
Supervisory	1.14	1.15	0	2.66	0	0	6.48
Miscellaneous	3.28	0	0	0	2.08	0	3.70
Total personnel errors	25.15	18.37	10.96	15.95	15.61	20.85	52.04
MATERIAL:							
Power Plant:							
Fuel system	3.85	3.85	6.71	6.39	7.30	8.49	3.70
Cooling system	0	0	0	0	0	0	0
Ignition system	1.64	.77	1.49	0	0	0	0
Lubrication system	0	1.54	0	0	0	0	0
Engine structure	3.28	1.54	7.47	6.38	2.08	7.55	0
Propellers and accessories	4.92	3.08	2.99	6.38	4.17	5.66	7.41
Engine-control system	0	0	1.49	0	2.08	0	0
Miscellaneous	1.64	5.39	.75	2.13	0	0	0
Undetermined	1.64	3.08	1.49	2.13	6.25	3.77	.74
Total power-plant failures	16.97	19.25	22.39	23.41	21.88	25.47	11.85
Structural:							
Flight-control system	0	1.54	0	1.06	0	0	0
Movable surfaces	0	0	0	0	0	0	0
Stabilizing surfaces	0	1.54	0	0	0	0	0
Wings, struts, and bracings	.57	1.54	0	0	0	0	0
Undercarriage	8.20	12.30	7.47	10.64	4.17	10.94	11.11
Wheels, tires and brakes	3.69	1.54	5.82	4.26	4.17	9.34	3.70
Pontoons or boats	0	0	0	0	0	0	0
Fuselage, engine mountings and fittings	0	1.54	0	0	0	0	0
Tail-skid assembly	0	0	0	3.19	2.08	0	3.70
Miscellaneous	0	0	0	0	0	0	0
Undetermined	0	0	0	4.26	0	0	0
Total structural failures	12.46	20.00	13.29	23.41	10.42	20.28	18.51
Handling qualities	10.65	0	5.97	1.06	2.08	3.78	0
Instruments	0	0	0	0	0	0	0
Total airplane failures	23.11	20.00	19.26	24.47	12.50	24.06	18.51
MISCELLANEOUS:							
Weather	21.73	26.00	31.72	25.53	27.09	18.30	14.82
Darkness	0	0	2.24	0	0	0	0
Airport and terrain	10.33	14.84	13.43	6.38	14.59	7.55	.93
Other	.25	0	0	2.13	8.33	0	1.85
Total miscellaneous causes	32.31	40.84	47.39	34.04	50.01	25.85	17.60
Undetermined and doubtful	2.46	1.54	0	2.13	0	3.77	0
Total percentages	100	100	100	100	100	100	100

CAUSES OF ACCIDENTS

Non-Scheduled Flying

Causes	Percentages						
	January-June, 1931	*July-December, 1931*	*January-June, 1932*	*July-December, 1932*	*January-June, 1933*	*July-December, 1933*	*January-June, 1934*
Number of accidents involved	991	1,212	847	1,104	765	838	649
PERSONNEL:							
Pilot:							
Error of judgment	9.23	8.04	7.19	6.85	7.00	9.18	8.07
Poor technique	32.98	37.95	35.85	34.25	36.62	33.09	34.72
Disobedience of orders	3.53	2.15	1.64	1.82	1.01	1.40	1.29
Carelessness or negligence	6.26	7.24	7.08	8.75	6.01	7.25	8.28
Miscellaneous	.55	.27	.12	.18	.36	.42	.36
Total pilot errors	52.55	55.65	51.88	51.85	51.00	51.34	52.72
Other personnel:							
Supervisory	.05	.04	0	0	0	.12	0
Miscellaneous	.86	.06	.74	.32	.39	.24	0
Total personnel errors	53.46	55.75	52.62	52.17	51.39	51.70	52.72
MATERIAL:							
Power Plant:							
Fuel system	4.20	2.87	6.27	6.69	7.90	7.06	5.68
Cooling system	.84	.17	.55	.14	.59	.71	.31
Ignition system	1.79	2.11	2.08	1.83	1.37	1.75	2.62
Lubrication system	.62	.64	.32	.34	.23	.30	0
Engine structure	3.15	2.80	3.89	2.83	4.09	1.86	3.41
Propellers and accessories	.60	.25	.12	.59	.52	.60	.46
Engine-control system	.18	.58	.12	.41	.52	.24	.28
Miscellaneous	3.18	4.94	.79	.61	0	.29	.55
Undetermined	4.81	4.31	2.25	3.77	4.67	2.78	2.94
Total power-plant failures	19.37	18.67	16.39	17.21	19.89	15.59	16.25
Structural:							
Flight-control system	1.01	.58	.46	.29	.66	.71	.46
Movable surfaces	.25	.12	.03	.36	.13	.12	.28
Stabilizing surfaces	.25	.17	.25	0	0	.36	0
Wings, struts, and bracings	1.65	1.07	1.26	.63	1.11	1.91	1.19
Undercarriage	4.06	5.22	4.69	4.86	4.74	6.36	4.82
Wheels, tires and brakes	1.38	1.90	2.27	1.63	.92	2.00	1.54
Pontoons or boats	0	.17	0	0	0	0	0
Fuselage, engine mountings and fittings	.50	.04	.24	.45	.26	.24	.15
Tail-skid assembly	.10	.17	.27	.27	0	.12	0
Miscellaneous	.30	.25	.53	1.65	.26	.12	.15
Undetermined	.23	.33	0	.18	0	0	.15
Total structural failures	9.73	10.02	10.00	10.32	8.08	11.94	8.74
Handling qualities	2.02	2.05	2.73	2.17	2.35	2.05	1.76
Instruments	0	0	0	.09	0	0	0
Total airplane failures	11.75	12.07	12.73	12.58	10.43	13.99	10.50
MISCELLANEOUS:							
Weather	3.81	3.29	7.64	5.85	7.69	7.46	7.67
Darkness	.25	.21	.53	.41	.02	0	0
Airport and terrain	9.96	8.21	8.64	8.56	7.54	8.37	10.24
Other	.75	1.28	.62	1.63	2.39	1.94	2.00
Total miscellaneous causes	14.77	12.99	17.43	16.45	17.64	17.77	19.91
Undetermined and doubtful	.65	.52	.83	1.59	.65	.95	.62
Total percentages	100	100	100	100	100	100	100

INJURIES CLASSIFIED

July to December, 1933, Inclusive

Kind of Flying	*Total Persons Involved*	*Pilots*					*Co-Pilots or Students*				
		Fatal	*Severe*	*Minor*	*No Injury*	*Total*	*Fatal*	*Severe*	*Minor*	*No Injury*	*Total*
Schedule......	234	4	1	5	43	53	1	1	2	14	18
Student Instruction....	277	18	14	11	170	213	8	4	3	43	58
Experimental..	31	3	3	3	12	21	2	0	0	0	2
Commercial....	432	25	11	13	130	179	2	0	0	2	4
Pleasure.......	749	40	29	50	312	431	1	2	0	2	5
Total.....	1723	90	58	82	667	897	14	7	5	61	87

Kind of Flying	*Total Persons Involved*	*Passengers*					*Aircraft Crew*				
		Fatal	*Severe*	*Minor*	*No Injury*	*Total*	*Fatal*	*Severe*	*Minor*	*No Injury*	*Total*
Schedule......	234	6	1	16	130	153	0	0	0	10	10
Student Instruction....	277	3	1	0	2	6	0	0	0	0	0
Experimental..	31	1	3	1	3	8	0	0	0	0	0
Commercial....	432	36	24	25	160	245	3	0	0	1	4
Pleasure.......	749	37	18	29	229	313	0	0	0	0	0
Total.....	1723	83	47	71	524	725	3	0	0	11	14

January to June, 1934, Inclusive

Kind of Flying	*Total Persons Involved*	*Pilots*					*Co-Pilots or Students*				
		Fatal	*Severe*	*Minor*	*No Injury*	*Total*	*Fatal*	*Severe*	*Minor*	*No Injury*	*Total*
Schedule......	179	6	1	3	17	27	3	2	0	4	9
Student Instruction....	273	25	10	22	139	196	10	6	7	30	53
Experimental..	20	0	0	6	8	14	0	0	0	0	0
Commercial....	298	9	3	16	97	125	1	0	1	2	4
Pleasure.......	550	34	22	32	229	317	1	0	1	0	2
Total.....	1320	74	36	79	490	679	15	8	9	36	68

Kind of Flying	*Total Persons Involved*	*Passengers*					*Aircraft Crew*				
		Fatal	*Severe*	*Minor*	*No Injury*	*Total*	*Fatal*	*Severe*	*Minor*	*No Injury*	*Total*
Schedule......	179	16	6	29	80	131	4	1	2	5	12
Student Instruction....	273	13	3	3	4	23	0	0	0	1	1
Experimental..	20	0	0	1	2	3	1	0	0	2	3
Commercial....	298	9	6	28	124	167	1	0	0	1	2
Pleasure.......	550	53	11	13	154	231	0	0	0	0	0
Total.....	1320	91	26	74	364	555	6	1	2	9	18

AIRPLANE AND PILOT LICENSES

JANUARY 1, 1935

Classified by States

BUREAU OF AIR COMMERCE, U. S. DEPARTMENT OF COMMERCE

STATE	AIRCRAFT			PILOTS					
	Licensed	*Unlicensed*	*Total*	*Transport*	*Ltd. Com.*	*Industrial*	*Private*	*Amateur*	*Total*
Alabama	27	30	57	60	4	0	40	1	105
Arizona	41	10	51	32	5	0	40	2	79
Arkansas	39	13	52	58	2	0	26	3	89
California	766	131	897	1,151	125	4	1,112	146	2,538
Colorado	41	15	56	51	3	0	22	8	84
Connecticut	96	4	100	81	18	0	92	12	203
Delaware	35	2	37	13	0	0	14	0	27
District of Columbia	74	5	79	149		0	63	4	221
Florida	100	48	148	175	19	0	98	18	310
Georgia	75	45	120	81	3	0	40	3	127
Idaho	33	6	39	24	6	0	16	5	51
Illinois	457	53	510	453	42	0	319	31	845
Indiana	141	116	257	121	26	0	101	18	266
Iowa	120	66	186	98	13	0	70	2	183
Kansas	122	101	223	118	13	0	59	8	198
Kentucky	39	14	53	39	1	0	19	2	61
Louisiana	87	21	108	87	11	0	44	9	151
Maine	49	12	61	30	3	0	19	2	54
Maryland	82	31	113	79	8	0	65	9	161
Massachusetts	185	28	213	167	32	0	166	29	394
Michigan	272	115	387	261	46	1	196	24	528
Minnesota	111	80	191	170	34	0	33	9	246
Mississippi	47	12	59	27	4	0	18	0	49
Missouri	169	73	242	241	22	0	95	10	368
Montana	46	20	66	32	7	0	37	2	78
Nebraska	81	50	131	88	11	0	47	9	155
Nevada	17	7	24	10	0	1	6	4	21
New Hampshire	19	7	26	15	6	0	10	3	34
New Jersey	184	33	217	213	34	0	142	16	405
New Mexico	17	17	34	12	3	0	10	1	26
New York	752	62	814	601	132	1	588	93	1,415
North Carolina	57	49	106	48	9	0	33	2	92
North Dakota	50	32	82	45	4	0	18	4	71
Ohio	365	95	460	374	91	0	310	37	812
Oklahoma	169	37	206	144	9	2	103	8	266
Oregon	65	62	127	77	8	1	67	14	167
Pennsylvania	416	74	490	299	81	0	311	41	732
Rhode Island	28	3	31	18	4	0	25	7	54
South Carolina	16	26	42	23	2	0	8	0	33
South Dakota	57	12	69	39	8	0	41	5	93
Tennessee	68	29	97	72	8	0	65	5	150
Texas	261	140	401	459	39	0	185	22	705
Utah	29	5	34	32	1	0	17	1	51
Vermont	13	1	14	13	3	0	6	3	25
Virginia	69	29	98	170	21	0	66	9	266
Washington	110	36	146	146	22	0	122	16	306
West Virginia	45	14	59	41	8	0	27	5	81
Wisconsin	131	96	227	123	34	0	50	9	216
Wyoming	26	11	37	40	3	0	14	2	59
Alaska	29	1	30	37	4	0	4	0	45
Canada (1)	0	1	1	1	1	0	2	0	4
Canal Zone	0	0	0	32	1	0	5	0	38
Hawaiian Islands	8	1	9	73	2	0	5	3	83
Mexico (1)	1	1	2	21	0	0	6	0	27
Philippine Islands	0	0	0	23	0	0	2	0	25
Foreign Misc. (1)	2	1	3	57	5	0	11	3	76
Totals	6,339	1,983	8,322	7,144(2)	1,006	10	5,110	679	13,949(3)
Percentage				51.22	7.21	.07	36.63	4.87	

(1) Figures for these countries mean pilots and aircraft licensed or identified by the United States.

(2) This figure includes 676 pilots who hold scheduled air transport ratings.

(3) This figure includes 371 women pilots—divided as follows—67 Transport, 34 Limited Commercial, 225 Private, 45 Amateur, and 1 woman autogiro pilot.

AIRPORTS AND LANDING FIELDS JANUARY 1, 1935

Classified by States

From Bureau of Air Commerce, U. S. Department of Commerce

	Municipal	*Commercial*	*Intermediate*	*Auxiliary*	*Army*	*Navy*	*Miscellaneous Government, private, and State*	*Totals*	*Partially or fully lighted*
Alabama	5	3	7	8	3	0	0	26	12
Alaska	2	2	0	72	0	0	0	76	2
Arizona	12	5	10	19	1	0	0	47	16
Arkansas	14	3	4	8	0	0	0	29	6
California	52	59	20	58	5	4	6	204	62
Colorado	12	4	2	12	1	0	0	31	7
Connecticut	7	7	1	4	0	0	2	21	8
Delaware	2	0	0	2	1	0	1	6	2
District of Columbia	0	1	0	0	1	1	0	3	3
Florida	37	18	3	14	1	5	3	81	22
Georgia	19	3	13	10	1	0	0	46	20
Idaho	22	0	9	17	0	0	11	59	15
Illinois	16	36	7	5	2	1	1	68	29
Indiana	10	16	8	4	2	0	2	42	17
Iowa	15	10	2	6	0	0	0	33	12
Kansas	20	10	5	10	2	0	0	47	18
Kentucky	7	0	4	5	1	0	0	17	5
Louisiana	10	3	2	10	1	0	1	27	11
Maine	5	8	0	11	0	0	1	25	2
Maryland	2	10	2	6	2	1	1	24	7
Massachusetts	5	26	1	9	0	1	2	44	7
Michigan	32	23	0	20	2	1	25	103	23
Minnesota	10	5	3	7	1	0	1	27	8
Mississippi	12	1	2	7	0	0	0	22	6
Missouri	12	9	7	5	0	0	2	35	13
Montana	27	1	4	25	0	0	0	66	4
Nebraska	12	4	6	1	1	0	0	24	15
Nevada	4	3	10	3	0	1	0	21	13
New Hampshire	4	4	0	10	0	0	1	19	0
New Jersey	5	20	0	2	1	1	1	30	8
New Mexico	7	5	10	12	1	0	2	37	13
New York	23	49	4	13	3	0	6	98	25
North Carolina	11	9	3	6	1	0	0	30	7
North Dakota	25	6	0	19	0	0	1	51	0
Ohio	25	40	9	30	4	0	5	113	22
Oklahoma	24	8	7	6	1	0	0	46	21
Oregon	14	4	8	5	0	0	2	33	19
Pennsylvania	10	70	12	13	2	1	8	116	40
Rhode Island	0	4	0	4	0	1	2	11	2
South Carolina	11	2	3	11	0	3	1	31	9
South Dakota	14	8	0	4	0	0	0	26	1
Tennessee	11	3	6	6	0	0	0	26	9
Texas	58	10	24	40	12	0	1	145	50
Utah	8	1	15	3	0	0	0	27	18
Vermont	3	5	0	2	1	0	0	11	0
Virginia	12	10	5	5	1	2	0	35	11
Washington	18	11	6	6	3	1	3	48	13
West Virginia	6	5	0	7	0	0	1	19	1
Wisconsin	19	25	5	6	0	0	2	57	17
Wyoming	11	1	10	12	0	0	0	34	13
Totals	702	570	259	580	58	24	104	2,297	664

AVIATION GASOLINE TAX SUMMARY

State	*Tax*	*Dispositions of Receipts*	*Applicable to Aircraft Fuel*	*Exemption or Refund*
Alabama	6c	Highways	Yes	No
Arizona	5c	Highways; R.F.C. Fund	Yes	Refund
Arkansas	6½c	Highways; Airports	No	Exemption
California	3c	Highways	Yes	Refund
Colorado	4c	Highways; Relief	Yes	Refund
Connecticut	2c	Highways	No	Exemption
Delaware	3c	Highways	Yes	Refund
Dist. of Columbia	2c	Highways	Yes	Refund
Florida	7c	Roads; Schools	Yes	Exemption (a)
Georgia	6c	Roads; Schools	Yes	No
Idaho	5c	Airfuel tax to Aeronautics Fund	Yes	Refund
Illinois	3c	Highways; Schools	Yes	Refund
Indiana	4c	Highways	Yes	Refund (b)
Iowa	3c	Highways	Yes	Refund
Kansas	3c	Highways	Yes	Exemption
Kentucky	5c	Highways	Yes	No
Louisiana	5c	Highways; Relief	Yes	No
Maine	4c	Highways	Yes	¾ of tax
Maryland	4c	Highways	Yes	Refund
Massachusetts*	3c	Highways; General Fund	Yes	Refund and/or Exemption
Michigan	3c	Highways; Aeronautics	Yes	Refund 1½c (c)
Minnesota	3c	Highways	Yes	Refund
Mississippi*	6c	Highways	Yes	Refund (d)
Missouri	2c	Highways	Yes	Refund
Montana	5c	Highways	Yes	Refund
Nebraska	5c	Highways	Yes	No
Nevada	4c	Highways	Yes	Refund
New Hampshire	4c	Highways	Yes	Refund
New Jersey	3c	Traffic; Waterways	No	Exemption
New Mexico	5c	Highways	Yes, unless sold in inter-state commerce	Refund (e)
New York	3c (f)	Highways; General Fund	Yes	Refund
North Carolina*	6c	Highways	Yes	Refund (g)
North Dakota	3c	Highways	Yes	Refund
Ohio	4c	Highways; Schools; Poor Relief	Yes	Refund
Oklahoma	4c	Highways	Yes, unless inter-state flying	No
Oregon	5c	Highways; Aeronautics	Yes	Refund
Pennsylvania	3c	Highways; Relief; Aeronautics	Yes	No
Rhode Island	2c	Highways	Yes	Refund
South Carolina	6c	Highways	Yes	No
South Dakota	4c	Highways	Yes	Refund
Tennessee	7c	Highways; General Fund except $50,000 to Airways	Yes	No
Texas	4c	Highways; Schools	Yes	Refund
Utah	4c	Highways	Yes, unless inter-state flying	No
Vermont	4c	Highways	Yes	No
Virginia	5c	Highways; Bridges	Yes	Refund
Washington	5c	Highways	Yes	Refund
West Virginia	4c	Highways	Yes	Refund
Wisconsin	4c	Highways	Yes	Refund
Wyoming	4c	Highways; Airports	Yes	No

(a) When stored and actually used in inter-state; otherwise must pay tax.
(b) Airports sell gasoline tax free.
(c) Only upon proof of inter-state schedules.
(d) Exempts U. S. Mails.
(e) On purchase of 50 or more gallons.
(f) To be 4c after April 1, 1935.
(g) Exemption if gasoline is adapted for airplane use only and cannot be used in motor vehicles.
* Includes both refund and exemption under certain conditions.

STATE LAWS RELATING TO LICENSING OF AIRCRAFT AND AIRMEN

January 1, 1935

The following summary of the status of state licensing laws, classifying them into nine different groups so as to indicate the character of the laws in each state and the year in which the acts were passed, was prepared by the Legal and Legislative Research Service of the Aeronautical Chamber of Commerce especially for The Aircraft Year Book for 1935.

I. STATES REQUIRING FEDERAL LICENSE FOR ALL AIRCRAFT AND AIRMEN:

1.	Alabama	(1931)	(See footnote a)
2.	Arizona	(1929)	
3.	California	(1929)	
4.	Delaware	(1929)	
5.	Florida	(1931)	(See footnotes a and b)
6.	Georgia	(1933)	(Same exceptions as stated in footnotes a and b)
7.	Idaho	(1931)	(State registration also required)
8.	Illinois	(1931)	(Same exceptions as stated in footnotes a and b)
9.	Indiana	(1929)	
10.	Iowa	(1929)	(See footnote c)
11.	Kansas	(1931)	
12.	Kentucky	(1930, 1932)	(State registration also required. See footnote d)
13.	Louisiana	(1932)	(See footnote e)
14.	Michigan	(1933)	(State registration also required. See footnote f)
15.	Minnesota	(1933)	(State registration may be required by Aeronautics Commission)
16.	Mississippi	(1928)	
17.	Missouri	(1929)	(Except solo pleasure. See footnote g)
18.	Montana	(1929)	
19.	Nebraska	(1929)	(Does not apply to non-commercial airmen)
20.	New Jersey	(1931)	
21.	New Mexico	(1929)	
22.	New York	(1928)	(Except airmen in private or pleasure flying) (h)
23.	North Dakota	(1930)	(Covers only civil aircraft flown for hire)
24.	Ohio	(1931)	(See footnote a)
25.	Oklahoma	(1931)	(See footnote a)
26.	Pennsylvania	(1933)	(Same exceptions as stated in footnotes a and b)
27.	Rhode Island	(1929)	
28.	South Carolina	(1930)	
29.	South Dakota	(1929)	
30.	Texas	(1929)	(Except public aircraft of U. S. or Texas)
31.	Utah	(1931)	(See footnote a—1st paragraph only)
32.	Washington	(1929)	
33.	Wisconsin	(1929)	
34.	Wyoming	(1931)	

II. STATES REQUIRING FEDERAL LICENSE FOR ALL COMMERCIAL AIRCRAFT AND ALL AIRMEN IN COMMERCIAL FLYING:

1.	Colorado	(1929)	(See entry under VII, post)
2.	Dist. of Columbia	(1926)	
3.	Nebraska	(1929)	(Applies to airmen of civil aircraft, passenger carrying)
4.	Nevada	(1929)	
5.	North Carolina	(1929)	
6.	Oregon	(1931)	(Does not apply to airmen—see entry under III, post)

III. STATES REQUIRING STATE OR FEDERAL LICENSE FOR ALL AIRCRAFT, AIRMEN:

1.	Maine	(1929)	(Except public aircraft and pilots thereof)
2.	Maryland	(1930)	
3.	Massachusetts	(1922)	
4.	New Hampshire	(1929)	(State registration required. See footnote j)
5.	Oregon	(1929)	(Does not apply to airmen—see entry under III, post) supra)
6.	Tennessee	(1931)	

IV. STATES REQUIRING STATE OR FEDERAL LICENSE FOR AIRCRAFT, AIRMEN IN COMMERCIAL FLYING ONLY:

None.

V. STATES REQUIRING STATE LICENSE FOR ALL AIRCRAFT, AIRMEN:

1. Arkansas (1927)
2. Connecticut (1927)
3. West Virginia (1931)

VI. STATES REQUIRING STATE LICENSE FOR AIRCRAFT, AIRMEN IN COMMERCIAL FLYING ONLY:

None.

VII. STATES REQUIRING STATE LICENSE FOR AIRCRAFT, AIRMEN IN NON-COMMERCIAL FLYING:

1. Colorado (1929) (Applies to airmen and not aircraft)

VIII. STATES REQUIRING BOTH STATE AND FEDERAL LICENSES FOR ALL AIRCRAFT AND AIRMEN:

1. Vermont (1929)
2. Virginia (1930)

IX. STATES HAVING NO LICENSE REQUIREMENTS:

None.

FOOTNOTES

(*a*) "Provided, however that this restriction shall not apply to military aircraft of the United States, or of a State, Territory, or possession thereof, or to aircraft licensed by a foreign country with which the United States has a reciprocal agreement covering the operation of such licensed aircraft."
"Provided, however, that this restriction shall not apply to pilots operating aircraft of the United States, or of a State, Territory, or possession thereof."

(*b*) ". . . or to persons operating aircraft licensed by a foreign country with which the United States has a reciprocal agreement covering the operation of licensed aircraft."

(*c*) Aircraft, and pilots thereof, used exclusively in the governmental service of the United States or of any of the States are excepted, as are pilots without passengers.

(*d*) Law does not apply to "public aircraft of the Federal Government, or of a State, Territory, or possession, or of a political subdivision thereof, or to aircraft licensed by a foreign country with which the United States has a reciprocal agreement covering the operation of such licensed aircraft."

(*e*) Law applies to all but "public aircraft," defined to mean "an aircraft used exclusively in the governmental service of the United States." "Airmen" includes anyone who engages in the navigation of aircraft while under way and anyone who is in charge of the inspection, overhauling, or repairing of aircraft.

(*f*) Law covers only airmen operating civil aircraft, and exempts from provisions military aircraft of the United States and aircraft licensed by country having reciprocal relations with United States, provided such aircraft is not engaged commercially within the State.

(*g*) Law does not apply to public aircraft owned by, or to pilots in the service of, the U. S. or State of Missouri.

(*h*) Law does not apply to aircraft used exclusively in the governmental service of the U. S., of the National Guard or of one or more of the civil departments of the State. Certain test flights also excepted.

(*j*) State registration required of resident owners and airmen and of non-resident airmen and aircraft operating commercially in State.

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U. S. Air Mail to Foreign Countries

Including dispatch by the United States domestic and foreign air mail routes to the country named and, in the case of Canada, Colombia, Cuba and Mexico, dispatch by the domestic air mail routes of those countries where available.

	Cents per half-ounce
Argentina	55
Bahamas	10
Barbados	20
Bolivia (by ordinary means from Arequipa, Peru)	40
Brazil	50
Canada	6 cents per ounce
Canal Zone	20
Chile	50
Colombia	35
Costa Rica	20
Cuba	10
Dominican Republic	10
Dutch West Indies:	
Curacao, Bonaire, Aruba	30
St. Martins, St. Eustatius, Saba	20
Ecuador	30
Guadeloupe (including Desirade, Les Saintes, Marie Galante, Petite Terre, St. Bartholomew (Barthelemy) and the French part of St. Martins)	20
Guatemala	15
Guianas (British, Dutch, French)	30
Haiti	10
Honduras (British)	15
Honduras (Republic)	15
Jamaica	10
Leeward Islands:	
Anguilla, Antigua, Barbuda, Dominica, Montserrat, Nevis, Redonda, St. Christopher (St. Kitts)	20
British Virgin Islands	10
Martinique	20
Mexico	10
Nicaragua	15
Panama Republic	20
Paraguay (by ordinary means from Buenos Aires, Argentina)	55
Peru	40
Puerto Rico	10
Salvador (El)	15
Trinidad	20
Uruguay	55
Venezuela (by air to Maracaibo, Cumarebo, La Guaira, Caripito)	30
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Virgin Islands (United States)	10
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Trade Index

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Finance Officer	Capt. John F. Connell
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San Diego, Calif.	Capt. J. H. Towers
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Pensacola, Fla.	Capt. R. F. Zogbaum
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Coco Solo, C. Z.	Capt. E. D. McWhorter
Sunnyvale, Calif.	Comdr. A. H. Dresel

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Navy Building, Washington, D. C.

Laboratories, Langley Field, Va.

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Fred H. Brown	(D-N. H.)	Vacancy	(R-)
Joseph C. O'Mahoney	(D-Wyo.)	Vacancy	(R-)

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		Vacancy	(R-)

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Clarence W. Turner	(D-Tenn.)	Vacancy	(R-)
Richard M. Duncan	(D-Mo.)	Vacancy	(R-)

Paul J. Kvale (F-L.-Minn.)

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Bernhard M. Jacobsen	(D-Ia.)	Vacancy	(R-)
Vacancy	(D-)	Vacancy	(R-)
Vacancy	(D-)	Vacancy	(R-)

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Arthur P. Lamneck	(D-Ohio)	Vacancy	(D-)
Martin L. Sweeney	(D-Ohio)	Isaac H. Doutrich	(R-Pa.)
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Donald C. Dobbins	(D-Ill.)	John T. Buckbee	(R-Ill.)
John F. Dockweiler	(D-Calif.)	William D. Thomas	(R-N. Y.)
Vacancy	(D-)	Vacancy	(R-)
		Vacancy	(R-)
		Vacancy	(R-)

Interstate and Foreign Commerce

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Clarence F. Lea	(D-Calif.)	Vacancy	(D-)
Robert Crosser	(D-Ohio)	Vacancy	(D-)
Parker Corning	(D-N. Y.)	Vacancy	(D-)
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Edward A. Kelly	(D-Ill.)	Schuyler Merritt	(R-Conn.)
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House Subcommittee of Military Affairs Committee
(Investigation into military aircraft contracts)

William N. Rogers (chairman) (D-N. H.)

Lister Hill	(D-Ala.)	Charles A. Plumley	(R-Vt.)
Numa F. Montet	(D-La.)	Samuel L. Collins	(R-Calif.)
Andrew Edmiston	(D-W. Va.)	Paul J. Kvale	(F-L-Minn.)

(Delegate) Samuel W. King (R-Hawaii)

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Bulgaria ....Mr. Vladimir S. Manoloff, Secretary of Legation
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Japan ....Colonel Kenji Matsumoto, Military Attaché
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Norway ... .Mr. Francis Irgens, Secretary of Legation
Panama ....Senor Don Juan B. Chevalier, Secretary of Legation
Persia ....Hossein Khan Navab, Secretary of Legation
Peru ....Dr. Juan Mendoza Almenara, First Secretary of Embassy
Poland ....Mr. Janusz Zoltowski, Financial Counselor
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Rumania ....Mr. George Boncesco, Financial Counselor of Legation
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Paris, France ....Col. Frank P. Lahm, Air Corps; Military Attaché, France and Belgium; Assistant Military Attaché for Air, Spain.
London, England ....Capt. John W. Monahan, Air Corps; Assistant Military Attaché for Air, Great Britain.
Rome, Italy ....Capt. Francis M. Brady, Air Corps; Assistant Military Attaché for Air, Italy and Greece.
Moscow, Russia ....1st Lt. Thomas D. White, Air Corps; Assistant Military Attaché for Air, U.S.S.R.

U. S. Navy

London, England ....Lt. Comdr. Leslie C. Stevens, Construction Corps, Naval Aviator; Assistant Naval Attaché.
Paris, France ....Lt. Comdr. Ben H. Wyatt, Naval Aviator; Assistant Naval Attaché.

AMENDMENT TO CODE OF FAIR COMPETITION OF THE AIR TRANSPORT INDUSTRY

EFFECTIVE DECEMBER 10, 1934

The Code of Fair Competition of the Air Transport Industry Shall be Amended by Adding to Article VII Sections 4 (Subsections a, b, c), 5, 6, and 7 as follows:

4a. All articles carried as private luggage of passengers (whether carried in the baggage compartment or by the passenger in the cabin), shall be considered as baggage and weighed and charged for as such.

b. Free Baggage Allowance: Thirty-five (35) pounds of baggage for each passenger shall be carried free of charge. This provision does not apply to services within either the territories of Alaska or Hawaii or between such territories and last point of departure or first point of landing in the continental United States.

c. Charge for Excess Baggage: Baggage in excess of thirty-five (35) pounds for each passenger shall be charged for at the tariff rate for such baggage. No more than fifty pounds of baggage per passenger shall be carried, except by special arrangement in each individual case. This provision does not apply to services within either the territories of Alaska or Hawaii or between such territories and last point of departure or first point of landing in the continental United States.

5. No member of the industry shall knowingly withhold information requested concerning air transportation facilities, or knowingly give inaccurate information concerning such facilities.

6. No member of the industry shall defame a competitor by falsely imputing to him dishonorable conduct, inability to perform contracts, questionable credit standing, or by falsely disparaging the character of his personnel or operation methods or the quality of his equipment or services.

7. No member of the industry shall, after December 10, 1934, directly or indirectly issue or give any free or reduced fare transportation to passengers, except (1) to Federal Government employees traveling on Government request for Transportation (Form 1030); (2) persons traveling on the carrier's business, its employees, its officers and directors, surgeons, physicians and attorneys, and the immediate families of employees (the immediate family of an employee to include only wife or husband, children, parents, sisters and brothers); (3) when on official business, to Post Office inspectors and officials, Bureau of Air Commerce inspectors and officials, Customs House inspectors, Immigration inspectors, Air Transport Code Authority officials and employees, and National Recovery Administration officials traveling on Air Transport Code Authority business; (4) witnesses in connection with any legal matters in which the carrier is interested; (5) persons injured in accidents and physicians and nurses attending such persons; Provided, however, that this provision shall not be construed to prohibit the interchange of passes for the officers, directors and employees of carriers by air and the immediate families of employees as described above; nor to prohibit any carrier from carrying passengers free with the object of providing relief in cases of general epidemic, pestilence, or other calamitous visitation; nor to prohibit the issuance of free transportation for educational purposes on regular scheduled flights not to exceed one hundred (100) miles or to the next scheduled stop beyond one hundred (100) miles.

Free passes may also be granted for scheduled flights in excess of a round trip from the point of origin to the next regular scheduled stop beyond one hundred (100) miles on any route, for educational purposes, after fifteen (15) days from the mailing date of notice in writing by the member of the industry in question to the Air Transport Code Authority. Non-scheduled flights for educational purposes may be granted within the discretion of any member of the industry. Educational purposes as herein used means any purpose which clearly serves to demonstrate the merits of air transportation to the public and which may reasonably be expected to increase air traffic at full tariff rates.

Any agreement made in writing for free transportation, prior to December 10, 1934, by any member of the industry, shall not be considered a violation of the provisions of this section.

The provisions of this Section shall not apply to services within either the territories of Alaska or Hawaii or between such territories and last point of departure or first point of landing in the continental United States.

AIR MAIL ACT OF 1934

[Public—No. 308—73d Congress] [S. 3170]

AN ACT

To revise air-mail laws, and to establish a commission to make a report to the Congress recommending an aviation policy.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act of April 29, 1930 (46 Stat. 259, 260; U.S.C., Supp. VII, title 39, secs. 464, 465e, 465d, and 465f), and the sections amended thereby are hereby repealed.

SEC 2. (a) Effective July 1, 1934, the rate of postage on air mail shall be 6 cents for each ounce or fraction thereof.

(b) When used in this Act—

(1) The term "air mail" means mail of any class prepaid at the rate of postage prescribed in subsection (a) of this section.

(2) The term "person" includes an individual, partnership, association, or corporation.

(3) The term "pilot" includes copilot.

SEC. 3. (a) The Postmaster General is authorized to award contracts for the transportation of air mail by airplane between such points as he may designate, and for initial periods of not exceeding one year, to the lowest responsible bidders tendering sufficient guaranty for faithful performance in accordance with the terms of the advertisement at fixed rates per airplane-mile: *Provided,* That where the Postmaster General holds that a low bidder is not responsible or qualified under this Act, such bidder shall have the right to appeal to the Comptroller General who shall speedily determine the issue, and his decision shall be final: *Provided further,* That the base rate of pay which may be bid and accepted in awarding such contracts shall in no case exceed 33 1/3 cents per airplane-mile for transporting a mail load not exceeding three hundred pounds. Payment for transportation shall be at the base rate fixed in the contract for the first three hundred pounds of mail or fraction thereof plus one tenth of such base rate for each additional one hundred pounds of mail or fraction thereof, computed at the end of each calendar month on the basis of the average mail load carried per mile over the route during such month, except that in no case shall payment exceed 40 cents per airplane-mile.

(b) No contract or interest therein shall be sold, assigned, or transferred by the person to whom such contract is awarded, to any other person without the approval of the Postmaster General; and upon any such transfer without such approval, the original contract, as well as such transfer, shall at the option of the Postmaster General become null and void.

(c) If, in the opinion of the Postmaster General, the public interest requires it, he may grant an extension of any route, for a distance not in excess of one hundred miles, and only one such extension shall be granted to any one person, and the rate of pay for such extension shall not be in excess of the contract rate on that route.

(d) The Postmaster General may designate certain routes as primary and secondary routes and shall include at least four transcontinental routes and the eastern and western coastal routes among primary routes. The character of the designation of such routes shall be published in the advertisements for bids, which bids may be asked for in whole or in part of such routes.

(e) If on any route only one bid is received, or if the bids received appear to the Postmaster General to be excessive, he shall either reject them or submit the same to the Interstate Commerce Commission for its direction in the premises before awarding the contract.

(f) The Postmaster General shall not award contracts for air-mail routes or extend such routes in excess of an aggregate of twenty-nine thousand miles, and shall not establish schedules for air-mail transportation on such routes and extensions in excess of an annual aggregate of forty million airplane-miles.

(g) Authority is hereby conferred upon the Postmaster General to provide and pay for the carriage of mail by air in conformity with the terms of any contract let by him prior to the passage of this Act, or which may be let pursuant to a call for competitive bids therefor issued prior to the passage of this Act, and to extend any such contract for an additional period or periods not exceeding nine months in the aggregate at a rate of compensation not exceeding that established by this Act nor that provided for in the original contract: *Provided*, That no such contract may be so extended unless the contractor shall agree in writing to comply with all the provisions of this Act during the extended period of the contract.

SEC. 4. The Postmaster General shall cause advertisements of air-mail routes to be conspicuously posted at each such post office that is a terminus of the route named in such advertisement, for at least twenty days, and a notice thereof shall be published at least once a week for two consecutive weeks in some daily newspaper of general circulation published in the cities that are the termini for the route before the time of the opening of bids.

SEC. 5. After the bids are opened, the Postmaster General may grant to a successful bidder a period of not more than thirty days from the date of award of the contract to take the steps necessary to qualify for mail services under the terms of this Act: *Provided*, That, at the time of the award, the successful bidder executes an adequate bond with sufficient surety guaranteeing and assuring that, within such period, said bidder will fully qualify under the Act faithfully to execute and to carry out the terms of the contract: *Provided further*, That, if there is a failure so to qualify, the amount designated in the bond will be forfeited and paid to the United States of America.

SEC. 6. (a) The Interstate Commerce Commission is hereby empowered and directed, after notice and hearing, to fix and determine by order, as soon as practicable and from time to time, the fair and reasonable rates of compensation for the transportation of air mail by airplane and the service connected therewith over each air-mail route, but not in excess of the rates provided for in this Act, prescribing the method or methods by weight or space, or both, or otherwise, for ascertaining such rates of compensation, and to publish the same, which shall continue in force until changed by the said Commission after due notice and hearing.

(b) The Interstate Commerce Commission is hereby directed, at least once in every calendar year from the date of letting of any contract, to review the rates of compensation being paid to the holder of such contract, in order to be assured that no unreasonable profit is resulting or accruing therefrom. In determining what may constitute an unreasonable profit, the said Commission shall take into consideration all forms of gross income derived from the operation of airplanes over the route affected.

(c) Any contract which may hereafter be let or extended pursuant to the provisions of this Act, and which has been satisfactorily performed by the contractor during its initial or extended period, shall thereafter be continued in effect for an indefinite period, subject to any reduction in the rate of payment therfor, and such additional conditions and terms, as the said Commission may prescribe, which shall be consistent with the requirements of this Act; but any contract so continued in effect may be terminated by the said Commission upon sixty days' notice, upon such hearing and notice thereof to interested parties as the Commission may determine to be reasonable; and may also be terminated by the contractor at its option upon sixty days' notice. On the termination of any air-mail contract, in accordance with any of the provisions of this Act, the Postmaster General may let a new contract for air-mail service over the route affected, as authorized in this Act.

(d) All provisions of section 5 of the Act of July 28, 1916 (39 Stat. 412; U.S.C., title 39, secs. 523 to 568, inclusive), relating to the administrative methods and procedure for the adjustment of rates for carriage of mail by railroads shall be applicable to the ascertainment of rates for the transportation of air mail by airplane under this Act so far as consistent with the provisions of this Act. For the purposes of this section the said Commission shall also have the same powers as the Postmaster General is authorized to exercise under section 10 of this Act with respect to the keeping, examination, and auditing of books, records, and accounts of air-mail contractors, and it is authorized to employ special agents or examiners to conduct such examination or audit, who shall have power to administer oaths, examine witnesses, and receive evidence.

(e) In fixing and determining the fair and reasonable rates of compensation for air-mail transportation, the Commission shall give consideration to the amount of air mail so carried, the facilities supplied by the carrier, and its revenue and profits from all sources, and from a consideration of these and other material elements, shall fix and establish rates for each route which, in connection with the rates fixed by it for all other routes, shall be designed to keep the aggregate cost of the transportation of air mail on and after July 1, 1938, within the limits of the anticipated postal revenue therefrom.

SEC. 7. (a) After December 31, 1934, it shall be unlawful for any person holding an air-mail contract to buy, acquire, hold, own, or control, directly or indirectly, any shares of stock or other interest in any other partnership, association, or corporation engaged directly or indirectly in any phase of the aviation industry, whether so engaged through air transportation of passengers, express, or mail, through the holding of an air-mail contract, or through the manufacture or sale of airplanes, airplane parts, or other materials or accessories generally used in air transportation, and regardless of whether such buying, acquisition, holding, ownership, or control is done directly, or is accomplished indirectly, through an agent, subsidiary, associate, affiliate, or by any other device whatsoever: *Provided*, That the prohibitions herein contained shall not extend to interests in landing fields, hangars, or other ground facilities necessarily incidental to the performance of the transportation service of such air-mail contractor, nor to shares of stock in corporations whose principal business is the maintenance or operation of such landing fields, hangars, or other ground facilities.

(b) After December 31, 1934, it shall be unlawful (1) for any partnership, association, or corporation, the principal business of which, in purpose or in fact, is the holding of stock in other corporations, or (2) for any partnership, association, or corporation engaged directly or indirectly in any phase of the aviation industry, as specified in subsection (a) of this section, to buy, acquire, hold, own, or control, directly or indirectly, either as specified in such subsection (a) or otherwise, any shares of stock or other interests in any other partnership, association, or corporation which holds an air-mail contract.

(c) No person shall be qualified to enter upon the performance of an air-mail contract, or thereafter to hold an air-mail contract, if at or after the time specified for the commencement of mail transportation under such contract, such person is (or, if a partnership, association, or corporation, has and retains a member, officer, or director that is) a member officer, director, or stockholder in any other partnership, association, or corporation, whose principal business, in purpose or in fact, is the holding of stock in other corporations, or which is engaged in any phase of the aviation industry, as specified in subsection (a) of this section.

(d) No person shall be qualified to enter upon the performance of, or thereafter to hold an air-mail contract, (1) if at or after the time specified for the commencement of mail transportation under such contract, such person is (or, if a partnership, association, or corporation, has a member, officer, or director, or an employee performing general managerial duties, that is) an individual who has theretofore entered into any unlawful combination to prevent the making of any bids for carrying the mails: *Provided*, That whenever required by the Postmaster General the bidder shall submit an affidavit executed by the bidder, or by such of its officers, directors, or general managerial employees as the Postmaster General may designate, sworn to before an officer authorized and empowered to administer oaths, stating in such affidavit that the affiant has not entered nor proposed to enter into any combination to prevent the making of any bid for carrying the mails, nor made any agreement, or given or performed, or promised to give or perform, any consideration whatever to induce any other person to bid or not to bid for any mail contract, or (2) if it pays any officer, director, or regular employee compensation in any form, whether as salary, bonus, commission, or otherwise, at a rate exceeding $17,500 per year for full time.

SEC. 8. Any company alleging to hold a claim against the Government on account of any air-mail contract that may have heretofore been annulled, may prosecute such claim as it may have against the United States for the cancelation of such contract in the Court of Claims of the United States, provided that such suit be brought within one year from the date of the passage of this Act; and any person not ineligible under the terms of this Act who qualifies under the other requirements of this Act, shall be eligible to contract for carrying air mail, notwithstanding the provisions of section 3950 of the Revised Statutes (Act of June 8, 1872).

SEC. 9. Each person desiring to bid on an air-mail contract shall be required to furnish in its bid a list of all the stockholders holding more than 5 per centum of its entire capital stock, and of its directors, and a statement covering the financial set-up, including a list of assets and liabilities; and in the case of a corporation, the original amount paid to such corporation for its stock, and whether paid in cash, and if not paid in cash, a statement for what such stock was issued. Such information and the financial responsibility of such bidder, as well as the bond offered, may be taken into consideration by the Postmaster General in determining the qualifications of the bidder.

SEC. 10. All persons holding air-mail contracts shall be required to keep their books, records, and accounts under such regulations as may be promulgated by the Postmaster General, and he is hereby authorized to examine and audit the books, records, and accounts of such contractors and to require a full financial report under such regulations as he may prescribe.

SEC. 11. Before the establishment and maintenance of an air-mail route the Postmaster General shall notify the Secretary of Commerce, who thereupon shall certify to the Postmaster General the character of equipment to be employed and maintained on each air-mail route. In making this determination the Secretary of Commerce, in his specifications furnished to the Postmaster General, shall determine only the speed, load capacity, and safety features and safety devices on airplanes to be used on the route, which said specifications shall be included in the advertisement for bids.

SEC. 12. The Secretary of Commerce is authorized and directed to prescribe the maximum flying hours of pilots on air-mail lines, and safe operation methods on such lines, and is further authorized to approve agreements between air-mail operating companies and their pilots and mechanics for retirement benefits to such pilots and mechanics. The Secretary of Commerce is authorized to prescribe all necessary regulations to carry out the provisions of this section and section 11 of this Act.

SEC. 13. It shall be a condition upon the awarding or extending and the holding of any air-mail contract that the rate of compensation and the working conditions and relations for all pilots, mechanics, and laborers employed by the holder of such contract shall conform to decisions of the National Labor Board. This section shall not be construed as restricting the right of collective bargaining on the part of any such employees.

SEC. 14. The Federal Radio Commission shall give equal facilities in the allocation of radio frequencies in the aeronautical band to those airplanes carrying mail and/or passengers during the time the contract is in effect.

SEC. 15. After October 1, 1934, no air-mail contractor shall hold more than three contracts for carrying air mail, and in case of the contractor of any primary route, no contract for any other primary route shall be awarded to or extended for such contractor. It shall be unlawful for air-mail contractors, competing in parallel routes, to merge or to enter into any agreement, express or implied, which may result in common control or ownership.

SEC. 16. The Postmaster General may provide service to Canada within one hundred and fifty miles of the international boundary line, over domestic routes which are now or may hereafter be established and may authorize the carrying of either foreign or domestic mail, or both, to and from any points on such routes and make payment for services over such routes out of the appropriation for the domestic Air Mail Service: *Provided,* That this section shall not be construed as repealing the authority given by the Act of March 2, 1929 (U.S.C., Supp. VII, title 39, sec. 465a).

SEC. 17. The Postmaster General may cause any contract to be canceled for willful disregard of or willful failure by the contractor to comply with the terms of its contract or the provisions of law herein contained and for any conspiracy or acts designed to defraud the United States with respect to such contracts. This provision is cumulative to other remedies now provided by law.

SEC. 18. Whoever shall enter into any combination, understanding, agreement, or arrangement to prevent the making of any bid for any contract under this Act, to induce any other person not to bid for any such contract, or to deprive the United States Government in any way of the benefit of full and free competition in the awarding of any such contract, shall, upon conviction thereof be fined not more than $10,000 or imprisoned for not more than five years, or both.

SEC. 19. If any person shall willfully or knowingly violate any provision of this Act his contract, if one shall have been awarded to him, shall be forfeited, and such person shall upon conviction be punished by a fine of not more than $10,000 or be imprisoned for not more than five years.

SEC. 20. The President is hereby authorized to appoint a Commission composed of five members to be appointed by him, not more than three members to be appointed from any one political party, for the purpose of making an immediate study and survey, and to report to Congress not later than February 1, 1935, its recommendations of a broad policy covering all phases of aviation and the relation of the United States thereto. Members appointed who are not already in the service of the United States shall receive compensation of not exceeding the rate of compensation of a Senator or Representative in Congress.

SEC. 21. Such Commission shall organize by electing one of its members as chairman, and it shall appoint a secretary whose salary shall not exceed the rate of $5,000 per annum. Said Commission shall have the power to pay actual expenses of members of the Commission in the performance of their duties, to employ counsel, experts, and clerks, to subpena witnesses, to require the production by witnesses of papers and documents pertaining to such matters as are within the jurisdiction of the Commission, to administer oaths, and to take testimony, and for such purpose there is hereby authorized to be appropriated the sum of $75,000.

Approved, June 12, 1934.

[Public Resolution—No. 48—73d Congress] [H. J. Res. 366]

To simplify the administration of air-mail routes and contracts.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That subsection (d) of section 3 of the Act entitled "An Act to revise air-mail laws, and to establish a commission to make a report to the Congress recommending an aviation policy," approved June 12, 1934, is hereby amended by adding at the end thereof the following sentence: "The Commission created under section 20 of this Act shall review the designations made by the Postmaster General under this subsection, and include in its report to Congress its conclusions reached upon such review."

SEC. 2. The first sentence of section 15 of such Act is hereby amended to read as follows: "After March 1, 1935, no person holding a contract or contracts for carrying air mail on a primary route shall be awarded or hold any contact[1] for carrying air mail on any other primary route, nor on more than two additional routes other than primary routes."

Approved, June 26, 1934.

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[1] So in original.

DOMESTIC AIR MAIL CONTRACTS, JANUARY 1, 1935

Date of Awards and Other Information.

All domestic air mail contracts were cancelled, effective at midnight, February 19, 1934. From that date the air mail was carried by the Army Air Corps up to the time service was resumed by private operators under temporary contracts. Service was suspended during the period of March 12 to March 18 (inclusive), 1934.

Because of the complete change in the air mail map, it is advisable to separate the new set-up from the old. Following is a tabulation giving dates on which service on each route was resumed by private contractors, and the operators to whom contracts were awarded.

A. M. 1—Newark, N. J. to Oakland, California.
Re-awarded May 8, 1934—To United Air Lines, Inc.

A. M. 2—Newark, N. J. to Los Angeles, California.
Re-awarded May 13, 1934—To TWA, Inc.

A. M. 3—Fargo, N. D. to Seattle, Washington.
Re-awarded May 26, 1934—To Northwest Airlines, Inc.

A. M. 4—Fort Worth, Texas to Los Angeles, California.
Re-awarded May 13, 1934—To American Airlines, Inc.

A. M. 5—Newark, N. J. to New Orleans, La.
Re-awarded May 16, 1934—(Newark-Atlanta)
May 28, 1934—(Newark-New Orleans)
To—Eastern Air Lines, Inc.

A. M. 6—Newark, N. J. to Miami, Florida.
Re-awarded May 16, 1934—To Eastern Air Lines, Inc.

A. M. 7—Newark, N. J. to Chicago, Ill.
Re-awarded May 13, 1934—To American Airlines, Inc.

A. M. 8—Chicago, Ill. to New Orleans, La.
Re-awarded June 3, 1934—To Pacific Seaboard Airlines, Inc.

A. M. 9—Chicago, Ill. to Dallas, Texas.
Re-awarded May 17, 1934—To Braniff Airways, Inc.

A. M. 10—Chicago, Ill. to Jacksonville, Fla.
Re-awarded June 1, 1934—To Eastern Air Lines, Inc.

A. M. 11—Seattle, Wash. to San Diego, California.
Re-awarded May 8, 1934—To United Air Lines, Inc.

A. M. 12—Salt Lake City, Utah to Seattle, Wash.
Re-awarded May 8, 1934—To United Air Lines, Inc.

A. M. 13—Salt Lake City, Utah to San Diego, Calif.
Re-awarded May 8, 1934—To General Air Lines, Inc.

A. M. 14—Washington, D. C. to Detroit, Mich.
Re-awarded May 17, 1934—To Central Airlines, Inc.

A. M. 15—Amarillo, Texas to Brownsville, Texas.
Re-awarded June 1, 1934—To Long and Harman, Inc.

A. M. 16—Chicago, Ill. to Pembina, N. D.
Re-awarded June 1, 1934—To Hanford Tri-State Airlines, Inc.

A. M. 17—Cheyenne, Wyo. to Pueblo, Colo.
Re-awarded May 15, 1934—(Cheyenne-Denver)
June 1, 1934—(Denver-Pueblo)
To—Wyoming Air Service, Inc.

A. M. 18—Boston, Mass. to Newark, N. J.
Re-awarded May 13, 1934—To American Airlines, Inc.

A. M. 19—Salt Lake City, Utah to Great Falls, Mont.
Re-awarded May 15, 1934—To Alfred Frank (National Parks Airways, Inc.)

A. M. 20—New Orleans, La. to Houston, Texas.
Re-awarded July 25, 1934—To Robertson Airplane Service Co.

A. M. 21—Boston, Mass. to Cleveland, Ohio.
Re-awarded June 10, 1934—To American Airlines, Inc.

A. M. 22—Cleveland, Ohio to Nashville, Tenn.
Re-awarded June 10, 1934—To American Airlines, Inc.

A. M. 23—Newark, N. J. to Fort Worth, Texas.
Re-awarded June 10, 1934—(Nashville-Ft. Worth)
July 1, 1934—(Nashville-Newark)
To—American Airlines, Inc.

A. M. 24—Charleston, S. C. to Dallas, Texas.
Re-awarded July 4, 1934—(Atlanta-Dallas)
July 7, 1934—(Charleston-Atlanta)
To—Delta Air Corporation.

A. M. 25—Washington, D. C. to Chicago, Ill.
Re-awarded June 10, 1934—To American Airlines, Inc.

A. M. 26—St. Paul and Minneapolis, Minn. to Omaha, Nebr.
Re-awarded July 3, 1934—To Hanford Tri-State Airlines, Inc.

A. M. 27—Boston, Mass. to Burlington, Vt.
Re-awarded June 25, 1934—(Boston-Burlington)
June 26, 1934—(Boston-Bangor)
To—National Airways, Inc.

A. M. 28—Billings, Mont. to Cheyenne, Wyo.
Re-awarded June 20, 1934—To Wyoming Air Service, Inc.

A. M. 29—Pueblo, Colo. to El Paso, Texas.
Re-awarded July 15, 1934—To Varney Speed Lines, Inc.

A. M. 30—Chicago, Ill. to Ft. Worth, Texas.
Re-awarded June 15, 1934—To American Airlines, Inc.

A. M. 31—Daytona Beach, Fla. to St. Petersburg, Fla.
Re-awarded Oct. 15, 1934—To D. K. Franklin & G. T. Baker.
(Route temporarily extended to Jacksonville, Fla. Nov. 19, 1934.)

A. M. 32—Detroit, Mich. to Milwaukee, Wis.
Re-awarded July 1, 1934—To Pennsylvania Airlines & Transport Company.

A. M. 33—Honolulu, Island of Oahu to Hilo, Island of Hawaii;
Honolulu, Island of Oahu to Lihue, Island of Kauai.
Re-awarded Oct. 8, 1934—To Inter-Island Airways, Ltd.

FOREIGN AIR MAIL ROUTES

U. S. Post Office Department

The United States Post Office Department pays for service only outbound on routes No. 1 and No. 7, and both ways on all other routes.

Route No.	*Contractor*	*One Way Distance*
	Canadian Colonial Airways, Inc. 4848 West 63d St., Chicago, Ill.	
F. A. M. 1	New York, N. Y., via Albany, N. Y., to Montreal, Canada (1)..	334 Miles
	Seattle Victoria Air Mail, Inc. 56 Roanoke Street, Seattle, Wash.	
F. A. M. 2	Seattle, Wash., to Victoria, B. C., and return (2)............	74 Miles
	Pan American Airways, Inc. 135 East 42nd St., New York, N. Y.	
F. A. M. 5	*Long Flight:* Miami, Florida to Habana, Cuba and return (3).............	229 Miles
	Habana, Cuba, via Cozumel, Mexico to Merida, Mexico, and return (4)..	521.5 Miles
	Merida, Mexico, via Belize, British Honduras and Puerto Barrios, Guatemala to San Salvador, El Salvador, and return (5)	559.5 Miles
	San Salvador, El Salvador, via Tegucigalpa, Republic of Honduras; Managua, Nicaragua; San José, Costa Rica; and David and Panama City, Panama, to Cristobal, Canal Zone, and return (4)..	918.5 Miles
	Total...........	2,228.5 Miles
	Short Flight: Habana, Cuba, via Cienfuegos, Cuba; Kingston, Jamaica; and Barranquilla, Colombia, to Cristobal, Canal Zone, and return (4)..	1,573.5 Miles
F. A. M. 5 (as of Sept. 23, 1929)	*Extended:* Port-of-Spain, Trinidad, via Georgetown, British Guiana, to Paramaribo, Dutch Guiana, and return (5)...............	626 Miles
(as of Aug. 5, 1932)	Barranquilla, Colombia, via Maracaibo, Cumarebo, LaGuaira, and Caripito, Venezuela, to Port-of-Spain, Trinidad, and return (4)..	1,021 Miles

Pan American Airways, Inc.

135 E. 42nd St., New York, N. Y.

F. A. M. 6	Miami, Florida, via Nuevitas, Cuba; Port au Prince, Haiti; and San Pedro de Marcoris, Dominican Republic, to San Juan, Porto Rico and return (6)	1,180.5 Miles
	San Juan, Porto Rico, via St. Thomas, U. S. Virgin Islands; and St. John, Antigua to Port-of-Spain, Trinidad and return (5)	749.5 Miles

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Pan American Airways, Inc.

135 E. 42nd St., New York, N. Y.

F. A. M. 7	Miami, Florida, to Nassau, Bahama Islands. (Bahamas mail carried on return trip) (7)	188 Miles

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Pan American Airways, Inc.

(Sub-contractor: Compañía Mexicana de Aviación, S.A.)

135 E. 42nd St., New York, N. Y.

F. A. M. 8	Brownsville, Texas, via Tampico, Mexico, to Mexico City, and return (3)	495.5 Miles
	Mexico City, Mexico, via Vera Cruz and Tapachula, Mexico, and Guatemala City, Guatemala, to San Salvador, and return (4)	869 Miles

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Pan American-Grace Airways, Inc.

135 E. 42nd St., New York, N. Y.

F. A. M. 9	Cristobal, Canal Zone, via Buenaventura and Tumaco, Colombia; Guayaquil, Ecuador; Talara, Trujillo, Lima, Arequipa and Tacna, Peru; Arica, Antofagasta, Ovalle and Santiago, Chile; Mendoza and Buenos Aires, Argentina; to Montevideo, Uruguay, and return (4)	4,551.5 Miles

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Pan American Airways, Inc.

135 East 42nd St., New York, N. Y.

F. A. M. 10	Paramaribo, Dutch Guiana, via Cayenne, French Guiana; Para, Maranhao, Fortaleza, Natal, Pernambuco, Maceio, Bahia, Victoria, Rio de Janeiro, Santos, Florianopolis, Porto Alegre and Rio Grande do Sul, Brazil; and Montevideo, Uruguay, to Buenos Aires, Argentina, and return (5)	4,840.5 Miles

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Pan American Airways, Inc.

135 East 42nd St., New York, N. Y.

F. A. M. 12	(Suspended until further notice) Bangor, Maine, via St. Johns, New Brunswick to Halifax, Nova Scotia	281 Miles

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(1) Daily except Sunday.
(2) In close connection with trans-Pacific mail steamers at Victoria.
(3) Daily.
(4) Bi-weekly.
(5) Weekly.
(6) Tri-weekly.
(7) Weekly, May 1 to December 31; Daily except Sunday, January 1 to April 30.

FOREIGN AIR MAIL ROUTES

Dates of Contract Awards, Terminals and Contractors

F. A. M. 1 From New York to Montreal, Canada, via Albany, N. Y.
Contract awarded July 9, 1928 to Canadian Colonial Airways, Inc. (American Airways), for a period of 10 years beginning with date of inauguration of service on October 1, 1928.

F. A. M. 2 From Seattle to Victoria, B. C., and return.
Contracts have been let as follows:
October 15, 1920 to June 30, 1923 to Edward Hubbard
July 1, 1923 to June 30, 1924 to Alaska Airways Co.
July 1, 1924 to June 30, 1925 to Edward Hubbard
July 1, 1925 to June 30, 1926 to Edward Hubbard
July 1, 1926 to June 30, 1927 to Edward Hubbard
July 1, 1927 to June 30, 1928 to Northwest Air Service, Inc.
July 1, 1928 to June 30, 1929 to P. F. Barnes and Vern C. Gorst
On May 10, 1929, a 4 year contract beginning July 1, 1929 was awarded to Seattle-Victoria Air Mail, Inc.
On July 1, 1933, a 4 year contract was awarded to Seattle-Victoria Air Mail, Inc.

F. A. M. 3 From New Orleans to Pilottown or Port Eads, La. and return.
Contracts have been let as follows:
April 9 to June 30, 1923, a temporary contract to M. K. Riddick
July 1, 1923 to June 30, 1924 to Gulf Coast Airline (Inc.)
July 1, 1924 to June 30, 1932, successive annual contracts to Arthur E. Cambas.
July 1, 1932—awarded to Johnson Airways (Inc.) for 1 year
Contract extended for 6 months July 1, 1933 to December 31, 1933.
January 1, 1934 to June 30, 1934 awarded to Tropical Airways, (Inc.)

F. A. M. 4 From Miami to Habana, Cuba and return.
Discontinued on February 1, 1933, and superseded by daily service, on F. A. M. 5 on the same date.
Contracts have been let as follows:
October 15, 1920 to October 14, 1921 to Florida West Indies Airways, Inc. (Key West to Habana, Cuba). This contract was terminated in June, 1921.
Contract authorized January 11, 1923 to June 30, 1923, with Aero-marine Airways, Inc. (Key West to Habana).
October 19, 1927—June 30, 1928 to Pan American Airways, Inc.
Contract made May 29, 1928 for a period of 5 years effective from July 1, 1928 with Pan American Airways, Inc. Contract amended to cover service both ways, effective December 1, 1930.

F. A. M. 5 From Miami, Florida to Cristobal, C. Z., with an extension to Port-of-Spain, Trinidad, and Paramaribo, Dutch Guiana, and return, including stops in Cuba, Mexico, British Honduras, Guatemala, El Salvador, Republic of Honduras, Nicaragua, British Guiana, Dutch Guiana, Trinidad, Costa Rica, Panama, Jamaica, Colombia and Venezuela.
Contract was made July 13, 1928 with Pan American Airways, Inc. for a 10 year term to begin with the inauguration of service on February 4, 1929.

F. A. M. 6 From Miami, Florida to San Juan, Porto Rico with an extension to Port-of-Spain, Trinidad and return, including stops in Cuba, Haiti, Dominican Republic, Puerto Rico, U. S. Virgin Islands, Antigua and Trinidad.
Contract was made July 13, 1928 with Pan American Airways, Inc. for a term of 10 years beginning with the inauguration of service on January 9, 1929.

F. A. M. 7 From Miami, Florida to Nassau, Bahama Islands, Bahaman mail carried on return trip.
Contract made on October 28, 1928 with Pan American Airways, Inc., for a 10 year term beginning with the inauguration of service on January 2, 1929.

F. A. M. 8 From Brownsville, Texas to San Salvador, El Salvador and return including stops in Mexico and Guatemala.
Contract made February 16, 1929 with Pan American Airways, Inc. (sub-contractor: Compania Mexicana de Aviacion, S.A.) for a 10 year term beginning March 9, 1929.

F. A. M. 9 From Cristobal, C. Z. to Montevideo, Uruguay and return, including stops in Colombia, Ecuador, Peru, Chile and Argentina.
Contract made March 2, 1929 with Pan American-Grace Airways, Inc. for a 10 year term beginning with the date of inauguration April 1, 1929.

F. A. M. 10 From Paramaribo, Dutch Guiana to Buenos Aires, Argentina and return, with stops in French Guiana, Brazil and Uruguay.
Contract made September 24, 1930 with Pan American Airways, Inc. for the period between October 20, 1930 and January 8, 1939.

F. A. M. 12 From Bangor, Maine to Halifax, Nova Scotia via St. Johns, N. B. Service suspended until further notice in October, 1931.
Contract made July 31, 1931 with Pan American Airways, Inc. for a 10 year term beginning with inauguration of service on August 1, 1931.

FLYING SCHOOLS GRANTED APPROVED CERTIFICATES BY DEPARTMENT OF COMMERCE

January 1, 1935

	Courses Offered	*License Qualifications*	*Certificate Issued*
Parks Air College, Inc. Parks Airport East St. Louis, Ill.	Ground and Flying	Transport Lim. Com. Private Amateur	7-15-29
D. W. Flying Service, Inc. LeRoy Airport LeRoy, New York	G & F	Lim. Com. Private Amateur	7-15-29
Boeing School of Aeronautics Oakland Municipal Airport Oakland, California	G & F	Transport Lim. Co. Private Amateur	10-17-29
Spartan School of Aeronautics Apache Blvd. & Chamberlain Drive Tulsa, Oklahoma	G & F	Transport Lim. Com. Private Amateur	10-18-29
Roosevelt Aviation School, Inc. Roosevelt Field, No. 1 Mineola, L. I., N. Y.	G & F	Transport Lim. Com. Private Amateur	10-25-29
Lincoln Airplane & Flying School 2415 O Street (Ground) Municipal Airport (Flying) Lincoln, Nebr.	G & F	Transport Lim. Com. Private Amateur	3-31-30
Furniture Capital Air Service Grand Rapids Airport Grand Rapids, Michigan	G & F	Private Amateur Transport Lim. Com.	8-21-30
Dallas Aviation School and Air College Love Field Dallas, Texas	G & F	Transport Lim. Com. Private Amateur	12-22-30
Los Angeles Aircraft, Ltd. Los Angeles Municipal Airport Inglewood, Calif.	G & F	Private	7-30-32
Ryan School of Aeronautics, Ltd. Lindbergh Field San Diego, Calif.	G & F	Transport Lim. Com. Private Amateur	9-1-32
United Air Services, Inc. Floyd Bennett Field Brooklyn, New York	G & F	Private	12-7-32

	Courses Offered	License Qualifications	Certificate Issued
Safair, Inc. Hangar B, Roosevelt Field Garden City, L. I., N. Y. in Combination with New York University 51 West Fourth St., N. Y. C.	G & F	Amateur Transport Lim. Com. Private	12–27–32
Northland Aviation Co. Wold-Chamberlain Airport Minneapolis, Minn.	G & F	Transport Lim. Com. Private Amateur	5–4–33
Grand Central Flying School Grand Central Air Terminal (Flying) Glendale, Calif. in Combination with Curtiss-Wright Technical Institute of Aeronautics Grand Central Air Terminal (Ground) Glendale, California	G & F	Amateur Transport Lim. Com. Private	12–18–33
Westfahl Airways, Inc. Milwaukee County Airport Milwaukee, Wisconsin in conjunction with Wisconsin School of Aviation, Inc. Milwaukee County Airport Milwaukee, Wisconsin	G & F	Lim. Com. Private Amateur	1–31–34
Chicago Aviation Corp., Shermor Road Glenview, Ill. In conjunction with Aeronautical University, Inc. 1338 So. Michigan Avenue Chicago, Ill.	G & F	Transport Lim. Com. Private Amateur	3–19–34
Erickson & Remmert Floyd Bennett Field Brooklyn, New York In conjunction with New York University Ground School	G & F	Private Amateur	6–30–34
Inter City Airlines, Inc. Boston Municipal Airport East Boston, Mass.	G & F	Transport Lim. Com. Private Amateur	6–30–34
Muncie Aviation Corporation Center Pike Muncie, Indiana	G & F	Lim. Com. Private Amateur	7–12–34
California Air Service, Ltd. Alhambra Airport Alhambra, California	G & F	Private Amateur	8–22–34

SEAPLANE ANCHORAGES WITHIN THE UNITED STATES

January 1, 1935

Prepared by the Hydrographic Office, U. S. Navy

CLASS I. ANCHORAGES WITH RAMPS, ETC.

Atlantic Coast

Maine

Bar Harbor (Hadley Point)
Rockland

Massachusetts

*Gloucester (Coast Guard air station)
*Boston (municipal airport)
*Squantum (Naval Reserve air station)
*South Dartmouth (Round Hill Airport)

Rhode Island

*Newport (Gould Island naval torpedo station)

Connecticut

*Bridgeport
Groton
*New Haven

New York

Brooklyn (Floyd Bennett Field)
College Point, Long Island
*Port Washington, Long Island
*North Beach, Long Island
New Dorp, Staten Island
*New York City, East River (2) Hudson River (1)

New Jersey

Atlantic City
*Cape May (Coast Guard air station)

Pennsylvania

*Philadelphia (naval aircraft factory)
Essington

Virginia

*Hampton (Langley Field)
*Hampton Roads (naval air station)
Hopewell
Quantico (Marine barrack)
Dahlgren (naval proving ground)

Maryland

Baltimore (2) (Middle River: Martin Airport) (municipal airport)

District of Columbia

Washington (naval air station, Anacostia)

Florida

West Palm Beach
*Miami (5)
*Key West (naval station)

Gulf Coast

Florida

*St. Petersburg
Pensacola (naval air station)
Tampa

Louisiana

New Orleans

Pacific Coast

California

San Diego (naval air station)
Catalina Island
Oakland (Oakland municipal airport)

Oregon

Portland

Washington

Seattle (5) (Sand Point Naval Reserve Air Station); (Renton Airport); (Elliott Bay); Lake Union (2)
Port Townsend (floating hangar)

Great Lakes

Illinois

Chicago
Great Lakes (naval training station)

Michigan

Detroit (2)
Grosse Ile (Naval Reserve aviation base)
Mount Clemens (Selfridge Field)

Minnesota

Duluth

Wisconsin

Delafield
Milwaukee
Racine

Alaska

Anchorage (floating ramp)
Cordova
Juneau (floating hangar)

*Description of anchorages published in the Naval Air Pilot, East and Gulf Coasts of the United States, H. O. Publication 190.

CLASS II. ANCHORAGES WITH ORDINARY HARBOR FACILITIES

Atlantic Coast

Maine

Calais
*Eastport
*Boothbay
Bath
*Portland

New Hampshire

*Portsmouth

Massachusetts

Salem
Provincetown
West Barnstable
*New Bedford
Fall River
Nantucket
Edgartown

Rhode Island

Providence

Connecticut

*New London

New York

*Port Jefferson, L. I.
Amityville, L. I.
Great Pond (Lake Montauk), L. I.

New Jersey

*Keyport

Maryland

*Aberdeen
Annapolis
Baltimore

North Carolina

Elizabeth City
*Edenton
Morehead City
New Bern
Wilmington

South Carolina

*Georgetown
*Charlestown
*Beaufort

Georgia

Savannah
*Brunswick

Florida

*Fernandina
*Jacksonville
*St. Augustine
*Daytona Beach
*Titusville
*Fort Pierce

Gulf Coast

Florida

*Fort Myers
*Sarasota
*Cedar Keys
Panama City

Alabama

Mobile

Mississippi

Pascagoula
Biloxi
Gulfport
Bay St. Louis

Louisiana

Weeks

Texas

Port Arthur
Houston
Corpus Christi
Rockport
Point Isabel

Pacific Coast

California

Los Angeles
Port San Luis
Monterey
Santa Cruz
San Francisco
Sausalito
Alameda
Eureka
Crescent City

Oregon

Astoria
Port Orford
Marshfield
Reedsport

Washington

Grays Harbor
Port Angeles
Blaine
Bellingham
Anacortes
New Dungeness
Everett
Bremerton (Navy Yard)

*Description of anchorages published in the Naval Air Pilot, East and Gulf Coasts of the United States, H. O. Publication 190.

SEAPLANE ANCHORAGES OUTSIDE THE UNITED STATES

CLASS I. ANCHORAGES WITH RAMPS, ETC.

Canada

British Columbia

Naniamo
Swanson Bay
Vancouver (2)
Victoria

New Brunswick

Fredericton
St. John

Nova Scotia

Halifax

Ontario

Sault Ste. Marie

Central America

Canal Zone

Coco Solo (United States Naval Air Station)
France Field (United States Army Air Corps)

British Honduras

Belize

Guatemala

Puerto Barrios

South America

Argentina

Puerto Belgrano

Brazil

Fortaleza (Ceara)
Ilheios
Natal
Para
Porto Alegre
Rio de Janeiro

British Guiana

Georgetown

Chile

Quintero

Colombia

Barranquilla
Buenaventura

Dutch Guiana

Paramaribo

Ecuador

Guayaquil
Santa Elena

Peru

Ancon

Venezuela

Maracaibo

West Indies

Bahama Islands

New Providence Island (Nassau)

Cuba

Guantanamo (Hicacal Beach)

Curacao

Willemstad

Haiti

Port au Prince (2) (United States Marine Corps) (floating ramp)

Jamaica

Kingston

Puerto Rico

San Juan (Isla Grande Airport)

St. Lucia

Port Castries

Trinidad

Port of Spain

STATE AIRPORT ADVISERS

Appointed by the Bureau of Air Commerce, U. S. Department of Commerce, to cooperate in the municipal airports development program of the Civil Works Administration.

State	*Name*	*Address*
Alabama	A. J. Hawkins	404 First Nat'l Bank Bldg., Montgomery
Arizona	Lynn Lockhart	P. O. Box 1328, Phoenix
Arkansas	Chas. M. Taylor	406 Louisiana St., Little Rock
California	B. M. Doolin	CWA, 49 Fourth St., San Francisco
Colorado	Danny Kearns	1375 Lincoln St., Denver
Connecticut	Charles L. Morris	State Capitol, Hartford
Florida	A. B. McMullin	State Capitol, Tallahassee
Georgia	William F. Cummings	61 Mitchell St., Atlanta
Idaho	Arthur Blomgren	State Capitol, Boise
Illinois	L. P. Bonfoey	State Capitol, Springfield
Indiana	Charles V. Cox	217 N. Senate Ave., Indianapolis

Iowa	Ralph W. Cram	"Davenport Democrat," Davenport
Kansas	Fred H. Grieme	Kansas Emergency Relief, 501 Nat'l Reserve Bldg., Topeka
Kentucky	John C. Bennett	Louisville Flying Service, Louisville
Maine	Harry M. Jones	State House, Portland
Maryland	W. D. Tipton	306 Stewart Bldg., Baltimore
Massachusetts	Lt. Col. Louis E. Boutwell	Nat'l Guard Hangar, Boston Airport, East Boston
Michigan	Col. Floyd Evans	Department of Aeronautics, Lansing
Minnesota	Maj. R. F. Miller	Athletic Club, St. Paul
Mississippi	John O'Keefe	Biloxi
Missouri	Roy C. Farrell	Kansas City Airport, Kansas City
Montana	Fred B. Sheriff	State Capitol, Helena
Nebraska	Dr. W. W. Arrasmith	Grand Island Clinic, Grand Island
Nevada	Robert E. Overman	Reno
New Jersey	Maj. Robert L. Copsey	Newark Metropolitan Airport, Newark
New Hampshire	W. N. Cogswell	State Capitol, Concord
New Mexico	R. L. Harrison	Albuquerque
New York	Paul Burwell	79 Madison Avenue, New York
North Carolina	R. B. Page	Wilmington
North Dakota	Noel Solien	Jamestown
Ohio	Fred L. Smith	Director of Aeronautics, Columbus
Oklahoma	W. C. Lewis	Federal Bldg., Oklahoma City
Oregon	Lt. Basil B. Smith	1117 Spalding Bldg., Portland
Pennsylvania	Raymond M. Marlier	715 Empire Bldg., Pittsburgh
Rhode Island	Dan W. Jones	26 Washington Square, Newport
South Carolina	Dr. L. B. Owens	Columbia
South Dakota	R. T. McKinnon	Pierre
Tennessee	Col. Herbert Fox	American Nat'l Bank, Nashville
Texas	A. C. Allen	Wichita Falls
Utah	D. R. Brimhall	R. H. Hinckley, State Capitol, Salt Lake City
Vermont	Porter Adams	Motor Vehicles, Montpelier
Virginia	A. H. Pettigrew	State Capitol, Richmond
Washington	Ellsworth French	Civic Bldg., Spokane
West Virginia	David M. Giltinan	State Capitol, Charleston
Wisconsin	A. D. Murphy	Association of Commerce, Green Bay
Wyoming	J. Kirk Baldwin	CWA, Casper

AERONAUTICAL MAGAZINES OF THE UNITED STATES

AERO DIGEST	515 Madison Avenue, New York, N. Y.
AIR LAW REVIEW	Washington Square East, New York, N. Y.
AIR LINE PILOT	3145 W. 63rd Street, Chicago, Ill.
AIR WORLD	30 Rockefeller Plaza, New York, N. Y.
AVIATION	330 W. 42nd St., New York, N. Y.
JOURNAL OF AIR LAW	357 E. Chicago Avenue, Chicago, Ill.
JOURNAL OF THE AERONAUTICAL SCIENCES	30 Rockefeller Plaza, New York, N. Y.
NATIONAL AERONAUTIC MAGAZINE	Dupont Circle, Washington, D. C.
OFFICIAL AVIATION GUIDE OF THE AIRWAYS	608 S. Dearborn Street, Chicago, Ill.
PILOT	Grand Central Air Terminal, Glendale, Calif.
POPULAR AVIATION	608 S. Dearborn Street, Chicago, Ill.
SOUTHWESTERN AVIATION	Ledger Bldg., Fort Worth, Texas.
SPORTSMAN PILOT	515 Madison Avenue, New York, N. Y.
U. S. AIR SERVICES	Transportation Building, Washington, D. C.
UNIVERSAL MODEL AIRPLANE NEWS	551 Fifth Avenue, New York, N. Y.
WESTERN FLYING	420 South San Pedro Street, Los Angeles, Calif.

· DIVISION I ·

AIRCRAFT AND ENGINE MANUFACTURERS

Airplane Manufacturers

BELLANCA AIRCRAFT CORPORATION
Manufacturers of
Commercial -- Military -- Special Airplanes
Contractors to United States and Foreign Governments.
Office, Factory and Flying Field
New Castle, Delaware
G. M. Bellanca, President

BOEING AIRCRAFT COMPANY
Seattle, Washington
Military and Commercial Aircraft
C. L. Egtvedt, president; J. P. Murray, G. W. Carr, Erik H. Nelson and C. N. Monteith, vice-presidents; H. E. Bowman, Sec-treas.

BREWSTER AERONAUTICAL CORPORATION
Long Island City, New York
Designers and manufacturers of airplanes and airplane and airship parts
President—James Work
Vice-Pres. & Treas.—R. M. Singer
Secretary—W. M. Grampp

CONSOLIDATED AIRCRAFT CORPORATION
Buffalo, New York
Designers and Manufacturers of Fleets, Military Airplanes and Flying Boats. Contractors to U. S. Government.
R. H. Fleet, Pres.; L. D. Bell, Gen. Mgr.; R. P. Whitman, Asst. Gen. Mgr.
Cable Address—"Consolairco"

CURTISS AEROPLANE & MOTOR CO., INC., Buffalo, N. Y.
A Division of Curtiss-Wright Corporation—Military Aircraft
Ralph S. Damon, Pres.; T. P. Wright, Vice-Pres.; B. S. Wright, Vice-Pres.; B. G. Leighton, Vice-Pres.; Geo. S. Lapp, Treas.; R. R. Reger, Sec.
Cable Address: "Aeroexco"

CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Missouri
A Division of Curtiss-Wright Corporation
Manufacturers of sport planes, commercial and military aircraft.
Ralph S. Damon, Pres.; G. J. Brandeweide, Vice-Pres.; George M. Ebert, Treas.; R. R. Reger, Sec.
Cable Address: "Aeroexco"

FAIRCHILD AVIATION CORPORATION
S. M. Fairchild, President
Subsidiaries: Fairchild Aerial Camera Corporation, Fairchild Aerial Surveys, Inc., 62-10 Woodside Ave., Woodside, L. I.; Kreider-Reisner Aircraft Co., Inc., Hagerstown, Md.; Fairchild Aircraft, Ltd., Longueuil, P. Q., Canada.

KELLETT AUTOGIRO CORPORATION
Designers and Manufacturers
of
AUTOGIROS
for military and commercial purposes.
Atlantic Bldg., Philadelphia, Pa.
W. Wallace Kellett, President

SIKORSKY AVIATION CORPORATION

Bridgeport, Conn.

Subsidiary
United Aircraft Corporation
Designers and manufacturers of single and multi-motored transport amphibions and flying boats for private, commercial and government service. F. W. Neilson, Pres. and Gen. Mgr.: I. I. Sikorsky, Vice-Pres. in charge Engineering; E. H. Glaettli, Secy. and Treas.

STINSON AIRCRAFT CORP.

Manufacturers of
Commercial & Military Airplanes
and
Contractors to United States
and Foreign Gov'ts.

MAIN OFFICE AND FACTORY
STINSON FIELD
WAYNE, MICHIGAN
(near Detroit)

CHANCE VOUGHT CORPORATION, East Hartford, Conn.

Subsidiary of United Aircraft Corporation
Designers and Manufacturers of Military and Commercial Aircraft and Seaplanes. Contractors to Governments of United States and Foreign Countries.
E. E. Wilson, President

THE WACO AIRCRAFT COMPANY

Manufacturers of WACO private light commercial and military landplanes and seaplanes. Aircraft designers and constructors.
Clayton J. Brukner, President
Lee N. Brutus, Vice President and Treasurer
L. E. St. John, Secretary
Hugh R. Perry, Sales Manager

Engine Manufacturers

ALLISON ENGINEERING COMPANY

Division of
General Motors Corporation
Indianapolis, Ind.
Aircraft Power Plant Engineering and Construction
Allison Steel Back Bearings

THE PRATT & WHITNEY AIRCRAFT COMPANY

(*Subsidiary United Aircraft Corporation*)

East Hartford, Conn.

Manufacturers of
"Wasp Junior," "Wasp," "Hornet," "Twin Wasp Junior" and "Twin Wasp" Aeronautical Engines.
President: D. L. Brown
Vice Presidents: L. S. Hobbs, B. H. Gilpin
Chief Engineer: A. V. D. Willgoos
Cable Address: "Aircraft"

WRIGHT AERONAUTICAL CORPORATION

Paterson, New Jersey

(*A Division of Curtiss-Wright Corp.*)
Manufacturers of
Wright "Whirlwinds," Wright "Cyclones" and Curtiss "Conqueror" and "Challenger" Engines. Guy W. Vaughan, Pres.; M. B. Gordon, Vice-Pres.; Arthur Nutt, Vice-Pres.; B. G. Leighton, Vice-Pres.; J. J. Donahue, Treas.; R. R. Reger, Sec.
Cable Address: "Wrightaero"

: DIVISION II :

MANUFACTURERS OF ACCESSORIES, MATERIALS AND SUPPLIES

AIRPLANE ACCESSORIES, MATERIALS, PARTS AND SUPPLIES

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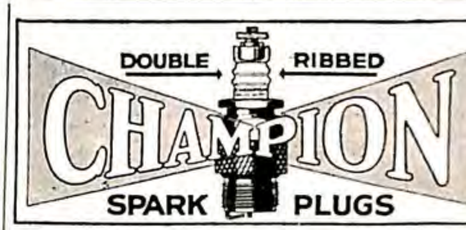

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